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Towards an Integration of Life Cycle Assessment and Material Flow Analysis Databases: an Efficient Estimation and Rebalancing of Iron Flows in Ecoinvent

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Mémoire présenté en vue de l'obtention du diplôme de *Maîtrise ès sciences appliquées*
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Ce mémoire intitulé :

Towards an Integration of Life Cycle Assessment and Material Flow Analysis Databases: an Efficient Estimation and Rebalancing of Iron Flows in Ecoinvent

présenté par **Han DE WACHTER**
en vue de l'obtention du diplôme de *Maîtrise ès sciences appliquées*
a été dûment accepté par le jury d'examen constitué de :

Robert LEGROS, président
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Réjean SAMSON, membre et codirecteur de recherche
Manuele MARGNI, membre

DEDICATION

"The one who plants trees, knowing that he will never sit in their shade, has at least started to understand the meaning of life." - Rabindranath Tagore

"Sometimes I wish I could photosynthesize so that just by being, just by shimmering at the meadow's edge or floating lazily on a pond, I could be doing the work of the world while standing silent in the sun." — Robin Wall Kimmerer, Braiding Sweetgrass: Indigenous Wisdom, Scientific Knowledge, and the Teachings of Plants

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RÉSUMÉ

L'analyse du cycle de vie (ACV) est une méthodologie qui évalue les impacts des produits et activités selon différentes catégories d'impact. Là où d'autres méthodes ne regardent que les impacts directs d'un produit (par exemple les émissions de gaz à effet de serre des voitures pendant leur phase d'utilisation), l'analyse du cycle de vie prend également les impacts indirects (comme la production et la fin de vie de la voiture elle-même) en compte. Ce faisant, les impacts complets d'un produit peuvent être quantifiés et comparés aux impacts complets d'une alternative, évitant le déplacement de l'impact vers, par exemple, différents pays ou étapes du cycle de vie. L'ACV peut ainsi aider des processus de prise de décision en comparant les impacts environnementaux des alternatives possibles pour différentes catégories d'impact. Pour réaliser une ACV, toute la chaîne de valeur d'un produit ou d'une activité doit être modélisée. Pour éviter d'avoir à modéliser la chaîne de valeur complète à partir de zéro pour chaque ACV, des bases de données avec des produits, des processus et des chaînes de valeur prédéfinis ont été développées. Parmi ces bases de données d'inventaires de cycle de vie (ICV), ecoinvent est parmi les plus importantes et utilisées au monde. Jusqu'à présent, le développement de ces bases de données s'est concentré sur la quantification des inventaires et les impacts connectés de chaque produit et activité sans prendre en compte la dimension matérielle. La dimension matérielle n'a pas été prise en compte, car les marchés ont été supposés homogènes. Cela implique que la composition des produits qui permettent la fabrication d'un autre produit n'a pas influencé les impacts dudit produit, rendant la dimension matérielle inutile. En raison de ce manque de concentration sur la composition des matériaux, il était impossible d'utiliser la loi de la conservation de la masse pour évaluer la validité de chaque modèle de processus individuel et la cohérence globale de l'ensemble de la base de données. Pourtant, il reste des preuves anecdotiques que la conservation de la masse, l'une des lois fondamentales de la nature, n'est pas respectée. De plus, l'émergence de notions d'économie circulaire comme le décyclage et le traitement en fin de vie a souligné l'importance de la pureté et de la composition des produits.

Dans ecoinvent version 3.6, des déséquilibres de masse sont présents et la composition des produits est largement indéfinie ou inconnue. Ce projet vise à résoudre ce problème et à bonifier la base de données ACV de telle sorte qu'elle puisse servir de base de données de flux de matières (AFM). Tout d'abord, une revue de littérature pour évaluer l'état de l'art en matière d'hybridation AFM et ACV a été menée. Ensuite, les déséquilibres de masse et leurs principales causes ont été identifiés, grâce au développement d'un algorithme de rééquilibrage efficace, transparent et réutilisable. Ce mémoire se concentre spécifiquement

sur la conservation du fer. Pour chaque produit de la base de données, une estimation initiale et la teneur en fer minimale et maximale sont estimées avant que la base de données ne soit redimensionnée et transmise à l'algorithme de rééquilibrage. L'algorithme calculera ensuite la composition en fer de chaque produit en équilibrant les entrées et sorties de fer de chaque activité tout en minimisant la différence par rapport à l'estimation initiale. Cette approche a permis d'identifier différentes sources de déséquilibres et d'élaborer un schéma pour les résoudre. Après quelques itérations, cela a abouti à une teneur en fer équilibrée pour tous les produits de la base de données ecoinvent 3.6 et pour tous les produits qui ont été ajoutés pour atteindre le bilan massique. Cette approche peut ensuite être utilisée pour rééquilibrer chaque élément dans la base de données.
La résolution des déséquilibres de masse permet le rapprochement avec le bilan de masse, le remplissage de la base de données et la validation du calcul des impacts.

ABSTRACT

Life cycle assessment (LCA) is a methodology which assesses impacts of products and activities for different impact categories. Where other methods only look at the direct impacts a product has (for example the emission of greenhouse gases from cars during their use phase), life cycle assessment also takes indirect impacts (like the production and end-of-life of the car itself) into account. By doing so, the complete impacts of a product can be quantified and compared to the complete impacts of a possible alternative, avoiding impact displacement to, for example, different countries or life cycle stages. LCA can thus support decision making processes by comparing the environmental impacts of the possible alternatives for different impact categories. To be able to perform an LCA, the whole value chain of a product or activity should be modelled. To avoid having to model the complete value chain from scratch for every LCA, databases with predefined products, processes and value chains were developed. Of these life cycle inventory (LCI) databases, ecoinvent is the self-proclaimed world's leading. Until now, the focus for developing these databases lied on quantifying the inventories and connected impacts of every product and activity without taking the material dimension into account. The material dimension was not taken into account because markets were assumed to be homogeneous. This implies that the composition of products that enable the production of another product did not influence the impacts of said product, making the material dimension unnecessary. Because of this lack of focus on material composition, it was impossible to use conservation of mass to assess the validity of each individual process model, and the overall consistency of the entire database. Still, there remains anecdotal evidence that conservation of mass, one of the fundamental laws of nature, is not respected. Additionally, the emergence of circular economy notions like down-cycling and end-of-life treatment underlined the importance of the purity and composition of products.

In ecoinvent version 3.6, mass imbalances are present and product composition is largely undefined or unknown. This project aims to solve this and transform the LCA into a material flow analysis (MFA) database. First, a literature review to assess the state-of-the-art in MFA and LCA hybridization was conducted. Next, mass imbalances and their main causes were identified, thanks to the development of an efficient, transparent and reusable rebalancing algorithm. In this thesis, the algorithm is used to identify the iron content of each product. For all products in the database, an initial guess and minimal and maximal iron content is estimated by hand before the database is rescaled and fed to the rebalancing algorithm. The algorithm will then compute the iron composition of each product by mass balancing each activity while minimizing the difference to the initial guess. This approach allowed to

identify different sources of imbalances and develop a schematic for resolving them. After a couple of iterations, this resulted in a balanced iron content for all products in the ecoinvent 3.6 database and for all products that were added to achieve mass balance. This approach can then be extended to rebalance every element in the database.

The resolution of mass imbalances allows for reconciliation with mass balance, completion of the database and validation of impacts calculation.

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LIST OF SYMBOLS AND ACRONYMS

LCA	Life Cycle Assessment
LCI	Life Cycle Inventory
MFA	Material Flow Analysis
SFA	Substance Flow Analysis
SUT	Supply and Use Table
IO	Input-Output
q^{LCA}	LCA impact vector
C^{LCA}	Characterisation factor matrix
B^{LCA}	Elementary flow matrix
A^{LCA}	Economical flow matrix
y^{LCA}	Functional unit vector
λ	Iron content
λ^0	Initial iron content
imb^+	Positive imbalance
imb^-	Negative imbalance
ef	Elementary flows
U	Use table
V	Supply table
VmU	Supply minus use table, V-U (what leaves minus what enters)
VmU^0	Initial supply minus initial use table, $V^0 - U^0$ (what initially leaves minus what initially enters)
F	Elementary flow table
F^0	Initial elementary flow table
S	Column rescaling matrix
R	Row rescaling matrix for U and V
R_f	Row rescaling matrix for F

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CHAPTER 1 INTRODUCTION

Our society impacts the environment in which it resides through a multitude of causal links. Every product and activity, from a toothbrush to the operation of an industrial arc furnace, ultimately requires the use of resources and generates emissions, bearing positive or negative impacts on the environment. When faced with a decision — during the design process of a product, choosing between two technologies, assessing what product to invest in or what product should be taxed — standardized quantification methods which can compare impacts of different alternatives should be used. Life cycle assessment (LCA) is one of these quantification methods, and it sets itself appart by its ability to take into account not only direct (for example the greenhouse gas emissions of cars) but also indirect impacts (the production and end-of-life of the car itself). By taking indirect impacts throughout the value chain into account, it is possible to avoid displacement of impact to different life cycle stages or regions. As an example, when looking at the direct impacts, an electric car (which has no emissions) clearly has less impacts than a car with a combustion engine (which emits greenhouse gases). An electric car can however be more polluting than a conventional car with a combustion engine. The indirect impacts, like the production of the batteries and the electricity the electric car runs on, should be included in the analysis and can change the outcome of the study. By implementing a life cycle perspective, all impacts are included and shift in impact from one stage to another (burning fuel in a generator which produces electricity for the electric car to run on instead of burning it in a car with a combustion engine) does not affect the outcome.

To perform an LCA, the impacts of all life cycle stages of a product should be quantified. For every stage, products, materials, electricity and a factory are needed, these factory, electricity and materials also need to be produced by other factories or machines using materials and energy which in their turn have to be produced. The value chain of one product thus consists of thousands of activities producing thousands of products. To avoid having to model every background activity that contributes to the impacts of a product from scratch every time an LCA is performed, databases with fixed process descriptions were developed. These databases describe all the background processes which contribute to the impact of the so-called foreground life cycle stages of a product. Where the foreground processes are specific and often created based on the current study, background processes need to be detailed, transparent and consistent in order to be reused for different LCA studies.

LCA databases in general have, however, been criticised in the literature for lack of detail, high uncertainty and inconsistencies. [6–8] They are the object of ongoing research efforts. We in this project focus on one of the greatest weaknesses of LCA databases: the lack of quantification of the material compositions of their flows and, consequently, the lack of explicit demonstration of conservation of mass and (non-radioactive) chemical elements in their different processes [9, 10]. Detailing the elemental and chemical composition of the flows exchanged between the processes was never a priority in the development of LCA databases, as these data did not directly influence the calculation of life-cycle impacts, under the restrictive historical assumption that each product's functionality can be quantified by a single dimension, the "functional unit", and that markets are homogeneous, as will be further explained in section 2. Because this was never a priority, the absence of data on material composition has made it impossible to directly assess the conformity with conservation of mass. Furthermore, anecdotal evidence [9] suggested that conservation of mass, one of the fundamental laws of nature, is not always respected.

Since the beginning of LCA, several databases [5, 11–13] have been built which describe all kinds of activities and products of the society in terms of their impact, focusing on their resource uptake and emissions without checking if the internally defined processes are mass balanced. Because of the heterogeneity of the market, not all products, even ones with the same name, have the same composition. "Alloyed steel" is seen as an alloyed steel flow without clarifying the alloying elements or level, thus creating imbalances in some processes which, for example, expect the alloyed steel flow to be a form of Incoloy while in fact, its production reflects that of corten steel. To give an example, the end-of-life phase of both materials is different and will thus be misrepresented. Additionally, reinforced concrete used in bridges does not have the same composition as reinforced concrete used in the construction of a cement factory. Still, activities have been defined using products that were previously defined for other activities and are thus not adapted to the newly defined activity, causing imbalances because of the market heterogeneity. The imbalances entail deviations in the calculation of impacts which can, in extreme cases, alternate the conclusion of LCA studies. Reinforced concrete used in the construction of a bridge contains more iron and thus has a bigger impact on the environment than concrete used for the contruction of a cement factory. When assuming the same identifier and composition for both types of concrete, the impact of the bridge will either be underestimated or the one of the factory overestimated. Other examples are products for which the description is too broad, allowing for ambiguity in their composition calculation. The ecoinvent product 'bicycle' represents a bike of 17kg including additionals (e.g. carriers, lights) with an aluminium frame. The identifier can easily be mistaken for another kind of bicycle (iron, carbon, titanium or wood) making the composition unclear. This heterogeneity can be compared to the price heterogeneity in Input–Output (IO) tables. [14] 'The conceptual core of the different results that arise from physical or extended monetary input–output models lies in the assumptions, explicit or implicit, about unit prices. [15]

Adding to the importance of mass balance and materials composition is a new focus on improving the material and resource efficiency of our economies, transitioning toward a more circular economy with a central role for dematerialisation, improved recycling, substitution of primary materials with secondary, etc. [16–19] This brings to the fore the need to account for the material dimension. Aluminium, for example, is often mixed with other materials to provide the desired mechanical properties, causing difficulties in recycling aluminium with high purity, frequently leading to downcycling. [20] The quality of streams and their exact composition thus becomes a crucial property. For this reason and to gain credibility, the LCA database needs to be consistent with mass and elemental balance, converting it to a material flow analysis (MFA) database.

A single process cannot be rebalanced without impacting the mass balance of other processes in its value chain. A change in the composition of a product leads to changes in the processes that consume that product, or the ones that supply its inputs. Since the entire technosphere (the part of the environment that is made or modified by humans) is inter-connected and no activity can produce products without the help of others, an optimization problem forms. This optimization will require all activities in the LCA database to be mass balanced while diverting as little as possible from the original data and the defined content of the flows they interact with. In other words, a constrained optimization is needed to find reconciliation between MFA and LCA system descriptions. Therefore, in this project, an algorithm was developed in python to semi-automatically optimize the content of products.

This is made possible by an update of the ecoinvent database (the principal database in life cycle assessment) to version 3. The transition to version 3 introduced unallocated process descriptions, following a Supply and Use Table (SUT) structure (discussed in section 2.4) enabling this optimization. [21]

This project will try to identify imbalances in the ecoinvent LCA database by requiring every process to be mass (and element) balanced, keep the composition of flows as close as possible to the original estimate value, and suggest solutions for the different problems identified, converting the LCA into an MFA database.

In the next section, a literature review on the used methods, databases and gaps in them will be presented, followed by the problem statement and objectives. Section 4 will discuss the methodology used to achieve a more balanced version of the database before discussing the results in section 5. Finally, a conclusion is formed and future recommendations given in section 6.

CHAPTER 2 LITERATURE REVIEW

2.1 Life Cycle Assessment

2.1.1 Overview of the standard method

Life cycle assessment (LCA) is a methodology that assesses impacts of activities and products on their complete life cycle. A complete life cycle consists of all the processes, from the production of a product to its end-of-life, required to fulfill a function. In contrast to other methodologies [22,23], LCA thus not only takes direct but also indirect impacts into account. A furnace is not only rated on the amount of electricity it uses during its use phase but also on the materials it is built from, their end-of-life, the equipment needed to build the furnace and so on. By doing this, LCA aims to empower a real reduction of impacts, avoiding underinformed, unintended impact displacements. A life cycle assessment consists of 4 stages: Goal and scope definition, Inventory analysis, Impact assessment and Interpretation. These stages are represented in figure 2.1. By assessing the complete life cycle, impact replacement from one stage to another does not affect the results, and all impacts, direct and indirect, are included in the assessment.

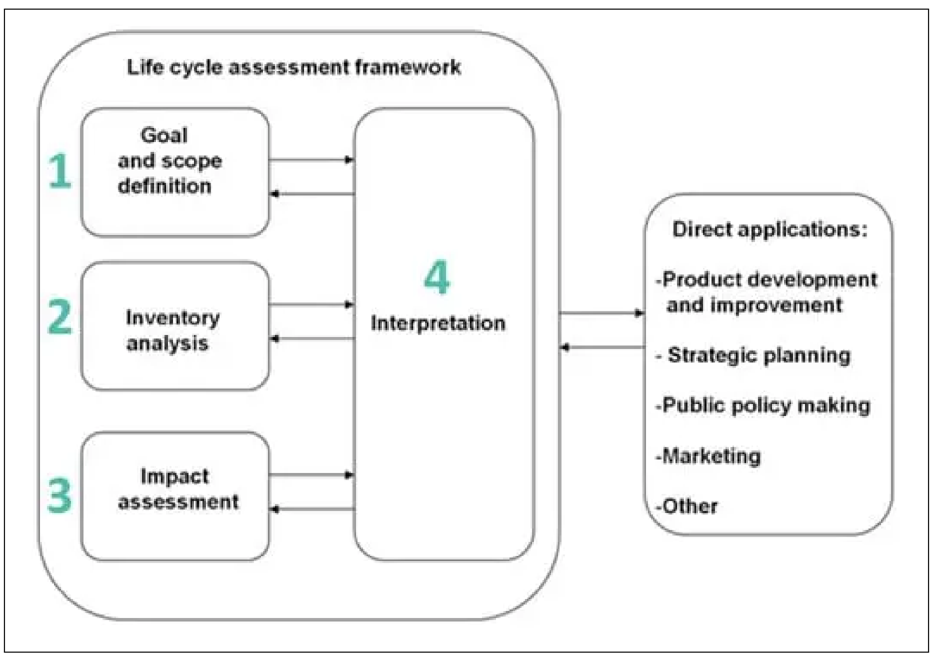

Figure 2.1 The four life cycle stages representing the LCA process. During the interpretation stage, feedback for the other stages is gained resulting in multiple iterations [1]

LCA is standardized in the ISO14040 and ISO14044 norms, describing its 4 stages [24, 25]:

1. The goal and scope definition phase: In this stage, the reason why the study is conducted is explained as well as the intended application and audience. Key parameters like the product system, functional unit, system boundary, allocation procedures, data requirements, assumptions, and limitations are defined. Of these key parameters, the functional unit is the most central in defining the study, giving a reference for which two activities can be compared. A fitting functional unit could be "the production of 100 kWh of electricity in Montréal in 2021" for the comparison between different electricity producing technologies.

2. The inventory analysis phase: During this phase, all the necessary data is collected and the relevant inputs and outputs of a product system are quantified in the life cycle inventory (LCI). At the end of this phase, the quantity of elementary (flows to or from the environment) and economic (flows between processes) flows to satisfy the functional unit is calculated. This phase usually involves the use of a database in which most of the activities and their flows are already defined.

3. The impact assessment phase: This phase converts the elementary flows calculated in the previous phase to impacts on the environment. These impacts are divided into several so-called “midpoint” impact categories like climate change, ozone layer depletion, freshwater eutrophication etc. [3] These midpoint impacts then contribute to damaging things that are valuable to humans, wich are captured in “endpoint” impacts: damage to Human health, Ecosystem quality and Resources & ecosystem services. The endpoint categories are easier to understand since they combine all the midpoint into a mere three categories, but greater uncertainty is tied to the results in endpoint than the results in midpoint categories.

4. The interpretation phase: The obtained results are analyzed and a conclusion is formed, with recommendations for further research and to guide decisions. It is very rare that one process is better than another for all impact categories. The result will thus depend on the relative importance of the impact categories to the stakeholders and decision makers.

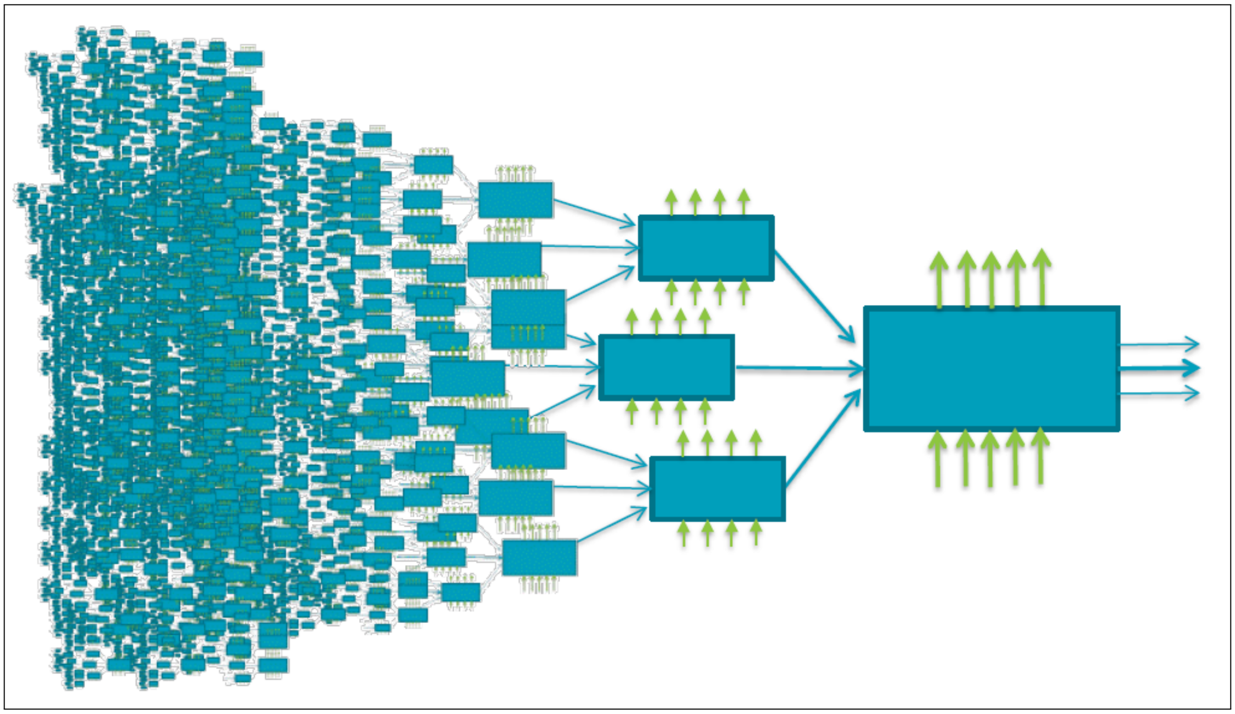

Figure 2.2 The background processes (left) that are needed to fulfill the functional unit (rightmost bold arrow). Every box represents a process, vertical arrows represent interaction with the environment (i.e., elementary flows: natural resources entering and emissions leaving every process) and horizontal arrows represent flows inside of the economy from one process to the other. The non-bold economical flows coming out of the rightmost process represent potential by-products and waste flows that are produced alongside the functional unit. The figure represents a complete product system [2]

During the goal and scope definition, the boundaries of figure 2.2 as well as the reference flow (100 kWh of electricity), fulfilling the functional unit, (middle horizontal arrow) coming out of the rightmost process (box) are defined. During the inventory analysis phase, all other boxes and their connecting flows are defined as well as the elementary flows (vertical arrows) for each box. The vertical arrows coming out of the box are emissions (CO_2, particulates, ...) and the ones going in are resources (Iron in ground, sand, ...) . The magnitude of these flows is scaled to fulfill the functional unit and thus the reference flow. In the impact assessment phase, the impact of the consumption of resources and emissions are calculated using a framework, as illustrated in figure 2.3. Using midpoint (problem) or endpoint (damage) level indicators, different for each impact category, the impacts are expressed in terms of human health, ecosystem quality and resources ecosystem services. The indicators are calculated using fate, exposure, effect and damage factors. The fate factor determines the quantity of pollutant reaching the environment after an emission occurred. The exposure factor relates this quantity in the environment to the amount that is taken in by an organism. The effect factor then calculates the potential effect of this intake, after which the damage factor deduces the potential damages of these potential effects. There are several impact assessment frameworks with different characterisation factors, indicators and results. These impact assessment frameworks are used in combination with a life cycle inventory like the ecoinvent database, the focus of our research. The last step in an LCA is the interpretation of the results. During this step, an answer on the initial question to compare two products or services or reveal the most impacting life cycle stage is formed. Then, sensitivity and uncertainty analyses are performed to assess the robustness of the results, which hypothesis or uncertainties have the most impact on the result and what is the uncertainty of the result itself. Since LCA is an iterative process, the first interpretation phase rarely gives the end result. It is often used to change the impact method, complete the inventory or adapt the functional unit.

There can be different reasons to conduct an LCA. An LCA can identify the alternative with a lower impact in a comparison based on a functional unit or identify the hot spot, the most polluting process, in a system. For both cases, consequential (CLCA) or attributional (ALCA) LCA can be used to quantify the impact [26]. In ALCA, a stable, fixed situation on which the choices tested during the LCA do not have any impact is analysed. Contrarily, CLCA takes the consequences of choices made during the LCA process into account, hereby including indirect impacts these consequences can generate. Economical and social LCA [27,] gain importance in the field as well, allowing the assessment of a sustainable economy on other than environmental scales.

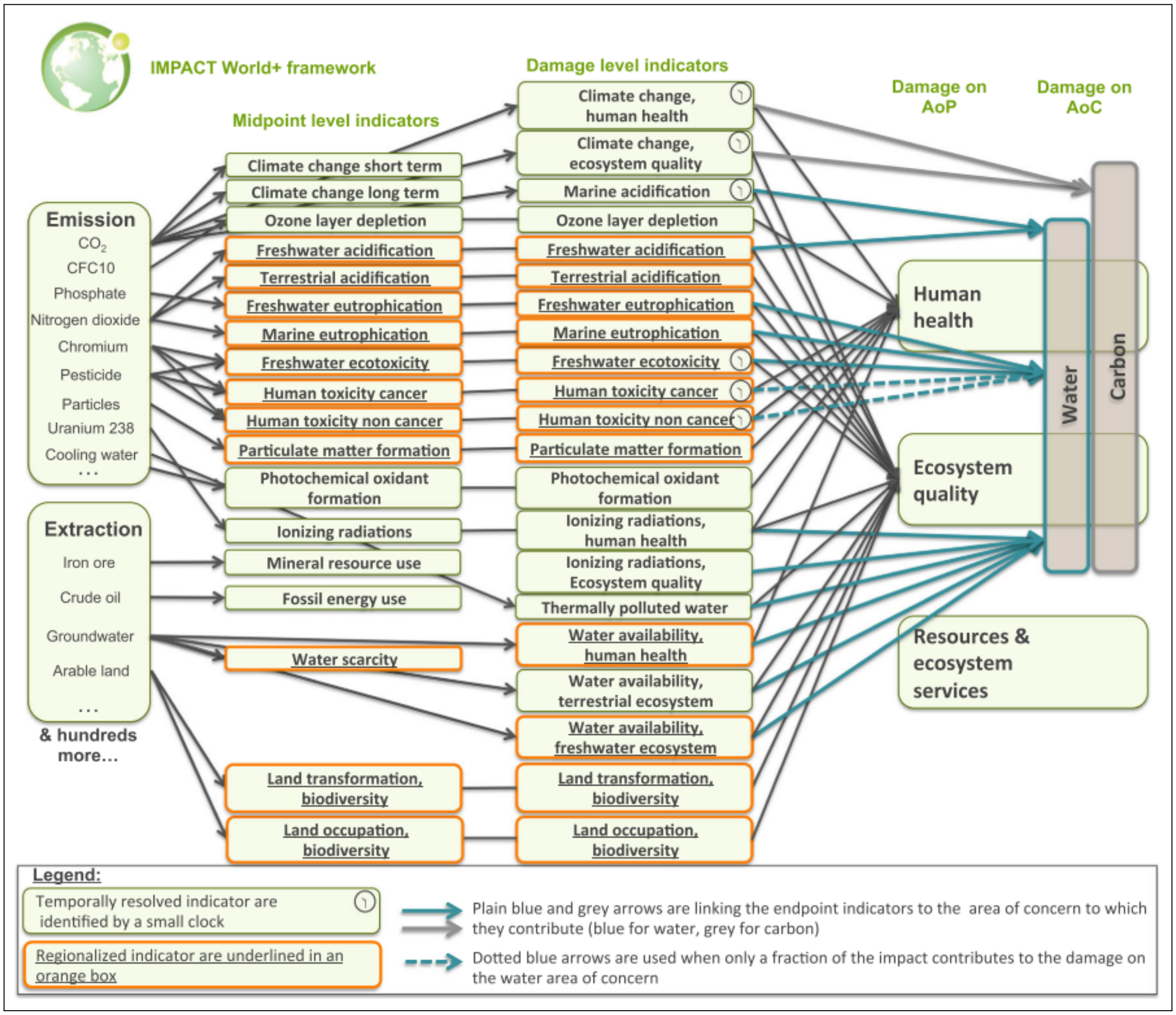

Figure 2.3 The characterisation of impacts in the IMPACT World+ framework. Emissions and extractions are converted into impacts through characterization factors. These impacts can be midpoint or endpoint level and are combined into three area of protection [3]

Figures 2.2 and 2.3 describe the steps that are subject to the most research in the LCA field, building the LCI and calculating the impacts of this inventory. They are described in section 2.1.2 and 2.1.3 respectively.

2.1.2 LCI calculation

The life cycle inventory includes an overview of the quantity of elementary flows that interact in a direct or indirect manner with each activity. Its calculation relies on two matrices where each column represents an activity and each row represents a product or elementary flow, respectively. An activity using 10 kg of reinforced steel per unit of output will have a coefficient of 10 in its column, on the row which represents reinforced steel. The matrix which represent all the normalized economical flows (arrows connecting the different boxes in figure 2.2) is matrix A. A fraction of a factory, transformed materials like reinforced steel or tomatoes, and a fraction of a machine or barbecue are all possible economical flows. The matrix which represents the elementary flows (vertical arrows representing resource uptake and emissions in figure 2.2) is matrix B. Iron in ground, extraction of wood, water well in ground and emissions like SO_2 to air, aerosols to air, oil to water and dissolved solids to water are possible elementary flows.

During the LCI calculation phase [24], the inventory needed to fulfill the final demand vector y is determined. This final demand vector contains the reference flow, which realizes the functional unit. Furthermore, y is the foreground process specific to the LCA where matrices A and B indicate the background processes, found in databases, needed to fulfill this final demand.

2.1.3 Calculation of impacts

After quantifying all products and elementary flows that are needed to produce the reference flow, their impacts, q, can be calculated. The calculation of q depends on the characterisation factors, defined in matrix C. These characterisation factors are, as mentioned before, calculated through the fate, exposure, effect and damage factors and characterize the impacts of the flows defined in the A and B matrices in different impact categories. The characterisation factors are needed because an emission of 1 kg of CO_2 does not have the same impacts as an emission of 1 kg of CH_4.

2.1.4 Equation and matrix representation

The LCA results can be calculated using the following equation [29]:

$$\mathbf{q}^{LCA} = \mathbf{C}^{LCA} * \mathbf{B}^{LCA} * (\mathbf{A}^{LCA})^{-1} * \mathbf{y}^{LCA} \tag{2.1}$$

Where $\mathbf{q}^{LCA}$ represents the impacts (expressed in eg. CO_2 equivalent, disability adjusted life years (DALY) or potentially disappeared fraction of species (PDF)), $\mathbf{C}^{LCA}$ the characterisation factors (converting emissions to impacts), $\mathbf{B}^{LCA}$ the elementary flows (flows to and from the environment), $\mathbf{A}^{LCA}$ contains the economical flows (flows to and from other activities) and $\mathbf{y}^{LCA}$ the functional unit. An example of the inventory of the production of an aluminium bike is shown in figure 2.4.

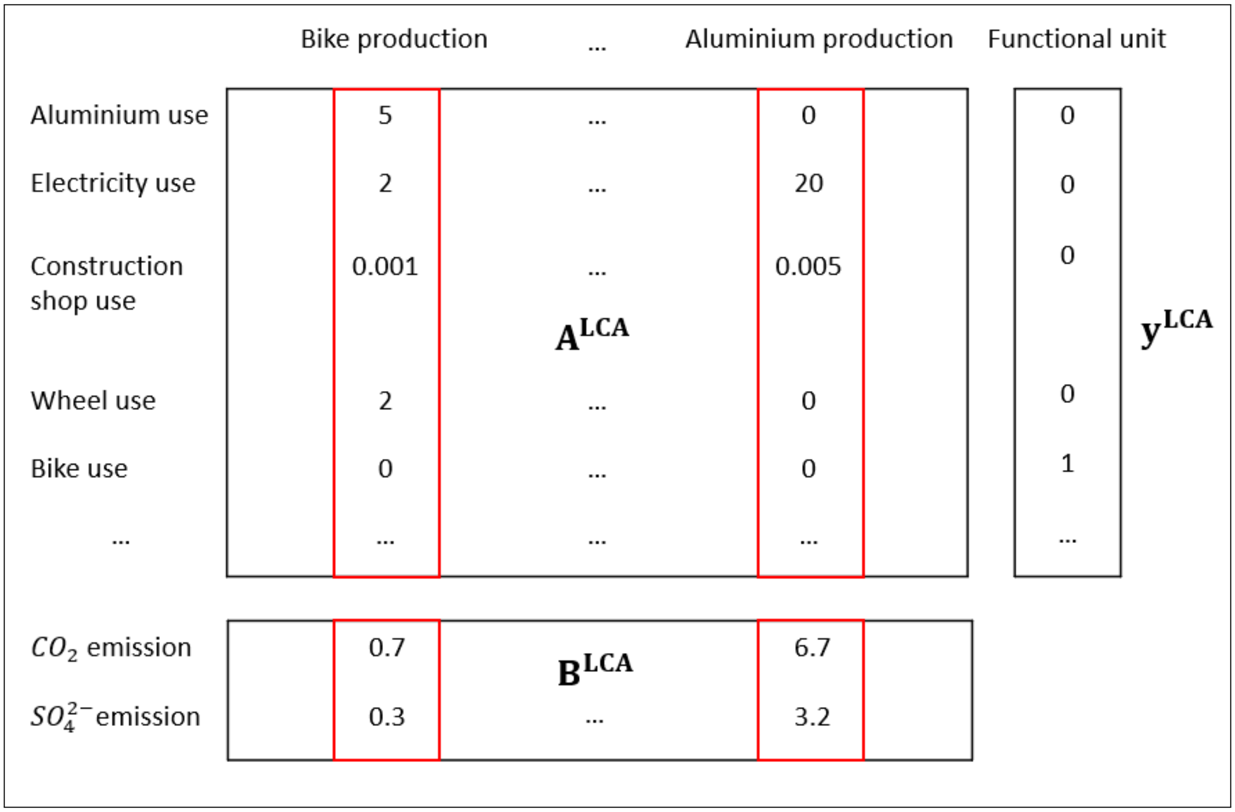

Figure 2.4 Visual representation of the A, B and y matrix used in an LCA process. The reference flow is a bike, which is produced in the A matrix using different products that have to be produced in their turn and emit emissions which are indicated in the B matrix

As the figure illustrates, the flows defining the different activities are all part of matrices $\mathbf{A}^{LCA}$ and $\mathbf{B}^{LCA}$. To mass balance each activity, the flows interacting with it should be balanced. This project will thus focus on the $\mathbf{A}^{LCA}$ and $\mathbf{B}^{LCA}$ matrices to verify if mass balance is respected within.

2.1.5 Research frontiers in LCA

Recent research efforts in LCI include completing the database through hybridization with IO tables [30] and the transition of ecoinvent version 2 to version 3. Version 3 introduced regionalization of processes and parametrization of products which enables the validation through mass balance and calculation of product composition [21]. These research efforts came in response to the data accumulation problem in sustainability research [31] and the long standing ambition to mass balance LCA [9,32]. Furthermore, data consolidation between LCA, MFA and SUT is needed. [33]

Other LCI databases include the internally consistent but smaller and paying GaBi database

[11], the even smaller but publicly available US LCI database [13] and the ESU LCA database which focuses on food [12]. The GaBi database consists of 100% rolled-up LCI inventories for which the unit-processes are not shared with the user, and is therefore not sufficiently transparent for an analysis of its mass conservation. Our project will focus on ecoinvent since it is widely considered as the main LCI database which models processes throughout the whole economy and we have open access.

On the impact calculation side, new characterization factors have been proposed and implemented through the IMPACT World+ framework [3]. Other developments include, for example, the development of new characterization factors for marine litter impacts with a focus on plastic [34].

In conclusion, LCA is a useful tool to accurately quantify impacts of specific processes. Made possible through adjustable databases and open-source software (like openLCA and SimaPro), enabling easy calculation of complex processes. Processes defined in the databases already represent a big part of the economy and more are added continuously. LCA does however also have some weak points. The results depend greatly on the hypotheses made. Although being great for specific impact calculation, LCA is weak at estimating impacts for big process systems because it assumes linear scaling for the economy. Allocations and imbalances also contribute to these weak points. To solve the imbalances, MFA will be introduced and discussed in the following section.

2.2 Material Flow Analysis

2.2.1 Overview of the standard method

Material flow analysis (MFA) aims to track the extraction, circulation, accumulation and dissipation of materials, with the overall aim of enabling a more efficient use of these materials [35], and thereby a reduction in our extraction of natural resources and in the emissions linked with these materials' transformation. The core principle of MFA modelling is the conservation of mass and of the different (non-radioactive) chemical elements.

There are different kinds of MFA's, some studies [36–38] follow mass as a whole, as it circulates through society, to use as an indicator of economic throughput or a level of circularity. Other studies follow specific substances (typically chemical elements) as they are transferred, accumulated and dissipated in society [39–41]. Other applications are the identification of critical flows for industrial sectors, the metabolism of regions or firms and the throughput of countries. Where MFA is either applied to one particular flow [42] or the whole economy [43].

By conducting an MFA, each process is required to be mass balanced in terms of their flows.

MFA is a dynamic tool that depends on time and place. The temporal dimension is added due to stocks that can be built or used over time to satisfy the material balance. The spatial dimension comes into play because the access to materials depends on location. The flow of Nickel and Tungsten over time are for example accurately described in [40] and [41]. MFA can describe a complete system by calculating the material balance in a stock, input or output driven way. It can even predict stock dynamics by taking the durability, recycling and extraction of materials into account. Coupled with a prediction of the future demand, it can predict future flows and availability. An example is the prospective estimate of emissions due to the aluminium stock dynamics, described in [39].

An MFA is conducted in 2 steps:

1. The system definition: In this stage, the system and its boundaries are defined. Questions like which processes and substances are involved, are answered during this stage. Because of the abundance of distinct MFA's, this stage needs to be clear to avoid confusion in later stages. An example of a system definition would be 'the amount of steel flowing into and out of the Canadian economy'.

2. The process balance: The material balance is constructed during this stage. Once the system and its boundaries are defined in the previous stage, the process is required to be mass, material and/or element balanced. The different flows and their composition get quantified.

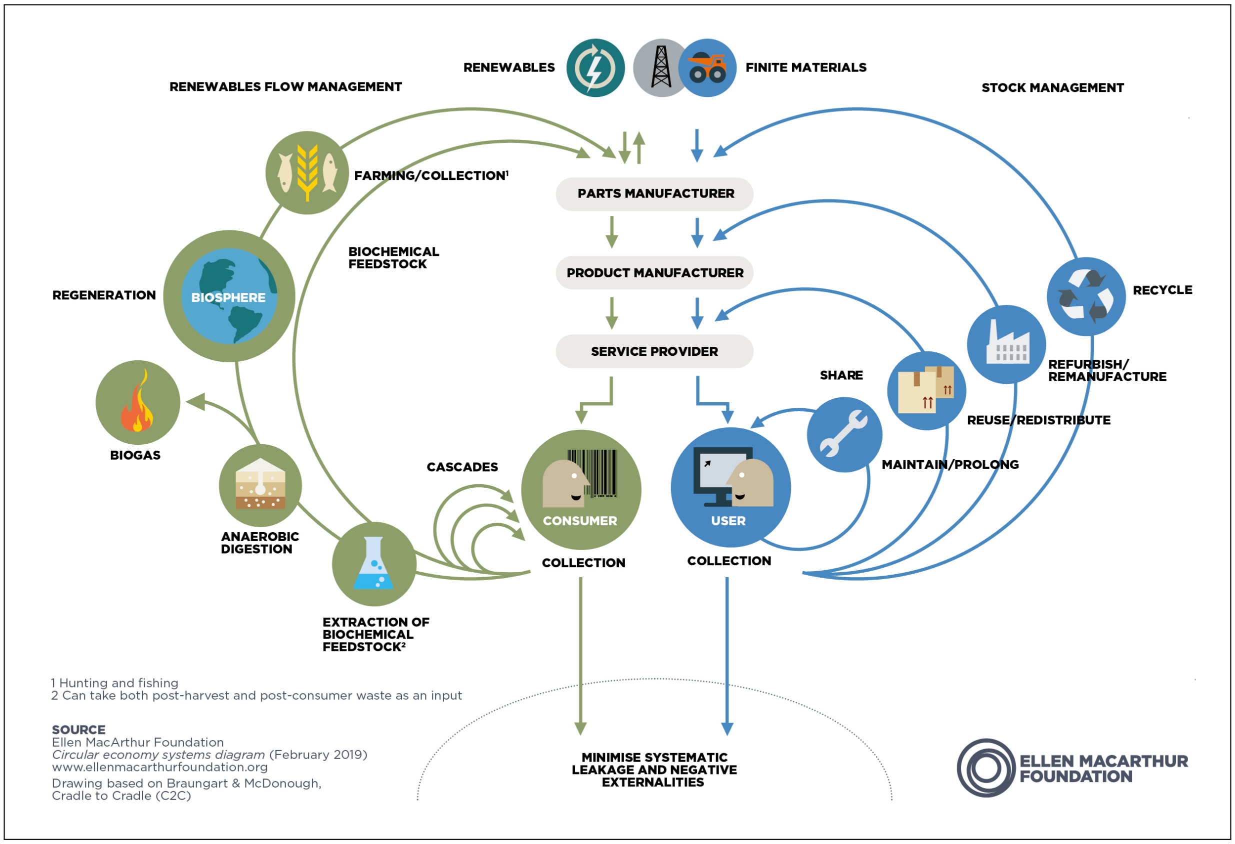

Figure 2.5 Representation of the desired continuous flow of materials in a circular economy. The left side represents the flows interacting with biosphere and the right those interacting with the technosphere [4]

2.2.2 Research frontiers in MFA

To diminish the impact we have on our surroundings, our society has to evolve to a more sustainable version of itself. One of the widely proposed examples for this sustainable version is a circular economy. As illustrated in figure 2.5 where, on the left side, the biosphere and on the right, the technosphere interactions in a circular economy are represented. A circular economy aims to minimize the waste of all processes by sharing, prolonging the lifetime of, reusing, remanufacturing or recycling materials. MFA is a key tool to validate these material flows, calculate impurities and predict downcycling where these flows cannot be achieved, as shown in [16–18, 44] and [39]. MFA can also track substitutability of one material by another, further specifying material interdependencies and recycling opportunities, as shown in [19]. It proves where a transition to a circular flow is impossible.

One of the weaknesses of MFA is the lack of a central database. Each MFA is built for a specific process and has to start from scratch, contrary to LCA [45]. MFA focuses on material flows and lacks a direct connection to the environmental impacts of these flows because causal links that lead to impacts do not include a material flow (eg. electricity consumption). MFA is therefore complementary with LCA. MFA aims at empowering gains in material efficiency, but to translate what these gains mean in terms of environmental impact, we need a lifecycle perspective.

2.3 MFA in LCA

Because of the mass balance issues and augmented interest in the material dimension in LCA, discussed in section 1, a primitive form of MFA in which space and time are not taken into account needs to be implemented. Some issues, like the imbalances caused by allocation because of multifunctionality [8], cannot be fixed by requiring mass balance. When calculating the impact of cow milk, it is unclear which part of the total impact of the cow should be attributed to the milk, meat and hide. In attributional studies, allocation necessarily introduces imbalances because of the deliberate fiction modeled to cope with multifunctionality. In this case, we are tracking responsibility for impacts which does not necessarily follow mass or elements, but potentially economic value. Consequential studies on the other hand would, ideally, not introduce imbalances but in practice they do when products with differing compositions substitute one another and the receiving processes do not adjust their flows due to lack of parametrisation. Prior to allocation, however, the raw process description with its multifunctionality in place in the Supply and Use Tables (SUT) should at least be mass balanced. The previous sections underlined the complementarity of MFA and LCA and described a knowledge gap in both domains which can be filled by their symbiosis in this project.

The implementation of mass balance for this project will take place for the $\mathbf{A}^{LCA}$ and $\mathbf{B}^{LCA}$ matrices thus including all flows going in and out of activities. All flows will be accounted for and their composition in terms of elements estimated. Due to the nature of these matrices, the temporal and spatial dimensions of MFA will not be used. The temporal dimension will not be used since these matrices do not have any stock building up as will be explained in section 2.4. The spatial dimension is not taken into account either because of the aggregation in SUT, as explained in section 2.4.

2.3.1 Typical implementations

There are multiple articles combining MFA and LCA [46–48]. These articles do however only use MFA to calculate the quantities for the inventory, after which LCA is used to translate this inventory into extractions, emissions and eventually impacts. They thus consist of a sequential use of MFA and LCA without integrating the mass balance principle into the LCA database. This leads to inconsistency in their calculation approach since mass balance is strictly required for the MFA stage after which the results are used in LCA which itself is not mass balanced. The additional effort put into calculating the MFA is, afterwards, (partly) negated by the imbalances in the LCA phase.

2.3.2 More consistent implementations

Some implementations of MFA and LCA are consistent in terms of mass balance. These are often waste LCA's where the part specifically constructed for waste management is mass balanced, but the more upstream part depends on ecoinvent and therefore fails to respect mass balance. An example is the EASETECH model described in [49], where the first of five layers in the model will define the material fraction in terms of chemical composition and fraction-specific parameters which is maintained throughout the model. The second layer then uses this data in combination with the LCI data to quantify the emissions and resource consumption. If this LCI data is collected from ecoinvent without any modifications, mass balance might not be respected. The EASETECH model then further evolved to be less dependant of ecoinvent, using a process-oriented modelling framework to perform a complete MFA from resource extraction until end-of-life, including interactions between materials and transformation of substances, described in [50].

2.4 Ecoinvent database structure

This project will focus on the ecoinvent version 3.6 database. It is the principal LCA database consisting of 16640 datasets. These datasets each describe an activity, giving its id, name, classification, geography, technology, time period, macro economic scenario and flows it interacts with. By providing the flows activities interact with, the activities get linked with other activities to form supply chains. These supply chains can then be used to calculate the impact certain activities or products have on their environment [21].

One major change of version 3 compared to the previous versions is the existence of a single identifier for each product. With the aim 'to more easily identify activities with the same product as output.' [21]. By doing this, products got more aggregated when similarly named products with different composition should have gotten a different identifier. This step led to more market heterogeneity when it could not have if performed properly. Another major change is the introduction of unallocated process descriptions, following a Supply and Use

Table (SUT) structure [21] enabling validation through mass balance.

Some datasets are build specifically to represent an accurate supply chain. These are called market datasets. Since multiple activities across different geographies can produce the same product, these market datasets generate product mixes that are consumed by activities in various regions. To have an accurate product mix, market datasets bundle the activities that produce the same product into a single supply chain, based on the geography in which they are used. Transport and corresponding losses and emissions are also taken into account in these market datasets. An average value for the contribution of each supplying activity is used where a specific market dataset should be defined for each consuming activity of each product to have an accurate supply chain and a negation of the market heterogeneity problem.

Why is there a dependance of market datasets on geographical location? Because one of the describing parameters of an activity is the geography in which it is performed. There are 476 different regions defined, going from countries to continents or RoW (Rest-of-World). These regions are defined because the in-and outputs of activities depend on their region. Electricity is, for example, produced differently in different countries and thus also has a different impact. The database therefore necessitates the implementation of different regions for which the activities and product mix can be defined differently.

Different properties are defined for different flows (eg. mass concentration, iron; iron content; dry mass; wet mass). These properties characterize the content of the flows but are only sparsely defined. They do however form a great starting point for a rebalancing algorithm, benchmarking some compositions.

When trying to visualize this database with all its features, some simplifications need to be made. Figure 2.2 visualizes the aggregation of different activity datasets to form a product system. An example of this system can be manufacturing an electric car where the box most to the right is the final assembly of the electric car (rightmost arrow). This is made possible by the column of boxes before which are battery manufacturing, frame manufacturing and the use of an assembly facility which are in their turn made possible by a battery assembly facility, a lithium mine and electricity production for the battery manufacturing, and so on. All these activities (boxes) also use elementary flows (extracted immediately from their environment), represented by the arrows coming in from the bottom and produce emissions (elementary flows to their environment), which are the arrows going out from the top.

The datasets can be ordered into matrices, called Supply and Use Tables (SUT's) which are clearer to work with than the aggregated datasets since all information is centralized in 3 tables. This transformation can be performed since we are using the unallocated (the activities are not linked together in product systems) form of ecoinvent because allocations do not preserve mass balance [14]. We will go through these tables as the materials flow through the processes and using the production of a bicycle as an example. First, there is the use table (U) whose rows are products and columns are activities. U describes how much of each product is used by each activity. It thus quantifies the amount of material that flows into the activity. For the bicycle, a frame, a saddle, two wheels consisting of tires and rims and a handlebar will enter. Next, the supply table (V) quantifies the amount of each product that is supplied or produced by every activity. V quantifies the amount of material that flows out of the activity. Like U, V has products as rows and activities as columns. For the bike example, the produced product is 1 bike. The third and last matrix is the elementary flow matrix (F). It quantifies the amount of elementary flows going in to and coming out of every activity. F has elementary flows for rows and activities for columns. The direct emissions of the production process of the bike will be described in this table as well as the direct consumption of, for example, wood as a packaging material.

Through the application of [51], the ecoinvent datasets get converted to SUT's by aggregating activities for different locations (the transformation is explained in section 4.2.1).

After aggregation, there are 4318 elementary flows, 3205 economical flows (or products) and 16561 from the original 35708 activities left. All these activities have been defined manually by people all around the world and checked by a select number of ecoinvent employees. Despite this review process, some mistakes are still caused by the shear size of the database in combination with human nature.

2.5 Balancing algorithms

Because the connected nature of our economy, no one process can be changed without influencing others. For our material rebalancing, the composition of each flow should thus be calculated simultaneously. Resulting in a constrained optimisation problem. The literature [52–57] describes different balancing techniques which can be split into two kinds. The first can be described as RAS-type with a straightforward algorithm and a more difficult objective function. The second kind, quadratic or linear programming, consists of a complex algorithm but easier objective function. [58]

CHAPTER 3 PROBLEM STATEMENT AND OBJECTIVES

3.1 Problem statement

As explained in the previous section, mass imbalances are present in the ecoinvent LCA database. They are present due to market heterogeneities, the shear size of the database, and the focus on linkage between processes rather than on the composition of the flows. On the other hand, MFA lacks a central database to build upon. The combination of both methodologies can form a symbiosis due to their complementary nature.

3.2 Objectives

The objective of this thesis is to pave the way for an integration of life cycle assessment and material flow analysis databases, i.e. to put forward a practical approach to document the material dimensions of the LCA flows efficiently and resolve any material imbalances in the ecoinvent database.

This objective is split up into different sub-objectives:

1. Characterize and identify the different types of imbalances in the ecoinvent 3.6 database and their causes, along with their occurrences.
2. Develop an opensource rebalancing algorithm which is efficient, transparent and reusable.
3. Illustrate the application of the developed algorithm by rebalancing the ecoinvent database for 1 element (Iron).
4. Develop the approach to generalize the algorithm for all elements and contributors to mass.

CHAPTER 4 METHODOLOGY

Due to the small number of products with a predefined iron content, the mass imbalances cannot be identified before an algorithm is developed which tries to determine the composition of all products by balancing all activities. The rebalancing algorithm was developed with different variations for three different phases. In phase 1, only the composition of flows can change where in phase 2, the magnitude of the flows can change and in phase 3, missing flows can be added. These phases are further explained in section 4.2.4.

4.1 Strategy

To achieve the objectives set in section 3, the LCA database should be transformed to an MFA database. We will try to achieve this for iron by requiring every activity in the SUT to be balanced and for the iron composition to deviate as little as possible from an initial guess. This approach assumes that the total magnitude of all flows in the SUT are correct and none are missing, making every activity balanceable by adjusting the iron concentration of the flows. In its simplest form, this approach also assumes that products to not require disaggregation (no excessive market heterogeneity), and that the bounds defined on the iron content of every product are accurate. The parameters that are needed for rebalancing (equation 4.1) are described in table 4.1.

Table 4.1 Parameters used in the objective function and constraints

λ	Final, balanced product iron content
λ^0	Initial product iron content
λ^f	Elementary flow iron content
ef	Elementary flows
U	Use table
V	Supply table
F	Elementary flow table
min	Minimum bound for the iron content per product
max	Maximum bound for the iron content per product

$$
\begin{aligned}
\underset{\lambda}{\text{minimize}} \quad & \sum_{p \in products} \left(\frac{\lambda_p - \lambda_p^0}{\lambda_p^0} \right)^2 \\
\text{subject to} \quad & \sum_{p \in products} \lambda_p \left(V_{p,a} - U_{p,a} \right) + \sum_{e \in \text{ef}} \lambda_e^f F_{e,a} = 0, \\
& \quad \forall a \in activities, \\
& min_p < \lambda_p < max_p \quad \forall p \in products
\end{aligned}
\tag{4.1}
$$

Equation 4.1 describes the minimization of the relative difference in iron content between the final iron content and the initial guess for every product. The first constraint requires every activity to be balanced in terms of iron. The iron that leaves minus the iron that enters for every products the activity interacts with plus the iron that is exchanged by the elementary flows should be equal to zero for every activity. The second constraint requires the iron content to stay in between the predefined bounds. Our approach thus consists of a quadratic objective function subject to linear constraints. The objective function is based on the normalized squared difference method which is frequently used to update input-output matrices [59]. Complete rebalancing of ecoinvent is more complicated and does not follow the assumptions made above due to a range of issues (scaling, database inconsistencies, etc.). The following section strives to have a systematic algorithm to implement this strategy despite all the hurdles encountered.

4.2 Rebalancing algorithm

The algorithm is included in appendix A and gets called in a jupyter notebook, added in appendix B. An overview of the algorithm is given in figure 4.1. The algorithm will try to balance each activity by adjusting the content of the products interacting with it while extracting the maximum amount of data that has been defined in the database. In other words, the flow chart aims to implement the maximum amount of available data. The steps inside of the red box are called and performed in the jupyter notebook. The steps inside the green box are imported from manually produced csv files. All steps are explained below and some are divided into multiple sub-steps. These will get their own flow chart with a number referencing to the step in figure 4.1 they explain.

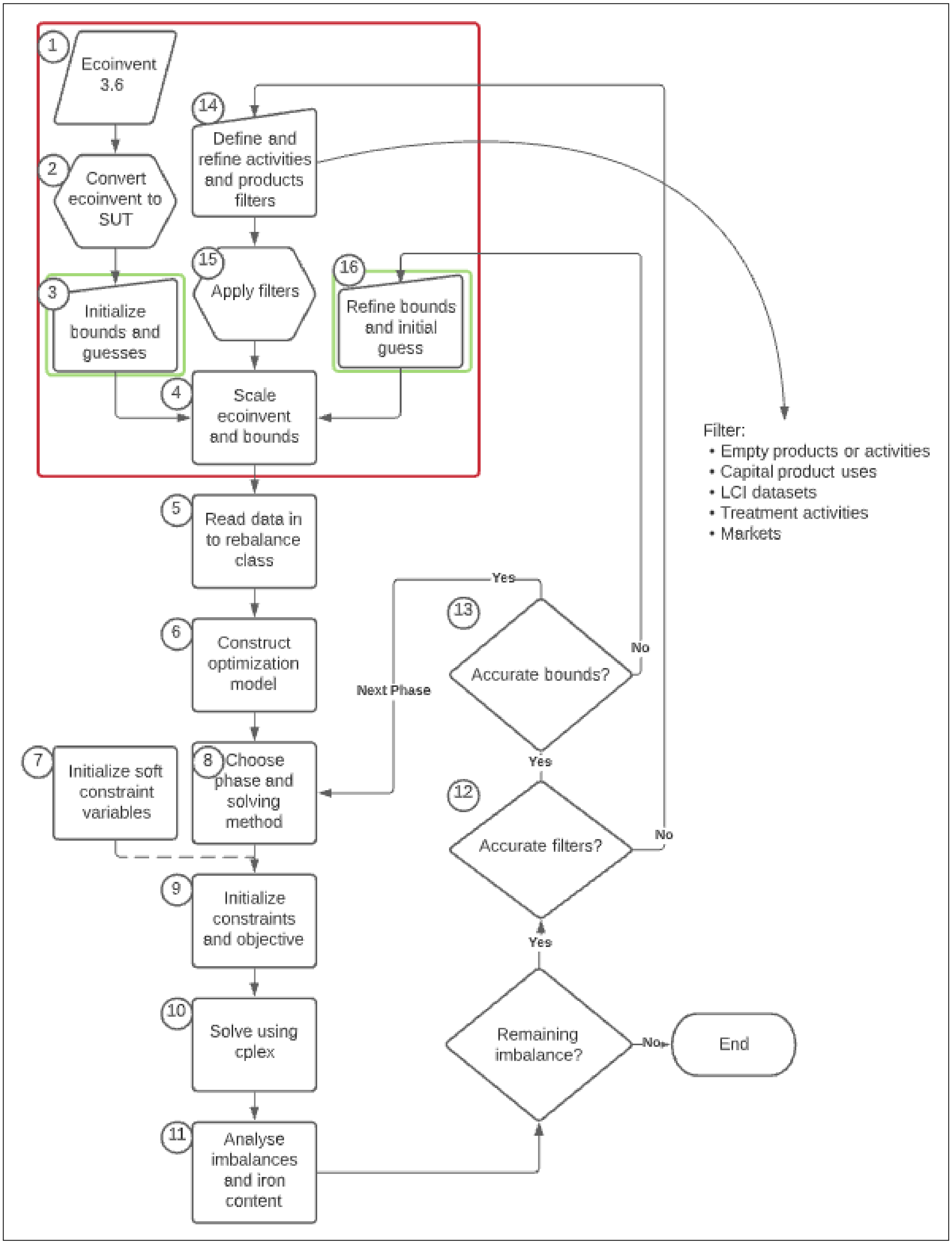

Figure 4.1 A flowsheet of the iterative application of the algorithm to rebalance the Ecoinvent 3.6 database. Starting at Ecoinvent 3.6 and (hopefully) ending without imbalances at the end. The filters are presented and several boxes are split up in the following figures

The algorithm has seventeen different steps. The first four can be described as data preparation. After which the data is read in (5), the model constructed (6) and the solving method chosen (8). Then, depending on the solving method chosen, soft constraint variables (7), constraints and the objective are defined (9) before solving (10). The last step consists of analysing the results (11) to adjust the input for the next run if balance was not achieved or contents were not accurately estimated. If there are no remaining imbalances, the algorithm ends and the results can be retrieved from an automatically generated pickle file. If, however, imbalances are still present, the activities with an imbalance are inspected (12) to assess if they should be filtered out (14, 15). If the activity should remain in the dataset that should be balanced, the bounds for the products interacting with the activity are inspected (13). If they are accurate, the algorithm will try to solve the problem in the next phase (leading to the iteration arrow leaving step 13, as explained in section 4.2.4) and refine them otherwise (16). The overall goal of the algorithm (in phase 1) is to fulfill mass balance for all activities, described in equation 4.2 (where ef stands for elementary flows and imb for imbalance) while minimizing the relative difference between the initial composition λ^0 and the resulting composition λ. The second term in the objective function minimizes the residual imbalances. For phase 2, the magnitude of the flows in U, V and F can change as well and are thus included in the objective function. In phase 3, all imbalances are solved by adding a waste or emission flow that was not but should have been included in the activity definition.

$$
\begin{aligned}
\underset{\lambda,\, imb}{\text{minimize}} \quad & \sum_{p \in products} \left(\left(\frac{\lambda_{i,p} - \lambda^0_{i,p}}{\lambda^0_{i,p}} \right)^2 + \sum_{a \in activities} \left(big * \frac{imb^+_{i,p,a} + imb^-_{i,p,a}}{totalflows_{i,p,a}} \right) \right) \quad \forall i \in elements \\
\text{subject to} \quad & \sum_{p \in products} \lambda_{i,p} \left(V_{p,a} - U_{p,a} \right) \left(+ imb^+_{i,p,a} - imb^-_{i,p,a} \right) + \sum_{e \in \text{ef}} \lambda^f_{i,e} F_{e,a} = 0, \\
& \quad \forall a \in activities, i \in elements, \\
& min_p < \lambda_p < max_p \quad \forall p \in products
\end{aligned}
\tag{4.2}
$$

4.2.1 Data preparation

Data preparation consists of all the steps needed to provide and transform the data to a suitable form before using it as inputs for the algorithm. The ecospold files are converted to SUT (2), the useful activities and products selected (14, 15) and bounds and initial guesses assigned and added (3, 16) before the data is scaled.

Ecoinvent to SUT

First, the ecoinvent database will be transformed to SUT using the `ecospold_to_sut` algorithm as mentioned in section 2.4. `ecospold_to_sut` is one of the functionalities of the `Ecospold2Matrix` class which can recast the unallocated Ecoinvent 3 data as SUT [51] and is publicly available on GitHub. This algorithm first stores and logs all relevant parameters before quality checks are performed and potential issues fixed. The unallocated data is then arranged as SUT and saved as a pickle. Duplicate entries are removed and flows are connected to their parent activity or a parent activity is generated. The results are pandas DataFrames which include, among others, the use, supply, elementary flow, activities and products matrices which will be rescaled in the next step. Through this conversion, we can apply our balancing algorithm on the SUT's by requiring each activity (column) to be balanced over the 3 matrices. This is possible since there is no temporal dimension in ecoinvent, as mentioned in section 2.3 and thus no stock build-up in the tables either. Landfills being an exception that only have inputs and thus a build up of stock. For the rebalancing, landfills will be excluded and waste flows will not have constraints for their composition since they will not be used by other processes and only accept waste.

Bounds and initial guesses

The complete bounds and initial guesses for iron for economical products (Iron) and natural resources (Iron_el) can be found in appendix D. The first column of the csv file gives the name of the product, the second whether or not the product is a capital product, the third the bounds for iron content, the fourth the initial iron content guess, the fifth whether or not the product is a heterogeneous product and should thus be disaggregated and the sixth column gives a comment in case the bounds or guess do not seem logical. For the natural resources, the three columns give the name, bounds and guess respectively. The bounds are defined between 0 and 1, designating 0 and 100 $m\%$ iron, if they are not defined, they are taken as 0,1 and give a range of possible iron contents to the rebalancing algorithm. The initial guess is a value within the bounds and serves as a starting point for the solver. It needs to be as accurate as possible since the solver will strive to minimize deviations from this initial guess.

Bounds
For each product in the database, an upper and lower possible content of the element to balance is manually initialized in the csv file in step 3 of the algorithm. They are later iteratively refined in step 16. The bounds are either 0,0 if there is no content of the element in the product possible and 0,1 if the element can be present in the product but the composition

is unknown. For some products, more specific bounds can be given if they are known or after analysing the results from a solve. The bounds get attributed to a product following the flow chart shown in figure 4.2. The bounds defined in the csv file are taken as default. If ecoinvent has an iron content defined for the product, the bounds are taken as 99% and 101% of this iron content unless the initial bounds were specified (not 0,1). In that case, the user receives a prompt where he or she can choose which bounds are taken, the ones defined in the csv file or in ecoinvent. If no iron content is defined in ecoinvent, we look whether or not a dry mass is defined for the product. If a dry mass is defined, the bounds are rescaled according to that dry mass. If not, the unit of the product is checked. If the product is not defined in kg, we check whether or not the unit can be related to kg through a physical principle. If it can be related, the unit is m^3, l or not a mass bearing unit, the bounds are rescaled with the density of the heaviest element (*22590 kg/m^3, *22.59 kg/l) or put to 0 respectively. The density of the heaviest element is used rather than the density of the actual product since there is no accurate data on the density of all products and to make sure the maximum bound is never too strict. If the unit is not relatable through a physical principle, accurate bounds are not obtainable and the bounds will be from 0 to infinity, leaving the algorithm to choose any suitable iron content for this product. If the product is expressed in kg, the bounds remain those defined in the csv file. The bounds of sponge iron will, for example, first be set as (0.8,1) following the input in the csv file. There is an iron content defined for sponge iron in ecoinvent so the user will receive the following question: 'Do you want to overwrite the iron content defined in ecoinvent for sponge iron from 0.82 to 0.8,1.0? [y/n]'. After answering this question with y (yes) or n (no) the bounds will become (0.8,1) or (0.99*0.82,1.01*0.82) respectively. On the other hand, the bounds for aluminium hydroxide factory will first be (0,1). There is no iron content or dry mass defined in ecoinvent for this product and the unit is 'unit', which is not relatable to a kg through a physical principle. The bounds for this factory will thus be (0,None), indicating that the iron content of this factory must be contained between 0 kg and infinity.

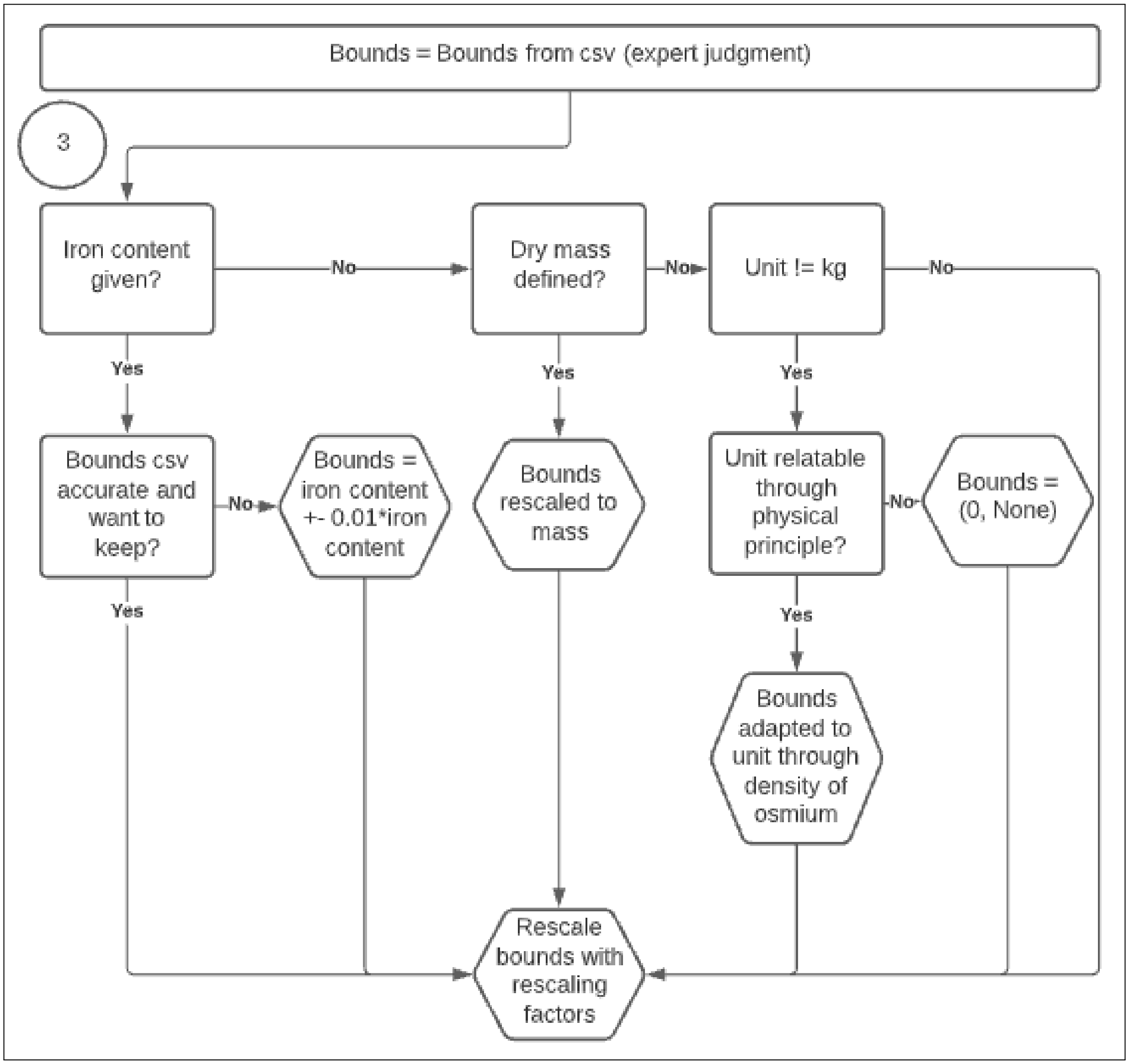

Figure 4.2 Bounds initialization flowsheet, starting from the bounds extracted from the csv and ending with more refined bounds, depending on the additional information available

For the elementary flows, bounds are defined in the iron_el csv file for all natural resources. Since elementary flows often consist of pure chemical elements, the bounds are either set to (0,0) or (1,1). Bounds for elementary flows that can have impurities are chosen to be (0,1). This is only the case for natural resource flows since the emissions are considered to be pure. Emissions that are not pure (aerosols, particulates, dissolved solids, inorganic solids and suspended solids) still have their iron content fixed to 0 because they represent small emissions in every activity.

Initial guess

For each product, an initial guess of the content of the element to balance is manually initialized in the csv file in step 3 of the algorithm. This guess is later iteratively refined in step 16. The guess is made on a m% basis and falls inside of the bounds. The guess is attributed to the product in a similar way as the bounds, following the approach shown in figure 4.3. The initial guess is first taken as the one defined in the csv file. If an iron content is given in ecoinvent, the guess will be changed to this defined iron content. If not, the uncertainty of the guess is assessed. If the guess is made with a high certainty (more than 3 significant figures), it is kept. Else, we look whether or not a dry mass for the product has been defined in ecoinvent. If it is, the guess is rescaled using that dry mass. If it is not, the unit is checked. If the unit is not kg, but relatable through a physical principle (m^3, l or not a mass bearing unit), the guess is adapted using the density of iron or set to 0. In this case, the density of iron is used rather than the density of the heaviest element to keep the accuracy as high as possible and because the initial guess is not binding. If the unit is not relatable through a physical principle or the unit is kg, the initial guess from the csv file is kept.

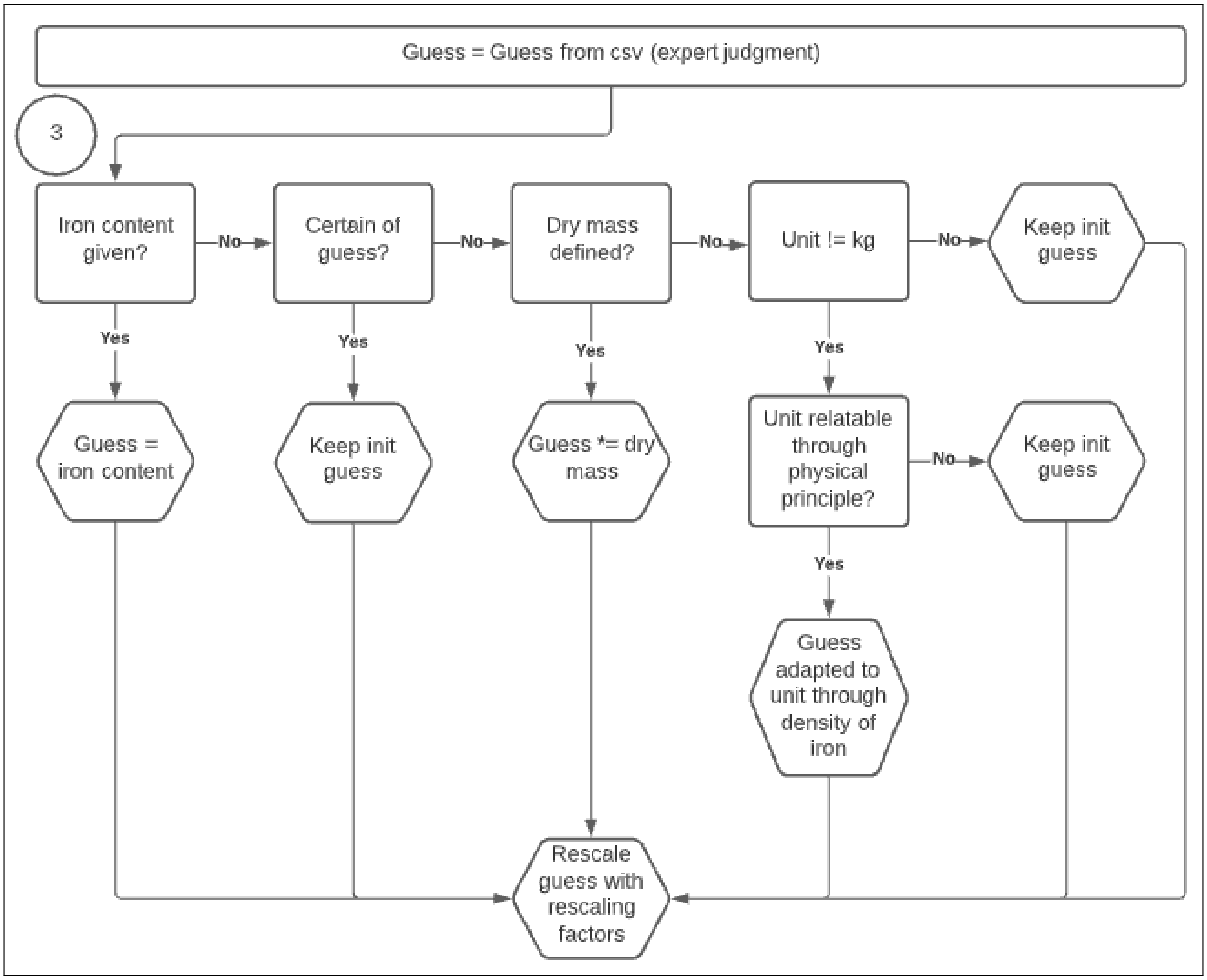

Figure 4.3 Guess initialization flowsheet, starting from the initial guess extracted from the csv and ending with more refined guesses, depending on the additional information available

The initial guesses of the elementary flows are initialized at 0, 1 or a specific value using the iron_el csv file and remain unchanged.

Filter activities and products

During the first iteration, all products and activities were taken into account. Analyzing the first results quickly led to the realization that not all activities and products should be taken into consideration or balanced. This led to the introduction of step 14 and 15 which are explained below.

Some datasets in ecoinvent do not have any flows interacting with them since they are old and not used anymore or an empty skeleton built for future datasets. These completely empty activities are filtered out. Landfilling activities are excluded since they are modelled as only having inputs. The rebalancing algorithm cannot process these kind of activities because it will try to reduce all these inputs to zero to achieve a mass balanced activity. By excluding these activities from the optimization and leaving their inputs unbounded, a more accurate representation of a landfill is achieved. In other words, the rebalancing algorithm is not designed to process activities that have a build up of stock. This stock accumulation is modelled post rebalancing as the sum of all products and their composition destined to landfill. Market datasets are filtered out as well since they are not linked to the other activities, balanced by default and would thus only add tight constraints to the problem.

On the product side, empty products that are not used or produced by any activity are filtered out since they do not impact the composition of other products. Capital goods are also treated differently since they are not consumed or integrated in the final product. A factory is needed to transform aluminium pipes into a bike frame but no part of the factory will be integrated into the frame, and the factory will need its own dedicated end-of-life treatment in order for mass balance to be preserved. In ecoinvent, capital goods are accounted for since they contribute to the impact of a product. If a factory produces 10.000.000 bikes in his lifetime, each bike is responsible for 1/10.000.000th of the impact the factory has during its lifetime. Every product is manually flagged as being capital or not, and the coefficients on the corresponding rows in the use table are set to 0 or left unchanged respectively. Instead of applying the rebalancing algorithm to capital goods, it is more straightforward to add an end-of-life flow in post processing that accounts for the magnitude of the capital good.

Not all units in ecoinvent are used to describe products with mass. The mass of units that are only connected to services that transform other products or products like 'heat' is set to 0. These units are 'guest night', 'ha', 'hour', 'kWh', 'kg*day', 'km*year', 'metric ton*km' and 'person*km'. The units that describe products with mass ('MJ', 'kg', 'km', 'l', 'm', 'm*year', 'm2', 'm2*year', 'm3', 'unit') are allowed to have a mass and get adjusted bounds to relate their unit to a kg, if possible. The elementary flows are easier to filter because they mainly consist of pure elements which can be given a content 0 or 1 according to which element is being balanced. Some resources can however have iron in them and are thus also allowed to adjust their iron contents based on an initial guess. Only units involving mass are selected for the elementary flows too. Their content, if 0, is considered as an unchangeable parameter. After the filtration, 9585 activities and 3144 products are left.

Scaling

Step 4 of the algorithm consists of a rescaling the previously defined data. In order for the solver to be able to solve the problem, all values need to be within a couple orders of magnitude. Otherwise, the solver identifies the problem as being infeasible. In ecoinvent, both the construction of big facilities like an iron mine and the production of concrete, needing a small fraction of superplasticizer are modelled. The resulting SUT have coefficients from 1e-51 to 1e13. A rescaling algorithm is needed to not only bring these coefficients closer together but also lower the quantity of very big and very small coefficients. As a first step, all coefficients smaller than 1e-20 are set to zero to avoid interference with floating point arithmetic (machine epsilon).

There are two separate rescaling algorithms used for scaling the matrices. The complete algorithms can be found in appendix C and are based on the RAS method. They work on the same principle but use the arithmetic and geometric mean respectively. The working principle is described in figure 4.4 and explained below.

First, the unscaled data is fed to the algorithm. Then, the amount of iterations is chosen and the suitable ranges of coefficients for the rows, columns and cells chosen. Next, the method that analyzes and saves the distribution of magnitude and makes sure the correct amount of iterations is performed, is called. The subsequent method consists of the selection of 'bad columns'. Bad columns are defined as those columns whose average of the merged U and F matrix column coefficients (without counting the 0 entries) is bigger or smaller than the preset column range. The column scaling S matrix is constructed in the next step by taking the inverse of the big or small average value after which U, V and F are rescaled through multiplication with S as shown in equations 4.3, 4.4, 4.5 and 4.6.

$$S[c] = \frac{1}{mean(U[c], F[c])} \; \forall c \in columns \tag{4.3}$$

$$U = U * S \tag{4.4}$$

$$V = V * S \tag{4.5}$$

$$F = F * S \tag{4.6}$$

Their bad columns are thus divided by the calculated mean. Now that the columns are scaled, the range of coefficients for every row should have decreased, increasing the effectiveness of the next step, rescaling the rows. First, the 'bad rows' are selected. These are the rows whose average of the merged U and V matrix row coefficients (without counting the 0 entries) is bigger or smaller than the preset row range. Then, the row scaling matrix R is constructed in similar fashion to the construction of S and applied to the U and V matrices as shown in equations 4.7, 4.8 and 4.9.

$$R[r] = \frac{1}{mean(U[r], V[r])} \; \forall r \in rows \tag{4.7}$$

$$U = R * U \tag{4.8}$$

$$V = R * V \tag{4.9}$$

The final step consists of rescaling the rows of F in the same way the rows of U and V were rescaled, using the R_f matrix and adding 1 to the order before the next iteration is launched as shown in equations 4.10 and 4.11.

$$R_f[r] = \frac{1}{mean(F[r])} \; \forall r \in rows \tag{4.10}$$

$$F = R_f * F \tag{4.11}$$

For the first iteration, F is row scaled before it is used to select bad columns to equalize its coefficients with the U matrix. An iterative approach is adopted since the adjustment of the row values makes rescaling the columns more efficient and vice versa. After rescaling, the performance is returned and all rescaling factors are saved to be able to rescale the lay variables and bounds accordingly and descale everything once balanced.

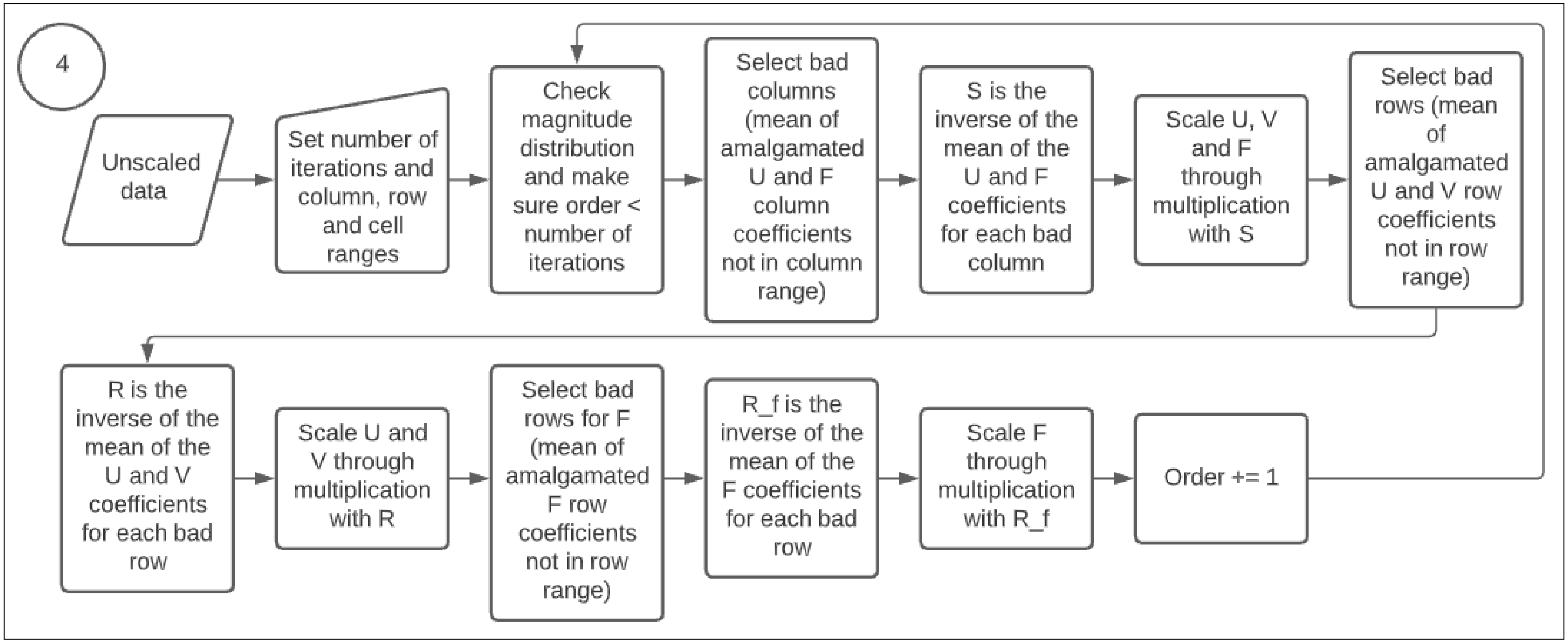

Figure 4.4 Visualization of the rescaling algorithm, starting from unscaled data and iteratively scaling until the desired amount of iterations is met

For our scaling, 5 iterations were chosen with (0.99, 1.01) as row and column ranges and (0.001, 1000) as suitable cell ranges. Before scaling, the biggest difference in order of magnitude (after setting the values smaller than 10e-20 to 0) is 32. After scaling, there are 25 active orders of magnitude left. The amount of numbers bigger than 1000 (the upper allowable cell value, designated by maxs per matrix) or smaller than 0,001 (the lower allowable cell value, designated by mins per matrix) do reduce spectacularly, as can be seen in figure 4.5. The biggest decline in values outside of the cell range was achieved with a sequential application of both algorithms where the arithmetic mean is used before the geometric mean. After the application of both rescaling algorithms, the rebalancing algorithm was able to converge to an optimal point thus avoiding the infeasibility. This rescaling technique proved to be effective because of how ecoinvent is defined. Facilities that are using a lot of materials to be constructed have very low use coefficients. When column scaling using the inputs (F and U), the corresponding supply coefficient (which is usually 1) is scaled down by the average input coefficient. By doing so, it reaches the level of the low use coefficients so row rescaling, using these supply and use coefficients (U and V), will be more effective and bring the coefficients on the corresponding row closer to 1.

	0	1	2	3	4
minsU	14639.0	24447.0	19980.0	16606.0	14275.0
maxsU	2988.0	423.0	55.0	23.0	19.0
minsV	5525.0	8354.0	6343.0	5272.0	5011.0
maxsV	1385.0	26.0	42.0	59.0	68.0
minsF	126706.0	56936.0	31605.0	18930.0	15276.0
maxsF	2207.0	0.0	1.0	2.0	2.0

	0	1	2	3	4
minsU	12964.0	3405.0	2717.0	2704.0	2653.0
maxsU	9.0	249.0	200.0	191.0	193.0
minsV	4816.0	157.0	139.0	132.0	130.0
maxsV	74.0	409.0	268.0	239.0	240.0
minsF	14035.0	4649.0	4563.0	4590.0	4811.0
maxsF	2.0	4250.0	3202.0	3041.0	2912.0

Figure 4.5 The amount of numbers too big (maxs) or small (mins) in each of the SUT matrices for every iteration when compared to the cell range chosen in the algorithm

4.2.2 Read in data

Once all the data is put in the right format, bounds and initial guesses are defined and rescaled and useless activities and products are filtered out, the data is handed to the rebalancing algorithm in step 5. The algorithm will then, for all phases, combine the data from the SUT with the data from the initial guess to define smart sets of active products and factors (the ones that have the element to balance in their composition) and active activities (the ones that interact with active products or factors). Where factors represent the elementary and products the technological flows. A dictionary is defined which links each activity to its active products and factors. These sets are defined for an easy transition to the next section.

4.2.3 Construction of the model

In step 6 of the algorithm, the Pyomo model is initialized. Pyomo was chosen as the most adequate python optimization package after testing and comparing with CVXPY and SciPy. For 2x2 problems, SciPy is the fastest solver, followed by CVXPY and Pyomo. However, for problems of size 100x100, Pyomo is the fastest followed by CVXPY, SciPy is 40 to 100 times slower, depending on the problem. This trend continues for even bigger matrices. Once exceeding 10.000 values in the SUT, CVXPY is not able to solve the problem while Pyomo can. These arguments, in combination with the possibility to implement pandas, led to Pyomo being chosen as the adequate optimization package.

To initialize the Pyomo model, a ConcreteModel is created. We can create a ConcreteModel since all coefficients of the equations are known through the implementation of the data, provided by ecoinvent. If the data were not to be available, an abstract model should be constructed first which would have been concretised when solving the model. Then, the lists of activities, products, products whose change in composition should be penalized and factors are defined which are subsequently used to initialize the variables, and their bounds, as Pyomo objects. They are defined as Pyomo objects to accelerate the solving process compared to directly using pandas objects in the constraints and objective function. The SUT stay in sparse pandas format to accelerate the process and not run into MemoryError's. The variables that are defined in this step depend on the phase. In phase 1, only the composition of the products, λ, and elementary flows, λ_f are defined while phase 2 and 3 also define VmU (V-U) and F as pyomo variables.

4.2.4 Selection of the solving phase

As mentioned at the beginning of this section, the rebalancing algorithm was developed with different variations for three different phases. In phase 1, only the composition of flows can change where in phase 2, the magnitude of the flows can change and in phase 3, missing flows can be added. The difference between phase 1 and phases 2 and 3 is made because the magnitude and existence of flows are generally checked by LCA practitioners and should thus be more accurate than the composition. Phase 2 and 3 are necessary because not all imbalances can be solved through the phase 1 approach. Phase 1 enables manual imbalance identification where phase 2 can automatically detect heterogeneous products and phase 3 can resolve all imbalances. The imbalances that can be resolved in phase 1 include product heterogeneity (after disaggregation), services, capital goods and waste treatment while phase 2 can solve imbalances caused by wrongly defined and phase 3 by missing flows. All three of the approaches are visualized in figure 4.6. The phase influences the definition of the constraints and objective function and is thus introduced as step 8.

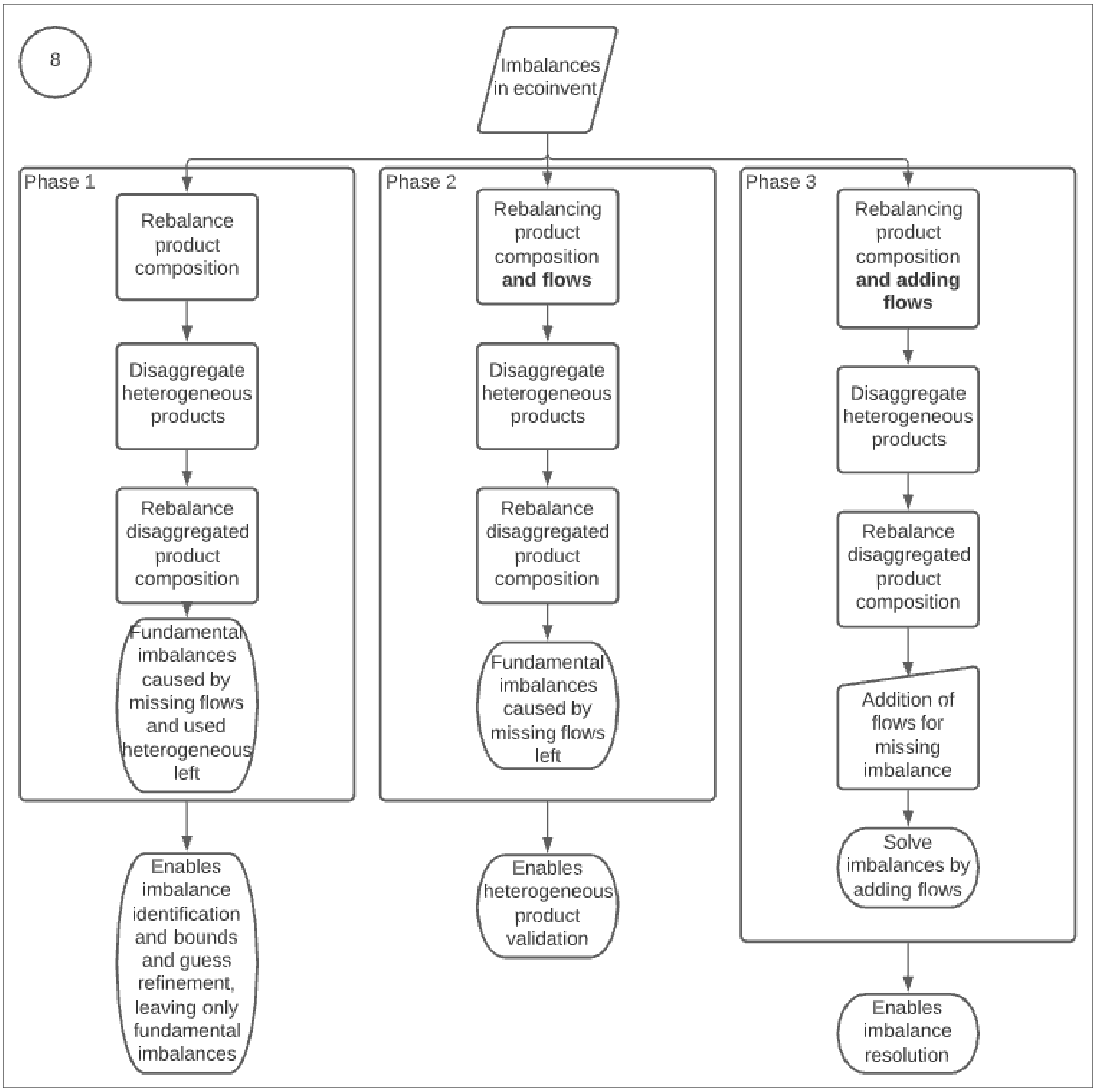

Figure 4.6 Phase 1, 2 and 3 of the rebalancing process. Where phase 1 only adjusts the composition of flows, phase 2 enables the magnitude of already defined flows to change and phase 3 enables flows to be added if needed

In phase 1, the element content of products is rebalanced before heterogeneous products are disaggregated and their composition is rebalanced. This phase leads to the identification of imbalances and bounds and guess refinement, leaving only fundamental imbalances and imbalances caused by used heterogeneous flows. Phase 2 rebalances product composition and flow magnitude after which the heterogeneous products are disaggregated and their composition rebalanced. The ability to adjust the magnitude of flows enables phase 2 to resolve the imbalances caused by the use of heterogeneous flows. To resolve the last imbalances that were not able to be resolved in the previous phases, phase 3 is added where flows can be added in post processing. By addition of an 'undefined iron waste or emission flow', the database is balanced. The addition of this flow only happens at the end of phase 3 because it would inaccurately resolve all imbalances when applied in a previous phase. All imbalances would still be resolved but instead of having accurate constraints and thus iron flows that model reality as close as possible, the new flow will absorb all imbalances.

4.2.5 Selection of the solving method

For one algorithm to be able to give useful information in each of the iterated solves, different solving methods had to be defined in step 8. We decided to define three solving methods: 'strict', 'soft' and 'soft_squared'. Strict initializes the constraints so every activity needs to be balanced and the objective function is squared. The soft method introduces soft constraints (step 7) by defining imbalance variables which allow the balance to be disturbed. These imbalances are initialized at zero and have a high penalty for differing in the objective function. This possibility is given for the first few iterations of the solving process to refine the initial guesses and identify the imbalances present. The objective function of the soft method includes the scaled difference of the content and the initial content to the initial content and implements a penalty for the imbalance. The soft squared method is similar to the soft method but the composition term in the objective function is squared. To be able to analyze the imbalances more accurately, two different imbalance variables were defined. The first one is an imbalance vector, giving each activity the opportunity, with a high penalty, to have an imbalance. The second one is an imbalance matrix which enables every non zero product activity interaction to have a penalized imbalance.

The 'strict' solving method is defined by equation 4.12 and requires the database to be fully balanced. This method was developed as the ultimate goal but proved to be incompatible with the issues encountered.

$$\begin{aligned} \underset{\lambda}{\text{minimize}} \quad & \sum_{p \in products} \left(\frac{\lambda_{i,p} - \lambda^0_{i,p}}{\lambda^0_{i,p}} \right)^2 \quad \forall i \in elements \\ \text{subject to} \quad & \sum_{p \in products} \lambda_{i,p} \left(V_{p,a} - U_{p,a} \right) + \sum_{e \in \text{ef}} \lambda^f_{i,e} F_{e,a} = 0, \\ & \forall a \in activities, i \in elements, \\ & min_p < \lambda_p < max_p \quad \forall p \in products \end{aligned} \tag{4.12}$$

The 'soft' solving method is defined by equation 4.13 and allows the database to have imbalances. This method was developed to easily identify different imbalances since an imbalance would be put on the product that causes the imbalance.

$$\begin{aligned} \underset{\lambda, imb}{\text{minimize}} \quad & \sum_{p \in products} \left(\left(\frac{\lambda_{i,p} - \lambda^0_{i,p}}{\lambda^0_{i,p}} \right) + \sum_{a \in activities} \left(big * \frac{imb^+_{i,p,a} + imb^-_{i,p,a}}{totalflows_{i,p,a}} \right) \right) \quad \forall i \in elements \\ \text{subject to} \quad & \sum_{p \in products} \lambda_{i,p} \left(V_{p,a} - U_{p,a} \right) + imb^+_{i,p,a} - imb^-_{i,p,a} + \sum_{e \in \text{ef}} \lambda^f_{i,e} F_{e,a} = 0, \\ & \forall a \in activities, i \in elements, \\ & min_p < \lambda_p < max_p \quad \forall p \in products \end{aligned} \tag{4.13}$$

The 'squared' solving method is defined by equation 4.14 and also allows the database to have imbalances. This method was developed to solve the problem as fast as possible and avoid infeasibility while solving. It also enabled to identify which products the imbalanced product interacts with since the imbalance would be spread out across multiple products. This complicated the identification of the product at the source of the imbalance but combining it with the 'soft' solving method resolved this inconvenience.

$$\begin{aligned}
\underset{\lambda,\, imb}{\text{minimize}} \quad & \sum_{p \in products} \left(\left(\frac{\lambda_{i,p} - \lambda^0_{i,p}}{\lambda^0_{i,p}} \right)^2 + \sum_{a \in activities} \left(big * \frac{imb^+_{i,p,a} + imb^-_{i,p,a}}{total flows_{i,p,a}} \right) \right) \quad \forall i \in elements \\
\text{subject to} \quad & \sum_{p \in products} \lambda_{i,p} \left(V_{p,a} - U_{p,a} \right) + imb^+_{i,p,a} - imb^-_{i,p,a} + \sum_{e \in \mathrm{ef}} \lambda^f_{i,e} F_{e,a} = 0, \\
& \quad \forall a \in activities, i \in elements, \\
& min_p < \lambda_p < max_p \quad \forall p \in products
\end{aligned} \tag{4.14}$$

4.2.6 Constraints and objective

The requirement for every activity to be balanced and the iron content to fall in between the bounds form the constraints, defined in step 9. Balance is achieved by requiring the in-and outputs (SUT rows) for every activity (column) with their corresponding content of the element to balance to be equal. The bounds are maintained by requiring every content to fall in between them. Equation 4.15 describes the constraints.

$$\begin{aligned}
\sum_{p \in products} \lambda_{i,p} \left(V_{p,a} - U_{p,a} \right) \left(+ imb^+_{i,p,a} - imb^-_{i,p,a} \right) + \sum_{e \in \mathrm{ef}} \lambda^f_{i,e} F_{e,a} = 0 \\
\forall a \in activities, i \in elements \\
min_p < \lambda_p < max_p \quad \forall p \in products
\end{aligned} \tag{4.15}$$

For every activity, the amount of every element going out (λ*V) minus the amount of every element coming in (λ*V) through each product plus the amount of that same element coming out or going in through elementary flows (λ^f*F) has to be equal to zero. The constraints can either be soft or strict constraints, dependant on the addition of the imbalance variables. The imbalance variables allow the content of non zero product activity interactions (as shown in equation 4.15) or the activity as a whole (at the end of the equation, as $imb^+_{i,a} - imb^-_{i,a}$) to deviate from the real content to fulfill the activity balance. This imbalance will then show which processes need to be adjusted to become balanced. For phase 2 and 3, V, U and F will be variables instead of parameters.

After requirement of the balance, the objective function is defined (equation 4.2.6) which requires the content of each product (λ), that is not unbounded, to deviate as little as possible from the originally defined content or guess (λ^0). When soft solving, the objective includes the imbalance variables, combined with a high penalty (big, calculated relative to the biggest entry of the SUT). The imbalance variables terms are not squared since this would spread out and impede the identification of the source of the imbalances.

$$\underset{\lambda, imb}{\text{minimize}} \quad \sum_{p \in products} \left(\frac{\lambda_{i,p} - \lambda_{i,p}^0}{\lambda_{i,p}^0} \right)^2 + \sum_{p \in products, a \in activities} \left(big * \frac{imb_{i,p,a}^+ + imb_{i,p,a}^-}{totalflows_{i,p,a}} \right) \quad \forall i \in elements \tag{4.16}$$

The objectives for phase 2 and 3 have two added terms with a slightly higher penalty than the change of the composition but lower than the penalty for an imbalance, the relative change in VmU and F. These added terms are shown in equation 4.17.

$$\begin{aligned} &\sum_{p \in products, a \in activities} \left(penalty * \frac{VmU_{i,p,a} - VmU_{i,p,a}^0}{VmU_{i,p,a}^0} \right) + \\ &\sum_{e \in ef, a \in activities} \left(penalty * \frac{F_{i,e,a} - F_{i,e,a}^0}{F_{i,e,a}^0} \right) \quad \forall i \in elements \end{aligned} \tag{4.17}$$

4.2.7 Solving the optimization problem

After the definition of the objective and constraints, the problem is solved using the cplex solver during step 10. This solver has been chosen because it is open source, faster than the proposed Pyomo solvers and the most adapted to our problem.

4.2.8 Analysis of the results

The results are automatically saved in a folder as a zipped pickle which can be opened and analyzed during step 11. If there is no imbalance remaining, the iterative application of the algorithm will end. Otherwise, the activities that are not balanced will show an imbalance in their corresponding column or on the row of the product for which the imbalance occurs. This way, the activity can be checked and the right adjustments (adding a flow, changing the magnitude of a flow, changing the initial guess and/or correct the bounds or exclude a product or activity) made. Step 12 and 13 help with determining the source of the remaining imbalance. If the activity belongs to a group that the algorithm is not able to balance, the filters are not accurate and a filter is added to (temporarily) remove this group from the dataset. If, after inspection of the activity, the algorithm should be able to balance it, the bounds of the interacting products are investigated and adjusted if needed. If the bounds were accurate, the only imbalances left are imbalances that can not be resolved during this phase so the next phase is called.

4.2.9 Disaggregation of heterogeneous flows

After the first solve, heterogeneous products are disaggregated. For every time a heterogeneous product is used by an activity, a new product line is added. Every activity using the heterogeneous product will pick one of these products in a way that every added product is only used by one activity. The bounds of the new products are the same as the bounds of the heterogeneous product. The initial guess is the initial guess of the heterogeneous product added to the imbalance of the interaction between the heterogeneous product and the activity that uses the new product. The composition of each of these products will then be calculated separately in a second solve.

4.3 Rebalancing for iron

First, a single element is chosen to be rebalanced as a stepping stone towards balancing all elements. This approach allows for more flexibility and degrees of freedom. As a first element to rebalance, iron was chosen because it is relatively easy to identify products that contain iron and how much they contain. Furthermore, there is no indirect consumption or emission from or to the atmosphere. Almost every activity in ecoinvent that uses iron will thus have specified iron flows going in and coming out. Another reason to pick iron is the fact that iron content is a property that is already defined for some products in ecoinvent. Finally, iron is a stable element that has abundant applications on different scales in our economy.

4.4 Expansion to all elements and contributors to mass

The final step would be to require all elements to be balanced for every activity. This enlarges the system on one hand but also adds constraints because the sum of the mass of all elements that constitute a product cannot exceed the mass of that product as shown in equation 4.18.

$$
\begin{aligned}
\underset{\lambda, imb}{\text{minimize}} \quad & \sum_{p \in products} \left(\left(\frac{\lambda_{i,p} - \lambda^0_{i,p}}{\lambda^0_{i,p}} \right)^2 + \sum_{a \in activities} \left(big * \frac{imb^+_{i,p,a} + imb^-_{i,p,a}}{totalflows_{i,p,a}} \right) \right) \quad \forall i \in elements \\
\text{subject to} \quad & \sum_{p \in products} \lambda_{i,p} \left(V_{p,a} - U_{p,a} \right) + imb^+_{i,p,a} - imb^-_{i,p,a} + \sum_{e \in \text{ef}} \lambda^f_{i,e} F_{e,a} = 0, \\
& \quad \forall a \in activities, i \in elements, \\
& min_{i,p} < \lambda_{i,p} < max_{i,p} \quad \forall p \in products, i \in elements, \\
& \sum_{i \in elements} \lambda_{i,p} = 1 \quad \forall p \in products\ with\ unit\ 'kg', \\
& \sum_{i \in elements} \lambda_{i,p} = dry\_mass_p \quad \forall p \in products\ with\ a\ different\ unit
\end{aligned}
\tag{4.18}
$$

CHAPTER 5 RESULTS AND DISCUSSION

Some of the results have already been discussed in section 4 since they were part of the methodology. These include the rescaling algorithms, the filtering of products and activities, the bounds and initial guesses and the rebalancing algorithm itself. In this section, we will first discuss the rebalancing algorithm in more detail before taking a look at the resulting iron contents that were achieved, the imbalances that led to the additions to the methodology, the expansion to all elements, the robustness and limitations of our results and the guidelines for future database development.

5.1 Rebalancing algorithm

The biggest result of this master's project is the development of the rebalancing algorithm which can, when given the right input, rebalance the whole database semi-automatically. It answers to objective 2, is written in python and will be open access. Several choices and adaptations where involved when developing the algorithm. First, an adequate optimization package had to be chosen. Pyomo, CVXPY and scipy were compared and pyomo was chosen due to its solving speed for big (100x100 and more) matrices and pandas compatibility. Next, ipopt was selected as the best of the default solvers. Although it is a non-linear solver, it performed better than the other default solvers for our quadratic problem with linear constraints. The constraints were fixed from the beginning of the project, requiring every activity to be mass balanced. The objective however was a point of discussion. Finally, we chose a quadratic objective with a change in composition to allow bigger flows to diverge more from their initial guess than small flows. The solver thought the problem was infeasible at first but rescaling the database prevented this infeasibility. Then, the solving time was several weeks but selecting only the products, elementary flows, activities and their interactions that can have iron in combination with other measures like introducing sparse matrices reduced this to 15 minutes. Other iterations that resulted in solving infeasibility issues were varying the tolerances and imbalance penalty as well as changing from ipopt, a solver in the pyomo library, to CPLEX, an opensource solver. The introduction of sparse matrices also resolved the MemoryError that was thrown once the problem was expanded by disaggregation of the heterogeneous products. The complete, documented code can be found in appendix A.

5.2 Iron rebalanced dataset

After the identification and resolution of the imbalances by the rebalancing algorithm, an iron content is produced for every product and natural resource flow in the ecoinvent database, answering objective 3. The full iron content estimate for every product is presented in appendix F due to its size. The first table shows the iron content of all products while the second table shows the elementary flow iron content.

5.3 Mass imbalances in ecoinvent version 3

In accordance with objective 1, using the rebalancing algorithm, different kinds of mass imbalances present in the ecoinvent database were identified. This section will give an overview of these different imbalances, using the SUT terminology defined in section 2.4. The different types of imbalances have different ways to be identified and resolved. Figure 5.1 gives an overview of the different approaches used with the red boxes representing manual and the green automated actions. Interpretation of the results after every solve gave insight into these different categories and how to recognize them.

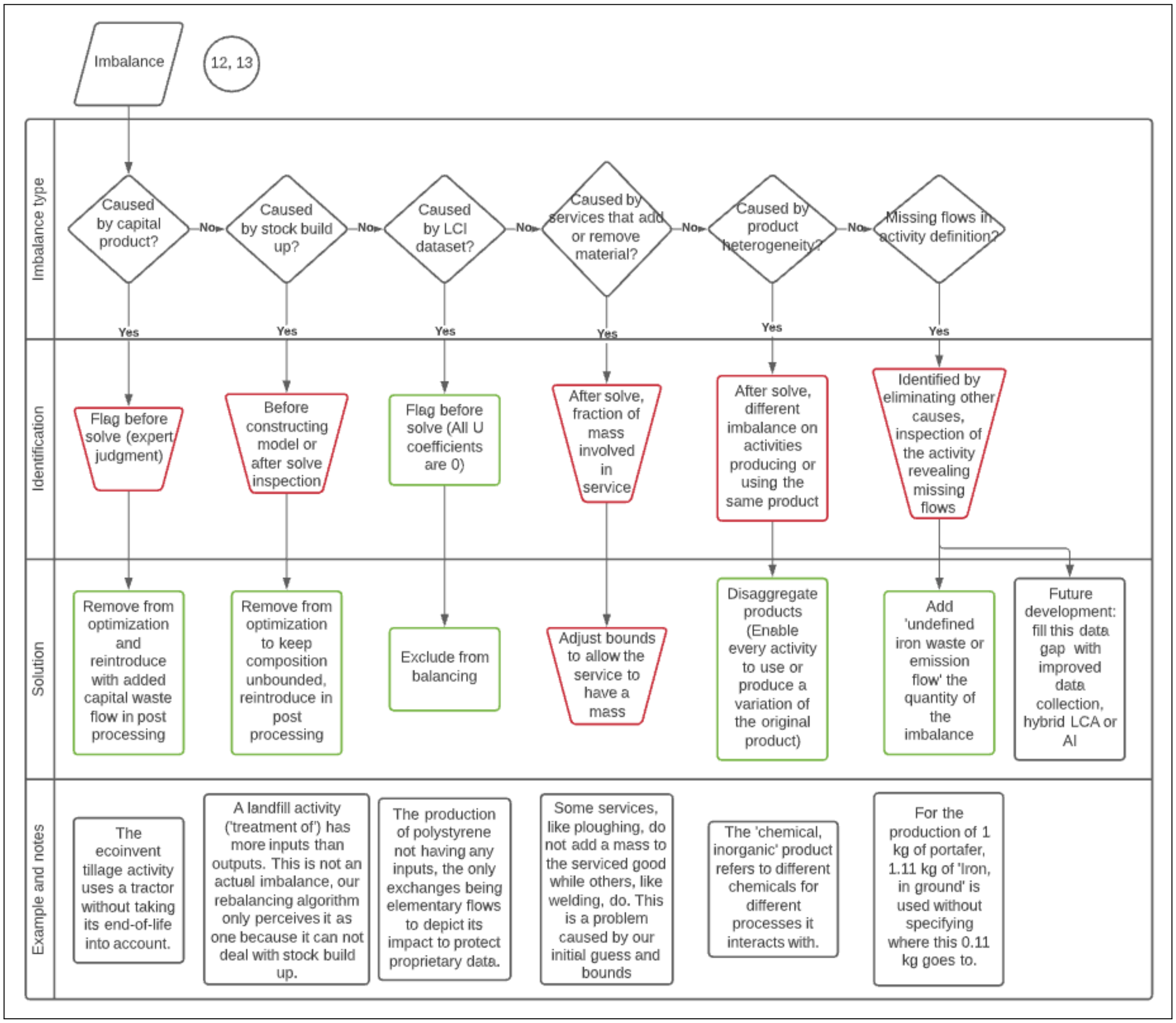

Figure 5.1 How to identify and resolve different imbalances. The red boxes have to be carried out manually while the green boxes can be done automatically by the algorithm

Not every type of imbalance is encountered as frequently as the others as illustrated in figures 5.2 and 5.3. There are 114 LCI activities that cannot be mass balanced. From the 6725 activities that interact with products containing iron, 991 are waste treatment and thus temporarily excluded, 5480 can be balanced by the algorithm and 140 imbalances remain after rebalancing. On the product side, 1133 of the 3144 products are capital and are temporarily excluded during rebalancing while 60 are heterogeneous and were disaggregated into 4106 different products.

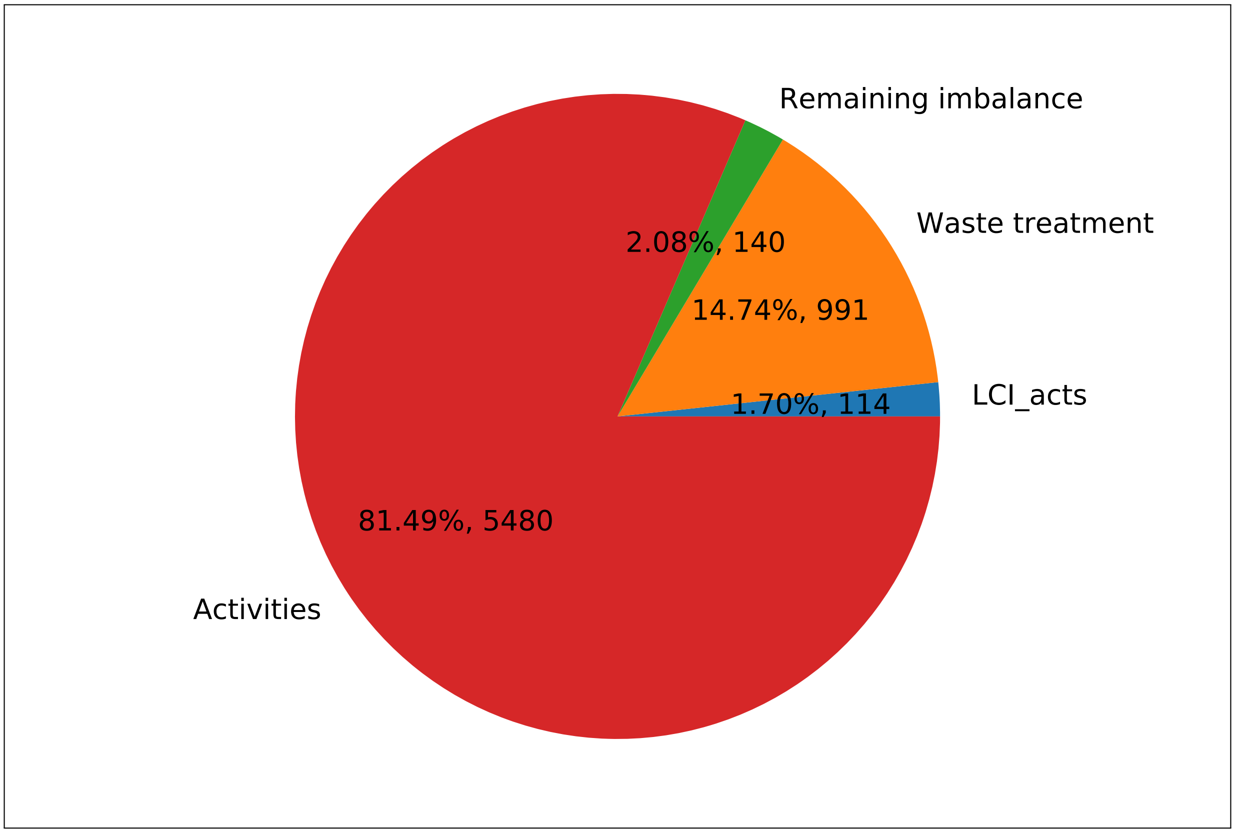

Figure 5.2 The distribution of activities over the different kinds of imbalances. 81.49% of the activities interacting with iron can be balanced by the algorithm when capital products are excluded and heterogeneous products disaggregated. 14.74% of the activities are waste treatments which are excluded from the rebalancing algorithm and reintroduced in post-processing in a balanced way. 1.70% are LCI activities which are completely excluded from the rebalancing without being reintroduced and 2.08% are still imbalanced after the resolution of all the other imbalance categories and resolved by adding an 'undefined iron waste or emission flow'

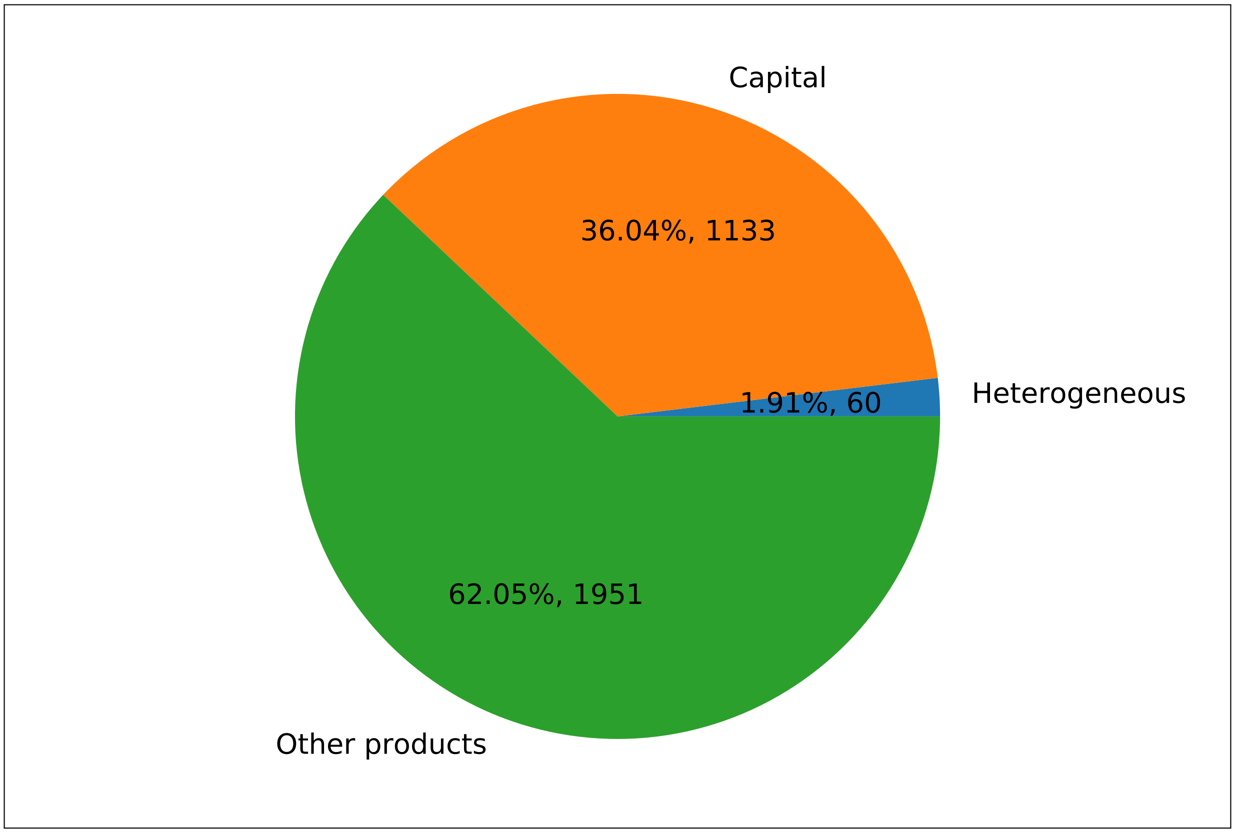

Figure 5.3 The distribution of products over the different kind of imbalances. 62.05% of products do not have an iron content or do not cause imbalances. 36.04% of products are capital, their use coefficients are put to zero for rebalancing and reintroduced with a matching capital waste flow in post-processing. 1.91% of products are heterogeneous in terms of their iron content and will be disaggregated before rebalancing

5.3.1 Capital goods

The first kind of mass imbalance is caused by taking into account capital goods. These capital goods are not part of the final product, they are manually flagged (attributed a value of 1 in a csv file to be used as a filter as described in section 4.2.1) through expert judgment. Every coefficient corresponding to the use of a capital product in the Use table is turned to 0 since they do not contribute to the composition of the products they produce. Their coefficients in the Supply table remain intact to make sure their composition is balanced through their producing activities. Once the composition of all products is calculated, the capital goods are reintroduced into the database. Their respective waste flows are introduced along with them to respect mass balance. This addition of waste treatment of capital goods adds to the impact of the produced product when performing an LCA. Since capital goods (almost) never contribute a significant amount to the impact of products, this additional waste flow will only add up to 1% to the impact.

5.3.2 Stock build up

If the imbalance was not caused by a capital good, the activity is checked for stock build up. This can be observed when a process has no or less output flows than it has input flows. The rebalancing algorithm will try to balance the in-and outcoming flows while this should not happen. Stock build up has been identified by looking at the imbalance for iron flows that were equal to the amount of the flow itself because the activity does not have any mass or flows going out. Landfill activities are removed from the database to allow their incoming flows to be unbounded and not be reduced to zero due to balancing with non-existent outgoing flows. The flows going to landfills are usually heterogeneous because the composition of waste is highly dependant on the activity it is produced in and will thus first be disaggregated. After the disaggregation, every product has complete liberty in terms of composition. After the calculation of all the (disaggregated) waste flows, landfills are reintroduced into the database without having any restriction on their mass and composition.

5.3.3 Rolled-up, precompiled LCI datasets

Another issue observed when analyzing the results of the rebalancing algorithm was the existence of heavily aggregated precompiled LCI datasets or rolled up inventories. These precompiled LCI datasets (like hydrogen cyanide production) are a type of activity defined in ecoinvent. They are different than unit processes in the sense that they reflect all impacts of a production process without showing the interacting technological flows. These processes exist because of companies that do not want to give up their detailed production processes to keep their market advantage. A middle road has been found where they provide the impacts these processes entail without unveiling the flows behind it. The activities thus only consist of elementary flows going in and a product coming out. They are not balanceable since they form a black box with multiple activities inside and will be excluded from the analysis. They are excluded automatically when filtering the data because their lack of entrances in their U matrix makes them easily distinguishable from other activities. There are 114 LCI activities, most of them coming from the European plastics industry (PlasticsEurope).

5.3.4 Services

Services, like welding, cannot be considered to be capital goods since they contribute to the product mass and composition. Other services, like milling can influence mass balance too since losses can occur. These losses were simulated while constructing the product system in an LCA but are not characterized in the database itself. The welding process of aluminium is represented in figure 5.4. The figure shows that there is an input of aluminium which causes emissions to the air and 1m being welded. When trying to calculate the mass balance, we observe that the sum of the inputs is 60 times heavier than the sum of the outputs while the parts that are being welded together do not gain any mass. This causes an imbalance. The services are applied to a product system to internalize their impact but do not influence the products they interact with in the current state of the database. On the other hand, some activities are defined as being a service when they are expected to be a facility which provides a service. The activity describing the production of a hydro power plant is for example defined as not having any mass since the by-products and waste take into account the whole end-of-life stage, thus representing the complete mass flow. The hydro power plant that is produced should not have any mass for the activity to be balanced. The activity represents the services a hydro power plant provides over its complete life cycle. Other activities that represent services which lack mass are transport and maintenance. They can be identified as being 'capital activities' since they do not influence the mass of a product, they alter other properties and will thus be ignored. Services can be identified because they produce products with different units than units of mass while interacting with mass flows. To resolve the first kind of service imbalance, services should be attributed a mass (allowing their bounds and initial guess to differ from 0). The composition can be calculated by the difference of the in-and outcoming flows with their respective compositions. This way, every time they are applied to another product, that product gains mass. The second type of service imbalance impacts the bounds and initial guesses of the products the activity with said imbalance produces. Because no clear guidelines exist on how to define these activities and because the definition can change depending on location and data availability, the bounds and guesses are adapted manually after inspection of the imbalance.

Exchange summary

Reference products	Material for treatment	Byproduct classif.	Amount
welding, arc, aluminium	no	allocatable product	1 m
Inputs from technosphere			Amount
aluminium, wrought alloy			0.0183 kg
argon, crude, liquid			0.00357 kg
electricity, medium voltage			0.075 kWh
electronics, for control units			1e-05 kg
Emissions to air			Amount
Aluminium			8.45e-05 kg
Carbon monoxide, fossil			6.67e-05 kg
Helium			3.57e-06 kg
Nitrogen oxides			2e-06 kg
Ozone			9.06e-06 kg
Particulates, < 2.5 um			0.000141 kg
Silicon			1.41e-05 kg
Zinc			4.23e-05 kg

Figure 5.4 Welding process as defined in ecoinvent 3.6, identical for Global, Europe and Québec. Specifying the service provided (1 m of welding, arc, aluminium), the inputs used and the emissions generated [5]

5.3.5 Product heterogeneity

As mentioned in the introduction, another form of imbalance is introduced by product heterogeneity. Product heterogeneity is introduced when the same product is expected to have a different composition for different activities it interacts with. Product heterogeneity can have different causes, from the product description being too vague to different LCA practitioners having different data sources, some more detailed than others, or regions building installations differently. The first case of product heterogeneity was observed for reinforced concrete where, depending on the activities it is used in, the amount of waste reinforcing steel coming out of the activity differs. By differing the amount of waste reinforcing steel, the end-of-life phase and its impacts of both types of concrete is accurately represented. This is however not the case for the production phase where they are produced by the same activity, thus expected to have the same composition. One of the products will have an accurate production phase while for the other one, the iron content will be over-or underestimated. This leads to a misrepresentation of the actual process entailing more or less impacts when calculating the impact of all processes using this product. Other examples of product heterogeneity are products with vaguely defined names like 'inorganic chemical' or 'municipal solid waste'. Their content is not fixed and depends on the activity they are produced in.

Product heterogeneity can be identified by looking at the imbalance a certain product has for different activities. If the imbalance is smaller than the total flow, only a partial adjustment of the iron content is needed, which indicates product heterogeneity. Another way is to look at all producing activities and assess how much of each flow enters. If the activities have different magnitudes of flows entering or leaving, the product is considered to be heterogeneous. To be able to resolve this, the product can be disaggregated into different products which each have a different composition, depending on the activity they are produced in. If the product is used by another activity, either this activity should be disaggregated as well or the use should be split over all disaggregated versions of the product. In our case, when a heterogeneous product was used, only its production phase was unbalanced. We thus decided to disaggregate the product and alter the use coefficients of the disagreggated products in equivalence with the relative imbalance on each producing activity.

5.3.6 Missing flows

The last imbalance is identified through elimination of all other imbalances. Basic production processes like portafer production, have missing flows, shown in figure 5.5. The flows going in are bigger than those coming out. Some flows disappear in the process. They are modelled this way to incorporate losses in the production process and can either be expressed through the change in magnitude of flows or by limiting the dry mass of a product to a quantity lower than the incoming flows producing it. For the production of portafer, 0,11 kg of iron is lost. A waste flow of iron needs to be added to balance the process. These imbalances are solved by adding an 'undefined iron waste or emission flow' after all other imbalances are resolved. Other imbalances caused by missing flows that are not a fraction of a defined flow but forgotten in their entirety can be resolved by adding data through hybridizing LCA with IO tables [30] or alternative data collection methods with the help of AI [60].

Unit Process Exchanges				
Name	**Amount**	**Unit**	**Uncertainty**	**SD**
Reference Products				
+ portafer	1	kg		
By-product/Waste				
To Environment				
air				
+ Particulates, < 2.5 um	0.000145	kg	Lognormal	3.0452
+ Particulates, > 10 um	0.00145	kg	Lognormal	1.6975
+ Particulates, > 2.5 um, and < 10um	0.00131	kg	Lognormal	2.1697
+ Water	6.0065E-06	m3	Lognormal	1.4918
water				
+ Water	2.3294E-05	m3	Lognormal	1.4918
From Environment				
natural resource				
+ Iron, in ground	1.11	kg	Lognormal	1.3269
+ Occupation, mineral extraction site	0.00012	m2*year	Lognormal	1.6975
+ Transformation, from forest, unspecified	2.13E-06	m2	Lognormal	2.1697
+ Transformation, to mineral extraction site	2.13E-06	m2	Lognormal	2.1697
+ Water, well, in ground	2.93E-05	m3	Lognormal	1.3269
From Technosphere				
+ blasting	0.000271	kg	Lognormal	1.3269
+ conveyor belt	2.78E-08	m	Lognormal	3.0452
+ diesel, burned in building machine	0.0255	MJ	Lognormal	1.3269
+ electricity, medium voltage	0.0339	kWh	Lognormal	1.3269
+ heat, central or small-scale, other than natural gas	0.00282	MJ	Lognormal	1.3269
+ heat, district or industrial, other than natural gas	0.0898	MJ	Lognormal	1.3269
+ industrial machine, heavy, unspecified	0.000231	kg	Lognormal	3.0452
+ mine infrastructure, iron	8.33E-13	unit	Lognormal	3.0452
+ recultivation, iron mine	2.13E-06	m2	Lognormal	2.1697

Figure 5.5 Portafer production as defined in ecoinvent 3.6. 1 kg of portafer is produced using natural resources from the environment and products from the technosphere and generating emissions to water and air [5]

5.3.7 Inconsistency in activity definition

The imbalances that were identified revealed inconsistencies in the definition of the ecoinvent database. These are caused because the focus of ecoinvent was to quantify the impact of processes and products and the activities are, despite being checked centrally, defined by practitioners all over the world. On top of that, not every practitioner has access to the same amount of data, leading to further inconsistency. Examples of these inconsistencies are, the activities that describe hydro power plants, nuclear facilities, wind turbines and power lines. Where some locations include the end-of-life of all construction materials, leading to an output product without mass which performs a service, others do not, requiring the same output product to have a mass. Other activities, like the treatment of waste flows, do not satisfy material balance. Their output product has a negative sign, indicating it is actually an input. Furthermore, yields and loss of material are often, but not always, ignored when defining an activity. Finally, the name of some products and activities might suggest it has a mass when in reality it does not because all flows are accounted for and it is actually a disguised service.

5.3.8 Demo problems and resolution

To get a better grasp on the effectiveness of the rescaling and different mass imbalances and how to solve them, several demo problems were developed. All demo problems can be found in appendix E. Each demo was used to identify and solve a different case of imbalance before trying to solve a more convoluted demo problem with a combination of different imbalances. The understanding of these problems led to the resolution of the imbalances in the ecoinvent database. The basic bike problem tests on bounds being too strict and their impact on a complete value chain. The wear boat problem tests on the disappearance of flow fractions where range concrete tests the accumulation of iron in gravel which is then passed on to a tightly bounded concrete. Wear alternative flower tests the complete disappearance of mass fractions by forgetting an output flow and the losses transformation problem describes the decreasing yield in consecutive transformation processes. The el flows problem tests the consecutive addition of iron containing elementary flows to a strictly bound flow where debug zeros's input are all zeros to make sure the algorithm does not have ZeroDivisionErrors. The last demo contains a mix of capital goods, recycling, thight bounds, flows that need to be rescaled and unwanted additional information.

5.4 Expansion to all elements and contributors of mass

This section responds to objective 4. Although the database is balanced for iron, the accuracy of the iron content of each product can be questioned. Expanding the rebalancing to all elements should add accuracy since the total mass of all elements consistuting a product should not exceed the total mass of that product. This adds constraints to the optimization which should favor the accuracy. This has not yet been implemented since we focused on having a solid base, being able to accurately determine the iron content for each product. This base can then be used as a sanity check when expanding the rebalancing to all elements, prohibiting a big change in the iron content of products. It also gave us knowledge of the different problems that we are likely to encounter and how to solve them. Another reason why the other elements are not yet implemented is the shear size of ecoinvent. Every product would need bounds and initial guesses for every element. Although modules like cirpy in combination with chempy would enable a fast recognition of elements in the chemical formula of certain products and elementary flows, not all products or elementary flows have chemical formula defined. Lastly, although iron gave us insights in how to solve certain sources of imbalances (for example product heterogeneity), others, like how ecoinvent disregards oxygen uptake or emissions since it is readily available, give other challenges for which we have not developed a framework or solution yet. The development of the algorithm itself always has been the main focus and took more time than foreseen because we ran into a number of unsuspected issues, from inefficient optimization problem definition leading to weeks of solving time to insufficient memory, impractical solvers and a lack of documentation for the pyomo optimization package. Through the rebalancing of iron, certain sources of imbalances (heterogeneous or capital products) that apply to all the elements have been identified and resolved. Others like the chemical interaction between substances has not been studied yet because of the relatively inert nature of iron. First, bounds and guesses should be defined for all elements for every product and elementary flow in ecoinvent. Next, the rebalancing algorithm should be expanded to deal with all elements and added constraints. The methodology presented in this thesis, with different solving methods and phases used for iron, will provide flexibility during the expansion to all elements.

5.5 Robustness and limitations

Our method is sufficiently robust to achieve this project's limited objectives, since mistakes can easily be identified and solved through the identification of imbalances and iterative solving. At first, multiple assumptions were made, all flows in the SUT were assumed to be correct and none missing, making every activity balanceable, the products were assumed to have a sufficient degree of heterogeneity and the bounds set on the iron content of every product were considered accurate. Through iterated solving, flexibility was added to the algorithm, making these assumptions dispensable.

The biggest limitation of our approach is the lack of data to start with. This has been partly resolved by adding our own bounds and initial guesses but these can be subjective. Iterative rebalancing does, however, identify issues caused by these bounds and hereby enables their refinement. Another limitation is the fact that we only balanced the database for iron, leaving big margins for the solver to play with. Until other elements are added to the rebalancing, the algorithm has an excess amount of freedom, allowing unrealistic iron contents to be calculated. This leads to our final limitation, the lack of data to validate the iron content computed by our algorithm. Every activity will be balanced leading to an internally consistent representation of iron flows and therefore internally coherent iron content of products. Nevertheless, we are not yet in a position to assess the accuracy of these iron contents because of the lack of validation data although our initial guesses and bounds stem from real world data and expert estimates.

5.6 Database development recommendations

Through this thesis, we have identified and fixed most of the imbalances in the ecoinvent database for iron. By doing so, we uncovered mistakes and inconsistencies and discovered elaborate recommendations for future database development. First, the rebalanced iron content should be added as a property. Next, guidelines should be formed for every type of activity on whether or not to include the end-of-life, how the other activities in this category are constructed and which data to use. Most importantly, every new activity should be constructed in a mass balanced way and this balance should be checked by the rebalancing algorithm. This will guarantee mass balance and resolve any imbalance it encounters. For this purpose, heterogeneous flows should be identified and disaggregated to allow for the rebalancing. A property describing whether or not a product is capital can be added. An 'undefined iron waste or emission flow' should be added and specified through cooperation with the ecoinvent team. Last but not least, rolled-up LCI datasets should either be excluded from the database because of their lack of transparency, specified and split up into different processes or identified with clear warnings.

CHAPTER 6 CONCLUSION AND RECOMMENDATIONS

The aim of this research was to identify and solve mass imbalances in the ecoinvent database for iron through an efficient, transparent and reusable semi-automatic rebalancing algorithm in order to reconcile LCA databases with MFA principles and to regain credibility in the LCA method. There was anecdotal evidence that mass balance was not met because of the focus on connections between processes rather than on the composition of these connecting flows, and the assumption that markets were homogeneous. Through the implementation of a rebalancing algorithm to the ecoinvent 3.6 LCA database, this result was achieved, enabling us to balance 96.22% of the flows and attribute an iron content to every product defined. Different categories of causes for imbalances, from capital flows to stock build up, rolled-up LCI datasets, services, product heterogeneity and missing flows were identified and specific solutions for each category proposed. The objectives, from identifying mass imbalances to developing a rebalancing algorithm, rebalancing the database for iron and describing the future approach to rebalance the database for all elements and contributors of mass, were all met. This research is a step forward for both the LCA and MFA community. The LCA community will gain credibility and accuracy while a start of a centralized database has been proposed for the MFA community. By finishing this thesis, the first step to a fully balanced version of ecoinvent for all elements and contributors of mass has been taken.

6.1 Summary of Works

To create a starting point for the rebalancing algorithm, bounds and initial guesses of the iron content for every product and natural resource in the ecoinvent 3.6 database have been manually set in a csv file. A flow chart was then developed to include all available data on potential bounds and guesses in order of importance in the definition of the bounds and initial guesses. This way, bounds and guesses were consistent with the previously defined data of the ecoinvent database. Next, two rescaling algorithms, one based on arithmetic and the other on geometric mean, were developed to reduce the number of big and small entries in the SUT and avoid infeasibility during rebalancing. An iterative approach, following a flow chart, was developed which introduced the bounds and guesses and the rescaling algorithms to the ecoinvent 3.6 database before passing it on to the rebalancing algorithm. This flow chart was implemented through a jupyter notebook. The rebalancing algorithm itself was constructed with a variety of methods and phases to be able to identify and deal with all imbalances encountered in a transparent, semi-automatic manner. Preliminary results showed different imbalances which have been identified, recreated using demo problems and resolved thanks to the implementation of filters on products or activities or adjustment of the bounds and initial guesses. The bounds and guesses were refined in an iterative way and comments were added whenever an estimation was counter-intuitive. The filters that were implemented ranged from the identification and exclusion of LCI datasets to the labelling of capital and heterogeneous products and the temporary exclusion of end-of-life treatments during rebalancing. Finally, mass imbalances were identified and categorized and a solution for every category of imbalance was found and implemented.

6.2 Limitations

The limitations are the lack of data to start from since we are the first to identify the iron content of all products in the ecoinvent 3.6 database. This added to the importance of an accurate estimation of the bounds and initial guesses, which is our second limitation. These were, however, ultimately refined using the rebalancing algorithm and visual inspection of most of the imbalances they caused. The bounds also form the most important data points implemented through the algorithm since they put strict boundaries on the minimal and maximal composition of iron in a product. The creation of more flexible solving methods allowed for this sensitivity to decrease. Another limitation is the fact that only iron is rebalanced, leaving room for unrealistic iron content through the lack of tight constraints on the product composition. This will be fixed in the future when all elements and contributors of mass are added, introducing a new constraint on the sum of the fractions of each element per product. The final limitation is the lack of data for validation once the iron content for every product was calculated. Since we are the first to compute this iron content, comparison with iron compositions of products (other than the few that were already defined in ecoinvent) was impossible.

6.3 Future Research

The future research that can build on the approach developed and the results achieved during this masters thesis can be divided into three parts. First, integration of a primitive version of MFA in the LCA community, allowing validation of newly developed and old datasets using mass balance. Second, this research forms a starting point for a centralized MFA database that can be built with the ecoinvent database as a starting point once the content for every element and contributor of mass is specified for every product. Last but not least, this research forms a starting point for the expansion of the methodology to all elements and contributors of mass to truly convert the ecoinvent LCA database into a mass balanced database which accounts for material flow and product composition, the subject of my PhD.

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APPENDIX A REBALANCING ALGORITHM

```python
import pandas as pd
import numpy as np
import pyomo.environ as po
import gzip
import pickle
from datetime import datetime
#opt = po.SolverFactory('ipopt')
opt = po.SolverFactory('cplex')
#opt.options['max_iter'] = 3000 #3000
#opt.options["tol"] = 10e-06 # 10e-08
#opt.options["acceptable_tol"] = 10e-06 #10e-06
#opt.options["dual_inf_tol"] = 1.5 #1
#opt.options["acceptable_dual_inf_tol"] = 10e5 #10e10
#opt.options["required_infeasibility_reduction"] = 0.1 #0.9
#opt.options["diverging_iterates_tol"] = 10e20 #10e20

def todf(data):
    """Simple function to recast pyomo element to Pandas DataFrame
    Parameters
    --------
    data :

    Returns
    --------
    pandas DataFrame
        Data has been recast into a pandas DataFrame
```

```
    """
    try:
        out = pd.Series(data.get_values())
    except AttributeError:
        # probably already is a dataframe
        out = data

    if out.index.nlevels > 1:
        out = out.unstack()
    return out


class RebalancingSystem:
    """ Organize the system """
    def __init__(self, phase, U, V, F, lay0, lay_f0, lay_bounds, lay_f_bounds, imb_bounds, lab,
                 tol=10e-06, div=1):
        """Init function
        Parameters
        --------
        phase : int
            The phase for which the problem will be solved.
        U : pandas DataFrame
            The use matrix.
        V : pandas DataFrame
            The supply matrix.
        F : pandas DataFrame
```

```
    The elementary flow matrix.
lay0 : pandas Series
    The initial guess of the iron composition for all products.
lay_f0 : pandas Series
    The initial guess of the iron composition for all elementary flows.
lay_bounds : pandas DataFrame
    The minimum and maximum iron content for all products.
lay_f_bounds : pandas DataFrame
    The minimum and maximum iron content for all elementary flows.
imb_bounds : pandas DataFrame
    The minimum and maximum allowable imbalance for all activities or product-activity
    interactions.
lab : dict
    Matching between the ecoinvent id and name for every product, activity and
    elementary flow.
tol : int
    Parameter to set the tolerance for the solver.
div : int
    Parameter to scale the _big parameter.

Returns
--------
model
    The pyomo model to solve is built.
"""
#opt.options["acceptable_tol"] = tol  # 10e-06
```

```
#opt.options["tol"] = tol # 10e-08
self.phase = phase
self.div = div

# Imbalance bounds
self.imb_bounds = imb_bounds

# Labels
self.lab = lab

# Smart pandas Sets
self.VmU = V - U
self.V = V
self.U = U
if phase == 1:
    del(U,V, self.U, self.V)
self.F = F
active_acts = list(set(self.VmU.loc[:, (lay0.dot(abs(self.VmU)) != 0).any()].T.index) | \
                   set(self.F.loc[:, (lay_f0.dot(abs(self.F)) != 0).any()].T.index))
#activities interacting with iron flows
active_prods = lay0.loc[:,(lay0!=0).any()].T.index #products with iron content
active_factors = lay_f0.loc[:,(lay_f0!=0).any()].T.index #el_flows with iron content

self.pertinent_entries = {}
self.pertinent_entriesf = {}
for act in active_acts:
```

```
        self.pertinent_entries[act] = set(self.VmU.loc[:, act].loc[self.VmU.loc[:, act] != 0].index)\
                                      & set(active_prods)
        #for each activity, the iron products interacting with it
        self.pertinent_entriesf[act] = set(self.F.loc[:, act].loc[self.F.loc[:, act] != 0].index) & \
                                       set(active_factors)
        #for each activity, the iron elementary flows interacting with it

    only_el = []
    for act in active_acts:
        if (self.pertinent_entriesf[act] != set()) & (self.pertinent_entries[act] == set()):
            #print("Activity", act, "only has elementary flows")
            only_el.append(act)
    active_acts = list(set(active_acts) - set(only_el))

    print("Done initializing Smart Sets","Current Time =", datetime.now().strftime("%H:%M:%S"))
    # Model initialization
    self.model = po.ConcreteModel()
    self.res = None
    model = self.model

    # Define optimization variables
    self.model.prods = po.Set(initialize=active_prods)
    self.model.cons_prods = po.Set(initialize=[prod for prod in self.model.prods if
                                               (lay_bounds.loc[prod,'max'] != None)])
    del(active_prods)
    self.model.acts = po.Set(initialize=active_acts)
```

```python
del(active_acts)
self.model.factors = po.Set(initialize=active_factors)
del(active_factors)
if phase == 2:
    self.model.V = po.Var(model.prods, model.acts, initialize={(prod, act): V.loc[prod, act]
                                                for prod in model.prods for act in model.acts})
    self.model.U = po.Var(model.prods, model.acts, initialize={(prod, act): U.loc[prod, act]
                                                for prod in model.prods for act in model.acts})
    self.model.F = po.Var(model.factors, model.acts, initialize={(factor, act):
                    self.F.loc[factor, act] for factor in model.factors for act in model.acts})
self.model.lay0 = po.Param(model.prods, within=po.NonNegativeReals,
                           initialize={prod: lay0.loc['A',prod] for prod in model.prods})
del(lay0)
def bounds(model,i):
    return (lay_bounds.loc[i, 'min'], lay_bounds.loc[i, 'max'])

self.model.lay = po.Var(model.prods, within=po.NonNegativeReals, bounds=bounds,
                        initialize={prod: model.lay0[prod] for prod in model.prods})

self.model.lay_f0 = po.Param(model.factors, within=po.NonNegativeReals,
                    initialize={factor: lay_f0.loc['A',factor] for factor in model.factors})
del(lay_f0)
def boundsf(model,i):
    return (lay_f_bounds.loc[i, 'min'], lay_f_bounds.loc[i, 'max'])

self.model.lay_f = po.Var(model.factors, within=po.NonNegativeReals, bounds=boundsf,
```

```
                            initialize={factor: model.lay_f0[factor] for factor in model.factors})

        print("Done initializing model", "Current Time =", datetime.now().strftime("%H:%M:%S"))

    @property
    def lay(self):
        """Composition of product flows, post-rebalancing"""
        return todf(self.model.lay)

    @property
    def lay_f(self):
        """Composition of factors of production, post-rebalancing"""
        return todf(self.model.lay_f)

    @property
    def imb(self):
        """Imbalance variable"""
        return todf(self.model.imb_neg) + todf(self.model.imb_pos)

    def init_obj_param_vect(self):
        """Function to initialize the parameters in the objective for 1 imbalance per activity solving.
        Parameters
        --------
        full : pandas DataFrame
            Selection of activities that interacts with iron.
        _big : float
```

```
            Penalty for the imbalance needed to balance an activity.
        tot_flows_act : dict
            The quantity of iron an activity interacts with.

        Returns
        --------
        objective parameters
            All objective parameters for 1 imbalance per activity solving are defined.
        """
        self.full = [(act) for act in self.model.acts]
        # self.model.acts instead of self.pertinent_entries.keys() because only_el activities in
        # pertinent_entries.keys()

        self._big = self.VmU.max().max() / self.div # abs(max(self.VmU.values(), key=abs)) / self.div
        self.tot_flows_act = {}
        for act in self.model.acts:
            self.tot_flows_act[act] = 0
            for prod in self.pertinent_entries[act]:
                self.tot_flows_act[act] += abs(self.model.lay0[prod]) * abs(self.VmU.loc[prod, act])
            for prod in self.pertinent_entriesf[act]:
                self.tot_flows_act[act] += abs(self.model.lay_f0[prod]) * abs(self.F.loc[prod, act])

        print("Done initializing objective parameters", "Current Time =",
              datetime.now().strftime("%H:%M:%S"))

    def init_obj_param_matr(self):
```

```python
"""Function to initialize the parameters in the objective for 1 imbalance per product-activity
interaction solving.
Parameters
---------
full : pandas DataFrame
     Selection of product-activity interaction that interacts with iron.
_big : float
    Penalty for the imbalance needed to balance an activity.
tot_flows : dict
    The quantity of iron a product-activity interaction interacts with.

Returns
---------
objective parameters
    All objective parameters for 1 imbalance per product-activity interaction
    solving are defined.
"""
self.full = [(prod, act) for act in self.model.acts for prod in self.pertinent_entries[act]]
# self.model.acts instead of self.pertinent_entries.keys() because only_el activities in
# pertinent_entries.keys()

self._big = self.VmU.max().max() / self.div #abs(max(self.VmU.values(), key=abs)) / self.div
self.tot_flows = {}
for act in self.model.acts:
    for prod in self.pertinent_entries[act]:
        self.tot_flows[prod, act] = abs(self.model.lay0[prod]) * abs(self.VmU.loc[prod, act])
```

```
        for prod in self.pertinent_entriesf[act]:
            self.tot_flows[prod, act] = abs(self.model.lay_f0[prod]) * abs(self.F.loc[prod, act])

    print("Done initializing objective parameters", "Current Time =",
          datetime.now().strftime("%H:%M:%S"))


def solve(self, how='strict'):
    """Simple function to choose the solving method.
    Parameters
    --------
    how : str
        The method to solve the optimization, 'strict' not allowing any imbalance,
        'soft' allowing imbalance, 'soft_squared_vect' allowing one imbalance per
        activity while squaring the objective and 'soft_squared_matr' allowing one
        imbalance per product-activity interaction while squaring the objective.

    Returns
    --------
    pandas DataFrame
        Balanced iron content for each product and the remaining imbalance.
    """
    # Set up system constrained and objectives
    if how == 'strict':
        self.init_obj_param_vect()
        self._define_rebalance_strict()
```

```
elif how == 'soft':
    self.init_obj_param_matr()
    self._define_rebalance_soft()
elif how == 'soft_squared_vect':
    self.init_obj_param_vect()
    self._define_rebalance_soft_squared()
elif how == 'soft_squared_matr':
    self.init_obj_param_matr()
    self._define_rebalance_soft_squared_matr()

# Perform optimization
self.res = opt.solve(self.model, tee = True)
print("Done solving", "Current Time =", datetime.now().strftime("%H:%M:%S"))
self.resultaat = {}
self.resultaat['lay'] = todf(self.model.lay)
if how == 'soft_squared_vect':
    self.resultaat['imb'] = todf(self.model.imb_pos_act) - todf(self.model.imb_neg_act)
else:
    self.resultaat['imb'] = todf(self.model.imb_pos) - todf(self.model.imb_neg)
self.resultaat['lay_f'] = todf(self.model.lay_f)
with gzip.open(r'C:\Users\hande\Documents\Maîtrise recherche\Maîtrise\jupyter\Python\gitlab\
Results\geo_scaling_2' + datetime.now().strftime("%Y%m%d-%H%M%S%f") +'.gz.pickle','wb') as f:
    pickle.dump(self.resultaat, f)

print("Done saving", "Current Time =", datetime.now().strftime("%H:%M:%S"))
return self.lay,self.imb
```

```python
def _initialize_soft_balance_constraint(self):
    """Initialize imbalance variables and use them to define soft constraints on
    product-activity balance, allowing one imbalance per activity.
    Parameters
    --------
    model.imb_pos_act : pyomo variable
        The positive imbalance per activity.
    model.imb_neg_act : pyomo variable
        The negative imbalance per activity.

    Returns
    --------
    pyomo constraints
        The constraints for solving with one imbalance per activity.
    """

    # Define two slack variables, one positive, one negative
    def bounds(model, act):
        return (self.imb_bounds.loc[act, 'min'], self.imb_bounds.loc[act, 'max'])
    self.model.imb_pos_act = po.Var(self.model.acts, initialize=0., within=po.NonNegativeReals)
    self.model.imb_neg_act = po.Var(self.model.acts, initialize=0., within=po.NonNegativeReals)

    # Define (soft) balance constraint
    def activity_balance(model, act):
        if self.phase == 1:
```

```
            return sum(model.lay[prod] * self.VmU.loc[prod, act] for prod in
                           self.pertinent_entries[act]) + \
                       sum(model.lay_f[factor] * self.F.loc[factor, act] for factor in
                           self.pertinent_entriesf[act])\
                       + model.imb_pos_act[act] - model.imb_neg_act[act] == 0
        elif self.phase == 2:
            return sum(model.lay[prod] * (model.V[prod, act] - model.U[prod, act]) for prod in \
                           self.pertinent_entries[act]) + \
                       sum(model.lay_f[factor] * model.F[factor, act] for factor in
                           self.pertinent_entriesf[act]) \
                       + model.imb_pos_act[act] - model.imb_neg_act[act] == 0

    self.model.cons_activity_balance = po.Constraint(self.model.acts, rule=activity_balance)

    print("Done initializing soft constraints", "Current Time =",
          datetime.now().strftime("%H:%M:%S"))

def _initialize_soft_balance_constraint_matr(self):
    """Initialize imbalance variables and use them to define soft constraints on
    product-activity balance, allowing one imbalance per product-activity interaction.
    Parameters
    --------
    model.imb_pos : pyomo variable
        The positive imbalance per product-activity interaction.
    model.imb_neg_act : pyomo variable
        The negative imbalance per product-activity interaction.
```

```
    Returns
    --------
    pyomo constraints
        The constraints for solving with one imbalance per product-activity interaction.
    """

    # Define two slack variables, one positive, one negative
    def bounds(model, prod, act):
        return (self.imb_bounds.loc[act, 'min'], self.imb_bounds.loc[act, 'max'])
    self.model.imb_pos = po.Var(self.full, initialize=0., within=po.NonNegativeReals)
    self.model.imb_neg = po.Var(self.full, initialize=0., within=po.NonNegativeReals)

    # Define (soft) balance constraint
    def activity_balance(model, act):
        if self.phase == 1:
            return sum(model.lay[prod] * self.VmU.loc[prod, act] + model.imb_pos[prod, act] -
                        model.imb_neg[prod, act] for prod in self.pertinent_entries[act]) + \
                    sum(model.lay_f[factor] * self.F.loc[factor, act] for factor in
                        self.pertinent_entriesf[act])\
                    == 0
        elif self.phase == 2:
            return sum(model.lay[prod] * (model.V[prod, act] - model.U[prod, act]) +
                        model.imb_pos[prod, act] - model.imb_neg[prod, act] for prod in
                        self.pertinent_entries[act]) + \
                    sum(model.lay_f[factor] * model.F[factor, act] for factor in
```

```
                        self.pertinent_entriesf[act])==0

        self.model.cons_activity_balance = po.Constraint(self.model.acts, rule=activity_balance)

        print("Done initializing soft constraints", "Current Time =",
              datetime.now().strftime("%H:%M:%S"))


    def _define_rebalance_soft_squared(self):
        """Soft-constrained balanced optimization, with squared-imbalanced penalty
        on objective function for one imbalance per activity solving.
        Parameters
        --------
        model.obj : pyomo objective
            The squared objective for one imbalance per activity.

        Returns
        --------
        pyomo objective
            The squared objective for solving with one imbalance per activity.
        """

        self._initialize_soft_balance_constraint()

        # Define penalty function
        if self.phase == 1:
```

```
    model = self.model
    self.expression = (sum(((model.lay[p] - model.lay0[p]) / model.lay0[p]) ** 2
                           for p in model.cons_prods )+
                  sum(((model.lay_f[f] - model.lay_f0[f]) / model.lay_f0[f]) ** 2
                      for f in model.factors) +
            sum(self._big * (model.imb_pos_act[act] + model.imb_neg_act[act])
                for act in self.full))
elif self.phase == 2:
    model = self.model
    penalty = 5000
    self.expression = (sum(((model.lay[p] - model.lay0[p]) / model.lay0[p]) ** 2
                           for p in model.cons_prods )+
                  sum(((model.lay_f[f] - model.lay_f0[f]) / model.lay_f0[f]) ** 2
                      for f in model.factors) +
                  sum(self._big * (model.imb_pos_act[act] + model.imb_neg_act[act])
                      for act in self.full) +
                  sum(penalty * (self.model.V[p,a] - self.V.loc[p,a])**2 for a in
                      self.full for p in self.pertinent_entries[a]) +
                  sum(penalty * (self.model.U[p,a] - self.U.loc[p,a])**2 for a in
                      self.full for p in self.pertinent_entries[a]) +
                  sum(penalty * (self.model.F[f,a] - self.F.loc[f,a])**2 for a in
                      self.full for f in self.pertinent_entriesf[a]))
print("Done defining expression for soft squared", "Current Time =",
      datetime.now().strftime("%H:%M:%S"))

#objective defined in front, then just minimize
```

```python
        self.model.obj = po.Objective(expr=self.expression, sense=po.minimize)

        print("Done initializing objective for soft squared", "Current Time =",
              datetime.now().strftime("%H:%M:%S"))

    def _define_rebalance_soft_squared_matr(self):
        """Soft-constrained balanced optimization, with squared-imbalanced penalty on
        objective function for one imbalance per product-activity interaction solving.
        Parameters
        ---------
        model.obj : pyomo objective
            The squared objective for one imbalance per product-activity interaction.

        Returns
        ---------
        pyomo objective
            The squared objective for solving with one imbalance per product-activity interaction.
        """

        self._initialize_soft_balance_constraint_matr()

        # Define penalty function
        if self.phase == 1:
            model = self.model
            self.expression = (sum(((model.lay[p] - model.lay0[p]) / model.lay0[p]) ** 2
```

```
                        for p in model.cons_prods )+
                   sum(((model.lay_f[f] - model.lay_f0[f]) / model.lay_f0[f]) ** 2
                       for f in model.factors) +
                   sum(self._big * (model.imb_pos[(prod, act)] + model.imb_neg[(prod, act)])
                       for (prod, act)
                       in self.full))
elif self.phase == 2:
    model = self.model
    penalty = 5000
    self.expression = (sum(((model.lay[p] - model.lay0[p]) / model.lay0[p]) ** 2
                        for p in model.cons_prods )+
                   sum(((model.lay_f[f] - model.lay_f0[f]) / model.lay_f0[f]) ** 2
                       for f in model.factors) +
                   sum(self._big * (model.imb_pos[(prod, act)] + model.imb_neg[(prod, act)])
                       for (prod, act) in self.full) +
                   sum(penalty * (self.model.V[p,a] - self.V.loc[p,a])**2
                       for (p,a) in self.full) +
                   sum(penalty * (self.model.U[p,a] - self.U.loc[p,a])**2
                       for (p,a) in self.full) +
                   sum(penalty * (self.model.F[f,a] - self.F.loc[f,a])**2
                       for a in model.acts
                       for f in self.pertinent_entriesf[a]))
print("Done defining expression for soft squared", "Current Time =",
      datetime.now().strftime("%H:%M:%S"))

#objective defined in front, then just minimize
```

```python
        self.model.obj = po.Objective(expr=self.expression, sense=po.minimize)

        print("Done initializing objective for soft squared", "Current Time =",
              datetime.now().strftime("%H:%M:%S"))


    def _define_rebalance_soft(self):
        """Soft-constrained balanced optimization, arithmetic sum of imbalances
        on objective function for one imbalance per product-activity interaction solving.
        Parameters
        --------
        model.obj : pyomo objective
            The soft objective for one imbalance per product-activity interaction.

        Returns
        --------
        pyomo objective
            The soft objective for solving with one imbalance per product-activity interaction.
        """

        model = self.model
        self._initialize_soft_balance_constraint()

        # Define penalty function
        self.model.obj = po.Objective(
```

```
        expr=(# Penalty for deviating from original guess
                sum(((model.lay[p] - self.model.lay0[p]) / self.model.lay0[p])
                    for p in self.model.cons_prods ) +
                # Penalty for remaining imbalance
                sum( self._big * (model.imb_pos[prod, act] - model.imb_neg[prod, act])
                     /self.tot_flows[prod, act] for (prod, act) in self.full)),
        sense=po.minimize)

    print("Done initializing objective for soft", "Current Time =",
          datetime.now().strftime("%H:%M:%S"))

def _define_rebalance_strict(self):
    """The pure rebalancing.
    Parameters
    --------
    model.obj : pyomo objective
        The objective for attaining balance.

    Returns
    --------
    pyomo objective
        The objective for attaining balance.
    """

    model = self.model
```

```
    # Define (soft) balance constraint
    def activity_balance(model, act):
        return sum(model.lay[prod] * self.model.VmU[prod, act] for prod in model.prods) + \
               sum(model.lay_f0[factor] * self.model.F[factor, act] for factor in model.factors) \
               >= 0,\
               sum(model.lay[prod] * self.model.VmU[prod, act] for prod in model.prods) + \
               sum(model.lay_f0[factor] * self.model.F[factor, act] for factor in model.factors) \
               <= 0
    self.model.cons_activity_balance = po.Constraint(self.model.acts, rule=activity_balance)

    print("Done initializing strict constraints", "Current Time =",
          datetime.now().strftime("%H:%M:%S"))

    # Define penalty function
    self.model.obj = po.Objective(
        expr=(# Penalty for deviating from original guess
                sum(((model.lay[p] - self.model.lay0[p]) / self.model.lay0[p]) ** 2
                    for p in self.model.prods)
        ),
        sense=po.minimize)

    print("Done initializing objective for strict", "Current Time =",
          datetime.now().strftime("%H:%M:%S"))

def check_balance(self):
    """Calculate any imbalance
```

```python
        Parameters
        ---------


        Returns
        ---------
        pandas DataFrame
            Any remaining imbalance.
        """
        return self.model.lay @ self.model.VmU + self.model.lay_f @ self.model.F

    def activity_inspector(self,act):
        """Inspect an activity.
        Parameters
        ---------
        act : str
            The activity to inspect.

        Returns
        ---------
        pandas DataFrame
            All iron flows interacting with the activity.
        """
        self.flows = pd.DataFrame(index = ('OUT', 'El', 'imb'))
        for prod in self.model.prods:
            if self.model.lay[prod].value * self.model.VmU[prod, act] != 0:
                self.flows.at['OUT', self.lab[prod]] = self.model.lay[prod].value * \
```

```
                                                    self.model.VmU[prod,act]
        for factor in self.model.factors:
            if self.model.lay_f0[factor] * self.model.F[factor, act] != 0:
                self.flows.at['El', self.lab[factor]] = self.model.lay_f0[factor] * \
                                                        self.model.F[factor,act]
        if self.resultaat['imb'].loc[act] != 0:
            self.flows.at['imb', self.lab[act]] = self.resultaat['imb'].loc[act]
        return self.flows.dropna(axis=1, how = 'all').fillna(0)

def template_reader(file):
    """Read template and generate a RebalancingSystem.
    Parameters
    --------
    file : excel
        An excel file containing supply and use tables, initial guesses and
        their bounds, bounds on the imbalance and labels.

    Returns
    --------
    RebalancingSystem
        The system to balance
    """

    U = pd.read_excel(file, 'U', index_col=0).fillna(0)
    V = pd.read_excel(file, 'V', index_col=0).fillna(0)
    F = pd.read_excel(file, 'F', index_col=0).fillna(0)
```

```python
def raw2bounds(raw):
    bounds = raw[['min','max']]
    bounds = bounds.replace({np.nan: None})
    return bounds

# Read lay and bounds on composition
raw = pd.read_excel(file, 'lay', index_col=0)
lay_0 = raw['iron']
lay0 = pd.DataFrame(index=['A'], columns=lay_0.index)
for prod in lay_0.index:
    lay0.at['A', prod] = lay_0.loc[prod]
lay_bounds = raw2bounds(raw)

# Read lay_f and bounds on composition
raw = pd.read_excel(file, 'lay_f', index_col=0)
lay_f_0 = raw['iron']
lay_f0 = pd.DataFrame(index = ['A'], columns = lay_f_0.index)
for prod in lay_f_0.index:
    lay_f0.at['A', prod] = lay_f_0.loc[prod]
lay_f_bounds = raw2bounds(raw)

# bounds on imbalance, to restrict soft constraint
imb_bounds = raw2bounds(pd.read_excel(file, 'imb_bounds', index_col=0))

# Retrieve the labels
```

```
raw = pd.read_excel(file, 'labels', index_col=0)
lab = raw['name']

return RebalancingSystem(1, U, V, F, lay0, lay_f0, lay_bounds, lay_f_bounds,
                         imb_bounds, lab)
```

APPENDIX B JUPYTER NOTEBOOK

Filtering ecoinvent into different versions

July 19, 2021

1 Filtering ecoinvent

This notebook will filter ecoinvent in different ways and explain each step in the filtering process.

2 Import ecoinvent 3.6 in SUT form

[ ]:
```
import pandas as pd
import gzip
import pickle
with gzip.open(r'C:\Users\hande\Documents\Maîtrise recherche\Maîtrise\jupyter\3.
↪6_undefined_datasets_public_unallocated\ecoinvent_3-6_sutPandas_SUT.gz.
↪pickle', 'rb') as f:
    sut = pickle.load(f)
```

2.1 Get rid of all empty activities (no interaction with any product) . . .

[ ]:
```
#Identify the empty columns for each interaction matrix
Uact_empty = (sut['U'] == 0).all()
Vact_empty = (sut['V'] == 0).all()
Fact_empty = (sut['G_act'] == 0).all()
#Identify the columns that are empty in all matrices
isact = ~ (Vact_empty & Fact_empty & Uact_empty)
#Select the non empty columns
U = sut['U'].loc[:,isact]
V = sut['V'].loc[:,isact]
F = sut['G_act'].loc[:,isact]
activities = sut['activities'].loc[isact,:]
#Save the non empty columns as the new matrices
sut['U'] = U
sut['V'] = V
sut['G_act'] = F
sut['activities'] = activities
```

2.2 … and useless products (not used or produced)

[ ]:
```
#Identify the empty rows for each interaction matrix
isnused = (sut['U'].T == 0).all()
isnprod = (sut['V'].T == 0).all()
#Identify the rows that are empty in both matrices
isuseless = ((isnused) & (isnprod))
#Select the non empty rows
pro = sut['products'].loc[~ isuseless,:]
U = sut['U'].loc[~ isuseless,:]
V = sut['V'].loc[~ isuseless,:]
#Save the non empty rows as the new matrices
sut['U'] = U
sut['V'] = V
sut['products'] = pro
```

3 Filter 1: Get rid of the coefficient in all activities using capital goods

Get rid of use coefficients of capital goods –> 0

[ ]:
```
#Import the excel file where activities are identified as capital or not
iscapital = {}
import csv
with open(r'C:\Users\hande\Documents\Maîtrise recherche\Maîtrise\jupyter\3.
 ↪6_undefined_datasets_public_unallocated\Iron_4.csv') as csv_file:
    reader = csv.reader(csv_file,dialect='excel')
    for row in reader:
        # Capital product or not
        iscapital[row[0]] = bool(int(row[2]))
iscapital['4c2b1cc3-84e5-4e35-b74e-8815eadbc674'] = False
```

[ ]:
```
empty = abs(sut['U']).sum() == 0
empty_acts = empty.loc[empty].index
LCI_acts = []
for i in empty_acts:
    if ('market' not in sut['activities'].loc[i,'activityName']) and␣
 ↪((('treatment' not in sut['activities'].loc[i,'activityName']) and ('land␣
 ↪already in use' not in sut['activities'].loc[i,'activityName'])) and␣
 ↪('clear-cutting' not in sut['activities'].loc[i,'activityName'])):
        LCI_acts.append(i)
U_sut = sut['U'].drop(empty_acts, axis=1)
V_sut = sut['V'].drop(empty_acts, axis=1)
F_sut = sut['G_act'].drop(empty_acts, axis=1)
act = sut['activities'].drop(empty_acts, axis = 0)
```

[ ]:
```
U_cap = U_sut
U_cap = U_cap.sparse.to_dense()
for i in U_cap.index:
    if iscapital[i]:
        U_cap.loc[i] = 0
U_cap = U_cap.astype(pd.SparseDtype("float", 0.0))
```

[ ]:
```
#Identify the empty columns for each interaction matrix
Uact_empty = (U_cap == 0).all()
Vact_empty = (V_sut == 0).all()
Fact_empty = (F_sut == 0).all()
#Identify the columns that are empty in all matrices
isact = ~ (Vact_empty & Fact_empty & Uact_empty)
#Select the non empty columns
U_cap = U_cap.loc[:,isact]
V_sut = V_sut.loc[:,isact]
F_sut = F_sut.loc[:,isact]
act = act.loc[isact,:]
```

[ ]:
```
#Identify the empty rows for each interaction matrix
isnused = (U_cap.T == 0).all()
isnprod = (V_sut.T == 0).all()
#Identify the rows that are empty in both matrices
isuseless = ((isnused) & (isnprod))
#Select the non empty rows
pro = sut['products'].loc[~ isuseless,:]
U_cap = U_cap.loc[~ isuseless,:]
V_sut = V_sut.loc[~ isuseless,:]
```

[ ]:
```
#Save the new version
sut1 = {}
sut1['U'] = U_cap
sut1['V'] = V_sut
sut1['G_act'] = F_sut
sut1['activities'] = act
sut1['products'] = pro
sut1['STR'] = sut['STR']
```

[ ]:
```
with gzip.open(r'C:\Users\hande\Documents\Maîtrise recherche\Maîtrise\jupyter\3.
↪6_undefined_datasets_public_unallocated\ecoinvent_versions\ecoinvent_3-6_no_cap_used.
↪gz.pickle', 'wb') as f:
    pickle.dump(sut1, f)
```

4 Filter 1_2: Get rid of all capital goods and activities that produce them

[ ]:
```
#Import the excel file where activities are identified as capital or not
iscapital = {}
import csv
with open(r'C:\Users\hande\Documents\Maîtrise recherche\Maîtrise\jupyter\3.
 ↪6_undefined_datasets_public_unallocated\Iron_4.csv') as csv_file:
    reader = csv.reader(csv_file,dialect='excel')
    for row in reader:
        # Capital product or not
        iscapital[row[0]] = bool(int(row[2]))
iscapital['4c2b1cc3-84e5-4e35-b74e-8815eadbc674'] = False
```

[ ]:
```
#Identify the activities that produce capital goods
capact2 = set()
for prod in sut['products'].index:
    if iscapital[prod]:
        for act in sut['activities'].index:
            if sut['V'].loc[prod,act] != 0:
                capact2.add(act)
```

[ ]:
```
#Delete the activities that produce capital goods
U_cap2 = sut['U'].drop(capact2, axis = 1)
V_cap2 = sut['V'].drop(capact2, axis = 1)
F_cap2 = sut['G_act'].drop(capact2, axis = 1)
activity_cap2 = sut['activities'].drop(capact2, axis = 0)
```

[ ]:
```
#Delete the capital goods
capprod = [key for key in iscapital if iscapital[key] == True]
U_cap2 = U_cap2.drop(capprod, axis = 0)
V_cap2 = sut['V'].drop(capprod, axis = 0)
prod_cap2 = sut['products'].drop(capprod, axis = 0)
```

[ ]:
```
#Save the new version
sut2 = {}
sut2['U'] = U_cap2
sut2['V'] = V_cap2
sut2['G_act'] = F_cap2
sut2['activities'] = activity_cap2
sut2['products'] = prod_cap2
```

[ ]:
```
with gzip.open(r'C:\Users\hande\Documents\Maîtrise recherche\Maîtrise\jupyter\3.
 ↪6_undefined_datasets_public_unallocated\ecoinvent_versions\ecoinvent_3-6_no_cap_or_act_prod_c
 ↪gz.pickle', 'wb') as f:
    pickle.dump(sut2, f)
```

5 Filter 2: Get rid of all activities producing only final demand goods

[ ]:

```
#Identify the activities that only produce products for final demand
final_act = {} #Dictionary saving the id's of the activities producing for final demand
for act in sut['activities'].index:
    final_act[act] = False #Default False
used = {} #Check which products are used
for act in sut['activities'].index:
    for prod in sut['products'].index:
        if sut['U'].loc[prod,act]!=0:
            used[prod] = True
for act in sut['activities'].index:
    produced = {}
    for prod in sut['products'].index:
        produced[prod] = (sut['V'].loc[prod,act] != 0) #Check all products produced by the activity
    if sum(prod in used for prod in produced.keys() if produced[prod]==True)<1:
    #sum([(sut['U'].loc[prod,:] == 0).all() for prod in produced.keys() if produced[prod]==True])\
    #>=sum(produced.values()):
    #For every product produced by an activity, see if it is used (->True -> total sum will be 1 or
    #higher indicating activity has to stay) otherwise, mark it as a final_activity
        final_act[act] = True
```

[ ]:

```
index_map = {v: i for i, v in enumerate(sut['U'].T.index)}
isfinal = sorted(final_act.items(), key=lambda pair: index_map[pair[0]])
import pandas
isfinal = pandas.Series((isfinal[i][1] for i in range(len(isfinal))), (isfinal[i][0] for i in range(len(isfinal))))
```

[ ]:

```
#Delete the activities that only produce for final demand
U_fin = sut['U'].loc[:,~ isfinal]
V_fin = sut['V'].loc[:,~ isfinal]
F_fin = sut['G_act'].loc[:,~ isfinal]
activities_fin = sut['activities'].loc[~ isfinal,:]
```

[ ]:

```
#Delete the products that are not produced or used anymore (bc activities were deleted)
isnprod_fin = (V_fin.T == 0).all()
isnused_fin = (U_fin.T == 0).all()
#Identify the rows that are empty in both matrices
isuseless_fin = ((isnused_fin) & (isnprod_fin))
#Select the non empty rows
```

```
pro_fin = sut['products'].loc[~ isuseless_fin,:]
U_fin = U_fin.loc[~ isuseless_fin,:]
V_fin = V_fin.loc[~ isuseless_fin,:]
```

[ ]:
```
#Save the new version
sut3 = {}
sut3['U'] = U_fin
sut3['V'] = V_fin
sut3['G_act'] = F_fin
sut3['activities'] = activities_fin
sut3['products'] = pro_fin
```

[ ]:
```
with gzip.open(r'C:\Users\hande\Documents\Maîtrise recherche\Maîtrise\jupyter\3.
↪6_undefined_datasets_public_unallocated\ecoinvent_versions\ecoinvent_3-6_no_final_demand.
↪gz.pickle', 'wb') as f:
    pickle.dump(sut3, f)
```

[ ]:
```

```

demo_lcamfa_rebalancer

July 19, 2021

1 Rebalancing ecoinvent for iron

[ ]:
```
# Extract the SUT
import gzip
import pickle
import pandas
with gzip.open(r'C:\Users\hande\Documents\Maîtrise recherche\Maîtrise\jupyter\
3.
↪6_undefined_datasets_public_unallocated\ecoinvent_versions\ecoinvent_3-6_no_cap_used.
↪gz.pickle', 'rb') as f:
    sut = pickle.load(f)
U_mar = sut['U'].drop([i for i in sut['activities'].index if sut['activities'].
↪loc[i,'activityType'] != 0],axis = 1)
V_mar = sut['V'].drop([i for i in sut['activities'].index if sut['activities'].
↪loc[i,'activityType'] != 0],axis = 1)
F_mar = sut['G_act'].drop([i for i in sut['activities'].index if␣
↪sut['activities'].loc[i,'activityType'] != 0],axis = 1)
services = [] #services and stock build up in landfill excluded
for i in U_mar.T.index:
    if (sut['activities'].loc[i, 'activityName'][:12] == 'treatment of'):
        services.append(i)
U_serv = U_mar.drop(services, axis = 1)
U_serv = U_serv.fillna(0)
V_serv = V_mar.drop(services, axis = 1)
V_serv = V_serv.fillna(0)
F_serv = F_mar.drop(services, axis = 1)
F_serv = F_serv.fillna(0)

del(U_mar,V_mar,F_mar)

#Identify the empty rows for each interaction matrix
isnused = (U_serv.T == 0).all()
isnprod = (V_serv.T == 0).all()
#Identify the rows that are empty in both matrices
isuseless = ((isnused) & (isnprod))
#Select the non empty rows
U = U_serv.loc[~ isuseless,:]
```

```
V = V_serv.loc[~ isuseless,:]
#Save the non empty rows as the new matrices
U_serv = U
V_serv = V
U_serv = U_serv.where(abs(U_serv) > 1e-20, 0)
V_serv = V_serv.where(abs(V_serv) > 1e-20, 0)
F_serv = F_serv.where(abs(F_serv) > 1e-20, 0)
products = sut['products'].loc[~ isuseless,:]

del(isnused,isnprod,isuseless,U,V)
```

[ ]:
```
#Inputs from environment should be negative
inputs = pandas.DataFrame(index = F_serv.index, columns = ['sign'], data = 1)
for factor in inputs.index:
    if sut['STR'].loc[factor,'comp'] == 'natural resource':
        inputs.loc[factor,'sign'] = -1
F_serv = F_serv.mul(inputs.loc[:,'sign'], axis = 0)

del(inputs)
```

[ ]:
```
# Initialize the bounds and initial guesses
import numpy as np

#Bounds and initial guess
guess_excel = pandas.Series(dtype = np.dtype(np.int32))
bounds_excel = pandas.Series(dtype = np.dtype(np.int32))
heterogen = pandas.Series(dtype = np.dtype(np.int32))
import csv
with open(r'C:\Users\hande\Documents\Maîtrise recherche\Maîtrise\jupyter\
3.6_undefined_datasets_public_unallocated\Iron_4.csv') as csv_file:
    reader = csv.reader(csv_file,dialect='excel')
    for row in reader:
        # Iron bounds 0,0 ; 0,1 ; 0.95,1 ; ... and guess 0; 0.1; 0.5; 0.7; 1
        bounds_excel[row[0]] = row[3]
        guess_excel[row[0]] = float(row[4])
        heterogen[row[0]] = float(row[5])

# ï»¿ in key so add manually
guess_excel['4c2b1cc3-84e5-4e35-b74e-8815eadbc674'] = float(0)
bounds_excel['4c2b1cc3-84e5-4e35-b74e-8815eadbc674'] = '0,0'
heterogen['4c2b1cc3-84e5-4e35-b74e-8815eadbc674'] = 0

# Convert the string into lists
for i in bounds_excel.keys():
    if bounds_excel[i] != '':
        bounds_excel[i] = [float(k) for k in bounds_excel[i].split(',')]
```

```
# Bounds flowchart
bounds = pandas.Series(dtype = np.dtype(np.int32))
iron = products.loc[:,['iron content [dimensionless]','mass concentration, iron␣
 ↪[kg/m3]']].dropna(how='all')
dry_mass = products.loc[:,'dry mass [kg]'].dropna()
mass_units = ['MJ', 'kg', 'km', 'l', 'm', 'm*year', 'm2', 'm2*year', 'm3',␣
 ↪'unit']
for i in products.index:
    if bounds_excel[i] != '':
        if i in iron.index:
            replace = input("Do you want to overwrite the iron content defined␣
 ↪in ecoinvent for "+
                            sut['products'].loc[i,'productName'] +' from␣
 ↪'+str(iron.loc[i].dropna()[0])+
                            ' to␣
 ↪'+str(bounds_excel[i][0])+','+str(bounds_excel[i][1])+'? [y/n]')
            if (replace != 'y') and (replace != 'n'):
                replace = input("Please answer with y or n")
            if replace == 'y':
                bounds[i] = bounds_excel[i]
            elif replace == 'n':
                bounds[i] = [0.99*float(iron.loc[i].dropna()[0]),1.01*float(iron.
 ↪loc[i].dropna()[0])]
            else:
                raise Exception("Please try again and answer using y or n")
        elif products.loc[i,'unitName'] == 'kg': #Only take our guess for␣
 ↪products measured in kg
            bounds[i] = bounds_excel[i]
        elif i in dry_mass.keys(): # Bounds = (0, mass)
            bounds[i] = [bounds_excel[i][0]*float(dry_mass[i]),␣
 ↪bounds_excel[i][1]*float(dry_mass[i])]
        elif products.loc[i,'unitName'] not in mass_units: # No mass
            bounds[i] = [0.0, 0.0]
        elif products.loc[i,'unitName'] == 'l': #relatable through physical␣
 ↪principle, heaviest element:
                                                 #Osmium, bounds cannot be too␣
 ↪strict
            bounds[i] = [bounds_excel[i][0]*22.59, bounds_excel[i][1]*22.59]
        elif products.loc[i,'unitName'] == 'm3': #relatable through physical␣
 ↪principle
            bounds[i] = [bounds_excel[i][0]*22590, bounds_excel[i][1]*22590]
        else: #No physical principle
            bounds[i] = [0, np.nan]
    elif i in iron.index: # Bounds = iron content +- 0.01*iron content
        bounds[i] = [0.99*float(iron.loc[i].dropna()[0]),1.01*float(iron.loc[i].
 ↪dropna()[0])]
```

```
    elif i in dry_mass.keys(): # Bounds = (0, mass)
        bounds[i] = [0, float(dry_mass[i])]
    elif products.loc[i,'unitName'] != 'kg':
        if products.loc[i,'unitName'] not in mass_units: # No mass
            bounds[i] = [0.0, 0.0]
        elif products.loc[i,'unitName'] == 'l': #relatable through physical␣
↪principle, heaviest element: Osmium
            bounds[i] = [0.0, 22.59]
        elif products.loc[i,'unitName'] == 'm3': #relatable through physical␣
↪principle
            bounds[i] = [0.0, 22590]
        else: #No physical principle
            bounds[i] = [0, np.nan]
    else: # Unit is kg, no dry mass, no iron content and no mass given in excel␣
↪-> [0,1]
        bounds[i] = [0.0, 1]

# Guess flowchart
guess = pandas.Series(dtype = np.dtype(np.int32))
for i in products.index:
    if i in iron.index: # Guess = iron content
        guess[i] = float(iron.loc[i].dropna()[0])
    elif len(str(guess_excel[i])) > 3: # Certain of guess -> keep it
        guess[i] = guess_excel[i]
    elif i in dry_mass.keys(): # Guess = Guess*dry_mass
        guess[i] = guess_excel[i]*float(dry_mass[i])
    elif products.loc[i,'unitName'] != 'kg':
        if products.loc[i,'unitName'] not in mass_units: # No mass
            guess[i] = 0
        elif products.loc[i,'unitName'] == 'l': #relatable through physical␣
↪principle, Guess for iron
            guess[i] = guess_excel[i]*7.874
        elif products.loc[i,'unitName'] == 'm3': #relatable through physical␣
↪principle
            guess[i] = guess_excel[i]*7874
        elif products.loc[i,'unitName'] == 'unit':
            guess[i] = guess_excel[i]*10000
        else: #No physical principle
            guess[i] = guess_excel[i]
    else: # Unit is kg, no dry mass and no iron content -> guess from excel
        guess[i] = guess_excel[i]

guess['cb262c3c-a7c7-4781-82e6-e1e90dd92b65'] = 0.65 # 'iron ore, beneficiated,␣
↪65% Fe' has iron content defined as 0
bounds['cb262c3c-a7c7-4781-82e6-e1e90dd92b65'] = [0.99*0.65, 1.01*0.65]
```

```
activity = U_serv.T.index
product = products.index
el_flow = sut['STR'].index
Iron = ['A']
#lay0
lay0 = pandas.DataFrame(index = Iron, columns = product, data={prod: guess[prod]␣
 ↪for prod in products.index})
lay0 = lay0.where(lay0!=0).astype(pandas.SparseDtype("float64",np.nan)).fillna(0)

#laf0
laf0 = pandas.DataFrame(dtype = np.dtype(np.int32))
for i in sut['STR'].index:
    if (('Iron' in sut['STR']['name'][i]) and (sut['STR']['name'][i] !=␣
 ↪'Iron-59')) or
    (('iron' in sut['STR']['name'][i]) and (sut['STR']['name'][i] != 'Iron-59')):
        laf0.at['A', i] = 1
    else:
        laf0.at['A', i] = 0
lay_f0 = pandas.DataFrame(index = Iron, columns = el_flow, data = laf0.values)

del(guess_excel, bounds_excel, iron, dry_mass, mass_units, replace, laf0)
```

[ ]:
```
#Precision of natural resource elementary flows
bounds_f_excel = pandas.Series(dtype = np.dtype(np.int32))
with open(r'C:\Users\hande\Documents\Maîtrise recherche\Maîtrise\jupyter\
3.6_undefined_datasets_public_unallocated\Iron_el.csv') as csv_file:
    reader = csv.reader(csv_file,dialect='excel')
    for row in reader:
        # Iron bounds 0,0 ; 0,1 ; ... and guess 0; 0.01; 0.3; 0.5; 1
        bounds_f_excel[row[0]] = row[2]
        lay_f0.loc['A', row[0]] = float(row[3])

# Convert the string into lists
for i in bounds_f_excel.keys():
    bounds_f_excel[i] = [float(k) for k in bounds_f_excel[i].split(',')]
lay_f_bounds = pandas.DataFrame(0, index = el_flow, columns = ['min','max'])
for i in bounds_f_excel.keys():
    lay_f_bounds.loc[i,'min'] = bounds_f_excel[i][0]
    lay_f_bounds.loc[i,'max'] = bounds_f_excel[i][1]

lay_f0 = lay_f0.where(lay_f0!=0).astype(pandas.SparseDtype("float64",np.nan)).
 ↪fillna(0)

del(bounds_f_excel)
```

```
[ ]: lay_bounds = pandas.DataFrame(index = product, columns = ['min','max'])

     for i in product:
         lay_bounds.loc[i,'min'] = bounds[i][0]
         lay_bounds.loc[i,'max'] = bounds[i][1]
     lab = {}
     for i in sut['products'].index:
         lab[i] = sut['products'].loc[i,'productName']
     for i in sut['STR'].index:
         lab[i] = sut['STR'].loc[i,'name']
     imb_bounds = pandas.DataFrame(index = activity, columns = ['min', 'max'])
```

1.1 Intermezzo, only select a fraction of the activities, in order of complexity

```
[ ]: with gzip.open(r'C:\Users\hande\Documents\Maîtrise recherche\Maîtrise\jupyter\
     3.6_undefined_datasets_public_unallocated\ISIC.gz.pickle', 'rb') as f:
         ISIC = pickle.load(f)
     ISIC = pandas.DataFrame(data = ISIC)
     for ind in ISIC.index:
         ISIC.loc[ind,'act'] = ind[:36]
     ISIC = ISIC.set_index('act')
     for act in activity:
         if act in ISIC.index:
             sut['activities'].loc[act,'ISIC'] = ISIC.loc[act,'ISIC']
```

```
[ ]: U_serv
```

```
[ ]: def activity_slice(U, V, F, code):
         actif = sut['activities'].where(sut['activities']['ISIC']<str(code)).
      ↪dropna(how='all').index
         U = U.reindex(columns = actif)
         V = V.reindex(columns = actif)
         F = F.reindex(columns = actif)
         return U, V, F
     U_serv, V_serv, F_serv = activity_slice(U_serv, V_serv, F_serv, '3000')
```

```
[ ]: U_serv
```

1.2 Return to the main algorithm implementation, rescaling

```
[ ]: import rescaling as resc
     schaal = resc.Rescale(U_serv, V_serv, F_serv)
     #scaling on products
     schaal.scale()
```

[ ]:
```
import rescaling_geo as resc_g
schaal_g = resc_g.Rescale(schaal.U, schaal.V, schaal.F)
#scaling on products
schaal_g.scale()
```

[ ]:
```
#LOI check
if (U_serv.where(U_serv!=0).notna().sum().sum() == schaal_g.U.where(schaal_g.U!
 ↪=0).notna().sum().sum()) & \
(V_serv.where(V_serv!=0).notna().sum().sum() == schaal_g.V.where(schaal_g.V!=0).
 ↪notna().sum().sum()) & \
(F_serv.where(F_serv!=0).notna().sum().sum() == schaal_g.F.where(schaal_g.F!=0).
 ↪notna().sum().sum()):
    print('No loss of information')
```

[ ]:
```
schaal.adapt_bounds_guesses(lay_bounds, lay_f_bounds, lay0, lay_f0)
```

[ ]:
```
schaal_g.adapt_bounds_guesses(schaal.lay_bounds, schaal.lay_f_bounds, schaal.
 ↪lay0, schaal.lay_f0)
```

[ ]:
```
del(schaal.U, schaal.V, schaal.F, schaal.acts, schaal.prods, schaal.factors,␣
 ↪schaal.order, schaal.r_total,
    schaal.rf_total, schaal.range_col, schaal.range_row, schaal.range_cell,␣
 ↪schaal.performance, schaal.lay_bounds,
    schaal.lay0, schaal.lay_f_bounds, schaal.lay_f0)
del(schaal_g.acts, schaal_g.prods, schaal_g.factors, schaal_g.order, schaal_g.
 ↪r_total, schaal_g.rf_total,
    schaal_g.range_col, schaal_g.range_row, schaal_g.range_cell, schaal_g.
 ↪performance)
```

[ ]:
```
import sys
sys.path.append(r'C:\Program Files\IBM\ILOG\CPLEX_Studio201')
import cplex
```

[ ]:
```
# Rebalance the first time
import lcamfa_rebalancer as reb
tol = [10e-6]
div = [1]
# Loop through penalty functions until the solver (hopefully) succeeds
for delen in div:
    for tl in tol:
        try:
            bal=reb.RebalancingSystem(1, schaal_g.U, schaal_g.V, schaal_g.F,␣
 ↪schaal_g.lay0, schaal_g.lay_f0,
                                      schaal_g.lay_bounds, schaal_g.
 ↪lay_f_bounds, imb_bounds, lab, tl, delen)
            lay, imb = bal.solve(how='soft_squared_matr')
```

```
        except ValueError as e:
            if (delen == div[-1]) and (tl == tol[-1]):
                raise e
del(schaal_g.U, schaal_g.V, schaal_g.F, schaal_g.lay_bounds, schaal_g.lay0,␣
 ↪schaal_g.lay_f_bounds, schaal_g.lay_f0)
del(lay,imb)
```

[ ]:
```
bal.lay
```

1.3 Disaggregation

[ ]:
```
schaal_g.readapt_lay(bal.resultaat['lay'])
schaal_g.readapt_lay_f(bal.resultaat['lay_f'])
schaal_g.readapt_imb(bal.resultaat['imb'])
schaal.readapt_lay(schaal_g.lay)
schaal.readapt_lay_f(schaal_g.lay_f)
schaal.readapt_imb(schaal_g.imb)
schaal.imb = schaal.imb.where(abs(schaal.imb)>10e-8,0)
del(schaal.iterations, schaal.s_total, schaal.resc_fact, schaal.resc_factf)
del(schaal_g.iterations, schaal_g.s_total, schaal_g.resc_fact, schaal_g.
 ↪resc_factf)
del(schaal_g.lay, schaal_g.lay_f, schaal_g.imb)
del(bal)
```

[ ]:
```
C = V_serv.sparse.to_dense()
Y = U_serv.sparse.to_dense()
#Select products that are used a lot
foo = (C != 0).sum(axis=1).sort_values()[-200:].index
for i in C.index:
    if int(heterogen[i]) == 1:
        if ((Y.loc[i,:]!=0).any()):
            #Count the number of non-zero entries
            counter = (C.loc[i,:]!=0).sum() # is sparse: .value_counts()[True]
            for c in range(counter):
                prod = pandas.Series(index = C.T.index, dtype = 'float64')
                #Set the coefficient for one activity
                prod.loc[C.loc[i,C.loc[i,:]!=0].index[c]] = C.loc[i,C.loc[i,C.
 ↪loc[i,:]!=0].index[c]]
                #Give prod a unique name -1, -2, -3, ...
                prod.name = i+'_'+str(c)
                #Add the disaggregated product to V
                C = C.append(prod.fillna(0))
                #Adapt the initial guess
                if i in schaal.imb.index:
                    guess[prod.name] = guess[i]+schaal.imb.loc[i,C.loc[i,C.
 ↪loc[i,:]!=0].index[c]]
```

```
                else:
                    guess[prod.name] = guess[i]
                bounds[prod.name] = bounds[i]
            uses = (Y.loc[i,:]!=0).sum() # is sparse: .value_counts()[True]
            totimb = sum(schaal.imb.loc[:,C.loc[i,C.loc[i,:]!=0].index[c]].sum()␣
↪for c in range(counter))
            for c in range(counter):
                for u in range(uses):
                    prod = pandas.Series(index = Y.T.index, dtype = 'float64')
                    #use = initial use*imbalance on activity c/sum(imbalance on␣
↪activities in counter)
                    if totimb !=0:
                        print('Rescale with imb')
                        prod.loc[Y.loc[i,Y.loc[i,:]!=0].index[u]] = Y.loc[i,Y.
↪loc[i,Y.loc[i,:]!=0].index[u]]*
                        (1-schaal.imb.loc[:,C.loc[i,C.loc[i,:]!=0].index[c]].
↪sum()/totimb)
                    else:
                        print('Absolute rescaling')
                        prod.loc[Y.loc[i,Y.loc[i,:]!=0].index[u]] = Y.loc[i,Y.
↪loc[i,Y.loc[i,:]!=0].index[u]]/counter
                    #Add the row to U
                prod.name = i+'_'+str(c)
                Y = Y.append(prod.fillna(0))
        elif ((Y.loc[i,:]==0).all()):
            #Count the number of non-zero entries
            counter = (C.loc[i,:]!=0).sum() # is sparse: .value_counts()[True]
            for c in range(counter):
                prod = pandas.Series(index = C.T.index, dtype = 'float64')
                #Set the coefficient for one activity
                prod.loc[C.loc[i,C.loc[i,:]!=0].index[c]] = C.loc[i,C.loc[i,C.
↪loc[i,:]!=0].index[c]]
                #Give prod a unique name -1, -2, -3, ...
                prod.name = i+'_'+str(c)
                #Add the disaggregated product to V
                C = C.append(prod.fillna(0))
                #Adapt the initial guess
                if i in schaal.imb.index:
                    guess[prod.name] = guess[i]+schaal.imb.loc[i,C.loc[i,C.
↪loc[i,:]!=0].index[c]]
                else:
                    guess[prod.name] = guess[i]
                bounds[prod.name] = bounds[i]
                #Add the row to U
                prod = pandas.Series(index = Y.T.index, dtype = 'float64')
                prod.name = i+'_'+str(c)
```

```
                Y = Y.append(prod.fillna(0))
            C = C.drop(index = i)
            Y = Y.drop(index = i)
C = C.where(C!=0).astype(pandas.SparseDtype("float64", np.nan)).fillna(0)
Y = Y.where(Y!=0).astype(pandas.SparseDtype("float64", np.nan)).fillna(0)
```

```
[ ]: #For used capital, check coefficient sum
print([sum(Y.loc[j,act] for j in Y.index if ((len(j)>36) and(j[:36] == i[:36]))),
       U_serv.loc[i[:36],act] for i in Y.index for act in Y.T.index if␣
 ↪(len(i)>36 and U_serv.loc[i[:36],act]!=0)])
```

```
[ ]: products = Y.index
#lay0
lay0 = pandas.DataFrame(index = Iron, columns = products, data={prod:␣
 ↪guess[prod] for prod in products})
lay0 = lay0.where(lay0!=0).astype(pandas.SparseDtype("float64",np.nan)).fillna(0)

lay_bounds = pandas.DataFrame(index = products, columns = ['min','max'])

for i in products:
    lay_bounds.loc[i,'min'] = bounds[i][0]
    lay_bounds.loc[i,'max'] = bounds[i][1]
```

```
[ ]: lay0 = lay0.where(lay0>0,abs(lay0))
```

```
[ ]: # Rescale the disaggregated dataset
import rescaling as resc
schaal = resc.Rescale(Y, C, F_serv)
#scaling on products
schaal.scale()
import rescaling_geo as resc_g
schaal_g = resc_g.Rescale(schaal.U, schaal.V, schaal.F)
#scaling on products
schaal_g.scale()
schaal.adapt_bounds_guesses(lay_bounds, lay_f_bounds, lay0, lay_f0)
schaal_g.adapt_bounds_guesses(schaal.lay_bounds, schaal.lay_f_bounds, schaal.
 ↪lay0, schaal.lay_f0)
```

```
[ ]: del(schaal.U, schaal.V, schaal.F, schaal.acts, schaal.prods, schaal.factors,␣
 ↪schaal.order, schaal.r_total,
    schaal.rf_total, schaal.range_col, schaal.range_row, schaal.range_cell,␣
 ↪schaal.performance, schaal.lay_bounds,
    schaal.lay0, schaal.lay_f_bounds, schaal.lay_f0)
del(schaal_g.acts, schaal_g.prods, schaal_g.factors, schaal_g.order, schaal_g.
 ↪r_total, schaal_g.rf_total,
    schaal_g.range_col, schaal_g.range_row, schaal_g.range_cell, schaal_g.
 ↪performance)
```

```
del(lay_bounds, lay_f_bounds, lay0, lay_f0)
```

[ ]:
```
boek = {}
boek['U'] = schaal_g.U.where(schaal_g.U!=0).astype(pandas.
 ↪SparseDtype("float64",np.nan)).fillna(0)
boek['V'] = schaal_g.V.where(schaal_g.V!=0).astype(pandas.
 ↪SparseDtype("float64",np.nan)).fillna(0)
boek['F'] = schaal_g.F.where(schaal_g.F!=0).astype(pandas.
 ↪SparseDtype("float64",np.nan)).fillna(0)
boek['lay0'] = schaal_g.lay0.where(schaal_g.lay0!=0).astype(pandas.
 ↪SparseDtype("float64",np.nan)).fillna(0)
boek['lay_f0'] = schaal_g.lay_f0.where(schaal_g.lay_f0!=0).astype(pandas.
 ↪SparseDtype("float64",np.nan)).fillna(0)
boek['lay_b'] = schaal_g.lay_bounds
boek['layf_b'] = schaal_g.lay_f_bounds
boek['imbb'] = imb_bounds.where(imb_bounds!=0).astype(pandas.
 ↪SparseDtype("float64",np.nan)).fillna(0)
boek['lab'] = lab
schaal.s_total.loc[:, 'rescale'] = 1
for factor in range(schaal.iterations):
    schaal.s_total.loc[:, 'rescale'] *= schaal.s_total.loc[:, factor]
schaal_g.s_total.loc[:, 'rescale'] = 1
for factor in range(schaal_g.iterations):
    schaal_g.s_total.loc[:, 'rescale'] *= schaal_g.s_total.loc[:, factor]
boek['ss_total'] = schaal.s_total
boek['ress_fact'] = schaal.resc_fact
boek['ress_factf'] = schaal.resc_factf
boek['sg_total'] = schaal_g.s_total
boek['resg_fact'] = schaal_g.resc_fact
boek['resg_factf'] = schaal_g.resc_factf
```

[ ]:
```
# Save everything to restart kernel to free up the RAM
import gzip
import pickle
with gzip.open(r'C:\Users\hande\Documents\Maîtrise␣
 ↪recherche\Maîtrise\jupyter\Python\gitlab\Results\
intermediate.gz.pickle','wb') as f:
    pickle.dump(boek, f)
```

[ ]:
```
```

[ ]:
```
import gzip
import pickle
import pandas
import numpy as np
```

```
with gzip.open(r'C:\Users\hande\Documents\Maîtrise␣
↪recherche\Maîtrise\jupyter\Python\gitlab\Results\
intermediate.gz.pickle', 'rb') as f:
    boek = pickle.load(f)
```

```
[ ]: for key in boek.keys():
         if key != 'lab' and key != 'lay_b' and key != 'layf_b':
             boek[key] = boek[key].where(boek[key]!=0).astype(pandas.
     ↪SparseDtype("float64", np.nan)).fillna(0)
```

```
[ ]: for key in boek.keys():
         if key != 'lab' and key != 'lay_b' and key != 'layf_b':
             boek[key] = boek[key].sparse.to_dense().fillna(0.)
             boek[key] = boek[key].astype(pandas.SparseDtype("float64", 0.))
```

```
[ ]: # Second rebalancing
     import sys
     sys.path.append(r'C:\Program Files\IBM\ILOG\CPLEX_Studio201')
     import cplex
     import lcamfa_rebalancer as reb
     tol = [10e-6]
     div = [1]
     # Loop through penalty functions until the solver (hopefully) succeeds
     for delen in div:
         for tl in tol:
             try:
                 bal=reb.RebalancingSystem(1, boek['U'], boek['V'], boek['F'],␣
     ↪boek['lay0'], boek['lay_f0'],
                                           boek['lay_b'], boek['layf_b'],␣
     ↪boek['imbb'], boek['lab'], tl, delen)
                 del(boek['U'], boek['V'], boek['F'], boek['lay0'], boek['lay_f0'],␣
     ↪boek['lay_b'], boek['layf_b'],
                     boek['imbb'], boek['lab'])
                 lay, imb = bal.solve(how='soft_squared_matr')
             except ValueError as e:
                 if (delen == div[-1]) and (tl == tol[-1]):
                     raise e
     del(lay,imb)
```

```
[ ]: #schaal_g.readapt_lay(bal.resultaat['lay'])
     lay = bal.resultaat['lay'].T.mul(boek['ress_fact'].loc[:, 'factor'], axis=0).T.
     ↪fillna(0)

     #schaal_g.readapt_lay_f(bal.resultaat['lay_f'])
     lay_f = bal.resultaat['lay_f'].T.mul(boek['ress_factf'].loc[:, 'factor']/1e2,␣
     ↪axis=0).T.fillna(0)
```

```
#schaal_g.readapt_imb(bal.resultaat['imb'])
imb = bal.resultaat['imb'].div(boek['ss_total'].loc[:, 'rescale'], axis=1).
 ↪fillna(0)
#del(bal)

#schaal.readapt_lay(schaal_g.lay)
lay = lay.T.mul(boek['resg_fact'].loc[:, 'factor'], axis=0).T.fillna(0)

#schaal.readapt_lay_f(schaal_g.lay_f)
lay_f = lay_f.T.mul(boek['resg_factf'].loc[:, 'factor']/1e2, axis=0).T.fillna(0)

#schaal.readapt_imb(schaal_g.imb)
imb = imb.div(boek['sg_total'].loc[:, 'rescale'], axis=1).fillna(0)

imb = imb.where(abs(imb)>10e-8,0)
del(boek)
```

[ ]:
```
# Save the results for analyzing
result = {}
result['lay'] = lay
result['lay_f'] = lay_f
result['imb'] = imb
import gzip
import pickle
with gzip.open(r'C:\Users\hande\Documents\Maîtrise␣
 ↪recherche\Maîtrise\jupyter\Python\gitlab\Results\
disaggr_result_July.gz.pickle','wb') as f:
    pickle.dump(result, f)
```

[ ]:
```

```

[ ]:
```
import gzip
import pickle
import pandas
import pandas as pd
import numpy as np
with gzip.open(r'C:\Users\hande\Documents\Maîtrise␣
 ↪recherche\Maîtrise\jupyter\Python\gitlab\Results\
intermediate.gz.pickle', 'rb') as f:
    boek = pickle.load(f)
with gzip.open(r'C:\Users\hande\Documents\Maîtrise␣
 ↪recherche\Maîtrise\jupyter\Python\gitlab\Results\
disaggr_result.gz.pickle','rb') as f:
    result = pickle.load(f)
for key in boek.keys():
    if key != 'lab' and key != 'lay_b' and key != 'layf_b':
```

```
        boek[key] = boek[key].where(boek[key]!=0).astype(pandas.
↪SparseDtype("float64", np.nan)).fillna(0)
for key in boek.keys():
    if key != 'lab' and key != 'lay_b' and key != 'layf_b':
        boek[key] = boek[key].sparse.to_dense().fillna(0.)
        boek[key] = boek[key].astype(pandas.SparseDtype("float64", 0.))
```

[ ]:
```
#Descale boek
boek['U'] = boek['U'].div(boek['ss_total'].loc[:, 'rescale'].
↪mul(boek['sg_total'].loc[:, 'rescale'])
                          .fillna(0), axis=1).fillna(0)
boek['U'] = boek['U'].div(boek['ress_fact'].loc[:, 'factor'].
↪mul(boek['resg_fact'].loc[:, 'factor'])
                          .fillna(0), axis=0).fillna(0)
boek['V'] = boek['V'].div(boek['ss_total'].loc[:, 'rescale'].
↪mul(boek['sg_total'].loc[:, 'rescale'])
                          .fillna(0), axis=1).fillna(0)
boek['V'] = boek['V'].div(boek['ress_fact'].loc[:, 'factor'].
↪mul(boek['resg_fact'].loc[:, 'factor'])
                          .fillna(0), axis=0).fillna(0)
boek['F'] = boek['F'].div(boek['ss_total'].loc[:, 'rescale'].
↪mul(boek['sg_total'].loc[:, 'rescale'])
                          .fillna(0), axis=1).fillna(0)
boek['F'] = boek['F'].div(boek['ress_factf'].loc[:, 'factor'].
↪mul(boek['resg_factf'].loc[:, 'factor'])
                          .fillna(0), axis=0).fillna(0)
```

[ ]:
```
VmU = boek['V'] - boek['U']
imb = result['imb'].sum()
```

[ ]:
```
import pandas as pd
def activity_inspector(act):
    """ Inspect an activity"""
    flows = pd.DataFrame(index = ('OUT', 'El', 'imb'))
    for prod in result['lay'].index:
        if result['lay'].loc[prod] * VmU.loc[prod, act] != 0:
            flows.at['OUT', sut['products'].loc[prod[:36],'productName']] =␣
↪result['lay'].loc[prod] * VmU.loc[prod,act]
    for factor in result['lay_f'].index:
        if result['lay_f'].loc[factor] * boek['F'].loc[factor, act] != 0:
            flows.at['El', sut['STR'].loc[factor,'name']] = result['lay_f'].
↪loc[factor] * boek['F'].loc[factor,act]
    if imb[act] != 0:
        flows.at['imb', sut['activities'].loc[act,'activityName']] = imb[act]
    return flows.dropna(axis=1, how = 'all').fillna(0)
```

[ ]:
```
def used_by(prod):
    return sut['activities'].loc[U_serv.loc[prod,:].where(U_serv.loc[prod,:]!=0).
 ↪dropna().index,'activityName']
def produced_by(prod):
    return sut['activities'].loc[V_serv.loc[prod,:].where(V_serv.loc[prod,:]!=0).
 ↪dropna().index,'activityName']
def prod_identifier(name):
    boo = sut['products'].loc[:,'productName'].str.contains(name)
    return sut['products'].loc[boo,'productName']
def act_identifier(name):
    boo = sut['activities'].loc[:,'activityName'].str.contains(name)
    return sut['activities'].loc[boo].index, sut['activities'].
 ↪loc[boo,'activityName']
```

[ ]:
```
#Analyse results
goo = (result['imb']>=1e-2)
result['imb'][goo].dropna(how='all', axis = 0).dropna(how='all', axis = 1).max()
```

[ ]:
```
goo = (imb>=1e-2)
groot = imb[goo].dropna(how='all', axis = 0)
```

[ ]:
```
import gzip
import pickle
import pandas
with gzip.open(r'C:\Users\hande\Documents\Maîtrise recherche\Maîtrise\jupyter\
3.
 ↪6_undefined_datasets_public_unallocated\ecoinvent_versions\ecoinvent_3-6_no_cap_used.
 ↪gz.pickle', 'rb') as f:
    sut = pickle.load(f)
U_mar = sut['U'].drop([i for i in sut['activities'].index if sut['activities'].
 ↪loc[i,'activityType'] != 0],axis = 1)
V_mar = sut['V'].drop([i for i in sut['activities'].index if sut['activities'].
 ↪loc[i,'activityType'] != 0],axis = 1)
F_mar = sut['G_act'].drop([i for i in sut['activities'].index if␣
 ↪sut['activities'].loc[i,'activityType'] != 0],axis = 1)
services = [] #services and stock build up in landfill excluded
for i in U_mar.T.index:
    if ('maintenance' in sut['activities'].loc[i,'activityName']) or␣
 ↪('transport' in
    sut['activities'].loc[i,'activityName']) or (('landfill' in␣
 ↪sut['activities'].loc[i,'activityName'])
                                        & ~ ('construction' in sut['activities'].
 ↪loc[i,'activityName'])):
        services.append(i)
U_serv = U_mar.drop(services, axis = 1)
U_serv = U_serv.fillna(0)
```

```
V_serv = V_mar.drop(services, axis = 1)
V_serv = V_serv.fillna(0)
F_serv = F_mar.drop(services, axis = 1)
F_serv = F_serv.fillna(0)
#del(U_mar,V_mar,F_mar)
#Identify the empty rows for each interaction matrix
isnused = (U_serv.T == 0).all()
isnprod = (V_serv.T == 0).all()
#Identify the rows that are empty in both matrices
isuseless = ((isnused) & (isnprod))
#Select the non empty rows
U = U_serv.loc[~ isuseless,:]
V = V_serv.loc[~ isuseless,:]
#Save the non empty rows as the new matrices
U_serv = U
V_serv = V
U_serv = U_serv.where(abs(U_serv) > 1e-20, 0)
V_serv = V_serv.where(abs(V_serv) > 1e-20, 0)
F_serv = F_serv.where(abs(F_serv) > 1e-20, 0)
products = sut['products'].loc[~ isuseless,:]

del(isnused,isnprod,isuseless,U,V)
```

[ ]:
```
import gzip
import pickle
import pandas
import csv
#Post processing
with gzip.open(r'C:\Users\hande\Documents\Maîtrise recherche\Maîtrise\jupyter\
3.6_undefined_datasets_public_unallocated\ecoinvent_3-6_sutPandas_SUT.gz.
↪pickle','rb') as f:
    sut = pickle.load(f)
iscapital = {}
heterogen = pandas.Series(dtype = np.dtype(np.int32))
comment = pandas.Series(dtype = np.dtype(np.int32))
with gzip.open(r'C:\Users\hande\Documents\Maîtrise recherche\Maîtrise\jupyter\
3.6_undefined_datasets_public_unallocated\ecoinvent_3-6_sutPandas_SUT.gz.
↪pickle', 'rb') as f:
    original = pickle.load(f)
with open(r'C:\Users\hande\Documents\Maîtrise recherche\Maîtrise\jupyter\
3.6_undefined_datasets_public_unallocated\Iron_4.csv') as csv_file:
    reader = csv.reader(csv_file,dialect='excel')
    for row in reader:
        # Capital product or not
        iscapital[row[0]] = bool(int(row[2]))
        heterogen[row[0]] = float(row[5])
        comment[row[0]] = str(row[6])
```

```
iscapital['4c2b1cc3-84e5-4e35-b74e-8815eadbc674'] = False
heterogen['4c2b1cc3-84e5-4e35-b74e-8815eadbc674'] = 0
comment['4c2b1cc3-84e5-4e35-b74e-8815eadbc674'] = ''
U_mar = sut['U'].drop([i for i in sut['activities'].index if sut['activities'].
 ↪loc[i,'activityType'] != 0]
                      ,axis = 1).sparse.to_dense()
V_mar = sut['V'].drop([i for i in sut['activities'].index if sut['activities'].
 ↪loc[i,'activityType'] != 0]
                      ,axis = 1).sparse.to_dense()
F_mar = sut['G_act'].drop([i for i in sut['activities'].index if␣
 ↪sut['activities'].loc[i,'activityType'] != 0],axis = 1)
services = []
for i in U_mar.T.index:
    if (sut['activities'].loc[i, 'activityName'][:12] == 'treatment of'):
        services.append(i)
```

```
[ ]: # Post-processing
for serv in services:
    for prod in V_mar.index:
        if V_mar.loc[prod,serv] < 0:
            V_mar.loc[prod+'waste',serv] = sum(V_mar.loc[prods,serv]-U_mar.
 ↪loc[prods,serv]+
            F_mar.loc[el,serv] for prods in U_mar.index if ((sut['products'].
 ↪loc[prods,'unitName'] == 'kg')
                                                              and␣
 ↪(~iscapital[prods])) for el in F_mar.index)
for serv in services:
    for prod in boek['V'].index:
        if len(prod)>36 and V_mar.loc[prod[:36],serv]!= 0:
            V_mar.loc[prod,serv] = V_mar.loc[prod[:36],serv]/boek['V'].index[:
 ↪36].count(prod[:36])
V_mar.drop(heterogen)
for serv in services:
    boek['V'].loc[:,serv] = V_mar.loc[:,serv]
```

```
[ ]: for i in original['U'].index:
    if iscapital[i]:
        for act in orininal['U'].T.index:
            if original['U'].loc[i,act]!=0:
                boek['U'].loc[i,act] = original['U'].loc[i,act]
            for act in boek['U'].T.index:
                boek['V'].loc[sut['products'].loc[i,'productName']+'waste',act]␣
 ↪= boek['U'].loc[i,act]*result['lay'].loc[i]
```

```
[ ]: #Phase 3
```

```
boek['V'] = boek['V'].append('unaccounted iron waste or emission, we dont know,␣
 ↪flow')
for i in groot.index:
    boek['V'].loc['unaccounted waste or emission, we dont know, flow',i] =␣
 ↪groot[i]
boek['U'].append('unaccounted waste or emission, we dont know, flow')
boek['U'].loc['unaccounted waste or emission, we dont know, flow'] = 0
```

[ ]:
```
del iscapital['ï»¿4c2b1cc3-84e5-4e35-b74e-8815eadbc674']
del comment['ï»¿4c2b1cc3-84e5-4e35-b74e-8815eadbc674']
```

[ ]:
```
from matplotlib import pyplot as plt
import numpy as np
fig = plt.figure()
ax = fig.add_axes([0,0,1,1])
ax.axis('equal')
langs = ['Heterogeneous', 'Capital', 'Other products']
students = [(heterogen!=0).sum(), sum(iscapital.values()),␣
 ↪len(iscapital)-(heterogen!=0).sum()-sum(iscapital.values())-1]
ax.pie(students, labels = langs,autopct= lambda p:f'{p:.2f}%, {p*sum(students)/
 ↪100 :.0f}')
plt.savefig('products.pdf')
plt.show()
```

[ ]:
```
from matplotlib import pyplot as plt
import numpy as np
fig = plt.figure()
ax = fig.add_axes([0,0,1,1])
ax.axis('equal')
langs = ['LCI_acts', 'Waste treatment', 'Remaining imbalance', 'Activities']
students = [114, len(services), len(groot), 6725-len(services)-114-len(groot)]
ax.pie(students, labels = langs,autopct= lambda p:f'{p:.2f}%, {p*sum(students)/
 ↪100 :.0f}')
plt.savefig('activities.pdf')
plt.show()
```

[ ]:
```
result['lay'].name = 'iron content'
comment.name = 'Comment'
```

[ ]:
```
# Generate readable results
readable_res = pd.merge(sut['products'],result['lay'], left_index=True,␣
 ↪right_index=True, how='outer')
readable_res = pd.merge(readable_res, comment, left_index=True,␣
 ↪right_index=True, how='outer')
```

```
[ ]: tuples = []
for i in readable_res.index:
    if len(tuple(i.split('_'))) == 1:
        tuples.append(tuple(i.split('_'))+(-42,))
    else:
        tuples.append(tuple(i.split('_')))
readable_res.index = pd.MultiIndex.from_tuples(tuples, names=["Product",␣
 ↪"Disaggregated"])
```

```
[ ]: for i in readable_res.index:
    if i[1]!=-42:
        for j in ['productName','unitName','productId','unitId','cpc', 'wet mass␣
 ↪[kg]', 'dry mass [kg]',
                  'iron content [dimensionless]', 'mass concentration, iron [kg/
 ↪m3]']:
            readable_res.loc[i,j] = readable_res.loc[i[0], -42].loc[j]
```

```
[ ]: pd.set_option('display.max_rows', None)
```

```
[ ]: readable_res.index = readable_res.index.set_levels(readable_res.index.levels[1].
 ↪astype(int), level=1)
```

```
[ ]: table = readable_res.sort_values(['Product', 'Disaggregated', 'iron content']).
 ↪loc[:,['productName','unitName',
                                                                                 ␣
 ↪     'iron content','Comment']].fillna('')
```

```
[ ]: null = []
for i in table.index:
    if ((table.loc[i,'iron content']) == 0 and (len(table.loc[i,'Comment']) ==␣
 ↪0)) or (table.loc[i,'iron content'] == ''):
        null.append(i)
```

```
[ ]: table = table.drop(null)
```

```
[ ]: table.to_latex(buf = 'iron.txt', longtable = True)
```

APPENDIX C RESCALING ALGORITHM

Rescaling with arithmetic mean:

```
import pandas as pd
import numpy as np

class Rescale:
    """ Organize the system """
    def __init__(self, U, V, F):
        """Init function
        Parameters
        --------
        U : pandas DataFrame
            The use matrix.
        V : pandas DataFrame
            The supply matrix.
        F : pandas DataFrame
            The elementary flow matrix.
        """

        self.U = U
        self.V = V
        self.F = F

        self.acts = U.T.index
        self.prods = U.index
        self.factors = F.index
```

```
        # Parameters RAS
        self.order = 0
        self.iterations = 5
        self.r_total = pd.DataFrame(1, index=self.prods, columns=list(range(self.iterations)))
        self.rf_total = pd.DataFrame(1, index=self.factors, columns=list(
            range(-1, self.iterations)))
        self.s_total = pd.DataFrame(1, index=self.acts, columns=list(range(self.iterations)))

        # Range for column sum, row average and cells
        self.range_col = (0.99, 1.01)
        self.range_row = (0.99, 1.01)
        self.range_cell = (0.001, 1000)

        self.performance = pd.DataFrame()

    def scale(self):
        """Function to call the scaling.
        Parameters
        --------
        order : int
            Indicates the iteration the scaling algorithm is on.

        Returns
        --------
        pandas DataFrame
            Data on the performance of the rescaling algorithm.
```

```
        """

        if self.order < self.iterations:
            self.performance_check()
        else:
            print(self.performance)

    def performance_check(self):
        """Check the amount of big and small numbers.
        Parameters
        ---------
        minsU : int
            Indicates the amount of numbers in U smaller than the cell range.
        maxsU : int
            Indicates the amount of numbers in U larger than the cell range.
        minsV : int
            Indicates the amount of numbers in V smaller than the cell range.
        maxsV : int
            Indicates the amount of numbers in V larger than the cell range.
        minsF : int
            Indicates the amount of numbers in F smaller than the cell range.
        maxsF : int
            Indicates the amount of numbers in F larger than the cell range.
        """
        minsU = int((abs(self.U).where(self.U != 0) < self.range_cell[0]).sum().sum())
        maxsU = int((abs(self.U) > self.range_cell[1]).sum().sum())
```

```python
        minsV = int((abs(self.V).where(self.V != 0) < self.range_cell[0]).sum().sum())
        maxsV = int((abs(self.V) > self.range_cell[1]).sum().sum())
        minsF = int((abs(self.F).where(self.F != 0) < self.range_cell[0]).sum().sum())
        maxsF = int((abs(self.F) > self.range_cell[1]).sum().sum())
        self.performance.loc['minsU', self.order] = minsU
        self.performance.loc['maxsU', self.order] = maxsU
        self.performance.loc['minsV', self.order] = minsV
        self.performance.loc['maxsV', self.order] = maxsV
        self.performance.loc['minsF', self.order] = minsF
        self.performance.loc['maxsF', self.order] = maxsF
        self.bad_columns()

    def bad_columns(self):
        """Function to select the bad columns.
        Parameters
        --------
        avg_U_col : pandas DataFrame
            Gives the arithmetic mean for every column in U.
        avg_F_col : pandas DataFrame
            Gives the arithmetic mean for every column in F.
        bad_cols : pandas DataFrame
            The arithmetic mean of the U and F arithmetic means for each column
            which falls out of the column range.
        Returns
        --------
        pandas DataFrame
```

```
        The arithmetic mean of the U and F arithmetic means for each column
        which falls out of the column range.
    """
    #Row balance F first
    if self.order == 0:
        avg_F = abs(self.F).where(self.F != 0).mean(axis=1).fillna(0)
        F_bad_rows = avg_F.where((avg_F > self.range_row[1]) | ((avg_F < self.range_row[0]) &
                                                                  (avg_F != 0))).dropna(how='all')
        for factor in F_bad_rows.index:
            self.rf_total.loc[factor, self.order-1] = 1 / (1e2 * F_bad_rows[factor])
        self.F = self.F.mul(self.rf_total.loc[:, self.order-1], axis=0)

    #Column balance U and F using their average coefficients
    avg_U_col = abs(self.U).where(self.U != 0).mean(axis=0).fillna(0)
    avg_F_col = abs(self.F).where(self.F != 0).mean(axis=0).fillna(0)
    bad_cols = pd.concat([avg_U_col, avg_F_col], axis=1).where(((avg_U_col > self.range_col[1])&
                                                              (avg_F_col > self.range_col[1])) |\
                ((avg_U_col > self.range_col[1]) & (avg_F_col == 0)) | ((avg_U_col == 0) &
                                                              (avg_F_col > self.range_col[1])) |\
        ((avg_U_col < self.range_col[0]) & (avg_F_col < self.range_col[0]) & ((avg_U_col != 0)|
                                              (avg_F_col != 0)))).dropna(how='all').mean(axis=1)
    self.populate_s(bad_cols)

def populate_s(self, bad_cols):
    """Populate the S rescaling matrix.
    Parameters
```

```
        --------
        bad_cols : pandas DataFrame
            The arithmetic mean of the U and F arithmetic means for each column which falls out
            of the column range.
        s_total : pandas DataFrame
            DataFrame to rescale the bad columns using the inverse of the arithmetic mean of
            the U and F arithmetic means for each column.

        Returns
        --------
        pandas DataFrame
            DataFrame to rescale the bad columns using the inverse of the arithmetic mean of
            the U and F arithmetic means for each bad column.
        """
        for act in bad_cols.index:
            self.s_total.loc[act, self.order] = 1 / bad_cols[act]
        self.apply_s()

    def apply_s(self):
        """Multiply the U, V and F matrix with S."""
        self.U = self.U * self.s_total.loc[:, self.order]
        self.V = self.V * self.s_total.loc[:, self.order]
        self.F = self.F * self.s_total.loc[:, self.order]
        self.bad_rows()

    def bad_rows(self):
```

```python
"""Function to select the bad rows in U and V.
Parameters
---------
avg_U : pandas DataFrame
    Gives the arithmetic mean for every row in U.
avg_V : pandas DataFrame
    Gives the arithmetic mean for every row in V.
UV_bad_rows : pandas DataFrame
    The arithmetic mean of the U and V arithmetic means for each row which falls out
    of the row range.
Returns
---------
pandas DataFrame
    The arithmetic mean of the U and V arithmetic means for each row which falls out
    of the row range.
"""
avg_U = abs(self.U).where(self.U != 0).mean(axis=1).fillna(0)
avg_V = abs(self.V).where(self.V != 0).mean(axis=1).fillna(0)
UV_bad_rows = pd.concat([avg_U, avg_V], axis=1).where(((avg_U > self.range_row[1])&
                                                       (avg_V > self.range_row[1])) | \
            ((avg_U > self.range_row[1]) & (avg_V == 0)) | ((avg_U == 0) &
                                                       (avg_V > self.range_row[1])) | \
    ((avg_U < self.range_row[0]) & (avg_V < self.range_row[0]) & ((avg_U != 0) |
                                    (avg_V != 0)))).dropna(how='all').mean(axis=1)
self.populate_r(UV_bad_rows)
```

```python
def populate_r(self, bad_rows):
    """Populate the R rescaling matrix.
    Parameters
    ---------
    bad_rows : pandas DataFrame
        The arithmetic mean of the U and V arithmetic means for each row which
        falls out of the row range.
    r_total : pandas DataFrame
        DataFrame to rescale the bad rows using the inverse of the arithmetic mean of
        the U and V arithmetic means for each row.

    Returns
    ---------
    pandas DataFrame
        DataFrame to rescale the bad rows using the inverse of the arithmetic mean of
        the U and V arithmetic means for each bad row.
    """
    for prod in bad_rows.index:
        self.r_total.loc[prod, self.order] = 1 / bad_rows[prod]
    self.apply_r()

def apply_r(self):
    """Multiply the U and V matrix with R."""
    self.U = self.U.mul(self.r_total.loc[:,self.order], axis = 0)
    self.V = self.V.mul(self.r_total.loc[:,self.order], axis = 0)
    self.bad_rows_F()
```

```
def bad_rows_F(self):
    """Function to select the bad rows in F.
    Parameters
    ---------
    avg_F : pandas DataFrame
        Gives the arithmetic mean for every row in F.
    F_bad_rows : pandas DataFrame
        The arithmetic mean of the rows in F for each row which falls out of the row range.
    Returns
    ---------
    pandas DataFrame
        The arithmetic mean of the rows in F for each row which falls out of the row range.
    """
    avg_F = abs(self.F).where(self.F != 0).mean(axis=1).fillna(0)
    F_bad_rows = avg_F.where((avg_F > self.range_row[1]) | ((avg_F < self.range_row[0]) &
                                                            (avg_F != 0))).dropna(how='all')
    self.populate_rf(F_bad_rows)

def populate_rf(self, bad_rows):
    """Populate the Rf rescaling matrix.
    Parameters
    ---------
    bad_rows : pandas DataFrame
        The arithmetic mean of the rows in F for each row which falls out of the row range.
    rf_total : pandas DataFrame
```

```
            DataFrame to rescale the bad rows using the inverse of the arithmetic mean of
            the rows in F for each bad row.

        Returns
        --------
        pandas DataFrame
            DataFrame to rescale the bad rows using the inverse of the arithmetic mean of
             the rows in F for each bad row.
        """
        for factor in bad_rows.index:
            self.rf_total.loc[factor, self.order] = 1 / bad_rows[factor]
        self.apply_rf()

    def apply_rf(self):
        """Multiply the F matrix with Rf."""
        self.F = self.F.mul(self.rf_total.loc[:,self.order], axis = 0)
        self.order += 1
        self.scale()

    def adapt_bounds_guesses(self, lay_bounds, lay_f_bounds, lay0, lay_f0):
        """Function to rescale the bounds and initial guess.
        Parameters
        --------
        lay_bounds : pandas DataFrame
            The bounds on the iron content for each product.
        lay_f_bounds : pandas DataFrame
```

```
        The bounds on the iron content for each elementary flow.
    lay0 : pandas DataFrame
        The initial guess of the iron content for each product.
    lay_f0 : pandas DataFrame
        The initial guess of the iron content for each elementary flow.

    Returns
    --------
    pandas DataFrame
        Rescaled bounds and initial guess.
    """
    # Adapt bounds and guesses with rescaling factors
    self.resc_fact = pd.DataFrame(1, index=self.prods, columns=['factor'])
    for i in self.r_total.index:
        for j in self.r_total.T.index:
            self.resc_fact.loc[i] *= self.r_total.loc[i, j]
    self.lay_bounds = lay_bounds.mul(1 / self.resc_fact.loc[:, 'factor'], axis=0)\
        .where(pd.notnull(lay_bounds), np.nan)
    self.lay0 = lay0.T.mul(1 / self.resc_fact.loc[:, 'factor'], axis=0).T.fillna(0)
    self.resc_factf = pd.DataFrame(1, index=self.factors, columns=['factor'])
    for i in self.rf_total.index:
        for j in self.rf_total.T.index:
            self.resc_factf.loc[i] *= self.rf_total.loc[i, j]
    self.lay_f_bounds = lay_f_bounds.mul(1e2 / self.resc_factf.loc[:, 'factor'], axis=0)\
        .where(pd.notnull(lay_f_bounds),np.nan)
    self.lay_f0 = lay_f0.T.mul(1e2 / self.resc_factf.loc[:, 'factor'], axis=0).T.fillna(0)
```

```python
def readapt_lay(self, lay):
    """Function to descale the iron content for each product.
    Parameters
    ---------
    lay : pandas DataFrame
        The iron content for each product, as calculated by the rebalancing algorithm.

    Returns
    ---------
    pandas DataFrame
        Descaled iron content for each product.
    """
    self.lay = lay.T.mul(self.resc_fact.loc[:, 'factor'], axis=0).T.fillna(0)

def readapt_lay_f(self, lay_f):
    """Function to descale the iron content for each elementary flow.
    Parameters
    ---------
    lay_f : pandas DataFrame
        The iron content for each elementary flow, as calculated by the rebalancing algorithm.

    Returns
    ---------
    pandas DataFrame
        Descaled iron content for each elementary flow.
```

```
        """
        self.lay_f = lay_f.T.mul(self.resc_factf.loc[:, 'factor']/1e2, axis=0).T.fillna(0)

    def readapt_imb(self, imb):
        """Function to descale the remaining imbalance.
        Parameters
        ---------
        imb : pandas DataFrame or Series
            The imbalance, as calculated by the rebalancing algorithm.

        Returns
        --------
        pandas DataFrame
            Descaled remaining imbalance.
        """
        # imbalance only needs to be corrected for activity scaling since defined in
        # reference to lay*VmU
        self.s_total.loc[:, 'rescale'] = 1
        for factor in range(self.iterations):
            self.s_total.loc[:, 'rescale'] *= self.s_total.loc[:, factor]
        if isinstance(imb, pd.DataFrame):
            self.imb = imb.div(self.s_total.loc[:, 'rescale'], axis=1).fillna(0)
        else: # Pandas Series
            self.imb = imb.div(self.s_total.loc[:, 'rescale']).fillna(0)
```

Rescaling with geometric mean:

```python
import pandas as pd
import numpy as np
from scipy.stats.mstats import gmean

class Rescale:
    """ Organize the system """
    def __init__(self, U, V, F):
        """Init function
        Parameters
        --------
        U : pandas DataFrame
            The use matrix.
        V : pandas DataFrame
            The supply matrix.
        F : pandas DataFrame
            The elementary flow matrix.
        """

        self.U = U
        self.V = V
        self.F = F

        self.acts = U.T.index
        self.prods = U.index
        self.factors = F.index
```

```python
        # Variables RAS
        self.order = 0
        self.iterations = 5
        self.r_total = pd.DataFrame(1, index=self.prods, columns=list(range(self.iterations)))
        self.rf_total = pd.DataFrame(1, index=self.factors, columns=list(
            range(-1, self.iterations)))
        self.s_total = pd.DataFrame(1, index=self.acts, columns=list(range(self.iterations)))

        # Range for column sum, row average and cells
        self.range_col = (0.99, 1.01)
        self.range_row = (0.99, 1.01)
        self.range_cell = (0.001, 1000)

        self.performance = pd.DataFrame()

    def scale(self):
        """Scale function
        Parameters
        --------
        order : int
            Indicates the iteration the scaling algorithm is on.

        Returns
        --------
        pandas DataFrame
            Data on the performance of the rescaling algorithm.
```

```
        """
        if self.order < self.iterations:
            self.performance_check()
        else:
            print(self.performance)

    def performance_check(self):
        """Check the amount of big and small numbers.
        Parameters
        --------
        minsU : int
            Indicates the amount of numbers in U smaller than the cell range.
        maxsU : int
            Indicates the amount of numbers in U larger than the cell range.
        minsV : int
            Indicates the amount of numbers in V smaller than the cell range.
        maxsV : int
            Indicates the amount of numbers in V larger than the cell range.
        minsF : int
            Indicates the amount of numbers in F smaller than the cell range.
        maxsF : int
            Indicates the amount of numbers in F larger than the cell range.
        """
        minsU = int((abs(self.U).where(self.U != 0) < self.range_cell[0]).sum().sum())
        maxsU = int((abs(self.U) > self.range_cell[1]).sum().sum())
        minsV = int((abs(self.V).where(self.V != 0) < self.range_cell[0]).sum().sum())
```

```python
        maxsV = int((abs(self.V) > self.range_cell[1]).sum().sum())
        minsF = int((abs(self.F).where(self.F != 0) < self.range_cell[0]).sum().sum())
        maxsF = int((abs(self.F) > self.range_cell[1]).sum().sum())
        self.performance.loc['minsU', self.order] = minsU
        self.performance.loc['maxsU', self.order] = maxsU
        self.performance.loc['minsV', self.order] = minsV
        self.performance.loc['maxsV', self.order] = maxsV
        self.performance.loc['minsF', self.order] = minsF
        self.performance.loc['maxsF', self.order] = maxsF
        self.bad_columns()

    def geo_mean(self, matrix, how):
        """Function to calculate the geometric mean of a DataFrame.
        Parameters
        --------
        matrix : pandas DataFrame
            The DataFrame of which the geometric mean should be calculated.
        how : str
            The manner for calculating the geometric mean, 'cols' signifying the mean along
            the columns and 'rows' the mean along the rows of the DataFrame.

        Returns
        --------
        pandas Series
            The geometric mean of the columns or rows.
        """
```

```
        matrix = abs(matrix)
        if how == 'cols':
            avg = pd.Series(dtype= 'float64')
            for i in matrix.T.index:
                avg[i] = gmean(abs(matrix.loc[:,i].where(matrix.loc[:,i]!=0)
                                   .dropna(how='all')))
            return avg.fillna(0)
        elif how == 'rows':
            avg = pd.Series(dtype= 'float64')
            for i in matrix.index:
                avg[i] = gmean(abs(matrix.loc[i, :].where(matrix.loc[i, :] != 0)
                                   .dropna(how='all')))
            return avg.fillna(0)

    def bad_columns(self):
        """Function to select the bad columns.
        Parameters
        --------
        avg_U_col : pandas DataFrame
            Gives the geometric mean for every column in U.
        avg_F_col : pandas DataFrame
            Gives the geometric mean for every column in F.
        bad_cols : pandas DataFrame
            The geometric mean of the U and F geometric means for each column which falls
            out of the column range.
        Returns
```

```
--------
pandas DataFrame
    The geometric mean of the U and F geometric means for each column which falls
    out of the column range.
        """
#Row balance F first
if self.order == 0:
    #Geometric mean instead of regular mean
    avg_F = self.geo_mean(self.F, how = 'rows')
    F_bad_rows = avg_F.where((avg_F > self.range_row[1]) | ((avg_F < self.range_row[0])
                                                    & (avg_F != 0))).dropna(how='all')
    for factor in F_bad_rows.index:
        self.rf_total.loc[factor, self.order-1] = 1 / (1e2 * F_bad_rows[factor])
    self.F = self.F.mul(self.rf_total.loc[:, self.order-1], axis=0)

#Column balance U and F using their average coefficients
# Geometric mean instead of regular mean
avg_U_col = self.geo_mean(self.U, how = 'cols')
avg_F_col = self.geo_mean(self.V, how = 'cols')
bad_cols_d = pd.concat([avg_U_col, avg_F_col], axis=1).where(((avg_U_col > self.range_col[1])&
                                                        (avg_F_col > self.range_col[1]))|\
            ((avg_U_col > self.range_col[1]) & (avg_F_col == 0)) | ((avg_U_col == 0) &
                                                        (avg_F_col > self.range_col[1]))|\
    ((avg_U_col < self.range_col[0]) & (avg_F_col < self.range_col[0]) & ((avg_U_col != 0) |
                                                        (avg_F_col != 0)))).dropna(how='all')
bad_cols = self.geo_mean(bad_cols_d, how = 'rows')
```

```
        self.populate_s(bad_cols)

    def populate_s(self, bad_cols):
        """Populate the S rescaling matrix.
        Parameters
        --------
        bad_cols : pandas DataFrame
            The geometric mean of the U and F geometric means for each column which falls out of
            the column range.
        s_total : pandas DataFrame
            DataFrame to rescale the bad columns using the inverse of the geometric mean of
            the U and F geometric means for each column.

        Returns
        --------
        pandas DataFrame
            DataFrame to rescale the bad columns using the inverse of the geometric mean of
            the U and F geometric means for each bad column.
        """
        for act in bad_cols.index:
            self.s_total.loc[act, self.order] = 1 / bad_cols[act]
        self.apply_s()

    def apply_s(self):
        """Multiply the U, V and F matrix with S."""
        self.U = self.U * self.s_total.loc[:, self.order]
```

```
        self.V = self.V * self.s_total.loc[:, self.order]
        self.F = self.F * self.s_total.loc[:, self.order]
        self.bad_rows()

    def bad_rows(self):
        """Function to select the bad rows in U and V.
        Parameters
        --------
        avg_U : pandas DataFrame
            Gives the geometric mean for every row in U.
        avg_V : pandas DataFrame
            Gives the geometric mean for every row in V.
        UV_bad_rows : pandas DataFrame
            The geometric mean of the U and V geometric means for each row which falls out of
            the row range.
        Returns
        --------
        pandas DataFrame
            The geometric mean of the U and V geometric means for each row which falls out of
            the row range.
        """
        # Geometric mean instead of regular mean
        avg_U = self.geo_mean(self.U, how = 'rows')
        avg_V = self.geo_mean(self.V, how = 'rows')
        UV_bad_rows_d = pd.concat([avg_U, avg_V], axis=1).where(((avg_U > self.range_row[1])&
                                                                 (avg_V > self.range_row[1]))|\
```

```
                ((avg_U > self.range_row[1]) & (avg_V == 0)) | ((avg_U == 0) &
                                                            (avg_V > self.range_row[1])) | \
            ((avg_U < self.range_row[0]) & (avg_V < self.range_row[0]) & ((avg_U != 0) |
                                                            (avg_V != 0)))).dropna(how='all')
        UV_bad_rows = self.geo_mean(UV_bad_rows_d, how = 'rows')
        self.populate_r(UV_bad_rows)

    def populate_r(self, bad_rows):
        """Populate the R rescaling matrix.
        Parameters
        --------
        bad_rows : pandas DataFrame
            The geometric mean of the U and V geometric means for each row which falls out of
            the row range.
        r_total : pandas DataFrame
            DataFrame to rescale the bad rows using the inverse of the geometric mean of
            the U and V geometric means for each row.

        Returns
        --------
        pandas DataFrame
            DataFrame to rescale the bad rows using the inverse of the geometric mean of
            the U and V geometric means for each bad row.
        """
        for prod in bad_rows.index:
            self.r_total.loc[prod, self.order] = 1 / bad_rows[prod]
```

```python
        self.apply_r()

    def apply_r(self):
        """Multiply the U and V matrix with R."""
        self.U = self.U.mul(self.r_total.loc[:,self.order], axis = 0)
        self.V = self.V.mul(self.r_total.loc[:,self.order], axis = 0)
        self.bad_rows_F()

    def bad_rows_F(self):
        """Function to select the bad rows in F.
        Parameters
        --------
        avg_F : pandas DataFrame
            Gives the geometric mean for every row in F.
        F_bad_rows : pandas DataFrame
            The geometric mean of the rows in F for each row which falls out of the row range.
        Returns
        --------
        pandas DataFrame
            The geometric mean of the rows in F for each row which falls out of the row range.
        """
        # Geometric mean instead of arithmetic mean
        avg_F = self.geo_mean(self.F, how = 'rows')
        F_bad_rows = avg_F.where((avg_F > self.range_row[1]) | ((avg_F < self.range_row[0]) &
                                                               (avg_F != 0))).dropna(how='all')
        self.populate_rf(F_bad_rows)
```

```python
def populate_rf(self, bad_rows):
    """Populate the Rf rescaling matrix.
    Parameters
    --------
    bad_rows : pandas DataFrame
        The geometric mean of the rows in F for each row which falls out of the row range.
    rf_total : pandas DataFrame
        DataFrame to rescale the bad rows using the inverse of the geometric mean of
        the rows in F for each bad row.

    Returns
    --------
    pandas DataFrame
        DataFrame to rescale the bad rows using the inverse of the geometric mean of
        the rows in F for each bad row.
    """
    for factor in bad_rows.index:
        self.rf_total.loc[factor, self.order] = 1 / bad_rows[factor]
    self.apply_rf()

def apply_rf(self):
    """Multiply the F matrix with Rf."""
    self.F = self.F.mul(self.rf_total.loc[:,self.order], axis = 0)
    self.order += 1
    self.scale()
```

```python
def adapt_bounds_guesses(self, lay_bounds, lay_f_bounds, lay0, lay_f0):
    """Function to rescale the bounds and initial guess.
    Parameters
    --------
    lay_bounds : pandas DataFrame
        The bounds on the iron content for each product.
    lay_f_bounds : pandas DataFrame
        The bounds on the iron content for each elementary flow.
    lay0 : pandas DataFrame
        The initial guess of the iron content for each product.
    lay_f0 : pandas DataFrame
        The initial guess of the iron content for each elementary flow.

    Returns
    --------
    pandas DataFrame
        Rescaled bounds and initial guess.
    """
    # Adapt bounds and guesses with rescaling factors
    self.resc_fact = pd.DataFrame(1, index=self.prods, columns=['factor'])
    for i in self.r_total.index:
        for j in self.r_total.T.index:
            self.resc_fact.loc[i] *= self.r_total.loc[i, j]
    self.lay_bounds = lay_bounds.mul(1 / self.resc_fact.loc[:, 'factor'], axis=0)\
        .where(pd.notnull(lay_bounds), None)
```

```
        self.lay0 = lay0.T.mul(1 / self.resc_fact.loc[:, 'factor'], axis=0).T.fillna(0)
        self.resc_factf = pd.DataFrame(1, index=self.factors, columns=['factor'])
        for i in self.rf_total.index:
            for j in self.rf_total.T.index:
                self.resc_factf.loc[i] *= self.rf_total.loc[i, j]
        self.lay_f_bounds = lay_f_bounds.mul(1e2 / self.resc_factf.loc[:, 'factor'], axis=0)\
            .where(pd.notnull(lay_f_bounds), None)
        self.lay_f0 = lay_f0.T.mul(1e2 / self.resc_factf.loc[:, 'factor'], axis=0).T.fillna(0)

    def readapt_lay(self, lay):
        """Function to descale the iron content for each product.
        Parameters
        ---------
        lay : pandas DataFrame
            The iron content for each product, as calculated by the rebalancing algorithm.

        Returns
        ---------
        pandas DataFrame
            Descaled iron content for each product.
        """
        self.lay = lay.T.mul(self.resc_fact.loc[:, 'factor'], axis=0).T.fillna(0)

    def readapt_lay_f(self, lay_f):
        """Function to descale the iron content for each elementary flow.
        Parameters
```

```
        --------
        lay_f : pandas DataFrame
            The iron content for each elementary flow, as calculated by the
            rebalancing algorithm.

        Returns
        --------
        pandas DataFrame
            Descaled iron content for each elementary flow.
        """
        self.lay_f = lay_f.T.mul(self.resc_factf.loc[:, 'factor']/1e2, axis=0).T.fillna(0)

    def readapt_imb(self, imb):
        """Function to descale the remaining imbalance.
        Parameters
        --------
        imb : pandas DataFrame or Series
            The imbalance, as calculated by the rebalancing algorithm.

        Returns
        --------
        pandas DataFrame
            Descaled remaining imbalance.
        """
        # imbalance only needs to be corrected for activity scaling since defined in
        # reference to lay*VmU
```

```
self.s_total.loc[:, 'rescale'] = 1
for factor in range(self.iterations):
    self.s_total.loc[:, 'rescale'] *= self.s_total.loc[:, factor]
if isinstance(imb, pd.DataFrame):
    self.imb = imb.div(self.s_total.loc[:, 'rescale'], axis=1).fillna(0)
else: # Pandas Series
    self.imb = imb.div(self.s_total.loc[:, 'rescale']).fillna(0)
```

APPENDIX D BOUNDS AND INITIAL GUESSES

Table D.1 Every product in ecoinvent with in the second column the difference between capital (1) and non capital goods (0) is made. The third column gives the bounds to the iron content of the product (0,1 if not defined), the fourth column gives the initial iron content guess, the fifth column makes a difference between heterogeneous (1) and homogeneous (0) products and the sixth column gives a comment if the iron content is different than expected

Name	Capital	Bounds	Guess	Heterogeneous	Comment
#[sulfonyl]urea-compound	0	"0,0"	0	0	
#[thio]carbamate-compound	0	"0,0"	0	0	
"#1,1-difluoroethane,HFC-152a"	0	"0,0"	0	0	
"#1,1-dimethylcyclopentane"	0	"0,0"	0	0	
#1-butanol	0	"0,0"	0	0	
#1-pentanol	0	"0,0"	0	0	
#1-propanol	0	"0,0"	0	0	
"#2,3-dimethylbutan"	0	"0,0"	0	0	
"#2,4-dichlorophenol"	0	"0,0"	0	0	
"#2,4-dichlorotoluene"	0	"0,0"	0	0	
"#2,4-dinitrotoluene"	0	"0,0"	0	0	
"#2,4-di-tert-butylphenol"	0	"0,0"	0	0	
"#2,5-dimethylhexane-2,5-dihydroperoxide"	0	"0,0"	0	0	
"#2,6-di-tert-butylphenol"	0	"0,0"	0	0	
#2-butanol	0	"0,0"	0	0	
#2-cyclopentone	0	"0,0"	0	0	
#2-methyl-1-butanol	0	"0,0"	0	0	
#2-methyl-2-butanol	0	"0,0"	0	0	
#2-methylpentane	0	"0,0"	0	0	
#2-nitroaniline	0	"0,0"	0	0	
#2-pyridinol	0	"0,0"	0	0	
#3-methyl-1-butanol	0	"0,0"	0	0	
#3-methyl-1-butylacetate	0	"0,0"	0	0	
#3-methylpyridine	0	"0,0"	0	0	
#4-methyl-2-pentanone	0	"0,0"	0	0	
#4-tert-butylbenzaldehyde	0	"0,0"	0	0	
#4-tert-butyltoluene	0	"0,0"	0	0	
"#absorptionchiller,100kW"	1		0.5	0	
#acetaldehyde	0	"0,0"	0	0	
"#acetamide-anillide-compound,unspecified"	0	"0,0"	0	0	

#acetanilide	0	"0,0"	0	0	
"#aceticacid,withoutwater,in98%solutionstate"	0	"0,0"	0	0	
#aceticanhydride	0	"0,0"	0	0	
#acetoaceticacid	0	"0,0"	0	0	
"#acetone,liquid"	0	"0,0"	0	0	
#acetonecyanohydrin	0	"0,0"	0	0	
#acetonitrile	0	"0,0"	0	0	
#acetylchloride	0	"0,0"	0	0	
#acetylene	0	"0,0"	0	0	
#aclonifen	0	"0,0"	0	0	
#acrolein	0	"0,0"	0	0	
#acrylicacid	0	"0,0"	0	0	
"#acrylicbinder,withoutwater,in34%solution..."	0		0.1	0	
"#acrylicdispersion,withoutwater,in65%solu..."	0	"0,0"	0	0	
#acrylicfiller	0	"0,0"	0	0	
"#acrylicvarnish,withoutwater,in87.5%solut..."	0	"0,0"	0	0	
#acrylonitrile	0	"0,0"	0	0	
#acrylonitrile-butadiene-styrenecopolymer	0	"0,0"	0	0	
#activatedbentonite	0		0.1	0	
"#activatedcarbon,granular"	0	"0,0"	0	0	
#activatedsilica	0	"0,0"	0	0	
"#adhesive,formetal"	0	"0,0"	0	0	
#adhesivemortar	0		0.1	0	
#adipicacid	0	"0,0"	0	0	
"#agriculturalmachinery,tillage"	1		0.5	1	
"#agriculturalmachinery,unspecified"	1		0.5	1	
#agriculturaltrailer	1		0.5	0	
"#aircompressor,screw-typecompressor,300kW"	1		0.5	0	
"#aircompressor,screw-typecompressor,4kW"	1		0.5	0	
"#aircraft,bellyfreight,longhaul"	1		0.5	0	
"#aircraft,bellyfreight,mediumhaul"	1		0.5	0	
"#aircraft,bellyfreight,shorthaul"	1		0.5	0	
"#aircraft,bellyfreight,veryshorthaul"	1		0.5	0	
"#aircraft,dedicatedfreight,longhaul"	1		0.5	0	
"#aircraft,dedicatedfreight,mediumhaul"	1		0.5	0	
"#aircraft,dedicatedfreight,shorthaul"	1		0.5	0	
"#aircraft,dedicatedfreight,veryshorthaul"	1		0.5	0	

"#aircraft,passenger,longhaul"	1		0.5	0	
"#aircraft,passenger,mediumhaul"	1		0.5	0	
"#aircraft,passenger,shorthaul"	1		0.5	0	
"#aircraft,passenger,veryshorthaul"	1		0.5	0	
"#airdistributionterminalpanel,steel,120m3/h"	1	"0.5,1"	0.7	0	
"#airfilter,centralunit,600m3/h"	1		0.5	0	
"#airfilter,decentralizedunit,180-250m3/h"	1		0.5	0	
"#airfilter,decentralizedunit,250m3/h"	1		0.5	0	
"#airfilter,inexhaustairvalve"	1		0.5	0	
"#airinput/outputunit,heatandpowerco-gener..."	1		0.5	0	
#airport	1		0.1	0	
#airseparationfacility	1		0.1	0	
"#alfalfa-grassmixture,Swissintegratedproduc..."	0	"0,0.1"	0.01	0	
#alfalfa-grasssilage	0	"0,0"	0	0	
"#alkydpaint,white,withoutsolvent,in60%so..."	0	"0,0"	0	0	
"#alkydpaint,white,withoutwater,in60%solu..."	0	"0,0"	0	0	
"#alkydresin,longoil,withoutsolvent,in70%..."	0	"0,0"	0	0	
"#alkylbenzene,linear"	0	"0,0"	0	0	
"#alkylbenzenesulfonate,linear,petrochemical"	0	"0,0"	0	0	
"#alkylketenedimersizingagent,forpaperprod..."	0	"0,0"	0	0	
#alkylsulphateC12-14	0	"0,0"	0	0	
#allylchloride	0	"0,0"	0	0	
#almond	0	"0,0.1"	0.01	0	
#alpha-naphthol	0	"0,0"	0	0	
#alpha-picoline	0	"0,0"	0	0	
"#aluminium,castalloy"	0	"0,0"	0	0	
"#aluminium,primary,castalloyslabfromconti..."	0	"0,0"	0	0	
"#aluminium,primary,ingot"	0	"0,0"	0	0	
"#aluminium,primary,liquid"	0	"0,0"	0	0	
"#aluminium,wroughtalloy"	0	"0,0"	0	0	
"#aluminiumalloy,AlLi"	0	"0,0"	0	0	
"#aluminiumalloy,AlMg3"	0	"0,0"	0	0	
"#aluminiumalloy,metalmatrixcomposite"	0		0.5	0	
#aluminiumaroundsteelbi-metalstrandedcable...	0		0.5	0	
"#aluminiumaroundsteelbi-metalwire,3.67mme..."	0		0.5	0	
#aluminiumcastingfacility	1		0.1	0	
#aluminiumchloride	0	"0,0"	0	0	

#aluminiumelectrolysisfacility	1		0.1	0	
#aluminiumfluoride	0	"0,0"	0	0	
#aluminiumhydroxide	0	"0,0"	0	0	
#aluminiumhydroxidefactory	1		0.1	0	
#aluminiumincarshredderresidue	0		0.1	0	
#aluminiummeltingfurnace	1		0.2	0	
"#aluminiumoxide,metallurgical"	0	"0,0"	0	0	
"#aluminiumoxide,non-metallurgical"	0	"0,0"	0	0	
#aluminiumoxidefactory	1		0.1	0	
"#aluminiumremovedbydrilling,computernumeri..."	0	"0,0"	0	0	
"#aluminiumremovedbydrilling,conventional"	0	"0,0"	0	0	
"#aluminiumremovedbymilling,average"	0	"0,0"	0	0	
"#aluminiumremovedbymilling,dressing"	0	"0,0"	0	0	
"#aluminiumremovedbymilling,largeparts"	0	"0,0"	0	0	
"#aluminiumremovedbymilling,smallparts"	0	"0,0"	0	0	
"#aluminiumremovedbyturning,average,compute..."	0	"0,0"	0	0	
"#aluminiumremovedbyturning,average,convent..."	0	"0,0"	0	0	
"#aluminiumremovedbyturning,primarilydressi..."	0	"0,0"	0	0	
"#aluminiumremovedbyturning,primarilydressi..."	0	"0,0"	0	0	
"#aluminiumremovedbyturning,primarilyroughi..."	0	"0,0"	0	0	
"#aluminiumremovedbyturning,primarilyroughi..."	0	"0,0"	0	0	
"#aluminiumscrap,new"	0	"0,0"	0	0	
"#aluminiumscrap,post-consumer"	0	"0,0"	0	0	
"#aluminiumscrap,post-consumer,preparedform..."	0	"0,0"	0	0	
"#aluminiumsulfate,powder"	0	"0,0"	0	0	
"#aluminiumsulfate,withoutwater,in4.33%alu..."	0	"0,0"	0	0	
#amineoxide	0	"0,0"	0	0	
#aminopyridine	0	"0,0"	0	0	
"#ammonia,liquid"	0	"0,0"	0	0	
#ammoniumbicarbonate	0	"0,0"	0	0	
#ammoniumcarbonate	0	"0,0"	0	0	
#ammoniumchloride	0	"0,0"	0	0	
"#ammoniumnitrate,asN"	0	"0,0"	0	0	
#ammoniumnitrite	0	"0,0"	0	0	
"#ammoniumsulfate,asN"	0	"0,0"	0	0	
#ammoniumthiocyanate	0	"0,0"	0	0	
"#anaerobicdigestionplant,agricultural"	1		0.1	0	

"#anaerobicdigestionplant,agriculture,withm..."	1		0.1	0	
"#anaerobicdigestionplant,forbiowaste"	1		0.1	0	
"#anaerobicdigestionplant,forsewagesludge"	1		0.1	0	
#anhydrite	0	"0,0"	0	0	
"#anhydrite,burned"	0	"0,0"	0	0	
#anhydritefloor	0	"0,0"	0	0	
#anhydriterock	0	"0,0"	0	0	
#aniline	0	"0,0"	0	0	
#anionicresin	0	"0,0"	0	0	
"#anode,formetalelectrolysis"	0		0.8	0	
"#anode,graphite,forlithium-ionbattery"	0	"0,0"	0	0	
"#anode,paste,foraluminiumelectrolysis"	0	"0,0"	0	0	
"#anode,prebake,foraluminiumelectrolysis"	0	"0,0"	0	0	
#anodefactory	1		0.1	0	
#anoderefinery	1		0.5	0	
"#anodeslime,silverandtelluriumcontaining,..."	0	"0,0"	0	0	
"#anodeslime,silverandtelluriumcontainings..."	0	"0,0"	0	0	
"#anodising,aluminiumsheet"	0	"0,0"	0	0	
#anthranilicacid	0	"0,0"	0	0	
#anthraquinone	0	"0,0"	0	0	
#antifoulingpaintemissions	0		0.1	0	
#antimony	0	"0,0"	0	0	
"#anti-reflex-coating,etching,solarglass"	0	"0,0"	0	0	
#apple	0	"0,0.1"	0.01	0	
"#applicationofplantprotectionproduct,byfi..."	0		0.1	0	
#apricot	0	"0,0.1"	0.01	0	
"#argon,crude,liquid"	0	"0,0"	0	0	
"#argon,liquid"	0	"0,0"	0	0	
#arsine	0	"0,0"	0	0	
"#asbestos,crysotiletype"	0	"0,0"	0	0	
#ascorbicacid	0	"0,0"	0	0	
"#ash,fromcombustionofbagassefromsugarcane"	0	"0,0"	0	0	
#ashfromdeinkingsludge	0		0.1	0	
#ashfrompaperproductionsludge	0		0.1	0	
"#asparagusseedling,forplanting"	0	"0,0"	0	0	
"#assemblyofgeneratorandmotor,auxilliaries..."	1		0.5	0	
"#assemblyofgeneratorandmotor,auxilliaries..."	1		0.5	0	

"#assemblyofliquidcrystaldisplay,auxilliari..."	1		0.5	0	
#atrazine	0	"0,0"	0	0	
#aubergine	0	"0,0.1"	0.01	0	
#autoclavedaeratedconcreteblock	0	"0,0.045"	0.022	0	
"#auxiliaryheatingunit,electric,5kW"	1		0.5	0	
#averageincinerationresidue	0		0.5	0	
#avocado	0	"0,0.1"	0.01	0	
#azodicarbonamide	0	"0,0"	0	0	
"#backlight,forliquidcrystaldisplay"	1		0.1	0	
"#bagasse,fromsugarcane"	0	"0,0"	0	0	
"#bagasse,fromsweetsorghum"	0	"0,0"	0	0	
#baleloading	1	"0,0"	0	0	shell capital service product
#baling	1	"0,0"	0	0	shell capital service product
#banana	0	"0,0.1"	0.01	0	
#barge	1		0.8	0	
#bargetanker	1		0.8	0	
#barite	0	"0,0"	0	0	
#bariumcarbonate	0	"0,0"	0	0	
#bariumhydroxide	0	"0,0"	0	0	
#bariumoxide	0	"0,0"	0	0	
#bariumsulfide	0	"0,0"	0	0	
#bark	0	"0,0.1"	0.01	0	
"#barkchips,wet,measuredasdrymass"	0		0.1	0	
#barleygrain	0	"0,0.1"	0.01	0	
"#barleygrain,feed"	0	"0,0.1"	0.01	0	
"#barleygrain,feed,organic"	0	"0,0.1"	0.01	0	
"#barleygrain,feed,Swissintegratedproduction"	0	"0,0.1"	0.01	0	
"#barleygrain,organic"	0	"0,0.1"	0.01	0	
"#barleygrain,Swissintegratedproduction"	0	"0,0.1"	0.01	0	
"#barleyseed,forsowing"	0	"0,0.1"	0.01	0	
"#barleyseed,organic,forsowing"	0	"0,0.1"	0.01	0	
"#barleyseed,Swissintegratedproduction,for..."	0	"0,0.1"	0.01	0	
#basalt	0		0.1	0	
#baseoil	0	"0,0.1"	0.01	0	
#baseplaster	0		0.1	0	
#basicoxygenfurnacewaste	0		0.2	0	
"#batchdyeing,fibre,cotton"	0	"0,0"	0	0	

"#battery,Li-ion,rechargeable,prismatic"	0		0.1	0	
"#battery,NaCl"	0		0.1	0	
"#battery,NiMH,rechargeable,prismatic"	0		0.1	0	
"#batterycell,Li-ion"	0		0.1	0	
#batteryseparator	0		0.5	0	
#bauxite	0	"0,0"	0	0	
"#beetseed,Swissintegratedproduction,forso..."	0	"0,0.1"	0.01	0	
#bellpepper	0	"0,0.1"	0.01	0	
#bentonite	0	"0,0"	0	0	
#bentonitequarryinfrastructure	1		0.5	0	
#benzalchloride	0	"0,0"	0	0	
#benzaldehyde	0	"0,0"	0	0	
#benzaldehyde-2-sulfonicacid	0	"0,0"	0	0	
#benzene	0	"0,0"	0	0	
#benzimidazole-compound	0	"0,0"	0	0	
#benzo[thia]diazole-compound	0	"0,0"	0	0	
#benzoicacid	0	"0,0"	0	0	
#benzoic-compound	0	"0,0"	0	0	
#benzylalcohol	0	"0,0"	0	0	
#benzylchloride	0	"0,0"	0	0	
#beveragecartonconverting	1	"0,0"	0	0	
#bicycle	1		0.5	0	
#bilgeoil	0		0.1	0	
#biogas	0	"0,0"	0	0	
"#biogas,fromgrass"	0	"0,0"	0	0	
#biowaste	0	"0,0"	0	0	
"#biowaste,gardenwaste"	0	"0,0"	0	0	
"#biowaste,kitchenandgardenwaste"	0	"0,0"	0	0	
#bipyridylium-compound	0	"0,0"	0	0	
"#bisphenolA,powder"	0	"0,0"	0	0	
#bisphenolAepoxybasedvinylesterresin	0	"0,0"	0	0	
"#bitumenadhesivecompound,cold"	0	"0,0"	0	0	
"#bitumenadhesivecompound,hot"	0	"0,0"	0	0	
#bitumenseal	0	"0,0"	0	0	
"#bitumenseal,Alu80"	0	"0,0"	0	0	
"#bitumenseal,polymerEP4flameretardant"	0	"0,0"	0	0	
"#bitumenseal,V60"	0	"0,0"	0	0	

"#bitumenseal,VA4"	0	"0,0"	0	0	
#blastfurnace	1		0.5	0	
#blastfurnacegas	0	"0,0"	0	0	
#blastfurnaceslag	0		0.2	0	
#blasting	1	"0,0"	0	0	
#blastoxygenfurnaceconverter	1		0.5	0	
"#bleaching,textile"	0	"0,0"	0	0	
"#bleachinganddyeing,yarn"	0	"0,0"	0	0	
#blister-copperconversionfacility	1		0.1	0	
"#blowerandheatexchangeunit,AventE97"	1		0.5	0	
"#blowerandheatexchangeunit,central,600-12..."	1		0.5	0	
"#blowerandheatexchangeunit,decentralized,..."	1		0.5	0	
"#blowerandheatexchangeunit,GE250RH"	1		0.5	0	
"#blowerandheatexchangeunit,KWL250"	1		0.5	0	
"#blowerandheatexchangeunit,KWLC1200"	1		0.5	0	
"#blowerandheatexchangeunit,StorkairG90"	1		0.5	0	
"#blowerandheatexchangeunit,Twl-700"	1		0.5	0	
#blowmoulding	1	"0,0"	0	0	shell capital service product
"#borax,anhydrous,powder"	0	"0,0"	0	0	
"#boreholeheatexchanger,150m"	1		0.5	0	
"#boricacid,anhydrous,powder"	0	"0,0"	0	0	
#boricoxide	0	"0,0"	0	0	
#boroncarbide	0	"0,0"	0	0	
#borontrifluoride	0	"0,0"	0	0	
"#brakewearemissions,lorry"	0		0.1	0	
"#brakewearemissions,passengercar"	0		0.1	0	
#brass	0	"0,0"	0	0	
"#brassremovedbydrilling,computernumerical..."	0	"0,0"	0	0	
"#brassremovedbydrilling,conventional"	0	"0,0"	0	0	
"#brassremovedbyturning,average,computernu..."	0	"0,0"	0	0	
"#brassremovedbyturning,average,conventional"	0	"0,0"	0	0	
"#brassremovedbyturning,primarilydressing,..."	0	"0,0"	0	0	
"#brassremovedbyturning,primarilydressing,..."	0	"0,0"	0	0	
"#brassremovedbyturning,primarilyroughing,..."	0	"0,0"	0	0	
"#brassremovedbyturning,primarilyroughing,..."	0	"0,0"	0	0	
"#brazingsolder,cadmiumfree"	0	"0,0"	0	0	
#breadcrumbs	0	"0,0.1"	0.01	0	

#brickproductionfacility	1		0.1	0	
#broccoli	0	"0,0.1"	0.01	0	
#bromine	0	"0,0"	0	0	
#bromopropane	0	"0,0"	0	0	
#bronze	0	"0,0"	0	0	
"#bronzescrap,post-consumer"	0	"0,0"	0	0	
"#building,budgethotel"	1		0.1	0	
"#building,hall"	1		0.1	0	
"#building,hall,steelconstruction"	1	"0.5,1"	0.7	0	
"#building,hall,woodconstruction"	1	"0,0"	0	0	
"#building,hostel"	1		0.1	0	
"#building,luxuryhotel"	1		0.1	0	
"#building,multi-storey"	1		0.1	0	
"#building,upmarkethotel"	1		0.1	0	
#buildingmachine	1		0.5	0	
"#buildingoperation,budgethotel"	1	"0,0"	0	0	shell capital service product
"#buildingoperation,hostel"	1	"0,0"	0	0	shell capital service product
"#buildingoperation,luxuryhotel"	1	"0,0"	0	0	shell capital service product
"#buildingoperation,upmarkethotel"	1	"0,0"	0	0	shell capital service product
"#bulkcarrier,fordrygoods"	1		0.5	0	
#bulklead-zincconcentrate	0	"0,0"	0	0	
"#bundle,energywood,measuredasdrymass"	0	"0,0"	0	0	
#burntshale	0	"0,0"	0	0	
#bus	1		0.5	0	
#butadiene	0	"0,0"	0	0	
#butane	0	"0,0"	0	0	
"#butane-1,4-diol"	0	"0,0"	0	0	
"#butene,mixed"	0	"0,0"	0	0	
"#butter,fromcowmilk"	0	"0,0"	0	0	
"#buttermilk,fromcowmilk"	0	"0,0"	0	0	
#butylacetate	0	"0,0"	0	0	
#butylacrylate	0	"0,0"	0	0	
#butyldiglycolacetate	0	"0,0"	0	0	
#butyrolactone	0	"0,0"	0	0	
#C3hydrocarbonmixture	0	"0,0"	0	0	
#cabbagered	0	"0,0.1"	0.01	0	
#cabbagewhite	0	"0,0.1"	0.01	0	

"#cable,connectorforcomputer,withoutplugs"	0		0.5	0	
"#cable,datacableininfrastructure"	0		0.5	0	
"#cable,networkcable,category5,withoutplugs"	0		0.5	0	
"#cable,printercable,withoutplugs"	0		0.5	0	
"#cable,ribboncable,20-pin,withplugs"	0		0.5	0	
"#cable,three-conductorcable"	0		0.5	0	
"#cable,unspecified"	0		0.5	0	
#cableyarderwithsledwinch	1		0.5	0	
#cableyarding	0	"0,0"	0	0	
#cadmium	0	"0,0"	0	0	
"#cadmium,semiconductor-grade"	0	"0,0"	0	0	
"#cadmiumchloride,semiconductor-grade"	0	"0,0"	0	0	
#cadmiumsludgefromzincelectrolysis	0	"0,0"	0	0	
#cadmiumsludgefromzincelectrolysisstockpiling	0	"0,0"	0	0	
"#cadmiumsulfide,semiconductor-grade"	0	"0,0"	0	0	
"#cadmiumtelluride,semiconductor-grade"	0	"0,0"	0	0	
#calcareousmarl	0		0.3	0	
#calcinedclay	0	"0,0"	0	0	
#calciumborates	0	"0,0"	0	0	
"#calciumcarbide,technicalgrade"	0	"0,0"	0	0	
"#calciumcarbonate,precipitated"	0	"0,0"	0	0	
#calciumchloride	0	"0,0"	0	0	
#calciumnitrate	0	"0,0"	0	0	
"#calendering,rigidsheets"	1	"0,0"	0	0	
#canal	1		0.1	0	
"#capacitor,auxilliariesandenergyuse"	0		0.5	0	
"#capacitor,electrolytetype,<2cmheight"	0		0.5	0	
"#capacitor,electrolytetype,>2cmheight"	0		0.5	0	
"#capacitor,filmtype,forthrough-holemounting"	0		0.5	0	
"#capacitor,forsurface-mounting"	0		0.5	0	
"#capacitor,tantalum-,forthrough-holemounting"	0		0.5	0	
#captan	0	"0,0"	0	0	
#carbonblack	0	"0,0"	0	0	
"#carbondioxide,liquid"	0	"0,0"	0	0	
#carbondisulfide	0	"0,0"	0	0	
"#carbonfibrereinforcedplastic,injectionmou..."	0	"0,0"	0	0	
#carbonmonoxide	0	"0,0"	0	0	

#carbontetrachloride	0	"0,0"	0	0	
"#carboxymethylcellulose,powder"	0	"0,0"	0	0	
#carrot	0	"0,0.1"	0.01	0	
"#carrotseed,forsowing"	0	"0,0.1"	0.01	0	
"#carrotseed,Swissintegratedproduction,atfarm"	0	"0,0.1"	0.01	0	
"#cartonboardboxproduction,withgravureprin..."	0		0.1	0	
"#cartonboardboxproduction,withoffsetprinting"	0		0.1	0	
#cashew	0	"0,0.1"	0.01	0	
"#casting,aluminium,lost-wax"	0	"0,0"	0	0	
"#casting,brass"	0	"0,0"	0	0	shell capital service product
"#casting,bronze"	0	"0,0"	0	0	shell capital service product
"#casting,steel,lost-wax"	0	"0,0"	0	0	shell capital service product
#castiron	0	"1,1"	1	0	
"#castironremovedbydrilling,computernumeri..."	0	"1,1"	1	0	
"#castironremovedbydrilling,conventional"	0	"1,1"	1	0	
"#castironremovedbymilling,average"	0	"1,1"	1	0	
"#castironremovedbymilling,dressing"	0	"1,1"	1	0	
"#castironremovedbymilling,largeparts"	0	"1,1"	1	0	
"#castironremovedbymilling,smallparts"	0	"1,1"	1	0	
"#castironremovedbyturning,average,compute..."	0	"1,1"	1	0	
"#castironremovedbyturning,average,convent..."	0	"1,1"	1	0	
"#castironremovedbyturning,primarilydressi..."	0	"1,1"	1	0	
"#castironremovedbyturning,primarilydressi..."	0	"1,1"	1	0	
"#castironremovedbyturning,primarilyroughi..."	0	"1,1"	1	0	
"#castironremovedbyturning,primarilyroughi..."	0	"1,1"	1	0	
#castorbean	0	"0,0.1"	0.01	0	
"#catalyticconverter,oxidation,20litre"	1		0.5	0	
"#catalyticconverter,selectivecatalyticreduc..."	1		0.5	0	
"#catalyticconverter,three-way,19.1l"	1		0.5	0	
"#catalyticconverter,three-way,miniCHPplant"	1		0.5	0	
"#cathode,foraluminiumelectrolysis"	1		0.5	0	
"#cathode,LiMn2O4,forlithium-ionbattery"	0	"0,0"	0	0	
"#cathode-raytube,cathoderaytubedisplay"	0		0.5	0	
#cationicresin	0	"0,0"	0	0	
"#cattleforslaughtering,liveweight"	0	"0,0.1"	0.01	0	
#cauliflower	0	"0,0.1"	0.01	0	
#celery	0	"0,0.1"	0.01	0	

"#cellulosefibre,inclusiveblowingin"	0	"0,0.1"	0.01	0	
"#cement,alternativeconstituents21-35%"	0	"0,0.045"	0.03	0	
"#cement,alternativeconstituents45%"	0	"0,0.045"	0.03	0	
"#cement,alternativeconstituents6-20%"	0	"0,0.045"	0.03	0	
"#cement,blastfurnace40-70%"	0	"0,0.045"	0.03	0	
"#cement,blastfurnaceslag,66-80%"	0	"0,0.045"	0.03	0	
"#cement,blastfurnaceslag18-30%and18-30%o..."	0	"0,0.045"	0.03	0	
"#cement,blastfurnaceslag21-35%"	0	"0,0.045"	0.03	0	
"#cement,blastfurnaceslag25-70%"	0	"0,0.045"	0.03	0	
"#cement,blastfurnaceslag31-50%and31-50%o..."	0	"0,0.045"	0.03	0	
"#cement,blastfurnaceslag35-70%"	0	"0,0.045"	0.03	0	
"#cement,blastfurnaceslag36-65%"	0	"0,0.045"	0.03	0	
"#cement,blastfurnaceslag5-25%"	0	"0,0.045"	0.03	0	
"#cement,blastfurnaceslag6-20%"	0	"0,0.045"	0.03	0	
"#cement,blastfurnaceslag6-34%"	0	"0,0.045"	0.03	0	
"#cement,blastfurnaceslag70-100%"	0	"0,0.045"	0.03	0	
"#cement,blastfurnaceslag81-95%"	0	"0,0.045"	0.03	0	
"#cement,limestone21-35%"	0	"0,0.045"	0.03	0	
"#cement,limestone6-10%"	0	"0,0.045"	0.03	0	
"#cement,limestone6-20%"	0	"0,0.045"	0.03	0	
"#cement,Portland"	0	"0,0.045"	0.03	0	
"#cement,portlandflyashcement21-35%"	0	"0,0.045"	0.03	0	
"#cement,portlandflyashcement6-20%"	0	"0,0.045"	0.03	0	
"#cement,pozzolanaandflyash11-35%"	0	"0,0.045"	0.03	0	
"#cement,pozzolanaandflyash15-40%"	0	"0,0.045"	0.03	0	
"#cement,pozzolanaandflyash15-50%"	0	"0,0.045"	0.03	0	
"#cement,pozzolanaandflyash25-35%"	0	"0,0.045"	0.03	0	
"#cement,pozzolanaandflyash36-55%"	0	"0,0.045"	0.03	0	
"#cement,pozzolanaandflyash5-15%"	0	"0,0.045"	0.03	0	
"#cement,pozzolanaandflyash6-14%"	0	"0,0.045"	0.03	0	
"#cement,sulphateresistant"	0	"0,0.045"	0.03	0	
"#cement,unspecified"	0	"0,0.045"	0.03	0	
#cementcastplasterfloor	0		0.1	0	
#cementfactory	1		0.1	0	
#cementmortar	0	"0,0.045"	0.03	0	
#cementplaster	0	"0,0.045"	0.03	0	
#cementtile	0	"0,0.045"	0.03	0	

#ceramicfactory	1		0.1	0	
#ceramictile	0	"0,0"	0	0	
"#ceriumconcentrate,60%ceriumoxide"	0		0.2	0	
#charcoal	0	"0,0"	0	0	
"#charger,electricpassengercar"	1		0.5	0	
"#charger,forelectricscooter"	1		0.5	0	
"#chassis,internetaccessequipment"	1		0.5	0	
"#cheese,fromcowmilk,fresh,unripened"	0	"0,0.1"	0.01	0	
"#chemical,inorganic"	0		0.1	1	
"#chemical,organic"	0	"0,0"	0	0	
#chemicalfactory	1		0.1	0	
"#chemicalfactory,organics"	1		0.1	0	
#chemi-thermomechanicalpulp	0	"0,0"	0	0	
"#chickenforslaughtering,liveweight"	0	"0,0.1"	0.01	0	
#chickpea	0	"0,0.1"	0.01	0	
#chilli	0	"0,0.1"	0.01	0	
#chimney	0		0.1	0	
"#chipper,mobile,diesel"	1		0.5	0	
"#chipper,stationary,electric"	1		0.5	1	
"#chlorine,gaseous"	0	"0,0"	0	0	
"#chlorine,liquid"	0	"0,0"	0	0	
#chlorinedioxide	0	"0,0"	0	0	
#chloroaceticacid	0	"0,0"	0	0	
#chloroacetylchloride	0	"0,0"	0	0	
#chlorodifluoromethane	0	"0,0"	0	0	
#chloromethylmethylether	0	"0,0"	0	0	
#chloronitrobenzene	0	"0,0"	0	0	
#chloropropionicacid	0	"0,0"	0	0	
#chlorosulfonicacid	0	"0,0"	0	0	
#chlorothalonil	0	"0,0"	0	0	
#chlorotoluron	0	"0,0"	0	0	
"#chopping,maize"	1	"0,0"	0	0	shell capital service product
#chromiteoreconcentrate	0		0.5	0	
#chromium	0	"0,0"	0	0	
"#chromiumoxide,flakes"	0	"0,0"	0	0	
#chromiumsteelpipe	0	"0.5,1"	0.7	0	
"#chromiumsteelremovedbydrilling,computern..."	0	"0.5,1"	0.7	0	

"#chromiumsteelremovedbydrilling,conventional"	0	"0.5,1"	0.7	0	
"#chromiumsteelremovedbymilling,average"	0	"0.5,1"	0.7	0	
"#chromiumsteelremovedbymilling,dressing"	0	"0.5,1"	0.7	0	
"#chromiumsteelremovedbymilling,largeparts"	0	"0.5,1"	0.7	0	
"#chromiumsteelremovedbymilling,smallparts"	0	"0.5,1"	0.7	0	
"#chromiumsteelremovedbyturning,average,co..."	0	"0.5,1"	0.7	0	
"#chromiumsteelremovedbyturning,average,co..."	0	"0.5,1"	0.7	0	
"#chromiumsteelremovedbyturning,primarilyd..."	0	"0.5,1"	0.7	0	
"#chromiumsteelremovedbyturning,primarilyd..."	0	"0.5,1"	0.7	0	
"#chromiumsteelremovedbyturning,primarilyr..."	0	"0.5,1"	0.7	0	
"#chromiumsteelremovedbyturning,primarilyr..."	0	"0.5,1"	0.7	0	
#citricacid	0	"0,0"	0	0	
"#cladding,crossbar-pole,aluminium"	1		0.1	0	
#clay	0	"0,0"	0	0	
#claybrick	0	"0,0"	0	0	
#claypitinfrastructure	1		0.1	0	
#clayplaster	0	"0,0"	0	0	
"#cleaningconsumables,withoutwater,in13.6%..."	1		0.5	0	
#cleftingofenergywood	1	"0,0"	0	0	shell capital service product
"#clefttimber,measuredasdrymass"	0	"0,0"	0	0	
#clinker	0	"0,0.1"	0.01	1	
"#cloverseed,Swissintegratedproduction,atfarm"	0	"0,0.1"	0.01	0	
"#cloverseed,Swissintegratedproduction,for..."	0	"0,0.1"	0.01	0	
#coalgas	0	"0,0"	0	0	
#coalslurry	0	"0,0"	0	0	
"#coalstove,5-15kW"	1		0.5	0	
#coaltar	0	"0,0"	0	0	
"#coating,withmelamineimpregnatedpaper"	0	"0,0"	0	0	
#coatingfromwastecathoderaytubedisplay	0	"0,0"	0	0	
#coatingpowder	0	"0,0"	0	0	
#cobalt	0	"0,0"	0	0	
#cobwork	0	"0,0"	0	0	
#cocamidediethanolamine	0	"0,0"	0	0	
#cocoabean	0	"0,0.1"	0.01	0	
"#coconut,dehusked"	0	"0,0.1"	0.01	0	
#coconuthusk	0	"0,0.1"	0.01	0	
"#coconutoil,crude"	0	"0,0.1"	0.01	0	

#cocoons	0	"0,0"	0	0	
"#coffee,greenbean"	0	"0,0.1"	0.01	0	
#coffeemaker	1		0.5	0	
#coke	0	"0,0"	0	0	
"#collectorfieldarea,solarthermalparabolic..."	1		0.5	0	
"#collectorfieldarea,solartowerpowerplant,..."	1		0.5	0	
#combineharvesting	1	"0,0"	0	0	shell capital service product
#compactfluorescentbulb	0	"0,0"	0	0	
#compost	0	"0,0.1"	0.01	0	
"#compostingfacility,open"	1		0.1	0	
"#compressedair,1000kPagauge"	0	"0,0"	0	0	
"#compressedair,1200kPagauge"	0	"0,0"	0	0	
"#compressedair,600kPagauge"	0	"0,0"	0	0	
"#compressedair,700kPagauge"	0	"0,0"	0	0	
"#compressedair,800kPagauge"	0	"0,0"	0	0	
"#computer,desktop,withoutscreen"	1		0.5	0	
"#computer,laptop"	1		0.5	0	
"#concentratedsolarpowerplant,solarthermal..."	1		0.5	0	
"#concentratedsolarpowerplant,solartower,2..."	1		0.5	0	
"#concrete,20MPa"	0	"0,0.045"	0.022	0	
"#concrete,25-30MPa"	0	"0,0.045"	0.022	0	
"#concrete,25MPa"	0	"0,0.045"	0.022	0	
"#concrete,30-32MPa"	0	"0,0.045"	0.022	0	
"#concrete,30MPa"	0	"0,0.1"	0.022	0	
"#concrete,35MPa"	0	"0,0.1"	0.022	0	
"#concrete,40MPa"	0	"0,0.1"	0.022	0	
"#concrete,45MPa"	0	"0,0.1"	0.022	0	
"#concrete,50MPa"	0	"0,0.1"	0.022	0	
"#concrete,forde-icingsaltcontact"	0	"0,0.045"	0.022	0	
"#concrete,highexactingrequirements"	0	"0,0.045"	0.022	0	
"#concrete,mediumstrength"	0	"0,0.045"	0.022	0	
"#concrete,normal"	0	"0,0.045"	0.022	0	
"#concrete,soleplateandfoundation"	0	"0,0.045"	0.022	0	
#concreteblock	0	"0,0.045"	0.022	0	
#concretemixingfactory	1		0.1	0	
#concreterooftile	0	"0,0.045"	0.022	0	
#concreteslab	0	"0,0.045"	0.022	0	

#condensatefromlightoilboiler	0		0.1	0	
#conditionedspentnuclearfuel	0		0.1	0	
"#constructionwork,heatandpowerco-generatio..."	1	"0,0"	0	0	shell capital service product
"#container,forcollectionofpost-consumerwas..."	1		0.8	0	
"#containerboard,flutingmedium"	1		0.5	0	
"#containerboard,linerboard"	1		0.5	0	
#containership	1		0.8	0	
"#continuousdyeing,fibre,cotton"	0	"0,0"	0	0	
"#contouring,brass"	0	"0,0"	0	0	shell capital service product
"#contouring,bronze"	0	"0,0"	0	0	shell capital service product
"#controlcabinet,heatandpowerco-generation..."	1		0.5	0	
"#controller,forelectricscooter"	0		0.5	0	
"#converter,forelectricpassengercar"	0		0.5	0	
#conveyorbelt	1		0.1	0	
#cookstove	1		0.5	0	
#coolingenergy	0		0.5	0	
#copper	0	"0,0"	0	0	
"#copper,blister-copper"	0	"0,0"	0	0	
"#copper,cathode"	1	"0,0"	0	0	
#coppercake	0		0.1	0	
#coppercarbonate	0	"0,0"	0	0	
"#copperconcentrate,sulfideore"	0		0.1	0	
#copperincarshredderresidue	0		0.1	0	
#copperoxide	0	"0,0"	0	0	
"#copperscrap,sorted,pressed"	0	"0,0"	0	0	
#copperslag	0	"0,0.5"	0.35	0	
#coppersulfate	0	"0,0"	0	0	
#coppertelluridecement	0	"0,0.045"	0.03	0	
#coreboard	0	"0,0"	0	0	
#coriander	0	"0,0.1"	0.01	0	
"#cork,raw"	0	"0,0.1"	0.01	0	
#corkslab	0	"0,0.1"	0.01	0	
#corrugatedboardbox	1	"0,0"	0	0	
#cottonseed	0	"0,0.1"	0.01	0	
"#cottonseed,forsowing"	0	"0,0.1"	0.01	0	
"#cottonseed,organic"	0	"0,0.1"	0.01	0	
"#cottonseed,organic,forsowing"	0	"0,0.1"	0.01	0	

#cottonseedmeal	0	"0,0.1"	0.01	0	
"#cottonseedoil,crude"	0	"0,0.1"	0.01	0	
"#cottonseedoil,refined"	0	"0,0.1"	0.01	0	
"#coverplaster,mineral"	0		0.1	0	
"#coverplaster,organic"	0	"0,0"	0	0	
#cowmilk	0	"0,0.1"	0.01	0	
"#cream,fromcowmilk"	0	"0,0.1"	0.01	0	
#crustfromParkesprocessforleadproduction	0	"0,0"	0	0	
#cryolite	0	"0,0"	0	0	
#cucumber	0	"0,0.1"	0.01	0	
#cumene	0	"0,0.1"	0.01	0	
#cyanoaceticacid	0	"0,0"	0	0	
#cyanogenchloride	0	"0,0"	0	0	
#cyanuricchloride	0	"0,0"	0	0	
#cyclicN-compound	0	"0,0"	0	0	
#cyclohexane	0	"0,0"	0	0	
#cyclohexanol	0	"0,0"	0	0	
#cyclohexanone	0	"0,0"	0	0	
#dairy	0	"0,0.1"	0.01	0	
#decabromodiphenylether	0	"0,0"	0	0	
#decarbonisingwaste	0	"0,0"	0	0	
"#decommissionedairportinfrastructure,contami..."	0		0.1	0	
#decommissionedchemicalproductionfacilities	0		0.1	0	
"#decommissionedpipeline,naturalgas"	0		0.1	0	
#decommissionedroad	0		0.1	0	
#decommissionedtramtrack	0		0.5	0	
"#deepdrawing,steel,10000kNpress,automode"	1	"0,0"	0	0	shell capital service product
"#deepdrawing,steel,10000kNpress,singlest..."	1	"0,0"	0	0	shell capital service product
"#deepdrawing,steel,3500kNpress,automode"	1	"0,0"	0	0	shell capital service product
"#deepdrawing,steel,3500kNpress,singlestroke"	1	"0,0"	0	0	shell capital service product
"#deepdrawing,steel,38000kNpress,automode"	1	"0,0"	0	0	shell capital service product
"#deepdrawing,steel,38000kNpress,singlest..."	1	"0,0"	0	0	shell capital service product
"#deepdrawing,steel,650kNpress,automode"	1	"0,0"	0	0	shell capital service product
"#deepdrawing,steel,650kNpress,singlestroke"	1	"0,0"	0	0	shell capital service product
"#deepwell,drilled,forgeothermalpower"	1		0.5	0	
"#deepwell,forgeothermalpower,onshore,6000m"	1		0.5	0	
#deepwellclosure	1		0.5	0	

"#degreasing,metalpartinalkalinebath"	1	"0,0"	0	0	shell capital service product
#de-icer	1		0.5	0	
"#deinkedpulp,wetlap"	0	"0,0"	0	0	
"#deinkingemulsion,inpaperproduction"	0		0.1	0	
"#delimbing/sorting,excavator-basedprocessor"	1	"0,0"	0	0	shell capital service product
"#demersalfish,fresh"	0	"0,0.1"	0.01	0	
#diazine-compound	0	"0,0"	0	0	
#diazole-compound	0	"0,0"	0	0	
#diborane	0	"0,0"	0	0	
#dichloromethane	0	"0,0"	0	0	
#dichloropropene	0	"0,0"	0	0	
#dicyclopentadienebasedunsaturatedpolyester...	0	"0,0"	0	0	
#diesel	0	"0,0.1"	0.01	0	
"#diesel,burnedinagriculturalmachinery"	1	"0,0.1"	0.01	0	
"#diesel,burnedinbuildingmachine"	1	"0,0.1"	0.01	0	
"#diesel,burnedindiesel-electricgeneratings..."	1	"0,0.1"	0.01	0	
"#diesel,burnedindiesel-electricgeneratings..."	1	"0,0.1"	0.01	0	
"#diesel,burnedinfishingvessel"	1	"0,0.1"	0.01	0	
"#diesel,low-sulfur"	0	"0,0.1"	0.01	0	
"#diesel-electricgeneratingset,10MW"	1	"0,0.1"	0.01	0	
"#diesel-electricgeneratingset,18.5kW"	1	"0,0.1"	0.01	0	
#diethanolamine	0	"0,0"	0	0	
#diethyleneglycol	0	"0,0"	0	0	
"#diethylether,withoutwater,in99.95%soluti..."	0	"0,0"	0	0	
#digestersludge	0	"0,0.1"	0.01	1	
#dimethenamide	0	"0,0"	0	0	
#dimethylacetamide	0	"0,0"	0	0	
#dimethylamine	0	"0,0"	0	0	
#dimethylamineborane	0	"0,0"	0	0	
#dimethylaminopropylamine	0	"0,0"	0	0	
#dimethylcarbonate	0	"0,0"	0	0	
#dimethyldichlorosilane	0	"0,0"	0	0	
#dimethylether	0	"0,0"	0	0	
#dimethylhexanediol	0	"0,0"	0	0	
#dimethylhexynediol	0	"0,0"	0	0	
#dimethylmalonate	0	"0,0"	0	0	
#dimethylsulfate	0	"0,0"	0	0	

#dimethylsulfide	0	"0,0"	0	0	
#dimethylsulfoxide	0	"0,0"	0	0	
#dinitroaniline-compound	0	"0,0"	0	0	
#dinitrogentetroxide	0	"0,0"	0	0	
"#diode,auxilliariesandenergyuse"	1		0.5	0	
"#diode,glass-,forsurface-mounting"	0		0.5	0	
"#diode,glass-,forthrough-holemounting"	0		0.5	0	
#dioxane	0	"0,0"	0	0	
#diphenylether-compound	0	"0,0"	0	0	
#dipropylamine	0	"0,0"	0	0	
#dipropyleneglycolmonomethylether	0	"0,0"	0	0	
#dishwasher	1		0.5	0	
"#diskdrive,CD/DVD,ROM,fordesktopcomputer"	0		0.5	0	
"#diskdrive,CD/DVD,ROM,forlaptopcomputer"	0		0.5	0	
"#display,cathoderaytube,17inches"	1		0.1	0	
"#display,liquidcrystal,17inches"	1		0.1	0	
#DistillersDriedGrainswithSolubles	0	"0,0"	0	0	
"#distributionnetwork,electricity,lowvoltage"	1		0.5	1	
#dithiocarbamate-compound	0	"0,0"	0	0	
#dodecanol	0	"0,0"	0	0	
#dolomite	0	"0,0"	0	0	
"#door,inner,glass-wood"	0		0.1	0	
"#door,inner,wood"	0		0.1	0	
"#door,outer,wood-aluminium"	0		0.1	0	
"#door,outer,wood-glass"	0		0.1	0	
"#drawingofpipe,steel"	1	"0.5,1"	0.7	0	
"#driedroughagestore,airdried,solar"	1		0.5	0	
"#driedroughagestore,cold-airdried,conventi..."	1		0.5	0	
"#driedroughagestore,nonventilated"	1		0.5	0	
#drillingwaste	0		0.1	1	
#drossfromAlelectrolysis	0		0.1	0	
#dryer	1		0.5	0	
"#drying,naturalgas"	1	"0,0"	0	0	shell capital service product
"#dryingofbreadgrain,seedandlegumes"	1	"0,0"	0	0	shell capital service product
#dryingoffeedgrain	1	"0,0"	0	0	shell capital service product
#dryingofgrass	1	"0,0"	0	0	shell capital service product
#dryingofmaizegrain	1	"0,0"	0	0	shell capital service product

#dryingofmaizestrawandwhole-plant	1	"0,0"	0	0	shell capital service product
"#DTPA,diethylenetriaminepentaaceticacid"	0	"0,0"	0	0	
#dungslab	0	"0,0"	0	0	
"#dust,alloyedelectricarcfurnacesteel"	0		0.5	0	
"#dust,unalloyedelectricarcfurnacesteel"	0		0.5	0	
"#dustcollector,electrostaticprecipitator,fo..."	1		0.5	0	
"#dustcollector,electrostaticprecipitator,fo..."	1		0.5	0	
"#dustcollector,multicyclone"	1		0.5	0	
"#EDTA,ethylenediaminetetraaceticacid"	0	"0,0"	0	0	
#electricarcfurnaceconverter	1		0.5	0	
#electricbicycle	1		0.5	0	
"#electricconnector,peripheralcomponentinter..."	0		0.5	0	
"#electricconnector,peripheraltypebuss"	0		0.5	0	
"#electricconnector,wireclamp"	0		0.5	0	
"#electricity,forreuseinmunicipalwasteinci..."	1	"0,0"	0	0	
"#electricity,highvoltage"	1	"0,0"	0	0	
"#electricity,highvoltage,aluminiumindustry"	1	"0,0"	0	0	
"#electricity,highvoltage,forinternalusein..."	1	"0,0"	0	0	
"#electricity,highvoltage,forSwissFederalR..."	1	"0,0"	0	0	
"#electricity,highvoltage,label-certified"	1	"0,0"	0	0	
"#electricity,lowvoltage"	1	"0,0"	0	0	
"#electricity,lowvoltage,label-certified"	1	"0,0"	0	0	
"#electricity,mediumvoltage"	1	"0,0"	0	0	
"#electricity,mediumvoltage,aluminiumindustry"	1	"0,0"	0	0	
"#electricity,mediumvoltage,label-certified"	1	"0,0"	0	0	
#electrickettle	1		0.5	0	
"#electricmotor,electricpassengercar"	0		0.5	0	
"#electricmotor,forelectricscooter"	0		0.5	0	
"#electricmotor,vehicle"	0		0.5	0	
"#electricparts,heatandpowerco-generationu..."	0		0.5	0	
"#electricparts,miniCHPplant"	0		0.5	0	
"#electricscooter,withoutbattery"	1		0.5	0	
"#electrode,negative,LiC6"	0	"0,0"	0	0	
"#electrode,negative,Ni"	0		0.1	0	
"#electrode,positive,LaNi5"	0	"0,0"	0	0	
"#electrolyte,KOH,LiOHadditive"	0	"0,0"	0	0	
"#electrongun,forcathoderaytubedisplay"	0		0.5	0	

"#electroniccomponent,active,unspecified"	0		0.5	0	
"#electroniccomponent,passive,unspecified"	0		0.5	0	
#electroniccomponentfactory	1		0.1	0	
"#electroniccomponentmachinery,unspecified"	0		0.5	0	
"#electronics,forcontrolunits"	0		0.5	0	
#electronicsscrap	0		0.5	0	
#electronicsscrapfromcontrolunits	0		0.5	0	
#electrostaticpaint	0		0.1	0	
"#elevator,hydraulic"	1		0.5	0	
#enamelling	0		0.3	0	
"#energyandauxilliaryinputs,metalworkingfa..."	1		0.5	0	
"#energyandauxilliaryinputs,metalworkingma..."	1		0.5	0	
"#energyfeed,gross"	0	"0,0.1"	0.01	0	
#energyrequirementforassemblyofheatandpo...	1	"0,0"	0	0	
#energysaving	1	"0,0"	0	0	shell capital service product
"#energyuseandoperationemissions,electricb..."	1		0.1	0	
"#energyuseandoperationemissions,electricb..."	1		0.1	0	
#energywoodharvester	1		0.5	0	
"#enricheduranium,4.2%"	0		0.1	0	
#enzymes	0	"0,0"	0	0	
#epichlorohydrin	0	"0,0"	0	0	
"#epoxyresin,liquid"	0	"0,0"	0	0	
"#epoxyresininsulator,Al2O3"	0	"0,0"	0	0	
"#epoxyresininsulator,SiO2"	0	"0,0"	0	0	
#establishingorchard	0		0.1	0	
#esterquat	0	"0,0"	0	0	
#estersofversaticacid	0	"0,0"	0	0	
#ethane	0	"0,0"	0	0	
"#ethanol,withoutwater,in95%solutionstate,..."	0	"0,0"	0	0	
"#ethanol,withoutwater,in99.7%solutionstat..."	0	"0,0"	0	0	
"#ethanol,withoutwater,in99.7%solutionstat..."	0	"0,0"	0	0	
"#ethanol,withoutwater,in99.7%solutionstat..."	0	"0,0"	0	0	
#ethanolfermentationplant	1		0.1	0	
#ethoxylatedalcoholAE>20	0	"0,0"	0	0	
#ethoxylatedalcoholAE11	0	"0,0"	0	0	
#ethoxylatedalcoholAE3	0	"0,0"	0	0	
#ethoxylatedalcoholAE7	0	"0,0"	0	0	

#ethylacetate	0	"0,0"	0	0	
#ethylamine	0	"0,0"	0	0	
#ethylbenzene	0	"0,0"	0	0	
"#ethylene,average"	0	"0,0"	0	0	
"#ethylene,pipelinesystem"	1		0.5	0	
#ethylenebromide	0	"0,0"	0	0	
#ethylenecarbonate	0	"0,0"	0	0	
#ethylenediamine	0	"0,0"	0	0	
#ethylenedichloride	0	"0,0"	0	0	
#ethyleneglycol	0	"0,0"	0	0	
#ethyleneglycoldiethylether	0	"0,0"	0	0	
#ethyleneglycoldimethylether	0	"0,0"	0	0	
#ethyleneglycolmonoethylether	0	"0,0"	0	0	
#ethyleneoxide	0	"0,0"	0	0	
#ethylenevinylacetatecopolymer	0	"0,0"	0	0	
#ethyltert-butylether	0	"0,0"	0	0	
"#ethylvinylacetate,foil"	0	"0,0"	0	0	
"#eucalyptusseedling,forplanting"	0	"0,0.1"	0.01	0	
#EUR-flatpallet	1		0.1	0	
#evacuatedtubecollector	1		0.5	0	
#evaporationofmilk	1	"0,0"	0	0	shell capital service product
"#excavation,hydraulicdigger"	1	"0,0"	0	0	shell capital service product
"#excavation,skid-steerloader"	1	"0,0"	0	0	shell capital service product
"#exhaustairoutlet,steel/aluminium,85x365mm"	1		0.5	0	
"#exhaustairroofhood,steel,DN400"	1	"0.5,1"	0.7	0	
"#exhaustairvalve,in-wallhousing,plastic/st..."	1		0.5	0	
#expandedclay	0	"0,0"	0	0	
#expandedperlite	0		0.5	0	
#expandedvermiculite	0	"0,0"	0	0	
"#expansionvessel,25l"	1		0.5	0	
"#expansionvessel,80l"	1		0.5	0	
"#explosive,tovex"	0		0.1	0	
#explosivesfactory	1		0.1	0	
"#extrusion,co-extrusion"	1	"0,0"	0	0	shell capital service product
"#extrusion,plasticfilm"	1	"0,0"	0	0	shell capital service product
"#extrusion,plasticpipes"	1	"0,0"	0	0	shell capital service product
"#extrusionofplasticsheetsandthermoforming,..."	1	"0,0"	0	0	shell capital service product

"#fan,forpowersupplyunit,desktopcomputer"	0		0.5	0	
#fattyacid	0	"0,0"	0	0	
#fattyalcohol	0	"0,0"	0	0	
#fattyalcoholsulfate	0	"0,0"	0	0	
"#favabean,feed,Swissintegratedproduction"	0	"0,0.1"	0.01	0	
"#favabean,organic"	0	"0,0.1"	0.01	0	
"#favabean,Swissintegratedproduction"	0	"0,0.1"	0.01	0	
"#favabeanseed,forsowing"	0	"0,0.1"	0.01	0	
"#favabeanseed,organic,forsowing"	0	"0,0.1"	0.01	0	
#feldspar	0	"0,0"	0	0	
#fennel	0	"0,0.0"	0.01	0	
#ferrite	0	"0.5,1"	0.8	0	
"#ferrochromium,highcarbon,55%Cr"	0		0.5	0	
"#ferrochromium,high-carbon,68%Cr"	0		0.5	0	
"#ferromanganese,high-coal,74.5%Mn"	0		0.5	0	
"#ferronickel,25%Ni"	0		0.5	0	
#ferrosilicon	0		0.5	0	
#ferry	0		0.5	0	
"#fertilising,bybroadcaster"	1	"0,0"	0	0	shell capital service product
"#fertilising,byrigfertiliser,sugarcane"	1	"0,0"	0	0	shell capital service product
"#fertilising,bystoolsplitter,sugarcane"	1	"0,0"	0	0	shell capital service product
"#fibre,cotton"	0	"0,0"	0	0	
"#fibre,cotton,organic"	0	"0,0"	0	0	
"#fibre,flax"	0	"0,0"	0	0	
"#fibre,jute"	0	"0,0"	0	0	
"#fibre,kenaf"	0	"0,0"	0	0	
"#fibre,polyester"	0	"0,0"	0	0	
"#fibre,silk,short"	0	"0,0"	0	0	
"#fibre,viscose"	0	"0,0"	0	0	
"#fibreandfabricwaste,polyester"	0	"0,0"	0	0	
"#fibreboard,hard"	0	"0,0"	0	0	
"#fibreboard,soft"	0	"0,0"	0	0	
"#fibreboard,soft,latexbonded"	0	"0,0"	0	0	
"#fibreboard,soft,withoutadhesives"	0	"0,0"	0	0	
#fibrecementcorrugatedslab	0	"0,0.045"	0.03	0	
#fibrecementfacingtile	0	"0,0.045"	0.03	0	
"#fibrecementfacingtile,largeformat"	0	"0,0.045"	0.03	0	

"#fibrecementfacingtile,smallformat"	0	"0,0.045"	0.03	0	
#fibrecementroofslate	0	"0,0.045"	0.03	0	
#fibre-reinforcedconcrete	0	"0,0.1"	0.01	0	
"#fieldleveling,sugarcane"	1	"0,0"	0	0	shell capital service product
"#filtercake,fromsugarcanejuicefiltration"	0		0.1	0	
#filterdustfromAlelectrolysis	0		0.1	0	
"#finishing,textile,knitcotton"	0	"0,0"	0	0	shell capital service product
"#finishing,textile,wovencotton"	0	"0,0"	0	0	shell capital service product
"#fish,marine"	0	"0,0.1"	0.01	0	
"#fishblock,hake"	0	"0,0"	0	0	
"#fishcanning,largefish"	1	"0,0"	0	0	shell capital service product
"#fishcanning,smallfish"	1	"0,0"	0	0	shell capital service product
#fishcanningplant	1		0.1	0	
"#fishcuring,smallfish"	0	"0,0"	0	0	shell capital service product
#fishcuringplant	1		0.1	0	
"#fishfreezing,smallfish"	0	"0,0"	0	0	shell capital service product
#fishfreezingplant	1		0.1	0	
"#fishmeal,63-65%protein"	0	"0,0.1"	0.01	0	
"#fishmeal,65-67%protein"	0	"0,0.1"	0.01	0	
#fishmealplant	1		0.1	0	
"#fishoil,fromanchovy"	0	"0,0.1"	0.01	0	
#fishresidues	0	"0,0.1"	0.01	0	
"#flatglass,coated"	0	"0,0.1"	0.01	0	
"#flatglass,uncoated"	0	"0,0.1"	0.01	0	
#flatglassfactory	1		0.1	0	
"#flatplatesolarcollector,Cuabsorber"	1		0.1	0	
#flaxhusks	0	"0,0"	0	0	
"#flaxplant,harvested"	0	"0,0"	0	0	
"#fleece,polyethylene"	0	"0,0"	0	0	
"#flexibleduct,aluminium/PET,DNof125"	1		0.1	0	
#floatingcollarcage	1		0.5	0	
#floatinghexagonalmetalcage	1		0.5	0	
"#fluorescentwhiteningagent,DAS1,triazinylam..."	0	"0,0"	0	0	
"#fluorescentwhiteningagent,distyrylbiphenyl..."	0	"0,0"	0	0	
"#fluorine,liquid"	0	"0,0"	0	0	
"#fluorspar,97%purity"	0	"0,0"	0	0	
"#fluosilicicacid,withoutwater,in22%soluti..."	0	"0,0"	0	0	

"#flux,forwavesoldering"	0		0.1	0	
#flyashandscrubbersludge	0		0.1	1	
#flyashbrick	0	"0,0"	0	0	
#foamglass	0	"0,0.1"	0.01	0	
"#foamglass,electricity,label-certified"	0	"0,0.1"	0.01	0	
#foamglassfactory	1		0.1	0	
#foamingagent	0		0.1	0	
"#fodderbeet,Swissintegratedproduction"	0	"0,0.1"	0.01	0	
"#fodderbeetseed,forsowing"	0	"0,0.1"	0.01	0	
"#fodderloading,byself-loadingtrailer"	1		0.5	0	
#fodderyeast	0	"0,0.1"	0.01	0	
#foldingboxboard/chipboard	1		0.1	0	
#folpet	0	"0,0"	0	0	
#forestryharvester	1		0.5	0	
"#forging,steel"	1	"0.5,1"	0.7	0	
#formaldehyde	0	"0,0"	0	0	
#formicacid	0	"0,0"	0	0	
#forwarder	1		0.5	0	
"#forwarding,forwarder"	1	"0,0"	0	0	shell capital service product
#fosetyl-Al	0	"0,0"	0	0	
#fraction1fromnaphthaseparation	0	"0,0"	0	0	
#fraction7fromnaphthaseparation	0	"0,0"	0	0	
#fraction8fromnaphthaseparation	0	"0,0"	0	0	
"#frit,forcathoderaytubedisplay"	0	"0,0"	0	0	
"#frit,forceramictile"	0	"0,0"	0	0	
"#frozenfishsticks,hake"	0	"0,0.1"	0.01	0	
"#fruittreeseedling,forplanting"	0	"0,0.1"	0.01	0	
"#fuelcell,polymerelectrolytemembrane,2kWe..."	0		0.1	0	
"#fuelcell,solidoxide,125kWelectrical,future"	0		0.1	0	
"#fuelcell,solidoxide,withmicrogasturbine..."	0		0.1	0	
"#fuelcell,stackpolymerelectrolytemembrane,..."	0		0.1	0	
"#fuelcell,stacksolidoxide,125kWelectrical..."	0		0.1	0	
"#funnelglass,forcathoderaytubedisplay"	0		0.1	0	
"#furnace,logs,30kW"	1		0.5	0	
"#furnace,logs,6kW"	1		0.5	0	
"#furnace,logs,averagestoragearea,100kW"	1		0.5	0	
"#furnace,logs,averagestoragearea,30kW"	1		0.5	0	

"#furnace,logs,averagestoragearea,6kW"	1		0.5	0	
"#furnace,logs,hardwoodstoragearea,100kW"	1		0.5	0	
"#furnace,logs,hardwoodstoragearea,30kW"	1		0.5	0	
"#furnace,logs,hardwoodstoragearea,6kW"	1		0.5	0	
"#furnace,logs,softwoodstoragearea,100kW"	1		0.5	0	
"#furnace,logs,softwoodstoragearea,30kW"	1		0.5	0	
"#furnace,logs,softwoodstoragearea,6kW"	1		0.5	0	
"#furnace,pellet,15kW"	1		0.5	0	
"#furnace,pellet,50kW"	1		0.5	0	
"#furnace,pellets,25kW"	1		0.5	0	
"#furnace,pellets,9kW"	1		0.5	0	
"#furnace,pellets,withsilo,300kW"	1		0.5	0	
"#furnace,woodchips,averagestoragearea,1000kW"	1		0.5	0	
"#furnace,woodchips,averagestoragearea,300kW"	1		0.5	0	
"#furnace,woodchips,averagestoragearea,50kW"	1		0.5	0	
"#furnace,woodchips,hardwoodstoragearea,10..."	1		0.5	0	
"#furnace,woodchips,hardwoodstoragearea,300kW"	1		0.5	0	
"#furnace,woodchips,hardwoodstoragearea,50kW"	1		0.5	0	
"#furnace,woodchips,softwoodstoragearea,10..."	1		0.5	0	
"#furnace,woodchips,softwoodstoragearea,300kW"	1		0.5	0	
"#furnace,woodchips,softwoodstoragearea,50kW"	1		0.5	0	
"#furnace,woodchips,withsilo,1000kW"	1		0.5	0	
"#furnace,woodchips,withsilo,300kW"	1		0.5	0	
"#furnace,woodchips,withsilo,5000kW"	1		0.5	0	
"#furnace,woodchips,withsilo,50kW"	1		0.5	0	
"#furniture,wooden"	0	"0,0"	0	0	
"#furrowcovering,sugarcane"	1	"0,0"	0	0	shell capital service product
"#furrowing,sugarcane"	1	"0,0"	0	0	shell capital service product
"#gallium,inBayerliquorfromaluminiumproduc..."	0	"0,0"	0	0	
"#gallium,semiconductor-grade"	0	"0,0"	0	0	
"#garage,wood,non-insulated,fire-protected"	1	"0,0"	0	0	
#gasboiler	1		0.5	0	
"#gasmotor,206kW"	1		0.5	0	
"#gasmotor,miniCHPplant"	1		0.5	0	
"#gaspowerplant,100MWelectrical"	1		0.5	0	
"#gaspowerplant,300MWelectrical"	1		0.5	0	
"#gaspowerplant,combinedcycle,400MWelectrical"	1		0.5	0	

"#gasturbine,10MWelectrical"	1		0.5	0	
"#generator,200kWelectrical"	1		0.5	0	
"#generator,miniCHPplant"	1		0.5	0	
"#geothermalpowerplant,5.5MWel"	1		0.5	0	
"#geothermalpowerplant,Hot-Dry-Rock"	1		0.5	0	
"#geothermalpowerplant,undefinedtype"	1		0.5	0	
"#glass,forliquidcrystaldisplay"	0	"0,0"	0	0	
"#glasscullet,forSaint-GobainISOVERSA"	0	"0,0"	0	0	
"#glasscullet,fromfluorescentlampstreatment"	0	"0,0"	0	0	
"#glasscullet,fromusedcathoderaytubepanels"	0	"0,0"	0	0	
"#glasscullet,leadcontaining,fromusedcatho..."	0	"0,0"	0	0	
"#glasscullet,mixedglassfromusedcathodera..."	0	"0,0"	0	0	
"#glasscullet,sorted"	0	"0,0"	0	0	
#glassetchingfactory	1		0.1	0	
#glassfibre	0	"0,0"	0	0	
"#glassfibrereinforcedplastic,polyamide,inj..."	0	"0,0"	0	0	
"#glassfibrereinforcedplastic,polyesterresi..."	0	"0,0"	0	0	
#glassfromusedcathoderaytube	0		0.1	0	
"#glasstube,borosilicate"	0	"0,0"	0	0	
#glasstubefactory	1		0.1	0	
#glasswoolmat	0	"0,0"	0	0	
"#glazing,double,U<1.1W/m2K"	0		0.1	0	
"#glazing,double,U<1.1W/m2K,laminatedsafety..."	0		0.1	0	
"#glazing,triple,U<0.5W/m2K"	0		0.1	0	
"#glider,forelectricscooter"	0		0.5	0	
"#glider,passengercar"	0		0.5	0	
#glucose	0	"0,0"	0	0	
"#gluedlaminatedtimber,forindooruse"	0	"0,0"	0	0	
"#gluedlaminatedtimber,foroutdooruse"	0	"0,0"	0	0	
#glycerine	0	"0,0"	0	0	
#glycine	0	"0,0"	0	0	
#glyoxal	0	"0,0"	0	0	
#glyphosate	0	"0,0"	0	0	
#gold	0	"0,0"	0	0	
"#gold,unrefined"	0		0.1	0	
"#gold-silver,ingot"	0	"0,0"	0	0	
#goodswagon	1		0.5	0	

#granulatedblastfurnaceslag	0		0.1	0	
#grape	0	"0,0.1"	0.01	0	
"#graphicpaper,100%recycled"	0	"0,0"	0	0	
#graphite	0	"0,0"	0	0	
"#graphite,batterygrade"	0	"0,0"	0	0	
"#grass,organic"	0	"0,0.1"	0.01	0	
"#grass,Swissintegratedproduction"	0	"0,0.1"	0.01	0	
#grassfibre	0	"0,0.1"	0.01	0	
"#grassseed,organic,forsowing"	0	"0,0.1"	0.01	0	
"#grassseed,Swissintegratedproduction,atfarm"	0	"0,0.1"	0.01	0	
"#grassseed,Swissintegratedproduction,fors..."	0	"0,0.1"	0.01	0	
"#grasssilage,organic"	1	"0,0"	0	0	shell capital service product
"#grasssilage,Swissintegratedproduction"	1	"0,0"	0	0	shell capital service product
"#gravel,crushed"	0		0.1	0	
"#gravel,round"	0		0.1	0	
#gravel/sandquarryinfrastructure	0		0.1	0	
#greenasparagus	0	"0,0.1"	0.01	0	
"#greenhouse,glasswallsandroof"	1	"0,0"	0	0	No mass because all eol flows included - service product
"#greenhouse,plasticwallsandroof"	1	"0,0"	0	0	No mass because all eol flows included - service product
#greenliquordregs	0		0.1	0	
"#greenmanure,organic,untilApril"	0	"0,0"	0	0	shell capital service product
"#greenmanure,organic,untilFebruary"	0	"0,0"	0	0	shell capital service product
"#greenmanure,organic,untilJanuary"	0	"0,0"	0	0	shell capital service product
"#greenmanure,organic,untilMarch"	0	"0,0"	0	0	shell capital service product
"#greenmanure,Swissintegratedproduction,unt..."	0	"0,0"	0	0	shell capital service product
"#greenmanure,Swissintegratedproduction,unt..."	0	"0,0"	0	0	shell capital service product
"#greenmanure,Swissintegratedproduction,unt..."	0	"0,0"	0	0	shell capital service product
"#greenmanure,Swissintegratedproduction,unt. . . "	0	"0,0"	0	0	shell capital service product
#groundgranulatedblastfurnaceslag	0		0.1	0	
"#gypsum,mineral"	0	"0,0"	0	0	
#gypsumfibreboard	0	"0,0"	0	0	
#gypsumplasterboard	0	"0,0"	0	0	
#H3PO4purificationresidue	0	"0,0"	0	0	
#hairdryer	1		0.1	0	
"#hardchromiumcoat,electroplating,steelsubs..."	0		0.5	0	
#hardcoal	0		0.1	0	
"#hardcoal,run-of-mine"	0	"0,0"	0	0	

#hardcoalash	0		0.1	0	
#hardcoalbriquettes	0	"0,0"	0	0	
#hardcoalbriquettesfactory	1		0.1	0	
#hardcoalcokefactory	1		0.1	0	
#hardcoalpowerplant	1		0.1	1	
#hardcoalpreparationplant	1		0.1	0	
"#harddiskdrive,fordesktopcomputer"	0		0.5	0	
"#harddiskdrive,forlaptopcomputer"	0		0.5	0	
#harvester	1		0.5	0	
"#harvesting,bycompleteharvester,beets"	1	"0,0"	0	0	shell capital service product
"#harvesting,bycompleteharvester,groundcrops"	1	"0,0"	0	0	shell capital service product
"#harvesting,forestryharvester"	1	"0,0"	0	0	shell capital service product
"#harvesting,sugarcane"	1	"0,0"	0	0	shell capital service product
"#harvesting/bundling,energywoodharvester"	1	"0,0"	0	0	shell capital service product
#hay	0	"0,0.1"	0.01	0	
"#hay,organic,intensive"	0	"0,0.1"	0.01	0	
"#hay,Swissintegratedproduction,extensive"	0	"0,0.1"	0.01	0	
"#hay,Swissintegratedproduction,intensive"	0	"0,0.1"	0.01	0	
"#haying,byrotarytedder"	1	"0,0"	0	0	shell capital service product
"#hazardouswaste,forincineration"	0		0.1	1	
"#hazardouswaste,forundergrounddeposit"	0		0.1	1	
#hazardouswasteincinerationfacility	1		0.1	0	
"#heat,air-waterheatpump10kW"	1	"0,0"	0	0	
"#heat,boreholeheatpump"	1	"0,0"	0	0	
"#heat,centralorsmall-scale,Jakobsberg"	1	"0,0"	0	0	
"#heat,centralorsmall-scale,naturalgas"	1	"0,0"	0	0	
"#heat,centralorsmall-scale,naturalgas,Jak..."	1	"0,0"	0	0	
"#heat,centralorsmall-scale,naturalgasand..."	1	"0,0"	0	0	
"#heat,centralorsmall-scale,otherthannatur..."	1	"0,0"	0	0	
"#heat,diffusionabsorptionheatpump"	1	"0,0"	0	0	
"#heat,districtorindustrial,naturalgas"	1	"0,0"	0	0	
"#heat,districtorindustrial,otherthannatur..."	1	"0,0"	0	0	
"#heat,forreuseinmunicipalwasteincineratio..."	1	"0,0"	0	0	
"#heat,fromsteam,inchemicalindustry"	1	"0,0"	0	0	
"#heat,future"	1	"0,0"	0	0	
"#heat,solar+electric,multiple-dwelling,forh..."	1	"0,0"	0	0	
"#heat,solar+gas,multiple-dwelling,forhotwater"	1	"0,0"	0	0	

"#heat,solar+gas,one-familyhouse,forcombine..."	1	"0,0"	0	0	
"#heat,solar+gas,one-familyhouse,forhotwater"	1	"0,0"	0	0	
"#heat,solar+wood,one-familyhouse,forcombin..."	1	"0,0"	0	0	
"#heatandpowerco-generationunit,160kWelect..."	1		0.5	0	
"#heatandpowerco-generationunit,160kWelect..."	1		0.5	0	
"#heatandpowerco-generationunit,160kWelect..."	1		0.5	0	
"#heatandpowerco-generationunit,1MWel,6.4MWth"	1		0.5	0	
"#heatandpowerco-generationunit,1MWelectri..."	1		0.5	0	
"#heatandpowerco-generationunit,1MWelectri..."	1		0.5	0	
"#heatandpowerco-generationunit,1MWelectri..."	1		0.5	0	
"#heatandpowerco-generationunit,200kWelect..."	1		0.5	0	
"#heatandpowerco-generationunit,200kWelect..."	1		0.5	0	
"#heatandpowerco-generationunit,200kWelect..."	1		0.5	0	
"#heatandpowerco-generationunit,200kWelect..."	1		0.5	0	
"#heatandpowerco-generationunit,200kWelect..."	1		0.5	0	
"#heatandpowerco-generationunit,200kWelect..."	1		0.5	0	
"#heatandpowerco-generationunit,500kWelect..."	1		0.5	0	
"#heatandpowerco-generationunit,500kWelect..."	1		0.5	0	
"#heatandpowerco-generationunit,500kWelect..."	1		0.5	0	
"#heatandpowerco-generationunit,50kWelectr..."	1		0.5	0	
"#heatandpowerco-generationunit,50kWelectr..."	1		0.5	0	
"#heatandpowerco-generationunit,50kWelectr..."	1		0.5	0	
"#heatandpowerco-generationunit,6400kWther..."	1		0.5	0	
"#heatandpowerco-generationunit,6400kWther..."	1		0.5	0	
"#heatandpowerco-generationunit,6400kWther..."	1		0.5	0	
"#heatandpowerco-generationunit,organicRan..."	1	"0,0"	0	0	No mass because all eol flows included - service product
"#heatandpowerco-generationunit,organicRan..."	1	"0,0"	0	0	No mass because all eol flows included - service product
"#heatandpowerco-generationunit,organicRan..."	1	"0,0"	0	0	No mass because all eol flows included - service product
"#heatandpowerco-generationunit,organicRan..."	1	"0,0"	0	0	No mass because all eol flows included - service product
"#heatandpowerco-generationunit,organicRan..."	1	"0,0"	0	0	No mass because all eol flows included - service product
"#heatandpowerco-generationunit,organicRan..."	1	"0,0"	0	0	No mass because all eol flows included - service product
"#heatandpowerco-generationunit,organicRan..."	1	"0,0"	0	0	No mass because all eol flows included - service product
"#heatcarrierliquid,40%C3H8O2"	0	"0,0"	0	0	
"#heatdistributionequipment,hydronicradiant..."	1		0.5	0	
"#heatingandsanitaryequipment,heatandpower..."	1		0.5	0	
"#heatingandsanitaryequipment,miniCHPplant"	1		0.5	0	
"#heatpump,30kW"	1		0.5	0	

"#heatpump,brine-water,10kW"	1		0.5	0	
"#heatpump,diffusionabsorption,4kW,future"	1		0.5	0	
"#heatpump,forheatandpowerco-generationun..."	1		0.5	0	
"#heatpump,forminiCHPplant"	1		0.5	0	
"#heatstorage,2000l"	1		0.5	0	
"#heattransportfluidsystem,solarthermalpar..."	1		0.5	0	
#heavyfueloil	0	"0,0"	0	0	
"#heavyfueloil,burnedinrefineryfurnace"	0	"0,0"	0	0	
#heavywater	0	"0,0"	0	0	
#helicopter	1		0.5	0	
#helium	0	"0,0"	0	0	
"#helium,crude"	0	"0,0"	0	0	
"#helium,crudestockpiling"	0	"0,0"	0	0	
#heptane	0	"0,0"	0	0	
#hexafluoroethane	0	"0,0"	0	0	
#hexamethyldisilazane	0	"0,0"	0	0	
#hexane	0	"0,0"	0	0	
#highlevelradioactivewasteforfinalrepository	0	"0,0.1"	0.01	0	
#hoeing	1	"0,0"	0	0	shell capital service product
#hornmeal	0	"0,0.1"	0.01	0	
#horticulturalfleece	0	"0,0"	0	0	
"#hotrolling,steel"	1	"0,0"	0	0	shell capital service product
"#hotwatertank,600l"	1		0.5	0	
#hotwatertankfactory	1		0.1	0	
"#housingsystem,cattle,loose,peranimalunit"	1	"0,0"	0	0	No mass because all eol flows included - service product
"#housingsystem,cattle,tied,peranimalunit"	1	"0,0"	0	0	No mass because all eol flows included - service product
"#housingsystem,pig,fully-slattedfloor,per..."	1	"0,0"	0	0	No mass because all eol flows included - service product
"#housingsystem,pig,label-certified,perpig..."	1	"0,0"	0	0	No mass because all eol flows included - service product
#hydraulicdigger	1		0.5	0	
#hydraulicfracturingfluid	0	"0,0"	0	0	
#hydrazine	0	"0,0"	0	0	
#hydrazinesulfate	0	"0,0"	0	0	
"#hydrochloricacid,withoutwater,in30%solut..."	0	"0,0"	0	0	
"#hydrogen,gaseous"	0	"0,0"	0	0	
"#hydrogen,liquid"	0	"0,0"	0	0	
#hydrogencyanide	0	"0,0"	0	0	
#hydrogenfluoride	0	"0,0"	0	0	

"#hydrogenperoxide,withoutwater,in50%solut..."	0		0.1	0	
#hydrogensulfide	0	"0,0"	0	0	
"#hydropowerplant,reservoir"	1		0.1	1	
"#hydropowerplant,reservoir,alpineregion"	1		0.1	0	
"#hydropowerplant,reservoir,non-alpineregions"	1		0.1	0	
"#hydropowerplant,run-of-river"	1		0.1	1	
#hydroquinone	0	"0,0"	0	0	
#hydroxylamine	0	"0,0"	0	0	
#iceberglettuce	0	"0,0.1"	0.01	0	
"#ilmenite,54%titaniumdioxide"	0		0.3	0	
#imidazole	0	"0,0"	0	0	
"#impactextrusionofaluminium,1stroke"	1	"0,0"	0	0	shell capital service product
"#impactextrusionofaluminium,2strokes"	1	"0,0"	0	0	shell capital service product
"#impactextrusionofaluminium,3strokes"	1	"0,0"	0	0	shell capital service product
"#impactextrusionofaluminium,4strokes"	1	"0,0"	0	0	shell capital service product
"#impactextrusionofaluminium,5strokes"	1	"0,0"	0	0	shell capital service product
"#impactextrusionofaluminium,cold,initials..."	1	"0,0"	0	0	shell capital service product
"#impactextrusionofaluminium,cold,tempering"	1	"0,0"	0	0	shell capital service product
"#impactextrusionofaluminium,deformationstroke"	1	"0,0"	0	0	shell capital service product
"#impactextrusionofsteel,cold,1strokes"	1	"0,0"	0	0	shell capital service product
"#impactextrusionofsteel,cold,2strokes"	1	"0,0"	0	0	shell capital service product
"#impactextrusionofsteel,cold,3strokes"	1	"0,0"	0	0	shell capital service product
"#impactextrusionofsteel,cold,4strokes"	1	"0,0"	0	0	shell capital service product
"#impactextrusionofsteel,cold,5strokes"	1	"0,0"	0	0	shell capital service product
"#impactextrusionofsteel,cold,deformations..."	1	"0,0"	0	0	shell capital service product
"#impactextrusionofsteel,cold,initialsurfa..."	1	"0,0"	0	0	shell capital service product
"#impactextrusionofsteel,cold,tempering"	1	"0,0"	0	0	shell capital service product
"#impactextrusionofsteel,hot,1strokes"	1	"0,0"	0	0	shell capital service product
"#impactextrusionofsteel,hot,2strokes"	1	"0,0"	0	0	shell capital service product
"#impactextrusionofsteel,hot,3strokes"	1	"0,0"	0	0	shell capital service product
"#impactextrusionofsteel,hot,4strokes"	1	"0,0"	0	0	shell capital service product
"#impactextrusionofsteel,hot,5strokes"	1	"0,0"	0	0	shell capital service product
"#impactextrusionofsteel,hot,deformationst..."	1	"0,0"	0	0	shell capital service product
"#impactextrusionofsteel,hot,initialwarming"	1	"0,0"	0	0	shell capital service product
"#impactextrusionofsteel,hot,tempering"	1	"0,0"	0	0	shell capital service product
"#impactextrusionofsteel,warm,1strokes"	1	"0,0"	0	0	shell capital service product
"#impactextrusionofsteel,warm,2strokes"	1	"0,0"	0	0	shell capital service product

"#impactextrusionofsteel,warm,3strokes"	1	"0,0"	0	0	shell capital service product
"#impactextrusionofsteel,warm,4strokes"	1	"0,0"	0	0	shell capital service product
"#impactextrusionofsteel,warm,5strokes"	1	"0,0"	0	0	shell capital service product
"#impactextrusionofsteel,warm,deformations..."	1	"0,0"	0	0	shell capital service product
"#impactextrusionofsteel,warm,initialwarming"	1	"0,0"	0	0	shell capital service product
#indium	0	"0,0"	0	0	
"#indiumrichleachingresidues,fromzincprodu..."	0		0.1	0	
"#indiumrichleachingresidues,fromzincprodu..."	0		0.1	0	
"#indiumtinoxidepowder,nanoscale,forsputte..."	0	"0,0"	0	0	
"#inductor,auxilliariesandenergyuse"	1		0.5	0	
"#inductor,lowvaluemultilayerchip"	1		0.5	0	
"#inductor,miniatureradiofrequencychip"	1		0.5	0	
"#inductor,ringcorechoketype"	1		0.5	0	
"#industrialfurnace,1MW,oil"	1		0.5	0	
"#industrialfurnace,coal,1-10MW"	1		0.5	0	
"#industrialfurnace,naturalgas"	1		0.5	0	
"#industrialmachine,heavy,unspecified"	1		0.5	0	
#inertfiller	0		0.1	0	
#inertgasfordischargelamps	0	"0,0"	0	0	
#inertmateriallandfill	1		0.1	1	
#inertwaste	0		0.1	1	
"#inertwaste,forfinaldisposal"	0		0.1	1	
"#infrastructure,forregionaldistributionofo..."	1		0.5	0	
#injectionmoulding	1	"0,0"	0	0	shell capital service product
"#insulatedgatebipolartransistor,electricve..."	0		0.5	0	
"#insulationspiral-seamduct,rockwool,DN400,..."	0		0.5	0	
"#integratedcircuit,logictype"	0		0.5	0	
"#integratedcircuit,memorytype"	0		0.5	0	
"#intermodalshippingcontainer,20-foot"	1		0.8	0	
"#intermodalshippingcontainer,40-foot"	1		0.8	0	
"#intermodalshippingcontainer,40-foot,high-cube"	1		0.8	0	
"#intermodalshippingcontainer,45-foot,high-cube"	1		0.8	0	
"#internalcombustionengine,forpassengercar"	1		0.5	0	
"#internetaccess,videoconference,0.7Mbit/s"	1	"0,0"	0	0	shell capital service product
"#internetaccess,work,0.2Mbit/s"	1	"0,0"	0	0	shell capital service product
#internetaccessequipment	1		0.5	0	
#intral	0	"0,0"	0	0	

"#inverter,0.5kW"	1		0.5	0	
"#inverter,2.5kW"	1		0.5	0	
"#inverter,500kW"	1		0.5	0	
"#inverter,forelectricpassengercar"	1		0.5	0	
#iodine	0	"0,0"	0	0	
#ion-exchangerforwatertreatment	0		0.1	0	
#ironIIchloride	0	"0.44,0.45"	0.440631164	0	
"#ironIIIchloride,withoutwater,in14%iron..."	0	"0.44,0.45"	0.440631164	0	
"#ironIIIchloride,withoutwater,in40%sol..."	0	"0.44,0.45"	0.440631164	0	
"#ironIIIchloride,withoutwater,ina12%ir..."	0	"0.44,0.45"	0.440631164	0	
"#ironIIIsulfate,withoutwater,in12.5%iro..."	0	"0.36,0.37"	0.36766158	0	
#iron-nickel-chromiumalloy	0		0.5	0	
"#ironore,beneficiated,65%Fe"	0	"0.64,0.66"	0.65	0	
"#ironore,crudeore,46%Fe"	0	"0.45,0.47"	0.46	0	
"#ironore,crudeore,63%Fe"	0	"0.62,0.64"	0.63	0	
#ironpellet	0	"1,1"	1	0	
"#ironscrap,sorted,pressed"	0	"1,1"	1	0	
"#ironscrap,unsorted"	0	"1,1"	1	1	
#ironsulfate	0	"0.36,0.37"	0.36766158	0	
#irrigation	0	"0,0"	0	0	shell capital service product
#isobutanol	0	"0,0"	0	0	
#isobutylacetate	0	"0,0"	0	0	
#isohexane	0	"0,0"	0	0	
#isophthalicacidbasedunsaturatedpolyesterr...	0	"0,0"	0	0	
#isopropanol	0	"0,0"	0	0	
#isopropylacetate	0	"0,0"	0	0	
#isopropylamine	0	"0,0"	0	0	
#isoproturon	0	"0,0"	0	0	
#jatrophaseed	0	"0,0.1"	0.01	0	
"#joist,engineeredwood"	0		0.1	0	
"#juteplant,harvested"	0	"0,0.1"	0.01	0	
#kaolin	0	"0,0"	0	0	
"#kenafplant,harvested"	0	"0,0.1"	0.01	0	
#kerosene	0	"0,0"	0	0	
#keyboard	0		0.1	0	
#kiwi	0	"0,0.1"	0.01	0	
"#kraftpaper,bleached"	0	"0,0"	0	0	

"#kraftpaper,unbleached"	0	"0,0"	0	0	
"#krypton,gaseous"	0	"0,0"	0	0	
#lacticacid	0	"0,0"	0	0	
"#laminatedtimberelement,transversallyprestr..."	0		0.1	0	
"#laminatingservice,foil,withacrylicbinder"	1		0.1	0	
"#landedanchovy,fresh"	0	"0,0.1"	0.01	0	
"#landedanchovyby-catch,fresh"	0	"0,0.1"	0.01	0	
"#landedhake,fresh"	0	"0,0.1"	0.01	0	
"#landedtuna,frozen,EPO"	0	"0,0.1"	0.01	0	
"#landtenure,arableland,measuredascarbonn..."	1	"0,0"	0	0	shell capital service product
"#landtenure,arableland,measuredascarbonn..."	1	"0,0"	0	0	shell capital service product
"#landtenure,arableland,measuredascarbonn..."	1	"0,0"	0	0	shell capital service product
"#landtenure,arableland,measuredascarbonn..."	1	"0,0"	0	0	shell capital service product
"#landusechange,annualcrop"	1	"0,0"	0	0	shell capital service product
"#landusechange,forest,intensive"	1	"0,0"	0	0	shell capital service product
"#landusechange,paddyrice"	1	"0,0"	0	0	shell capital service product
"#landusechange,pasture,manmade"	1	"0,0"	0	0	shell capital service product
"#landusechange,perennialcrop"	1	"0,0"	0	0	shell capital service product
#lanthanumoxide	0	"0,0"	0	0	
"#lasermachining,metal,withCO2-laser,2000W..."	1	"0,0"	0	0	shell capital service product
"#lasermachining,metal,withCO2-laser,2700W..."	1	"0,0"	0	0	shell capital service product
"#lasermachining,metal,withCO2-laser,3200W..."	1	"0,0"	0	0	shell capital service product
"#lasermachining,metal,withCO2-laser,4000W..."	1	"0,0"	0	0	shell capital service product
"#lasermachining,metal,withCO2-laser,5000W..."	1	"0,0"	0	0	shell capital service product
"#lasermachining,metal,withCO2-laser,6000W..."	1	"0,0"	0	0	shell capital service product
"#lasermachining,metal,withYAG-laser,120Wp..."	1	"0,0"	0	0	shell capital service product
"#lasermachining,metal,withYAG-laser,200Wp..."	1	"0,0"	0	0	shell capital service product
"#lasermachining,metal,withYAG-laser,30Wpower"	1	"0,0"	0	0	shell capital service product
"#lasermachining,metal,withYAG-laser,330Wp..."	1	"0,0"	0	0	shell capital service product
"#lasermachining,metal,withYAG-laser,40Wpower"	1	"0,0"	0	0	shell capital service product
"#lasermachining,metal,withYAG-laser,500Wp..."	1	"0,0"	0	0	shell capital service product
"#lasermachining,metal,withYAG-laser,50Wpower"	1	"0,0"	0	0	shell capital service product
"#lasermachining,metal,withYAG-laser,60Wpower"	1	"0,0"	0	0	shell capital service product
"#laterite,mineral"	0		0.5	0	
#latex	0	"0,0"	0	0	
"#layeredsodiumsilicate,SKS-6,powder"	0		0.1	0	
#lead	0	"0,0"	0	0	

#leadconcentrate	0	"0,0"	0	0	
#leadconcentratestockpiling	0		0.1	0	
#leadincarshredderresidue	0		0.1	0	
#leadsmelterslag	0		0.1	0	
#leanconcrete	0	"0,0.045"	0.022	0	
#lemon	0	"0,0.1"	0.01	0	
#lettuce	0	"0,0.1"	0.01	0	
#lightclaybrick	0	"0,0"	0	0	
#lightcommercialvehicle	1		0.5	0	
#lightemittingdiode	0		0.5	0	
#lightfueloil	0		0.1	0	
#lightmortar	0		0.1	0	
"#lightweightconcreteblock,expandedclay"	0	"0,0.045"	0.022	0	
"#lightweightconcreteblock,expandedperlite"	0	"0,0.045"	0.022	0	
"#lightweightconcreteblock,expandedvermiculite"	0	"0,0.045"	0.022	0	
"#lightweightconcreteblock,polystyrene"	0	"0,0.045"	0.022	0	
"#lightweightconcreteblock,pumice"	0	"0,0.045"	0.022	0	
#lignite	0	"0,0"	0	0	
#ligniteash	0	"0,0"	0	0	
#lignitebriquettes	0		0.1	0	
#lignitebriquettesfactory	1		0.1	0	
#lignitedustfactory	1		0.1	0	
#lignitepowerplant	1		0.1	0	
#lime	0	"0,0.1"	0.01	0	
"#lime,hydrated,looseweight"	0	"0,0.1"	0.01	0	
"#lime,hydrated,packed"	0	"0,0.1"	0.01	0	
"#lime,hydraulic"	0	"0,0.1"	0.01	0	
"#lime,packed"	0	"0,0.1"	0.01	0	
#limemortar	0	"0,0.1"	0.01	0	
"#limestone,crushed,formill"	0	"0,0.1"	0.01	0	
"#limestone,crushed,washed"	0	"0,0.1"	0.01	0	
"#limestone,unprocessed"	0	"0,0.1"	0.01	0	
"#limestoneandgypsumapplication,byspreader"	1	"0,0.1"	0.01	0	
#limestonequarryinfrastructure	1	"0,0.1"	0.01	0	
#limestoneresidue	0	"0,0.1"	0.01	0	
#linseed	0	"0,0.1"	0.01	0	
"#linseedseed,atfarm"	0	"0,0.1"	0.01	0	

"#linseedseed,forsowing"	0	"0,0.1"	0.01	0	
#liquefiedpetroleumgas	0	"0,0"	0	0	
"#liquidcrystaldisplay,minorcomponents,auxi..."	0		0.1	0	
"#liquidcrystaldisplay,unmounted"	0		0.1	0	
"#liquidmanurespreading,byvacuumtanker"	1		0.1	0	
#liquidmanurestorageandprocessingfacility	1		0.1	0	
#liquidmanuretanktrailer	1		0.5	0	
#liquidpackagingboard	1		0.1	0	
#liquidpackagingboardcontainer	1		0.1	0	
"#liquidstoragetank,chemicals,organics"	1	"0,0"	0	0	
#lithium	0	"0,0"	0	0	
"#lithiumbrine,6.7%Li"	0		0.1	0	
#lithiumcarbonate	0	"0,0"	0	0	
#lithiumchloride	0	"0,0"	0	0	
#lithiumfluoride	0	"0,0"	0	0	
#lithiumhexafluorophosphate	0	"0,0"	0	0	
#lithiumhydroxide	0	"0,0"	0	0	
#lithiummanganeseoxide	0	"0,0"	0	0	
#locomotive	1	"0,0"	0	0	No mass because all eol flows included - service product
"#longliner,steel"	0	"0,0"	0	0	No mass because all eol flows included - service product
"#longlinermaintenance,steel"	1		0.5	0	
"#lorry,16metricton"	1	"0,0"	0	0	No mass because all eol flows included - service product
"#lorry,28metricton"	1	"0,0"	0	0	No mass because all eol flows included - service product
"#lorry,40metricton"	1	"0,0"	0	0	No mass because all eol flows included - service product
"#lorrywithrefrigerationmachine,carbondioxi..."	1	"0,0"	0	0	No mass because all eol flows included - service product
"#lorrywithrefrigerationmachine,R134aasref..."	1	"0,0"	0	0	No mass because all eol flows included - service product
#lowlevelradioactivewaste	0		0.1	0	
#lowlevelradioactivewasteforfinalrepository	0		0.1	0	
#lubricatingoil	0		0.1	0	
"#machine,fortreatmentofwasteelectricande..."	1		0.5	0	
"#machineoperation,diesel,<18.64kW,generators"	1	"0,0"	0	0	shell capital service product
"#machineoperation,diesel,<18.64kW,highlo..."	1	"0,0"	0	0	shell capital service product
"#machineoperation,diesel,<18.64kW,lowloa..."	1	"0,0"	0	0	shell capital service product
"#machineoperation,diesel,<18.64kW,steady-..."	1	"0,0"	0	0	shell capital service product
"#machineoperation,diesel,<18.64kW,undergr..."	1	"0,0"	0	0	shell capital service product
"#machineoperation,diesel,>=18.64kWand<7..."	1	"0,0"	0	0	shell capital service product
"#machineoperation,diesel,>=18.64kWand<7..."	1	"0,0"	0	0	shell capital service product

"#machineoperation,diesel,>=18.64kWand<7..."	1	"0,0"	0	0	shell capital service product
"#machineoperation,diesel,>=18.64kWand<7..."	1	"0,0"	0	0	shell capital service product
"#machineoperation,diesel,>=18.64kWand<7..."	1	"0,0"	0	0	shell capital service product
"#machineoperation,diesel,>=74.57,undergrou..."	1	"0,0"	0	0	shell capital service product
"#machineoperation,diesel,>=74.57kW,genera..."	1	"0,0"	0	0	shell capital service product
"#machineoperation,diesel,>=74.57kW,highl..."	1	"0,0"	0	0	shell capital service product
"#machineoperation,diesel,>=74.57kW,lowlo..."	1	"0,0"	0	0	shell capital service product
"#machineoperation,diesel,>=74.57kW,steady..."	1	"0,0"	0	0	shell capital service product
#magnesium	0	"0,0"	0	0	
"#magnesium-alloy,AZ91"	0		0.1	0	
"#magnesium-alloy,AZ91,diecast"	0		0.1	0	
#magnesiumfactory	1		0.1	0	
#magnesiumoxide	0	"0,0"	0	0	
#magnesiumsulfate	0	"0,0"	0	0	
#magnetite	0		0.5	0	
"#maintenance,barge"	1	"0,0"	0	0	No mass because all eol flows included - service product
"#maintenance,bicycle"	1		0.1	0	
"#maintenance,bulkcarrier,fordrygoods"	1		0.1	0	
"#maintenance,bus"	1		0.1	0	
"#maintenance,containership"	1		0.1	0	
"#maintenance,electricbicycle"	1		0.1	0	
"#maintenance,electricscooter,withoutbattery"	1	"0,0"	0	0	No mass because all eol flows included - service product
"#maintenance,ferry"	1		0.1	0	
"#maintenance,goodswagon"	1		0.1	0	
"#maintenance,heatandpowerco-generationunit..."	1		0.1	0	
"#maintenance,intermodalshippingcontainer,20..."	1	"0,0"	0	0	No mass because all eol flows included - service product
"#maintenance,intermodalshippingcontainer,40..."	1	"0,0"	0	0	No mass because all eol flows included - service product
"#maintenance,intermodalshippingcontainer,40..."	1	"0,0"	0	0	No mass because all eol flows included - service product
"#maintenance,intermodalshippingcontainer,45..."	1	"0,0"	0	0	No mass because all eol flows included - service product
"#maintenance,lightcommercialvehicle"	1		0.1	0	
"#maintenance,locomotive"	1		0.1	0	
"#maintenance,lorry16metricton"	1		0.1	0	
"#maintenance,lorry28metricton"	1		0.1	0	
"#maintenance,lorry40metricton"	1		0.1	0	
"#maintenance,microgasturbine,100kWelectrical"	1		0.1	0	
"#maintenance,miniCHPplant"	1		0.1	0	
"#maintenance,motorscooter"	1		0.1	0	

"#maintenance,passengercar,electric,without..."	1	"0,0"	0	0	No mass because all eol flows included - service product
"#maintenance,polymerelectrolytemembranefuel..."	1		0.1	0	
"#maintenance,reefer,intermodalshippingconta..."	1	"0,0"	0	0	No mass because all eol flows included - service product
"#maintenance,refrigerationmachine"	1	"0,0"	0	0	No mass because all eol flows included - service product
"#maintenance,solidoxidefuelcell,125kWelec..."	1		0.1	0	
"#maintenance,solidoxidefuelcell,withmicro..."	1		0.1	0	
"#maintenance,stirlingheatandpowerco-genera..."	1		0.1	0	
"#maintenance,tanker,forliquefiednaturalgas"	1		0.1	0	
"#maintenance,tanker,forpetroleum"	1		0.1	0	
"#maintenance,tankerforliquidgoodsothertha..."	1		0.1	0	
"#maintenance,train,passenger,high-speed"	1		0.1	0	
"#maintenance,train,passenger,longdistance"	1		0.1	0	
"#maintenance,train,passenger,regional"	1		0.1	0	
"#maintenance,tram"	1	"0,0"	0	0	No mass because all eol flows included - service product
#maizechop	0	"0,0.1"	0.01	0	
#maizeflour	0	"0,0.1"	0.01	0	
#maizegrain	0	"0,0.1"	0.01	0	
"#maizegrain,feed"	0	"0,0.1"	0.01	0	
"#maizegrain,feed,organic"	0	"0,0.1"	0.01	0	
"#maizegrain,feed,Swissintegratedproduction"	0	"0,0.1"	0.01	0	
"#maizegrain,organic"	0	"0,0.1"	0.01	0	
"#maizegrain,Swissintegratedproduction"	0	"0,0.1"	0.01	0	
"#maizeseed,atfarm"	0	"0,0.1"	0.01	0	
"#maizeseed,forsowing"	0	"0,0.1"	0.01	0	
"#maizeseed,organic,atfarm"	0	"0,0.1"	0.01	0	
"#maizeseed,organic,forsowing"	0	"0,0.1"	0.01	0	
"#maizeseed,Swissintegratedproduction,atfarm"	0	"0,0.1"	0.01	0	
"#maizeseed,Swissintegratedproduction,fors..."	0	"0,0.1"	0.01	0	
#maizesilage	0	"0,0"	0	0	
"#maizesilage,organic"	0	"0,0"	0	0	
"#maizesilage,Swissintegratedproduction"	0	"0,0"	0	0	
#maizestarch	0	"0,0.1"	0.01	0	
#maleicanhydride	0	"0,0"	0	0	
#maleicunsaturatedpolyesterresin	0	"0,0"	0	0	
#malusil	0	"0,0"	0	0	
#mancozeb	0	"0,0"	0	0	
#mandarin	0	"0,0.1"	0.01	0	

"#mandarin,freshgrade"	0	"0,0.1"	0.01	0	
"#mandarin,processinggrade"	0	"0,0.1"	0.01	0	
#manganese	0	"0,0"	0	0	
#manganeseIIIoxide	0	"0,0"	0	0	
#manganeseconcentrate	0	"0,0"	0	0	
#manganesedioxide	0	"0,0"	0	0	
#manganesesulfate	0	"0,0"	0	0	
#mango	0	"0,0.1"	0.01	0	
"#mango,conditioned"	0	"0,0.1"	0.01	0	
"#mangoseedling,forplanting"	0	"0,0.1"	0.01	0	
#manualdismantlingofelectricscooter	1	"0,0"	0	0	shell capital service product
#manualdismantlingofusedelectricpassengercar	1	"0,0"	0	0	shell capital service product
#manualdismantlingofusedpassengercarwith...	1	"0,0"	0	0	shell capital service product
"#manualtreatmentfacility,wasteelectricand..."	1		0.1	0	
"#manure,liquid,cattle"	0	"0,0.1"	0.01	0	
"#manure,liquid,swine"	0	"0,0.1"	0.01	0	
"#manure,solid,cattle"	0	"0,0.1"	0.01	0	
#marineelectricmotor	1		0.5	0	
#marineengine	1		0.5	0	
#masticasphalt	1	"0,0.045"	0.022	0	
#mattress	0		0.1	0	
#meatandbonemeal	0	"0,0"	0	0	
"#mechanicaltreatmentfacility,wasteelectric..."	1		0.1	0	
#mecoprop	0	"0,0"	0	0	
#mediumdensityfibreboard	0		0.1	0	
#melamine	0	"0,0"	0	0	
#melamineformaldehyderesin	0	"0,0"	0	0	
#melon	0	"0,0.1"	0.01	0	
"#mercerizing,textile"	0	"0,0"	0	0	
#mercury	0	"0,0"	0	0	
#metalcatalystforcatalyticconverter	0		0.5	0	
#metalcoatingfacility	1		0.1	0	
#metaldehyde	0	"0,0"	0	0	
#metalliferoushydroxidesludge	0		0.5	1	
"#metallizationpaste,backside"	0		0.5	0	
"#metallizationpaste,backside,aluminium"	0		0.5	0	
"#metallizationpaste,frontside"	0		0.5	0	

"#metalpartofelectronicsscrap,inblister-co..."	0		0.5	0	
"#metalworking,averageforaluminiumproductm..."	1	"0,0"	0	0	shell capital service product
"#metalworking,averageforchromiumsteelprod..."	1		0.23	0	
"#metalworking,averageforcopperproductmanu..."	1	"0,0"	0	0	shell capital service product
"#metalworking,averageformetalproductmanuf..."	1		0.18	0	
"#metalworking,averageforsteelproductmanuf..."	1		0.23	0	
#metalworkingfactory	1		0.1	0	
"#metalworkingmachine,unspecified"	1		0.5	0	
#metamitron	0	"0,0"	0	0	
#meta-phenylenediamine	0	"0,0"	0	0	
#methacrylicacid	0	"0,0"	0	0	
"#methane,96%byvolume"	0	"0,0"	0	0	
"#methane,96%byvolume,frombiogas,fromhigh..."	0	"0,0"	0	0	
"#methane,96%byvolume,frombiogas,fromlow..."	0	"0,0"	0	0	
"#methane,96%byvolume,frombiogas,frommedi..."	0	"0,0"	0	0	
"#methane,96%byvolume,frombiogas,highpres..."	0	"0,0"	0	0	
"#methane,96%byvolume,frombiogas,lowpress..."	0	"0,0"	0	0	
#methanesulfonicacid	0	"0,0"	0	0	
#methanol	0	"0,0"	0	0	
"#methanol,frombiomass"	0	"0,0"	0	0	
#methanolfactory	1		0.1	0	
#methyl-3-methoxypropionate	0	"0,0"	0	0	
#methylacetate	0	"0,0"	0	0	
#methylacrylate	0	"0,0"	0	0	
#methylamine	0	"0,0"	0	0	
#methylchloride	0	"0,0"	0	0	
#methylcyclohexane	0	"0,0"	0	0	
#methylcyclopentane	0	"0,0"	0	0	
#methylenediphenyldiisocyanate	0	"0,0"	0	0	
#methylethylketone	0	"0,0"	0	0	
#methylformate	0	"0,0"	0	0	
#methyliodide	0	"0,0"	0	0	
#methylmethacrylate	0	"0,0"	0	0	
#methyltert-butylether	0	"0,0"	0	0	
#metolachlor	0	"0,0"	0	0	
"#microgasturbine,100kWelectrical"	1		0.5	0	
#microwaveoven	1		0.5	0	

#milking	0	"0,0"	0	0	shell capital service product
#milkingparlour	0	"0,0"	0	0	
#millet	0	"0,0"	0	0	
"#mineinfrastructure,bauxite"	1		0.5	0	
"#mineinfrastructure,gold"	1		0.5	0	
"#mineinfrastructure,goldandsilver"	1		0.5	0	
"#mineinfrastructure,gold-silver-zinc-lead-copper"	1		0.5	0	
"#mineinfrastructure,iron"	1		0.5	0	
"#mineinfrastructure,opencast,hardcoal"	1		0.5	0	
"#mineinfrastructure,opencast,ilmenitefrom..."	1		0.5	0	
"#mineinfrastructure,opencast,lignite"	1		0.5	0	
"#mineinfrastructure,opencast,non-ferrousmetal"	1		0.5	0	
"#mineinfrastructure,opencast,peat"	1		0.5	0	
"#mineinfrastructure,opencast,uranium"	1		0.5	0	
"#mineinfrastructure,phosphaterock"	1		0.5	1	
"#mineinfrastructure,steatite"	1		0.5	0	
"#mineinfrastructure,treatmentofsulfidictai..."	1		0.5	0	
"#mineinfrastructure,underground,hardcoal"	1		0.5	0	
"#mineinfrastructure,underground,non-ferrous..."	1		0.5	0	
"#mineinfrastructure,underground,uranium"	1		0.5	0	
"#mineinfrastructure,vermiculite"	1		0.5	0	
"#mineralsupplement,forbeefcattle"	0		0.1	0	
"#miniCHPplant,commoncomponentsforheat+ele..."	1		0.1	0	
"#miniCHPplant,componentsforelectricityonly"	1		0.1	0	
"#miniCHPplant,componentsforheatonly"	1		0.1	0	
#mint	0	"0,0"	0	0	
"#mintseedling,forplanting"	0	"0,0"	0	0	
"#miscanthus,chopped"	0	"0,0"	0	0	
"#miscanthusrhizome,forplanting"	0	"0,0"	0	0	
#mischmetal	0		0.5	0	
"#mobilecableyarder,trailer-mounted"	1		0.5	0	
"#mobilecableyarder,truck-mounted,incl.proc..."	1		0.5	0	
"#molasses,fromsugarbeet"	0	"0,0"	0	0	
#molybdenite	0	"0,0"	0	0	
#molybdenum	0	"0,0"	0	0	
#molybdenumtrioxide	0	"0,0.01"	0.004	0	
#monochlorobenzene	0	"0,0"	0	0	

#monochloropentafluoroethane	0	"0,0"	0	0	
#monoethanolamine	0	"0,0"	0	0	
#morpholine	0	"0,0"	0	0	
"#motorscooter,50cubiccmengine"	1		0.5	0	
"#mounting,surfacemounttechnology,Pb-contain..."	1	"0,0"	0	0	shell capital service product
"#mounting,surfacemounttechnology,Pb-freeso..."	1	"0,0"	0	0	shell capital service product
"#mounting,through-holetechnology,Pb-containi..."	1	"0,0"	0	0	shell capital service product
"#mounting,through-holetechnology,Pb-freesolder"	1	"0,0"	0	0	shell capital service product
"#mowing,bymotormower"	1	"0,0"	0	0	shell capital service product
"#mowing,byrotarymower"	1	"0,0"	0	0	shell capital service product
"#MOXfuelelement,forlightwaterreactor"	0		0.1	0	
#mulberryleaves	0	"0,0.1"	0.01	0	
#mulching	1	"0,0"	0	0	shell capital service product
#multi-Siwafer	0	"0,0"	0	0	
"#multi-Siwafer,ribbon"	0	"0,0"	0	0	
#municipalsolidwaste	0		0.1	1	
#municipalwastecollectionserviceby21metri...	1		0.1	0	
#municipalwasteincinerationfacility	1		0.1	0	
#mustard	0	"0,0"	0	0	
"#N,N-dimethylformamide"	0	"0,0"	0	0	
#naphtha	0	"0,0"	0	0	
#naphthalenesulfonicacid	0	"0,0"	0	0	
#napropamide	0	"0,0"	0	0	
"#naturalgas,burnedingasmotor,forstorage"	0	"0,0"	0	0	
"#naturalgas,fromhighpressurenetwork1-5b..."	0	"0,0"	0	0	
"#naturalgas,fromlowpressurenetwork<0.1b..."	0	"0,0"	0	0	
"#naturalgas,frommediumpressurenetwork0.1..."	0	"0,0"	0	0	
"#naturalgas,highpressure"	0	"0,0"	0	0	
"#naturalgas,liquefied"	0	"0,0"	0	0	
"#naturalgas,lowpressure"	0	"0,0"	0	0	
"#naturalgas,unprocessed,atextraction"	0	"0,0"	0	0	
"#naturalgas,vented"	0	"0,0"	0	0	
#naturalgasliquids	0	"0,0"	0	0	
#naturalgasprocessingplant	1		0.1	0	
#naturalgasservicestation	1		0.1	0	
"#naturalstoneplate,cut"	0		0.1	0	
"#naturalstoneplate,grounded"	0		0.1	0	

"#naturalstoneplate,polished"	0		0.1	0	
#neodymiumoxide	0	"0,0"	0	0	
"#neutralisingagent,sodiumhydroxide-equivalent"	0	"0,0"	0	0	
"#nickel,99.5%"	0	"0,0.05"	0.02	0	
"#nickelore,beneficiated,16%"	0		0.5	0	
#nickelsmelterslag	0		0.1	0	
#nickelsulfate	0	"0,0"	0	0	
"#nitratesalts,forsolarpowerapplication"	0	"0,0"	0	0	
"#nitricacid,withoutwater,in50%solutionstate"	0	"0,0"	0	0	
#nitricoxide	0	"0,0"	0	0	
#nitrile-compound	0	"0,0"	0	0	
#nitrobenzene	0	"0,0"	0	0	
#nitro-compound	0	"0,0"	0	0	
"#nitrogen,liquid"	0	"0,0"	0	0	
"#nitrogenfertiliser,asN"	0	"0,0"	0	0	
#nitrousdioxide	0	"0,0"	0	0	
#nitrousoxide	0	"0,0"	0	0	
#N-methyl-2-pyrrolidone	0	"0,0"	0	0	
#n-olefins	0	"0,0"	0	0	
"#non-Fe-Co-metals,fromLi-ionbattery,hydrome..."	0	"0,0"	0	0	
"#non-Fe-Co-metals,fromusedLi-ionbattery,py..."	0	"0,0"	0	0	
#non-ferrousmetalsmelter	1		0.5	0	
#non-ionicsurfactant	0		0.1	0	
"#non-sulfidicoverburden,off-site"	0	"0,0"	0	0	
"#non-sulfidictailing,off-site"	0		0.1	1	
"#NOxretained,byselectivecatalyticreduction"	0	"0,0"	0	0	
"#nuclearfuelelement,forboilingwaterreacto..."	0		0.1	0	
"#nuclearfuelelement,forpressurewaterreact..."	0		0.1	0	
"#nuclearfuelelement,forpressurewaterreact..."	0		0.1	0	
"#nuclearfuelelement,forpressurewaterreact..."	0		0.1	0	
"#nuclearfuelelement,forpressurewaterreact..."	0		0.1	0	
"#nuclearfuelelement,forpressurewaterreact..."	0		0.1	0	
#nuclearfuelfactory	1		0.1	0	
"#nuclearpowerplant,boilingwaterreactor1000MW"	1		0.1	0	
"#nuclearpowerplant,pressurewaterreactor,6..."	1		0.1	0	
"#nuclearpowerplant,pressurewaterreactor10..."	1		0.1	0	
#nuclearspentfuelconditioningfacility	1		0.1	0	

#nuclearspentfuelreprocessingfacility	1		0.1	0	
"#nuclearwastestorage,finalrepositoryforhi..."	1		0.1	0	
"#nuclearwastestorage,finalrepositoryforlo..."	1		0.1	0	
"#nuclearwastestorage,interim,forhighlevel..."	1		0.1	0	
"#nuclearwastestorage,interim,forlowlevel..."	1		0.1	0	
#nylon6	0	"0,0"	0	0	
"#nylon6,glass-filled"	0	"0,0"	0	0	
#nylon6-6	0	"0,0"	0	0	
"#nylon6-6,glass-filled"	0	"0,0"	0	0	
#o-aminophenol	0	"0,0"	0	0	
#oatgrain	0	"0,0.1"	0.01	0	
"#oatgrain,feed"	0	"0,0.1"	0.01	0	
"#oatseed,forsowing"	0	"0,0.1"	0.01	0	
"#oatseed,Swissintegratedproduction,atfarm"	0	"0,0.1"	0.01	0	
#o-chlorobenzaldehyde	0	"0,0"	0	0	
#o-chlorotoluene	0	"0,0"	0	0	
#o-cresol	0	"0,0"	0	0	
#octabenzone	0	"0,0"	0	0	
#o-dichlorobenzene	0	"0,0"	0	0	
"#offshoreplatform,naturalgas"	1		0.5	0	
"#offshoreplatform,petroleum"	1		0.5	0	
"#offshorewell,oil/gas"	1		0.5	0	
"#oilboiler,100kW"	1		0.5	0	
"#oilboiler,10kW"	1		0.5	0	
#oilmill	1		0.1	0	
"#oilpowerplant,500MW"	1		0.1	0	
"#oilstorage,3000l"	1		0.5	0	
#olive	0	"0,0.1"	0.01	0	
#onion	0	"0,0.1"	0.01	0	
"#onionseedling,forplanting"	0	"0,0.1"	0.01	0	
#o-nitrophenol	0	"0,0"	0	0	
#onshorenaturalgasfieldinfrastructure	1		0.1	0	
#onshorepetroleumfieldinfrastructure	1		0.1	0	
"#onshorewell,oil/gas"	1		0.1	0	
"#operation,computer,desktop,homeuse"	1	"0,0"	0	0	shell capital service product
"#operation,computer,desktop,officeuse"	1	"0,0"	0	0	shell capital service product
"#operation,computer,desktop,withcathoderay..."	1	"0,0"	0	0	shell capital service product

"#operation,computer,desktop,withcathoderay..."	1	"0,0"	0	0	shell capital service product
"#operation,computer,desktop,withcathoderay..."	1	"0,0"	0	0	shell capital service product
"#operation,computer,desktop,withliquidcrys..."	1	"0,0"	0	0	shell capital service product
"#operation,computer,desktop,withliquidcrys..."	1	"0,0"	0	0	shell capital service product
"#operation,computer,desktop,withliquidcrys..."	1	"0,0"	0	0	shell capital service product
"#operation,computer,laptop,23%activework"	1	"0,0"	0	0	shell capital service product
"#operation,computer,laptop,68%activework"	1	"0,0"	0	0	shell capital service product
"#operation,computer,laptop,68%activework,..."	1	"0,0"	0	0	shell capital service product
"#operation,computer,laptop,68%activeworkw..."	1	"0,0"	0	0	shell capital service product
"#operation,computer,laptop,68%activeworkw..."	1	"0,0"	0	0	shell capital service product
"#operation,computer,laptop,activemode"	1	"0,0"	0	0	shell capital service product
"#operation,computer,laptop,offmode"	1	"0,0"	0	0	shell capital service product
"#operation,computer,laptop,standby/sleepmode"	1	"0,0"	0	0	shell capital service product
"#operation,computer,laptop,videoconference"	1	"0,0"	0	0	shell capital service product
"#operation,computer,laptop,videoconference,..."	1	"0,0"	0	0	shell capital service product
"#operation,computer,laptop,videomode"	1	"0,0"	0	0	shell capital service product
"#operation,computer,laptop,videomode,label..."	1	"0,0"	0	0	shell capital service product
"#operation,driedroughagestore,airdried,solar"	1	"0,0"	0	0	shell capital service product
"#operation,driedroughagestore,cold-airdrie..."	1	"0,0"	0	0	shell capital service product
"#operation,driedroughagestore,nonventilated"	1	"0,0"	0	0	shell capital service product
"#operation,housingsystem,cattle,loose,per..."	1	"0,0"	0	0	shell capital service product
"#operation,housingsystem,cattle,tied,pera..."	1	"0,0"	0	0	shell capital service product
"#operation,housingsystem,pig,fully-slatted..."	1	"0,0"	0	0	shell capital service product
"#operation,housingsystem,pig,label-certifie..."	1	"0,0"	0	0	shell capital service product
"#operation,intermodalshippingcontainer"	1	"0,0"	0	0	shell capital service product
"#operation,internetaccessequipment"	1	"0,0"	0	0	shell capital service product
"#operation,internetaccessequipment,label-ce..."	1	"0,0"	0	0	shell capital service product
"#operation,liquidmanurestorageandprocessin..."	1	"0,0"	0	0	shell capital service product
"#operation,reefer,cooling"	1	"0,0"	0	0	shell capital service product
"#operation,reefer,freezing"	1	"0,0"	0	0	shell capital service product
"#opticalbrighteners,forpaperproduction"	0		0.1	0	
"#orange,freshgrade"	0	"0,0.1"	0.01	0	
"#orange,processinggrade"	0	"0,0.1"	0.01	0	
#orbencarb	0	"0,0"	0	0	
"#organophosphorus-compound,unspecified"	0	"0,0"	0	0	
#orientedstrandboard	0	"0,0"	0	0	
#ortho-phenylenediamine	0	"0,0"	0	0	

#orthophthalicacidbasedunsaturatedpolyester...	0	"0,0"	0	0	
"#outsideairintake,stainlesssteel,DN370"	1	"0.5,1"	0.7	0	
"#oxygen,liquid"	0	"0,0"	0	0	
"#ozone,liquid"	0	"0,0"	0	0	
"#packaging,forfertilisers"	1	"0,0"	0	0	shell capital service product
"#packaging,forfertilisersorpesticides"	1	"0,0"	0	0	shell capital service product
"#packaging,forpesticides"	1	"0,0"	0	0	shell capital service product
#packagingboxfactory	1		0.5	0	
"#packagingfilm,lowdensitypolyethylene"	0	"0,0"	0	0	
"#packagingglass,brown"	0	"0,0"	0	0	
"#packagingglass,green"	0	"0,0"	0	0	
"#packagingglass,white"	0	"0,0"	0	0	
#packagingglassfactory	1		0.1	0	
#packagingglasssortingfacility	1		0.1	0	
"#packing,cement"	1	"0,0"	0	0	shell capital service product
"#packing,clayproduct"	1	"0,0"	0	0	shell capital service product
"#packing,fibrecementproduct"	1	"0,0"	0	0	shell capital service product
"#packing,limeproduct"	1	"0,0"	0	0	shell capital service product
#palladium	0	"0,0"	0	0	
#palmdate	0	"0,0.1"	0.01	0	
"#palmdate,conditionedanddried"	0	"0,0.1"	0.01	0	
"#palmdate,conditionedanddried,organic"	0	"0,0.1"	0.01	0	
"#palmdate,organic"	0	"0,0.1"	0.01	0	
#palmfruitbunch	0	"0,0.1"	0.01	0	
#palmkernelmeal	0	"0,0.1"	0.01	0	
"#palmkerneloil,crude"	0	"0,0.1"	0.01	0	
"#palmoil,crude"	0	"0,0.1"	0.01	0	
"#palmoil,refined"	0	"0,0.1"	0.01	0	
"#panelglass,forcathoderaytubedisplay"	0	"0,0"	0	0	
#papaya	0	"0,0.1"	0.01	0	
"#paper,melamineimpregnated"	0	"0,0"	0	0	
"#paper,newsprint"	0	"0,0"	0	0	
"#paper,woodcontaining,lightweightcoated"	0	"0,0"	0	0	
"#paper,woodcontaining,supercalendered"	0	"0,0"	0	0	
"#paper,woodfree,coated"	0	"0,0"	0	0	
"#paper,woodfree,uncoated"	0	"0,0"	0	0	
#papermachine	1		0.5	0	

"#papermill,integrated"	1		0.1	0	
"#papermill,non-integrated"	1		0.1	0	
#paraffin	0	"0,0"	0	0	
#para-phenylenediamine	0	"0,0"	0	0	
#parismarketcarrot	0	"0,0"	0	0	
"#particleboard,cementbonded"	0		0.1	0	
"#particleboard,forindooruse"	0		0.1	0	
"#particleboard,foroutdooruse"	0		0.1	0	
"#particleboard,uncoated"	0		0.1	0	
"#passengercar,diesel"	1		0.5	0	
"#passengercar,electric,withoutbattery"	1		0.5	0	
"#passengercar,petrol/naturalgas"	1		0.5	0	
#passengercarmaintenance	1		0.1	0	
#p-chlorophenol	0	"0,0"	0	0	
#p-dichlorobenzene	0	"0,0"	0	0	
#peach	0	"0,0.1"	0.01	0	
#peanut	0	"0,0.1"	0.01	0	
"#peanutseed,atfarm"	0	"0,0.1"	0.01	0	
"#peanutseed,forsowing"	0	"0,0.1"	0.01	0	
#pear	0	"0,0.1"	0.01	0	
"#peaseed,forsowing"	0	"0,0.1"	0.01	0	
"#peaseed,organic,forsowing"	0	"0,0.1"	0.01	0	
#peat	0	"0,0.1"	0.01	0	
#peatmoss	0	"0,0.1"	0.01	0	
#pendimethalin	0	"0,0"	0	0	
#pentaerythritol	0	"0,0"	0	0	
#pentane	0	"0,0"	0	0	
#perfluoropentane	0	"0,0"	0	0	
#perlite	0	"0,0.1"	0.01	0	
"#permanentmagnet,forelectricmotor"	0		0.5	0	
"#pesticide,unspecified"	0	"0,0"	0	0	
"#petrol,15%ETBEadditivebyvolume,withetha..."	0	"0,0.1"	0.01	0	
"#petrol,4%ETBEadditivebyvolume,withethan..."	0	"0,0.1"	0.01	0	
"#petrol,5%ethanolbyvolumefrombiomass"	0	"0,0.1"	0.01	0	
"#petrol,85%ethanolbyvolumefrombiomass"	0	"0,0.1"	0.01	0	
"#petrol,low-sulfur"	0	"0,0.1"	0.01	0	
"#petrol,two-strokeblend"	0	"0,0.1"	0.01	0	

"#petrol,unleaded"	0	"0,0"	0	0	
"#petrol,unleaded,burnedinmachinery"	1	"0,0.1"	0.01	0	
#petroleum	0	"0,0.1"	0.01	0	
#petroleumcoke	0	"0,0.1"	0.01	0	
"#petroleumcombustion,indrillingtests"	0	"0,0"	0	0	
#petroleumrefinery	1	"0,0.1"	0.01	0	
#petroleumslackwax	0	"0,0"	0	0	
#phaceliasilage	0	"0,0"	0	0	
#phenol	0	"0,0"	0	0	
#phenolicresin	0	"0,0"	0	0	
#phenoxy-compound	0	"0,0"	0	0	
#phenylaceticacid	0	"0,0"	0	0	
#phenylisocyanate	0	"0,0"	0	0	
"#phosgene,liquid"	0	"0,0"	0	0	
#phosphane	0	"0,0"	0	0	
"#phosphatefertiliser,asP2O5"	0	"0,0"	0	0	
"#phosphaterock,asP2O5,beneficiated,dry"	0	"0,0"	0	0	
"#phosphaterock,asP2O5,beneficiated,wet"	0	"0,0"	0	0	
"#phosphoricacid,fertilisergrade,withoutwat..."	0	"0,0"	0	0	
"#phosphoricacid,industrialgrade,withoutwat..."	0	"0,0"	0	0	
"#phosphoricacidfactory,fertilisergrade"	1		0.5	0	
#phosphorouschloride	0	"0,0"	0	0	
"#phosphorus,white,liquid"	0	"0,0"	0	0	
#phosphorusoxychloride	0	"0,0"	0	0	
#phosphoruspentachloride	0	"0,0"	0	0	
#phosphorustrichloride	0	"0,0"	0	0	
#phosphorylchloride	0	"0,0"	0	0	
"#photovoltaiccell,multi-Siwafer"	0		0.1	0	
"#photovoltaiccell,ribbon-Si"	0		0.1	0	
"#photovoltaiccell,single-Siwafer"	0		0.1	0	
#photovoltaiccellfactory	0		0.1	0	
"#photovoltaicfacadeinstallation,3kWp,multi-..."	1		0.1	0	
"#photovoltaicfacadeinstallation,3kWp,multi-..."	1		0.1	0	
"#photovoltaicfacadeinstallation,3kWp,single..."	1		0.1	0	
"#photovoltaicfacadeinstallation,3kWp,single..."	1		0.1	0	
"#photovoltaicflat-roofinstallation,3kWp,mul..."	1		0.1	0	
"#photovoltaicflat-roofinstallation,3kWp,sin..."	1		0.1	0	

"#photovoltaiclaminate,a-Si"	0		0.96	0	
"#photovoltaiclaminate,CdTe"	0		0.22	0	
"#photovoltaiclaminate,CIS"	0	"0,0"	0	0	
"#photovoltaiclaminate,multi-Siwafer"	0	"0,0"	0	0	
"#photovoltaiclaminate,ribbon-Si"	0		0.1	0	
"#photovoltaiclaminate,single-Siwafer"	0		0.1	0	
"#photovoltaicmodule,building-integrated,for..."	1		0.5	0	
"#photovoltaicmodule,building-integrated,for..."	1		0.5	0	
"#photovoltaicmountingsystem,for570kWpopen..."	1		0.5	0	
"#photovoltaicmountingsystem,forfacadeinsta..."	1		0.5	0	
"#photovoltaicmountingsystem,forflat-roofin..."	1		0.5	0	
"#photovoltaicmountingsystem,forslanted-roof..."	1		0.5	0	
"#photovoltaicpanel,a-Si"	1		0.1	0	
"#photovoltaicpanel,CIS"	1		0.1	0	
"#photovoltaicpanel,multi-Siwafer"	1		0.1	0	
"#photovoltaicpanel,ribbon-Si"	1		0.1	0	
"#photovoltaicpanel,single-Siwafer"	1		0.1	0	
#photovoltaicpanelfactory	1		0.1	0	
"#photovoltaicplant,570kWp,multi-Si,onopen..."	1		0.1	0	
"#photovoltaicplant,electricinstallationfor..."	1		0.1	0	
"#photovoltaicplant,electricinstallationfor..."	1		0.1	0	
"#photovoltaicslanted-roofinstallation,3kWp,..."	1		0.1	0	
"#photovoltaicslanted-roofinstallation,3kWp,..."	1		0.1	0	
"#photovoltaicslanted-roofinstallation,3kWp,..."	1		0.1	0	
"#photovoltaicslanted-roofinstallation,3kWp,..."	1		0.1	0	
"#photovoltaicslanted-roofinstallation,3kWp,..."	1		0.1	0	
"#photovoltaicslanted-roofinstallation,3kWp,..."	1		0.1	0	
"#photovoltaicslanted-roofinstallation,3kWp,..."	1		0.1	0	
"#photovoltaicslanted-roofinstallation,3kWp,..."	1		0.1	0	
"#photovoltaicslanted-roofinstallation,3kWp,..."	1		0.1	0	
"#photovoltaicslanted-roofinstallation,3kWp,..."	1		0.1	0	
#phthalicanhydride	0	"0,0"	0	0	
#phthalimide	0	"0,0"	0	0	
#phthalimide-compound	0	"0,0"	0	0	
#pigiron	0	"1,1"	1	0	
#pineapple	0	"0,0.1"	0.01	0	
"#pipeline,liquidmanure"	1		0.5	0	

"#pipeline,naturalgas,highpressuredistribut..."	1		0.5	1	
"#pipeline,naturalgas,longdistance,highcap..."	1		0.5	0	
"#pipeline,naturalgas,longdistance,highcap..."	1		0.5	0	
"#pipeline,naturalgas,longdistance,lowcapa..."	1		0.5	0	
"#pipeline,naturalgas,lowpressuredistributi..."	1		0.5	1	
"#pipeline,petroleum"	1		0.5	0	
"#pipeline,petroleum,offshore"	1		0.5	0	
#piperidine	0	"0,0"	0	0	
#pitch	0	"0,0"	0	0	
"#pitchdespergents,inpaperproduction"	0		0.1	0	
#planingmill	1		0.1	0	
"#planning,cogenunitminiCHPplant"	1	"0,0"	0	0	shell capital service product
"#planning,heatandpowerco-generationunit,1..."	1	"0,0"	0	0	shell capital service product
#planting	1	"0,0"	0	0	shell capital service product
"#planting,sugarcane"	1	"0,0"	0	0	shell capital service product
#plantingtree	1	"0,0"	0	0	shell capital service product
"#plantingwithstarterfertiliser,bynotillp..."	1	"0,0"	0	0	shell capital service product
#plastermixing	0	"0,0"	0	0	shell capital service product
"#plasticflake,consumerelectronics,forrecyc..."	0	"0,0"	0	0	
"#plasticgranulate,unspecified,recycled"	0	"0,0"	0	0	
"#plasticiser,forconcrete,basedonsulfonated..."	0		0.1	0	
#plasticprocessingfactory	1		0.1	0	
#plastictunnel	1	"0,0"	0	0	
#platinum	0	"0,0"	0	0	
#platinumgroupmetalconcentrate	0		0.1	0	
"#plug,inletandoutlet,forcomputercable"	0		0.5	0	
"#plug,inletandoutlet,fornetworkcable"	0		0.5	0	
"#plug,inletandoutlet,forprintercable"	0		0.5	0	
"#plywood,forindooruse"	0	"0,0"	0	0	
"#plywood,foroutdooruse"	0	"0,0"	0	0	
#p-nitrophenol	0	"0,0"	0	0	
#p-nitrotoluene	0	"0,0"	0	0	
"#pointingdevice,opticalmouse,withcable"	1		0.5	0	
"#polarfleeceproduction,energyuseonly"	1		0.1	0	
"#polarizer,liquidcrystalsandcolourfilters,..."	1		0.1	0	
#polishingpowder	0		0.1	0	
#pollutantfromrailballast	0		0.1	0	

#polyacrylamide	0	"0,0"	0	0	
#polyaluminiumchloride	0	"0,0"	0	0	
#polybutadiene	0	"0,0"	0	0	
#polycarbonate	0	"0,0"	0	0	
"#polycarboxylates,40%activesubstance"	0	"0,0"	0	0	
#polydimethylsiloxane	0	"0,0"	0	0	
#polyester-complexedstarchbiopolymer	0	"0,0"	0	0	
"#polyesterresin,unsaturated"	0	"0,0"	0	0	
"#polyethylene,highdensity,granulate"	0	"0,0"	0	0	
"#polyethylene,highdensity,granulate,recycled"	0	"0,0"	0	0	
"#polyethylene,linearlowdensity,granulate"	0	"0,0"	0	0	
"#polyethylene,lowdensity,granulate"	0	"0,0"	0	0	
"#polyethylenepipe,corrugated,DN75"	0	"0,0"	0	0	
"#polyethylenepipe,DN200,SDR41"	0	"0,0"	0	0	
"#polyethyleneterephthalate,granulate,amorpho..."	0	"0,0"	0	0	
"#polyethyleneterephthalate,granulate,amorphous"	0	"0,0"	0	0	
"#polyethyleneterephthalate,granulate,bottle..."	0	"0,0"	0	0	
"#polyethyleneterephthalate,granulate,bottle..."	0	"0,0"	0	0	
"#polylactide,granulate"	0	"0,0"	0	0	
#polymerfoaming	0	"0,0"	0	0	shell capital service product
"#polymethylmethacrylate,beads"	0	"0,0"	0	0	
"#polymethylmethacrylate,sheet"	0	"0,0"	0	0	
#polyol	0	"0,0"	0	0	
#polyphenylenesulfide	0	"0,0"	0	0	
"#polypropylene,granulate"	0	"0,0"	0	0	
"#polystyrene,expandable"	0	"0,0"	0	0	
"#polystyrene,extruded"	0	"0,0"	0	0	
"#polystyrene,generalpurpose"	0	"0,0"	0	0	
"#polystyrene,highimpact"	0	"0,0"	0	0	
#polystyrenefoamslab	0	"0,0"	0	0	
"#polystyrenefoamslab,10%recycled"	0	"0,0"	0	0	
#polystyrenefoamslabforperimeterinsulation	0	"0,0"	0	0	
"#polystyrenefoamslabwithgraphite,6%recycled"	0	"0,0"	0	0	
"#polystyrenescrap,post-consumer"	0	"0,0"	0	0	
"#polysulfide,sealingcompound"	0	"0,0"	0	0	
#polysulfone	0	"0,0"	0	0	
"#polyurethane,flexiblefoam"	0	"0,0"	0	0	

"#polyurethane,rigidfoam"	0	"0,0"	0	0	
"#polyvinylchloride,bulkpolymerised"	0	"0,0"	0	0	
"#polyvinylchloride,emulsionpolymerised"	0	"0,0"	0	0	
"#polyvinylchloride,suspensionpolymerised"	0	"0,0"	0	0	
#polyvinylfluoride	0	"0,0"	0	0	
"#polyvinylfluoride,dispersion"	0	"0,0"	0	0	
"#polyvinylfluoride,film"	0	"0,0"	0	0	
"#polyvinylidenchloride,granulate"	0	"0,0"	0	0	
#pomegranate	0	"0,0.1"	0.01	0	
#portachrom	0		0.5	0	
#portafer	0		0.8	0	
#portfacilities	1		0.1	0	
#potassiumcarbonate	0	"0,0"	0	0	
"#potassiumchloride,asK2O"	0	"0,0"	0	0	
"#potassiumchloride,industrialgrade"	0	"0,0"	0	0	
"#potassiumfertiliser,asK2O"	0	"0,0"	0	0	
#potassiumhydroxide	0	"0,0"	0	0	
#potassiumnitrate	0	"0,0"	0	0	
"#potassiumnitrate,agriculturalgrade"	0	"0,0"	0	0	
"#potassiumnitrate,industrialgrade"	0	"0,0"	0	0	
"#potassiumnitrate,technicalgrade"	0	"0,0"	0	0	
#potassiumperchlorate	0	"0,0"	0	0	
#potassiumpermanganate	0	"0,0"	0	0	
"#potassiumsulfate,asK2O"	0	"0,0"	0	0	
#potato	0	"0,0.1"	0.01	0	
"#potato,organic"	0	"0,0.1"	0.01	0	
"#potato,Swissintegratedproduction"	0	"0,0.1"	0.01	0	
#potatograding	0	"0,0"	0	0	shell capital service product
#potatohaulmcutting	1	"0,0"	0	0	shell capital service product
#potatoplanting	0	"0,0"	0	0	shell capital service product
"#potatoseed,atfarm"	0	"0,0.1"	0.01	0	
"#potatoseed,forsetting"	0	"0,0.1"	0.01	0	
"#potatoseed,organic,atfarm"	0	"0,0.1"	0.01	0	
"#potatoseed,organic,forsetting"	0	"0,0.1"	0.01	0	
"#potatoseed,Swissintegratedproduction,atfarm"	0	"0,0.1"	0.01	0	
"#potatoseed,Swissintegratedproduction,for..."	0	"0,0.1"	0.01	0	
#potatostarch	0	"0,0.1"	0.01	0	

"#potentiometer,unspecified"	1		0.5	0	
"#poultrymanure,dried"	0	"0,0.1"	0.01	0	
"#poultrymanure,fresh"	0	"0,0.1"	0.01	0	
"#powdercoat,aluminiumsheet"	0		0.1	0	
"#powdercoat,steel"	0	"0.5,1"	0.7	0	
"#poweradapter,forlaptop"	0		0.5	0	
"#powerblock,solarthermalparabolictrough,5..."	1		0.5	0	
"#powerblock,solartowerpowerplant,20MW"	1		0.5	0	
"#powerdistributionunit,forelectricpassenge..."	1		0.5	0	
"#powersaw,withcatalyticconverter"	1	"0,0"	0	0	No mass because all eol flows included - service product
"#powersaw,withoutcatalyticconverter"	1	"0,0"	0	0	No mass because all eol flows included - service product
"#powersawing,withcatalyticconverter"	1	"0,0"	0	0	shell capital service product
"#powersawing,withoutcatalyticconverter"	1	"0,0"	0	0	shell capital service product
"#powersupplyunit,fordesktopcomputer"	1		0.5	0	
"#powertrain,forelectricpassengercar"	1		0.5	0	
"#powertrain,forelectricscooter"	1		0.5	0	
#praseodymiumoxide	0	"0,0"	0	0	
#preciousmetalforjewellery	0	"0,0"	0	0	
"#preciousmetalfromelectronicsscrap,inanod..."	0	"0,0"	0	0	
#preciousmetalrefinery	1		0.5	0	
#printedpaper	0	"0,0"	0	0	
"#printedpaper,offset"	0	"0,0"	0	0	
"#printedwiringboard,forpowersupplyunit,d..."	0		0.2	0	
"#printedwiringboard,forpowersupplyunit,d..."	0		0.2	0	
"#printedwiringboard,forsurfacemounting,Pb..."	0		0.2	0	
"#printedwiringboard,forsurfacemounting,Pb..."	0		0.2	0	
"#printedwiringboard,forthrough-holemountin..."	0		0.2	0	
"#printedwiringboard,forthrough-holemountin..."	0		0.2	0	
"#printedwiringboard,mountedmainboard,deskt..."	0		0.2	0	
"#printedwiringboard,mountedmainboard,deskt..."	0		0.2	0	
"#printedwiringboard,mountedmainboard,lapto..."	0		0.2	0	
"#printedwiringboard,mountedmainboard,lapto..."	0		0.2	0	
"#printedwiringboard,surfacemounted,unspeci..."	0		0.2	0	
"#printedwiringboard,surfacemounted,unspeci..."	0		0.2	0	
"#printedwiringboard,through-holemounted,un..."	0		0.2	0	
"#printedwiringboard,through-holemounted,un..."	0		0.2	0	
#printedwiringboardmountingfacility	1		0.1	0	

"#printedwiringboardmountingfacility,surfac..."	0		0.1	0	
"#printedwiringboardmountingfacility,throug..."	0		0.1	0	
"#printer,laser,black/white"	1		0.2	0	
"#printer,laser,colour"	1		0.2	0	
"#printingink,offset,withoutsolvent,in47.5..."	0	"0,0.1"	0.01	0	
"#printingink,rotogravure,withoutsolvent,in..."	0	"0,0.1"	0.01	0	
"#process-specificburdens,hazardouswasteinci..."	1	"0,0"	0	0	shell capital service product
"#process-specificburdens,importofcopperto..."	1	"0,0"	0	0	shell capital service product
"#process-specificburdens,inertmateriallandfill"	1	"0,0"	0	0	shell capital service product
"#process-specificburdens,municipalwasteinci..."	1	"0,0"	0	0	shell capital service product
"#process-specificburdens,residualmaterialla..."	1	"0,0"	0	0	shell capital service product
"#process-specificburdens,sanitarylandfill"	1	"0,0"	0	0	shell capital service product
"#process-specificburdens,slaglandfill"	1	"0,0"	0	0	shell capital service product
#propanal	0	"0,0"	0	0	
#propane	0	"0,0"	0	0	
"#propane,burnedinbuildingmachine"	0	"0,0"	0	0	
#propionicacid	0	"0,0"	0	0	
#propylamine	0	"0,0"	0	0	
#propylene	0	"0,0"	0	0	
"#propylene,pipelinesystem"	1		0.5	0	
"#propyleneglycol,liquid"	0	"0,0"	0	0	
"#propyleneoxide,liquid"	0	"0,0"	0	0	
#prosulfocarb	0	"0,0"	0	0	
"#proteinfeed,100%crude"	0	"0,0"	0	0	
#proteinpea	0	"0,0.1"	0.01	0	
"#proteinpea,feed,Swissintegratedproduction"	0	"0,0.1"	0.01	0	
"#proteinpea,organic"	0	"0,0.1"	0.01	0	
"#proteinpea,Swissintegratedproduction"	0	"0,0.1"	0.01	0	
#pulpfactory	1		0.1	0	
"#pulpwood,hardwood,measuredassolidwoodund..."	0	"0,0.1"	0.01	0	
"#pulpwood,softwood,measuredassolidwoodund..."	0	"0,0.1"	0.01	0	
#pulverisedlignite	0	"0,0"	0	0	
#pumice	0		0.1	0	
"#pump,40W"	1		0.5	0	
#pumpstation	1		0.5	0	
"#purgegas,richinsodiumnitrate"	0	"0,0"	0	0	
#purifiedterephthalicacid	0	"0,0"	0	0	

"#purseseiner,steel"	1	"0,0"	0	0	No mass because all eol flows included - service product
"#purseseiner,wood"	1	"0,0"	0	0	No mass because all eol flows included - service product
"#purseseinermaintenance,steel"	1	"0,0"	0	0	shell capital service product
"#purseseinermaintenance,wood"	1	"0,0"	0	0	shell capital service product
#pyrazole	0	"0,0"	0	0	
#pyrethroid-compound	0	"0,0"	0	0	
#pyridazine-compound	0	"0,0"	0	0	
#pyridine	0	"0,0"	0	0	
#pyridine-compound	0	"0,0"	0	0	
#pyriteash	0		0.1	0	
"#quicklime,inpieces,loose"	0	"0,0"	0	0	
"#quicklime,milled,loose"	0	"0,0"	0	0	
"#quicklime,milled,packed"	0	"0,0"	0	0	
#radish	0	"0,0.1"	0.01	0	
#railwaytrack	1		0.5	0	
"#railwaytrack,forhigh-speedtrain"	1		0.5	0	
#rainwatermineraloilstorage	1		0.5	0	
#rapemeal	0	"0,0.1"	0.01	0	
"#rapeoil,crude"	0	"0,0.1"	0.01	0	
#rapeseed	0	"0,0.1"	0.01	0	
"#rapeseed,forsowing"	0	"0,0.1"	0.01	0	
"#rapeseed,organic"	0	"0,0.1"	0.01	0	
"#rapeseed,organic,forsowing"	0	"0,0.1"	0.01	0	
"#rapeseed,Swissintegratedproduction"	0	"0,0.1"	0.01	0	
"#rareearthconcentrate,70%REO,frombastnäsite"	0		0.1	0	
#rawsewagesludge	0		0.1	1	
"#receiversystem,solartowerpowerplant,20MW"	1		0.5	0	
"#recultivation,bauxitemine"	0	"0,0"	0	0	shell capital service product
"#recultivation,bentonitemine"	0	"0,0"	0	0	shell capital service product
"#recultivation,ilmenitemine"	0	"0,0"	0	0	shell capital service product
"#recultivation,ironmine"	0	"0,0"	0	0	shell capital service product
"#recultivation,limestonemine"	0	"0,0"	0	0	shell capital service product
"#recultivation,shalequarry"	0	"0,0"	0	0	shell capital service product
"#redmeat,liveweight"	0		0.1	0	
#redmudfrombauxitedigestion	0		0.1	0	
"#reefer,intermodalshippingcontainer,40-foot..."	1		0.5	0	
"#reefer,intermodalshippingcontainer,40-foot..."	1		0.5	0	

#reeledrawsilkhank	0		0.1	0	
#refinerygas	0	"0,0"	0	0	
#refinerysludge	0		0.1	1	
#reformate	0	"0,0"	0	0	
"#refractory,basic,packed"	0	"0,0"	0	0	
"#refractory,fireclay,packed"	0	"0,0"	0	0	
"#refractory,highaluminiumoxide,packed"	0	"0,0"	0	0	
"#refractorymaterial,acid"	0	"0,0"	0	0	
#refractoryspentpotlinerfromAlelectrolysis	0	"0,0"	0	0	
#refrigerantR134a	1	"0,0"	0	0	
"#refrigerationmachine,carbondioxide,liquid..."	1		0.5	0	
"#refrigerationmachine,R134aasrefrigerant"	1		0.5	0	
#refrigerator	1		0.5	0	
#reinforcingsteel	0	"0.5,1"	0.7	0	
"#residentialsewergrid,0.087km"	1		0.5	0	
"#residualhardwood,wet"	0	"0,0.1"	0.01	0	
#residualmateriallandfill	1		0.1	1	
"#residualsoftwood,wet"	0	"0,0.1"	0.01	0	
"#residualwood,dry"	0	"0,0.1"	0.01	0	
#residuefromcoolingtower	0		0.1	0	
"#residuefrommechanicaltreatment,cathoderay..."	0		0.1	0	
"#residuefrommechanicaltreatment,desktopcom..."	0		0.1	0	
"#residuefrommechanicaltreatment,industrial..."	0		0.1	0	
"#residuefrommechanicaltreatment,ITaccessory"	0		0.1	0	
"#residuefrommechanicaltreatment,laptopcomp..."	0		0.1	0	
"#residuefrommechanicaltreatment,laserprinter"	0		0.1	0	
"#residuefrommechanicaltreatment,liquidcrys..."	0		0.1	0	
#residuefromNa-dichromateproduction	0		0.1	0	
"#residuefromrutileproduction,synthetic,56%..."	0		0.1	0	
#residuefromshredderfractionfrommanualdis...	0		0.1	0	
"#residuefromTiO2production,chlorideprocess"	0	"0,0"	0	0	
"#residuefromTiO2production,sulfateprocess"	0	"0,0"	0	0	
"#resistor,auxilliariesandenergyuse"	0		0.5	0	
"#resistor,metalfilmtype,through-holemounting"	0		0.5	0	
"#resistor,surface-mounted"	0		0.5	0	
"#resistor,wirewound,through-holemounting"	0		0.5	0	
"#retentionaid,forpaperproduction"	0		0.1	0	

#rhodium	0	"0,0"	0	0	
"#rice,basmati"	0	"0,0.1"	0.01	0	
"#rice,non-basmati"	0	"0,0.1"	0.01	0	
"#riceseed,forsowing"	0	"0,0.1"	0.01	0	
#road	1		0.1	0	
"#road,company,internal"	1		0.1	0	
#roadmaintenance	1		0.1	0	
#roadvehiclefactory	1		0.1	0	
"#roadwearemissions,lorry"	0		0.1	0	
"#roadwearemissions,passengercar"	0		0.1	0	
#rockcrushing	0		0.1	0	
#rollingmill	1		0.1	0	
#rooftile	0		0.1	0	
"#room-connectingoverflowelement,steel,appro..."	1	"0.5,1"	0.7	0	
"#rosinsize,forpaperproduction"	0	"0,0"	0	0	
"#roundwood,azobefromsustainableforestmanag..."	0	"0,0"	0	0	
"#roundwood,azobefromsustainableforestmanag..."	0	"0,0"	0	0	
"#roundwood,eucalyptusssp.fromsustainablefo..."	0	"0,0"	0	0	
"#roundwood,merantifromsustainableforestman..."	0	"0,0"	0	0	
"#roundwood,merantifromsustainableforestman..."	0	"0,0"	0	0	
"#roundwood,paranápinefromsustainableforest..."	0	"0,0"	0	0	
"#router,internet"	1		0.5	0	
"#rutile,95%titaniumdioxide"	0	"0,0"	0	0	
#ryegrain	0	"0,0.1"	0.01	0	
"#ryegrain,feed,organic"	0	"0,0.1"	0.01	0	
"#ryegrain,feed,Swissintegratedproduction"	0	"0,0.1"	0.01	0	
"#ryegrain,organic"	0	"0,0.1"	0.01	0	
"#ryegrain,Swissintegratedproduction"	0	"0,0.1"	0.01	0	
#ryegrass-Egyptian&Persianclover-mixturesilage	0	"0,0.1"	0.01	0	
#ryegrass-red&Egyptianclover-mixturesilage	0	"0,0.1"	0.01	0	
#ryegrasssilage	0	"0,0.1"	0.01	0	
"#ryeseed,forsowing"	0	"0,0.1"	0.01	0	
"#ryeseed,organic,forsowing"	0	"0,0.1"	0.01	0	
"#ryeseed,Swissintegratedproduction,forsowing"	0	"0,0.1"	0.01	0	
#salicylicacid	0	"0,0"	0	0	
#salt	0	"0,0"	0	0	
#salttailingfrompotashmine	0		0.1	0	

"#samariumeuropiumgadoliniumconcentrate,94%..."	0	"0,0"	0	0	
#sand	0	"0,0"	0	0	
#sand-limebrick	0	"0,0.1"	0.01	0	
"#sanforizing,textile"	0	"0,0"	0	0	
#sanitaryceramics	0	"0,0"	0	0	
#sanitarylandfillfacility	1		0.1	0	
"#sawdust,loose,wet,measuredasdrymass"	0	"0,0"	0	0	
"#sawdust,wet,measuredasdrymass"	0	"0,0"	0	0	
"#sawlogandveneerlog,hardwood,measuredass..."	0	"0,0"	0	0	
"#sawlogandveneerlog,softwood,debarked,mea..."	0	"0,0"	0	0	
"#sawlogandveneerlog,softwood,measuredass..."	0	"0,0"	0	0	
#sawmill	1	"0,0"	0	0	No mass because all eol flows included - service product
"#sawnwood,azobefromsustainableforestmanage..."	0	"0,0.1"	0.01	0	
"#sawnwood,beam,hardwood,driedu=10%planed"	0	"0,0.1"	0.01	0	
"#sawnwood,beam,hardwood,driedu=20%planed"	0	"0,0.1"	0.01	0	
"#sawnwood,beam,hardwood,raw,driedu=10%"	0	"0,0.1"	0.01	0	
"#sawnwood,beam,hardwood,raw,driedu=20%"	0	"0,0.1"	0.01	0	
"#sawnwood,beam,softwood,driedu=10%planed"	0	"0,0.1"	0.01	0	
"#sawnwood,beam,softwood,driedu=20%planed"	0	"0,0.1"	0.01	0	
"#sawnwood,beam,softwood,raw,driedu=10%"	0	"0,0.1"	0.01	0	
"#sawnwood,beam,softwood,raw,driedu=20%"	0	"0,0.1"	0.01	0	
"#sawnwood,board,hardwood,driedu=10%planed"	0	"0,0.1"	0.01	0	
"#sawnwood,board,hardwood,driedu=20%planed"	0	"0,0.1"	0.01	0	
"#sawnwood,board,hardwood,raw,driedu=10%"	0	"0,0.1"	0.01	0	
"#sawnwood,board,hardwood,raw,driedu=20%"	0	"0,0.1"	0.01	0	
"#sawnwood,board,softwood,driedu=10%planed"	0	"0,0.1"	0.01	0	
"#sawnwood,board,softwood,driedu=20%planed"	0	"0,0.1"	0.01	0	
"#sawnwood,board,softwood,raw,driedu=10%"	0	"0,0.1"	0.01	0	
"#sawnwood,board,softwood,raw,driedu=20%"	0	"0,0.1"	0.01	0	
"#sawnwood,hardwood,driedu=10%planed"	0	"0,0.1"	0.01	0	
"#sawnwood,hardwood,driedu=20%planed"	0	"0,0.1"	0.01	0	
"#sawnwood,hardwood,raw"	0	"0,0.1"	0.01	0	
"#sawnwood,hardwood,raw,driedu=10%"	0	"0,0.1"	0.01	0	
"#sawnwood,hardwood,raw,driedu=20%"	0	"0,0.1"	0.01	0	
"#sawnwood,lath,hardwood,driedu=10%planed"	0	"0,0.1"	0.01	0	
"#sawnwood,lath,hardwood,driedu=20%planed"	0	"0,0.1"	0.01	0	
"#sawnwood,lath,hardwood,raw,driedu=10%"	0	"0,0.1"	0.01	0	

"#sawnwood,lath,hardwood,raw,driedu=20%"	0	"0,0.1"	0.01	0	
"#sawnwood,lath,softwood,driedu=10%planed"	0	"0,0.1"	0.01	0	
"#sawnwood,lath,softwood,driedu=20%planed"	0	"0,0.1"	0.01	0	
"#sawnwood,lath,softwood,raw,driedu=10%"	0	"0,0.1"	0.01	0	
"#sawnwood,lath,softwood,raw,driedu=20%"	0	"0,0.1"	0.01	0	
"#sawnwood,paranápinefromsustainableforest..."	0	"0,0.1"	0.01	0	
"#sawnwood,softwood,driedu=10%planed"	0	"0,0.1"	0.01	0	
"#sawnwood,softwood,driedu=20%planed"	0	"0,0.1"	0.01	0	
"#sawnwood,softwood,raw"	0	"0,0.1"	0.01	0	
"#sawnwood,softwood,raw,driedu=10%"	0	"0,0.1"	0.01	0	
"#sawnwood,softwood,raw,driedu=20%"	0	"0,0.1"	0.01	0	
#scrapaluminium	0	"0,0"	0	0	
#scrapcopper	0	"0,0"	0	0	
#scrapleadacidbattery	0		0.1	0	
#scrappreparationfacility	0		0.1	0	
#scrapsteel	0	"0.5,1"	0.7	1	
#scraptinsheet	0		0.1	1	
"#seal,naturalrubberbased"	0	"0,0"	0	0	
"#sealingtape,aluminium/PE,50mmwide"	0	"0,0"	0	0	
#seawaterreverseosmosismodule	0		0.5	0	
"#sectionbarextrusion,aluminium"	0	"0,0"	0	0	shell capital service product
"#sectionbarrolling,steel"	0	"0,0"	0	0	shell capital service product
#seed-cotton	0	"0,0.1"	0.01	0	
"#seed-cotton,organic"	0	"0,0.1"	0.01	0	
"#selectivecoat,aluminiumsheet,nickelpigmen..."	0		0.1	0	
"#selectivecoat,coppersheet,blackchrome"	0		0.1	0	
"#selectivecoat,coppersheet,blackmajic"	0		0.1	0	
"#selectivecoat,coppersheet,physicalvapour..."	0		0.1	0	
"#selectivecoat,coppersheet,sputterdeposition"	0		0.1	0	
"#selectivecoat,stainlesssteelsheet,blackc..."	0	"0.5,1"	0.1	0	
#selenium	0	"0,0"	0	0	
#sesameseed	0	"0,0.1"	0.01	0	
#sewagesludge	0		0.1	1	
"#sewagesludge,dried"	0		0.1	1	
"#sewergrid,1.1E10l/year,242km"	1		0.5	1	
"#sewergrid,1.6E8l/year,6km"	1		0.5	1	
"#sewergrid,1E9l/year,30km"	1		0.5	1	

"#sewergrid,4.7E10l/year,583km"	1		0.5	1	
"#sewergrid,5E9l/year,110km"	1		0.5	1	
#shale	0	"0,0"	0	0	
#shalebrick	0		0.1	0	
"#shavings,hardwood,loose,measuredasdrymass"	0	"0,0.1"	0.01	0	
"#shavings,hardwood,measuredasdrymass"	0	"0,0.1"	0.01	0	
"#shavings,softwood,loose,measuredasdrymass"	0	"0,0.1"	0.01	0	
"#shavings,softwood,measuredasdrymass"	0	"0,0.1"	0.01	0	
#shed	1		0.5	0	
"#shed,large,wood,non-insulated,fire-unprote..."	1		0.1	0	
#sheepfleeceinthegrease	0	"0,0"	0	0	
"#sheepforslaughtering,liveweight"	0	"0,0.1"	0.01	0	
"#sheetrolling,aluminium"	1	"0,0"	0	0	shell capital service product
"#sheetrolling,chromiumsteel"	1	"0,0.1"	0.052	0	
"#sheetrolling,copper"	1	"0,0"	0	0	shell capital service product
"#sheetrolling,steel"	1	"0,0.1"	0.086	0	
#shredderfractionaftermanualdismantlingof...	1		0.5	0	
"#silencer,steel,DN125"	1	"0.5,1"	0.7	0	
"#silencer,steel,DN315,50mm"	1	"0.5,1"	0.7	0	
"#silicafume,densified"	0	"0,0"	0	0	
#silicasand	0	"0,0"	0	0	
"#silicon,electronicsgrade"	0	"0,0"	0	0	
"#silicon,metallurgicalgrade"	0	"0,0"	0	0	
"#silicon,multi-Si,casted"	0	"0,0"	0	0	
"#silicon,singlecrystal,Czochralskiprocess,..."	0	"0,0"	0	0	
"#silicon,singlecrystal,Czochralskiprocess,..."	0	"0,0"	0	0	
"#silicon,solargrade"	0	"0,0"	0	0	
#siliconcarbide	0	"0,0"	0	0	
#siliconefactory	1		0.1	0	
#siliconeproduct	1	"0,0"	0	0	
#silicontetrachloride	0	"0,0"	0	0	
#silicontetrahydride	0	"0,0"	0	0	
#silver	0	"0,0"	0	0	
"#silver,unrefined"	0	"0,0"	0	0	
"#single-Siwafer,forelectronics"	0		0.1	0	
"#single-Siwafer,photovoltaic"	0		0.1	0	
"#sinter,iron"	0	"1,1"	1	0	

#skidder	1		0.5	0	
"#skidding,skidder"	1	"0,0"	0	0	shell capital service product
"#skimmedmilk,fromcowmilk"	0	"0,0.1"	0.01	0	
"#slabandsiding,hardwood,wet,measuredasdr..."	0	"0,0.1"	0.01	0	
"#slabandsiding,softwood,wet,measuredasdr..."	0	"0,0.1"	0.01	0	
"#slag,unalloyedelectricarcfurnacesteel"	0		0.1	0	
#slagfrommetallurgicalgradesiliconproduction	0		0.1	0	
#slaglandfill	1		0.1	1	
#slaughterhousewaste	0	"0,0"	0	0	
"#sludge,NaClelectrolysis"	0		0.1	0	
"#sludge,NaClelectrolysisHg"	0	"0,0"	0	0	
"#sludge,pigironproduction"	0		0.5	1	
#sludgefromFeCl3production	0		0.5	0	
#sludgefrompulpandpaperproduction	0		0.1	0	
#sludgefromsteelrolling	0		0.5	0	
"#smallpelagicfish,fresh"	0	"0,0"	0	0	
#soap	0	"0,0"	0	0	
"#sodaash,dense"	0	"0,0"	0	0	
"#sodaash,light,crystalline,heptahydrate"	0	"0,0"	0	0	
#sodium	0	"0,0"	0	0	
"#sodiumaluminate,powder"	0	"0,0"	0	0	
#sodiumamide	0	"0,0"	0	0	
#sodiumarsenide	0	"0,0"	0	0	
#sodiumbicarbonate	0	"0,0"	0	0	
#sodiumborates	0	"0,0"	0	0	
"#sodiumchlorate,powder"	0	"0,0"	0	0	
"#sodiumchloride,brinesolution"	0	"0,0"	0	0	
"#sodiumchloride,powder"	0	"0,0"	0	0	
#sodiumchloroacetate	0	"0,0"	0	0	
#sodiumcumenesulphonate	0	"0,0"	0	0	
#sodiumcyanide	0	"0,0"	0	0	
#sodiumdichromate	0	"0,0"	0	0	
"#sodiumdithionite,anhydrous"	0	"0,0"	0	0	
#sodiumethoxide	0	"0,0"	0	0	
#sodiumfluoride	0	"0,0"	0	0	
#sodiumformate	0	"0,0"	0	0	
#sodiumhydrogensulfate	0	"0,0"	0	0	

#sodiumhydrogensulfite	0	"0,0"	0	0	
#sodiumhydrosulfide	0	"0,0"	0	0	
"#sodiumhydroxide,withoutwater,in50%soluti..."	0	"0,0"	0	0	
"#sodiumhypochlorite,withoutwater,in15%sol..."	0	"0,0"	0	0	
"#sodiummetasilicatepentahydrate,58%actives..."	0	"0,0"	0	0	
#sodiummethoxide	0	"0,0"	0	0	
#sodiumnitrate	0	"0,0"	0	0	
"#sodiumnitrate,technicalgrade"	0	"0,0"	0	0	
"#sodiumnitrate,unrefined"	0	"0,0"	0	0	
#sodiumnitrite	0	"0,0"	0	0	
#sodiumoxide	0	"0,0"	0	0	
"#sodiumperborate,monohydrate,powder"	0	"0,0"	0	0	
"#sodiumperborate,tetrahydrate,powder"	0	"0,0"	0	0	
"#sodiumpercarbonate,powder"	0	"0,0"	0	0	
#sodiumperchlorate	0	"0,0"	0	0	
#sodiumpersulfate	0	"0,0"	0	0	
#sodiumphenolate	0	"0,0"	0	0	
#sodiumphosphate	0	"0,0"	0	0	
#sodiumpyrophosphate	0	"0,0"	0	0	
"#sodiumsilicate,solid"	0	"0,0"	0	0	
"#sodiumsilicate,spraypowder,80%"	0	"0,0"	0	0	
"#sodiumsilicate,withoutwater,in37%solutio..."	0	"0,0"	0	0	
"#sodiumsilicate,withoutwater,in48%solutio..."	0	"0,0"	0	0	
"#sodiumsulfate,anhydrite"	0	"0,0"	0	0	
#sodiumsulfide	0	"0,0"	0	0	
#sodiumsulfite	0	"0,0"	0	0	
#sodiumtetrafluoroborate	0	"0,0"	0	0	
#sodiumtetrahydridoborate	0	"0,0"	0	0	
#sodiumtripolyphosphate	0	"0,0"	0	0	
"#softsolder,Sn97Cu3"	0	"0,0"	0	0	
"#soil,contaminated"	0		0.1	0	
"#soilpHraisingagent,asCaCO3"	0	"0,0"	0	0	
#solarcollectorfactory	1		0.1	0	
"#solarcollectorglasstube,withsilvermirror"	0		0.1	0	
"#solarcollectorsystem,Cuflatplatecollecto..."	1		0.1	0	
"#solarcollectorsystem,Cuflatplatecollecto..."	1		0.1	0	
"#solarcollectorsystem,Cuflatplatecollecto..."	1		0.1	0	

"#solarcollectorsystem,withevacuatedtubeco..."	1		0.1	0	
"#solarglass,low-iron"	0		0.1	0	
"#solder,bar,Sn63Pb37,forelectronicsindustry"	0		0.1	0	
"#solder,bar,Sn95.5Ag3.9Cu0.6,forelectronics..."	0		0.1	0	
"#solder,paste,Sn63Pb37,forelectronicsindustry"	0		0.1	0	
"#solder,paste,Sn95.5Ag3.9Cu0.6,forelectroni..."	0		0.1	0	
#solderfactory	1		0.1	0	
#solidbleachedboard	0	"0,0"	0	0	
"#solidmanureloadingandspreading,byhydraul..."	0		0.1	0	
#solidunbleachedboard	0		0.1	0	
"#solvent,organic"	0	"0,0"	0	0	
#solventforchromatographyanalysis	0		0.1	0	
#solventforpaint	0	"0,0"	0	0	
"#sortingfacility,forconstructionwaste"	1		0.1	0	
"#soundinsulation,heatandpowerco-generation..."	1		0.1	0	
"#sourgas,burnedingasturbine"	0	"0,0"	0	0	
#sowing	1	"0,0"	0	0	shell capital service product
"#SOxretained,inhardcoalfluegasdesulfuris..."	0	"0,0"	0	0	
"#SOxretained,inlignitefluegasdesulfurisation"	0	"0,0"	0	0	
#soybean	0	"0,0.1"	0.01	0	
"#soybean,feed"	0	"0,0.1"	0.01	0	
"#soybean,organic"	0	"0,0.1"	0.01	0	
"#soybean,Swissintegratedproduction"	0	"0,0.1"	0.01	0	
#soybeanbeverage	0	"0,0.1"	0.01	0	
#soybeanmeal	0	"0,0.1"	0.01	0	
"#soybeanoil,crude"	0	"0,0.1"	0.01	0	
"#soybeanoil,refined"	0	"0,0.1"	0.01	0	
"#soybeanseed,forsowing"	0	"0,0.1"	0.01	0	
"#soybeanseed,organic,forsowing"	0	"0,0.1"	0.01	0	
"#spentactivatedcarbon,granular"	0	"0,0"	0	0	
#spentactivatedcarbonwithmercury	0	"0,0"	0	0	
#spentanionexchangeresinfrompotablewater...	0	"0,0.1"	0.01	0	
#spentantifreezerliquid	0	"0,0.1"	0.01	0	
#spentautomobilecatalyst	0	"0,0.1"	0.01	0	
#spentcatalystbasefromethyleneoxideproduction	0	"0,0.1"	0.01	0	
#spentcatalyticconverterforcars	0	"0,0.1"	0.01	0	
#spentcatalyticconverterNOxreduction	0	"0,0.1"	0.01	0	

#spentcationexchangeresinfrompotablewater...	0	"0,0.1"	0.01	0	
#spentFormoxcatalystbasefromformaldehydep...	0	"0,0.1"	0.01	0	
#spentnuclearfuel	0	"0,0.1"	0.01	0	
#spentoxychlorcatalystforethylenedichlorid...	0	"0,0.1"	0.01	0	
"#spentpotlinerfromAlelectrolysis,carbonf..."	0	"0,0.1"	0.01	0	
#spentsawingslurryfromSi-wafercutting	0	"0,0.1"	0.01	0	
#spentsolventmixture	0	"0,0.1"	0.01	1	
#spinach	0	"0,0.1"	0.01	0	
"#spiral-seamduct,steel,DN125"	0	"0.5,1"	0.7	0	
"#spiral-seamduct,steel,DN400"	0	"0.5,1"	0.7	0	
#spodumene	0	"0,0"	0	0	
#spoilfromhardcoalmining	0		0.1	0	
#spoilfromlignitemining	0		0.1	0	
#spongeiron	0	"0.8,1"	0.9	0	
#spray-dryingofmilk	0	"0,0"	0	0	shell capital service product
"#sputtering,indiumtinoxide,forliquidcryst..."	1		0.1	0	
"#sputteringtarget,sintered,indiumtinoxide"	0	"0,0"	0	0	
#stalk	0	"0,0"	0	0	
"#start-up,heatandpowerco-generationunit,1..."	1		0.1	0	
"#steam,inchemicalindustry"	0	"0,0"	0	0	
"#steamgenerationsystem,solartowerpowerpla..."	1		0.5	0	
#stearicacid	0	"0,0"	0	0	
#steatite	0	"0,0"	0	0	
"#steel,chromiumsteel18/8"	0	"0.5,1"	0.7	0	
"#steel,chromiumsteel18/8,hotrolled"	0	"0.5,1"	0.7	0	
"#steel,low-alloyed"	0	"0.5,1"	0.7	0	
"#steel,low-alloyed,hotrolled"	0	"0.5,1"	0.7	0	
"#steel,unalloyed"	0	"0.98,1"	0.99	0	
#steelincarshredderresidue	0	"0.5,1"	0.7	1	
"#steelremovedbydrilling,computernumerical..."	0	"0.5,1"	0.7	0	
"#steelremovedbydrilling,conventional"	0	"0.5,1"	0.7	0	
"#steelremovedbymilling,average"	0	"0.5,1"	0.7	0	
"#steelremovedbymilling,dressing"	0	"0.5,1"	0.7	0	
"#steelremovedbymilling,largeparts"	0	"0.5,1"	0.7	0	
"#steelremovedbymilling,smallparts"	0	"0.5,1"	0.7	0	
"#steelremovedbyturning,average,computernu..."	0	"0.5,1"	0.7	0	
"#steelremovedbyturning,average,conventional"	0	"0.5,1"	0.7	0	

"#steelremovedbyturning,primarilydressing,..."	0	"0.5,1"	0.7	0	
"#steelremovedbyturning,primarilydressing,..."	0	"0.5,1"	0.7	0	
"#steelremovedbyturning,primarilyroughing,..."	0	"0.5,1"	0.7	0	
"#steelremovedbyturning,primarilyroughing,..."	0	"0.5,1"	0.7	0	
"#stibniteore,70%stibnite"	0	"0,0.3"	0.15	0	
"#stimulation,deepwell"	1		0.1	0	
"#stirlingheatandpowerco-generationunit,3k..."	0		0.5	0	
#stonegroundwoodpulp	0	"0,0"	0	0	
#stonemeal	0	"0,0"	0	0	
#stonewool	0	"0,0"	0	0	
"#stonewool,packed"	0		0.1	0	
#stonewoolfactory	0		0.1	0	
"#storage,10000l"	1		0.5	0	
"#storage,650lminiCHPplant"	1		0.5	0	
"#storagebuilding,chemicals,solid"	1		0.5	0	
#straw	0	"0,0.1"	0.01	0	
"#straw,organic"	0	"0,0.1"	0.01	0	
"#straw,stand-aloneproduction"	0	"0,0.1"	0.01	0	
#strawberry	0	"0,0.1"	0.01	0	
"#strawberryseedling,forplanting"	0	"0,0.1"	0.01	0	
#stretchblowmoulding	1		0.5	0	
#strontiumcarbonate	0	"0,0"	0	0	
"#strontiumsulfate,unprocessed"	0	"0,0"	0	0	
#stucco	0	"0,0"	0	0	
#styrene	0	"0,0"	0	0	
#styrene-acrylonitrilecopolymer	0	"0,0"	0	0	
#succinicacid	0	"0,0"	0	0	
"#sugar,fromsugarbeet"	0	"0,0"	0	0	
"#sugar,fromsugarcane"	0	"0,0"	0	0	
#sugarbeet	0	"0,0"	0	0	
#sugarbeetpulp	0	"0,0"	0	0	
"#sugarbeetseed,forsowing"	0	"0,0"	0	0	
#sugarcane	0	"0,0.1"	0.01	0	
"#sugarcaneloading,byloader"	1		0.5	0	
"#sugarcanetransfer,bydumpcart"	1	"0,0"	0	0	
"#sugarcanevinasseapplication,bywheelreeli..."	1	"0,0"	0	0	
#sugarrefinery	1		0.1	0	

#sulfamicacid	0	"0,0"	0	0	
"#sulfatepulp,bleached"	0	"0,0"	0	0	
"#sulfatepulp,unbleached"	0	"0,0"	0	0	
"#sulfidictailing,off-site,highgoldcontent"	0		0.5	1	
"#sulfidictailings,fromcinnabarmineoperation"	0		0.5	1	
"#sulfidictailings,fromcoppermineoperation"	0		0.5	1	
"#sulfidictailings,fromgoldmineoperation"	0		0.5	1	
"#sulfidictailings,fromnickelmineoperation"	0		0.5	1	
"#sulfidictailings,fromsilvermineoperation"	0		0.5	1	
"#sulfidictailings,fromzinc-leadmineoperation"	0		0.5	1	
"#sulfidictailings,generic"	0		0.5	1	
#sulfite	0	"0,0"	0	0	
"#sulfitepulp,bleached"	0	"0,0"	0	0	
#sulfur	0	"0,0"	0	0	
#sulfurdichloride	0	"0,0"	0	0	
"#sulfurdioxide,liquid"	0	"0,0"	0	0	
"#sulfurhexafluoride,liquid"	0	"0,0"	0	0	
#sulfuricacid	0	"0,0"	0	0	
#sulfurstockpiling	0	"0,0"	0	0	
#sulfurtrioxide	0	"0,0"	0	0	
#sulfurylchloride	0	"0,0"	0	0	
#sunflowerseed	0	"0,0.1"	0.01	0	
"#sunflowerseed,forsowing"	0	"0,0.1"	0.01	0	
"#sunflowerseed,Swissintegratedproduction"	0	"0,0.1"	0.01	0	
#sunflowersilage	0	"0,0"	0	0	
"#sunnhempplant,harvested"	0	"0,0.1"	0.01	0	
#supplementarycementitiousmaterials	0		0.1	0	
"#supplyairinlet,steel/SS,DN75"	1	"0.5,1"	0.7	0	
"#swath,byrotarywindrower"	1	"0,0"	0	0	
#sweetcorn	0	"0,0.1"	0.01	0	
"#sweetening,naturalgas"	0	"0,0"	0	0	shell capital service product
"#sweetgas,burnedingasturbine"	0	"0,0"	0	0	
#sweetsorghumgrain	0	"0,0.1"	0.01	0	
#sweetsorghumstem	0	"0,0.1"	0.01	0	
"#swineforslaughtering,liveweight"	0	"0,0"	0	0	
"#switch,toggletype"	0		0.5	0	
#syntheticgas	0		0.1	0	

#syntheticgasfactory	1		0.1	0	
#syntheticrubber	0	"0,0"	0	0	
"#tailing,fromuraniummilling"	0		0.1	0	
"#talloil,crude"	0	"0,0"	0	0	
"#tallow,unrefined"	0	"0,0"	0	0	
"#tanker,forliquefiednaturalgas"	1		0.5	0	
"#tanker,forliquidgoodsotherthanpetroleum..."	1		0.5	0	
"#tanker,forpetroleum"	1		0.5	0	
"#tantalum,powder,capacitor-grade"	0	"0,0"	0	0	
#tapwater	0	"0,0"	0	0	
"#tea,dried"	0	"0,0.1"	0.01	0	
#technicalwooddryingfacility	1		0.1	0	
#television	1		0.5	0	
"#tellurium,semiconductor-grade"	0	"0,0"	0	0	
"#tempering,flatglass"	0		0.01	0	
#terrainchipperonforwarder	1		0.5	0	
#tert-butylamine	0	"0,0"	0	0	
#tetrachloroethylene	0	"0,0"	0	0	
#tetraethylorthosilicate	0	"0,0"	0	0	
#tetrafluoroethane	0	"0,0"	0	0	
#tetrafluoroethylene	0	"0,0"	0	0	
"#tetrafluoroethylenefilm,onglass"	0	"0,0"	0	0	
#tetrahydrofuran	0	"0,0"	0	0	
"#textile,jute"	0	"0,0"	0	0	
"#textile,kenaf"	0	"0,0"	0	0	
"#textile,knitcotton"	0	"0,0"	0	0	
"#textile,non-wovenpolyester"	0	"0,0"	0	0	
"#textile,non-wovenpolypropylene"	0	"0,0"	0	0	
"#textile,silk"	0	"0,0"	0	0	
"#textile,wovencotton"	0	"0,0"	0	0	
"#thermalplaster,outdoor"	0	"0,0"	0	0	
"#thermalstoragesystem,solarthermalparaboli..."	1		0.1	0	
"#thermalstoragesystem,solartowerpowerplan..."	1		0.1	0	
"#thermoforming,withcalendering"	1		0.1	0	
#thermoformingofplasticsheets	1	"0,0"	0	0	shell capital service product
#thermo-mechanicalpulp	0		0.1	0	
#thionylchloride	0	"0,0"	0	0	

#threelayeredlaminatedboard	0		0.5	0	
#tilapia	0	"0,0.1"	0.01	0	
"#tilapiafeed,24-28%protein"	0	"0,0.1"	0.01	0	
"#tillage,cultivating,chiselling"	1	"0,0"	0	0	shell capital service product
"#tillage,currying,byweeder"	1	"0,0"	0	0	shell capital service product
"#tillage,harrowing,byoffsetdiskharrow"	1	"0,0"	0	0	shell capital service product
"#tillage,harrowing,byoffsetlevelingdischa..."	1	"0,0"	0	0	shell capital service product
"#tillage,harrowing,byrotaryharrow"	1	"0,0"	0	0	shell capital service product
"#tillage,harrowing,byspringtineharrow"	1	"0,0"	0	0	shell capital service product
"#tillage,hoeingandearthing-up,potatoes"	1	"0,0"	0	0	shell capital service product
"#tillage,ploughing"	1	"0,0"	0	0	shell capital service product
"#tillage,rolling"	1	"0,0"	0	0	shell capital service product
"#tillage,rotarycultivator"	1	"0,0"	0	0	shell capital service product
"#tillage,subsoiling,bysubsoilerplow"	1	"0,0"	0	0	shell capital service product
#tin	0	"0,0"	0	0	
#tinconcentrate	0	"0,0"	0	0	
#tindioxide	0	"0,0"	0	0	
"#tinplatedchromiumsteelsheet,2mm"	0	"0.5,1"	0.7	0	
"#tinplating,pieces"	1	"0,0"	0	0	shell capital service product
#tinslag	0		0.1	0	
#tissuepaper	0	"0,0"	0	0	
"#titaniaslag,85%titaniumdioxide"	0		0.1	0	
"#titanium,primary"	0		0.1	0	
#titaniumdioxide	0	"0,0"	0	0	
"#titaniumprimary,triple-melt"	0		0.1	0	
#titaniumtetrachloride	0	"0,0"	0	0	
"#titaniumzincplate,withoutpre-weathering"	0	"0,0"	0	0	
#tofu	0	"0,0.1"	0.01	0	
"#toluene,liquid"	0	"0,0"	0	0	
#toluenediisocyanate	0	"0,0"	0	0	
"#tomato,freshgrade"	0	"0,0.1"	0.01	0	
"#tomato,processinggrade"	0	"0,0.1"	0.01	0	
"#tomatoseedling,forplanting"	0	"0,0.1"	0.01	0	
"#toner,black,powder"	0		0.1	0	
"#toner,colour,powder"	0		0.1	0	
"#tonermodule,laserprinter,black/white"	0		0.1	0	
"#tonermodule,laserprinter,colour"	0		0.1	0	

"#towersilo,plastic"	1	"0,0"	0	0	
"#tractor,4-wheel,agricultural"	1		0.5	0	
"#train,passenger,highspeed"	1	"0,0"	0	0	No mass because all eol flows included - service product
"#train,passenger,long-distance"	1	"0,0"	0	0	No mass because all eol flows included - service product
"#train,passenger,regional"	1	"0,0"	0	0	No mass because all eol flows included - service product
#tram	1	"0,0"	0	0	No mass because all eol flows included - service product
#tramtrack	1		0.5	0	
"#transformer,highvoltageuse"	1		0.5	0	
"#transformer,lowvoltageuse"	1		0.5	0	
"#transistor,auxilliariesandenergyuse"	1		0.5	0	
"#transistor,surface-mounted"	1		0.5	0	
"#transistor,wired,bigsize,through-holemoun..."	1		0.5	0	
"#transistor,wired,smallsize,through-holemo..."	1		0.5	0	
"#transmissionnetwork,electricity,highvoltage"	1		0.5	1	
"#transmissionnetwork,electricity,mediumvoltage"	1		0.5	1	
"#transmissionnetwork,long-distance"	1		0.5	0	
"#transport,freight,aircraft,longhaul"	1	"0,0"	0	0	shell capital service product
"#transport,freight,aircraft,mediumhaul"	1	"0,0"	0	0	shell capital service product
"#transport,freight,aircraft,shorthaul"	1	"0,0"	0	0	shell capital service product
"#transport,freight,aircraft,unspecified"	1	"0,0"	0	0	shell capital service product
"#transport,freight,aircraft,veryshorthaul"	1	"0,0"	0	0	shell capital service product
"#transport,freight,aircraftwithreefer,cooling"	1	"0,0"	0	0	shell capital service product
"#transport,freight,aircraftwithreefer,free..."	1	"0,0"	0	0	shell capital service product
"#transport,freight,conveyorbelt"	1	"0,0"	0	0	shell capital service product
"#transport,freight,inlandwaterways,barge"	1	"0,0"	0	0	shell capital service product
"#transport,freight,inlandwaterways,bargeta..."	1	"0,0"	0	0	shell capital service product
"#transport,freight,inlandwaterways,bargewi..."	1	"0,0"	0	0	shell capital service product
"#transport,freight,inlandwaterways,bargewi..."	1	"0,0"	0	0	shell capital service product
"#transport,freight,lightcommercialvehicle"	1	"0,0"	0	0	shell capital service product
"#transport,freight,lightcommercialvehicle,..."	1	"0,0"	0	0	shell capital service product
"#transport,freight,lightcommercialvehicle,..."	1	"0,0"	0	0	shell capital service product
"#transport,freight,lightcommercialvehicle,..."	1	"0,0"	0	0	shell capital service product
"#transport,freight,lorry,unspecified"	1	"0,0"	0	0	shell capital service product
"#transport,freight,lorry>32metricton,EURO1"	1	"0,0"	0	0	shell capital service product
"#transport,freight,lorry>32metricton,EURO2"	1	"0,0"	0	0	shell capital service product
"#transport,freight,lorry>32metricton,EURO3"	1	"0,0"	0	0	shell capital service product
"#transport,freight,lorry>32metricton,EURO4"	1	"0,0"	0	0	shell capital service product

"#transport,freight,lorry>32metricton,EURO5"	1	"0,0"	0	0	shell capital service product
"#transport,freight,lorry>32metricton,EURO6"	1	"0,0"	0	0	shell capital service product
"#transport,freight,lorry>32metricton,unre..."	1	"0,0"	0	0	shell capital service product
"#transport,freight,lorry16-32metricton,EURO1"	1	"0,0"	0	0	shell capital service product
"#transport,freight,lorry16-32metricton,EURO2"	1	"0,0"	0	0	shell capital service product
"#transport,freight,lorry16-32metricton,EURO3"	1	"0,0"	0	0	shell capital service product
"#transport,freight,lorry16-32metricton,EURO4"	1	"0,0"	0	0	shell capital service product
"#transport,freight,lorry16-32metricton,EURO5"	1	"0,0"	0	0	shell capital service product
"#transport,freight,lorry16-32metricton,EURO6"	1	"0,0"	0	0	shell capital service product
"#transport,freight,lorry16-32metricton,un..."	1	"0,0"	0	0	shell capital service product
"#transport,freight,lorry28metricton,veget..."	1	"0,0"	0	0	shell capital service product
"#transport,freight,lorry3.5-7.5metricton,..."	1	"0,0"	0	0	shell capital service product
"#transport,freight,lorry3.5-7.5metricton,..."	1	"0,0"	0	0	shell capital service product
"#transport,freight,lorry3.5-7.5metricton,..."	1	"0,0"	0	0	shell capital service product
"#transport,freight,lorry3.5-7.5metricton,..."	1	"0,0"	0	0	shell capital service product
"#transport,freight,lorry3.5-7.5metricton,..."	1	"0,0"	0	0	shell capital service product
"#transport,freight,lorry3.5-7.5metricton,..."	1	"0,0"	0	0	shell capital service product
"#transport,freight,lorry3.5-7.5metricton,..."	1	"0,0"	0	0	shell capital service product
"#transport,freight,lorry7.5-16metricton,E..."	1	"0,0"	0	0	shell capital service product
"#transport,freight,lorry7.5-16metricton,E..."	1	"0,0"	0	0	shell capital service product
"#transport,freight,lorry7.5-16metricton,E..."	1	"0,0"	0	0	shell capital service product
"#transport,freight,lorry7.5-16metricton,E..."	1	"0,0"	0	0	shell capital service product
"#transport,freight,lorry7.5-16metricton,E..."	1	"0,0"	0	0	shell capital service product
"#transport,freight,lorry7.5-16metricton,E..."	1	"0,0"	0	0	shell capital service product
"#transport,freight,lorry7.5-16metricton,u..."	1	"0,0"	0	0	shell capital service product
"#transport,freight,lorrywithreefer,cooling"	1	"0,0"	0	0	shell capital service product
"#transport,freight,lorrywithreefer,freezing"	1	"0,0"	0	0	shell capital service product
"#transport,freight,lorrywithrefrigerationm..."	1	"0,0"	0	0	shell capital service product
"#transport,freight,lorrywithrefrigerationm..."	1	"0,0"	0	0	shell capital service product
"#transport,freight,lorrywithrefrigerationm..."	1	"0,0"	0	0	shell capital service product
"#transport,freight,lorrywithrefrigerationm..."	1	"0,0"	0	0	shell capital service product
"#transport,freight,lorrywithrefrigerationm..."	1	"0,0"	0	0	shell capital service product
"#transport,freight,lorrywithrefrigerationm..."	1	"0,0"	0	0	shell capital service product
"#transport,freight,lorrywithrefrigerationm..."	1	"0,0"	0	0	shell capital service product
"#transport,freight,lorrywithrefrigerationm..."	1	"0,0"	0	0	shell capital service product
"#transport,freight,lorrywithrefrigerationm..."	1	"0,0"	0	0	shell capital service product
"#transport,freight,lorrywithrefrigerationm..."	1	"0,0"	0	0	shell capital service product

"#transport,freight,lorrywithrefrigerationm..."	1	"0,0"	0	0	shell capital service product
"#transport,freight,lorrywithrefrigerationm..."	1	"0,0"	0	0	shell capital service product
"#transport,freight,lorrywithrefrigerationm..."	1	"0,0"	0	0	shell capital service product
"#transport,freight,lorrywithrefrigerationm..."	1	"0,0"	0	0	shell capital service product
"#transport,freight,lorrywithrefrigerationm..."	1	"0,0"	0	0	shell capital service product
"#transport,freight,lorrywithrefrigerationm..."	1	"0,0"	0	0	shell capital service product
"#transport,freight,lorrywithrefrigerationm..."	1	"0,0"	0	0	shell capital service product
"#transport,freight,lorrywithrefrigerationm..."	1	"0,0"	0	0	shell capital service product
"#transport,freight,lorrywithrefrigerationm..."	1	"0,0"	0	0	shell capital service product
"#transport,freight,lorrywithrefrigerationm..."	1	"0,0"	0	0	shell capital service product
"#transport,freight,lorrywithrefrigerationm..."	1	"0,0"	0	0	shell capital service product
"#transport,freight,lorrywithrefrigerationm..."	1	"0,0"	0	0	shell capital service product
"#transport,freight,lorrywithrefrigerationm..."	1	"0,0"	0	0	shell capital service product
"#transport,freight,lorrywithrefrigerationm..."	1	"0,0"	0	0	shell capital service product
"#transport,freight,lorrywithrefrigerationm..."	1	"0,0"	0	0	shell capital service product
"#transport,freight,lorrywithrefrigerationm..."	1	"0,0"	0	0	shell capital service product
"#transport,freight,lorrywithrefrigerationm..."	1	"0,0"	0	0	shell capital service product
"#transport,freight,lorrywithrefrigerationm..."	1	"0,0"	0	0	shell capital service product
"#transport,freight,lorrywithrefrigerationm..."	1	"0,0"	0	0	shell capital service product
"#transport,freight,lorrywithrefrigerationm..."	1	"0,0"	0	0	shell capital service product
"#transport,freight,lorrywithrefrigerationm..."	1	"0,0"	0	0	shell capital service product
"#transport,freight,lorrywithrefrigerationm..."	1	"0,0"	0	0	shell capital service product
"#transport,freight,lorrywithrefrigerationm..."	1	"0,0"	0	0	shell capital service product
"#transport,freight,lorrywithrefrigerationm..."	1	"0,0"	0	0	shell capital service product
"#transport,freight,sea,bulkcarrierfordry..."	1	"0,0"	0	0	shell capital service product
"#transport,freight,sea,containership"	1	"0,0"	0	0	shell capital service product
"#transport,freight,sea,containershipwithr..."	1	"0,0"	0	0	shell capital service product
"#transport,freight,sea,containershipwithr..."	1	"0,0"	0	0	shell capital service product
"#transport,freight,sea,ferry"	1	"0,0"	0	0	shell capital service product
"#transport,freight,sea,tankerforliquefied..."	1	"0,0"	0	0	shell capital service product
"#transport,freight,sea,tankerforliquidgoo..."	1	"0,0"	0	0	shell capital service product
"#transport,freight,sea,tankerforpetroleum"	1	"0,0"	0	0	shell capital service product
"#transport,freight,trainwithreefer,cooling"	1	"0,0"	0	0	shell capital service product
"#transport,freight,trainwithreefer,freezing"	1	"0,0"	0	0	shell capital service product
"#transport,freighttrain"	1	"0,0"	0	0	shell capital service product
"#transport,helicopter"	1	"0,0"	0	0	shell capital service product
"#transport,helicopter,LTOcycle"	1	"0,0"	0	0	shell capital service product

"#transport,passenger,aircraft,unspecified"	1	"0,0"	0	0	shell capital service product
"#transport,passenger,bicycle"	1	"0,0"	0	0	shell capital service product
"#transport,passenger,electricbicycle"	1	"0,0"	0	0	shell capital service product
"#transport,passenger,electricbicycle,label-..."	1	"0,0"	0	0	shell capital service product
"#transport,passenger,electricscooter"	1	"0,0"	0	0	shell capital service product
"#transport,passenger,motorscooter"	1	"0,0"	0	0	shell capital service product
"#transport,passengercar"	1	"0,0"	0	0	shell capital service product
"#transport,passengercar,electric"	1	"0,0"	0	0	shell capital service product
"#transport,passengercar,EURO3"	1	"0,0"	0	0	shell capital service product
"#transport,passengercar,EURO4"	1	"0,0"	0	0	shell capital service product
"#transport,passengercar,EURO5"	1	"0,0"	0	0	shell capital service product
"#transport,passengercar,largesize,diesel,..."	1	"0,0"	0	0	shell capital service product
"#transport,passengercar,largesize,diesel,..."	1	"0,0"	0	0	shell capital service product
"#transport,passengercar,largesize,diesel,..."	1	"0,0"	0	0	shell capital service product
"#transport,passengercar,largesize,natural..."	1	"0,0"	0	0	shell capital service product
"#transport,passengercar,largesize,natural..."	1	"0,0"	0	0	shell capital service product
"#transport,passengercar,largesize,natural..."	1	"0,0"	0	0	shell capital service product
"#transport,passengercar,largesize,petrol,..."	1	"0,0"	0	0	shell capital service product
"#transport,passengercar,largesize,petrol,..."	1	"0,0"	0	0	shell capital service product
"#transport,passengercar,largesize,petrol,..."	1	"0,0"	0	0	shell capital service product
"#transport,passengercar,mediumsize,diesel,..."	1	"0,0"	0	0	shell capital service product
"#transport,passengercar,mediumsize,diesel,..."	1	"0,0"	0	0	shell capital service product
"#transport,passengercar,mediumsize,diesel,..."	1	"0,0"	0	0	shell capital service product
"#transport,passengercar,mediumsize,liquefi..."	1	"0,0"	0	0	shell capital service product
"#transport,passengercar,mediumsize,natural..."	1	"0,0"	0	0	shell capital service product
"#transport,passengercar,mediumsize,natural..."	1	"0,0"	0	0	shell capital service product
"#transport,passengercar,mediumsize,natural..."	1	"0,0"	0	0	shell capital service product
"#transport,passengercar,mediumsize,petrol,..."	1	"0,0"	0	0	shell capital service product
"#transport,passengercar,mediumsize,petrol,..."	1	"0,0"	0	0	shell capital service product
"#transport,passengercar,mediumsize,petrol,..."	1	"0,0"	0	0	shell capital service product
"#transport,passengercar,smallsize,diesel,..."	1	"0,0"	0	0	shell capital service product
"#transport,passengercar,smallsize,diesel,..."	1	"0,0"	0	0	shell capital service product
"#transport,passengercar,smallsize,diesel,..."	1	"0,0"	0	0	shell capital service product
"#transport,passengercar,smallsize,natural..."	1	"0,0"	0	0	shell capital service product
"#transport,passengercar,smallsize,natural..."	1	"0,0"	0	0	shell capital service product
"#transport,passengercar,smallsize,natural..."	1	"0,0"	0	0	shell capital service product
"#transport,passengercar,smallsize,petrol,..."	1	"0,0"	0	0	shell capital service product

"#transport,passengercar,smallsize,petrol,..."	1	"0,0"	0	0	shell capital service product
"#transport,passengercar,smallsize,petrol,..."	1	"0,0"	0	0	shell capital service product
"#transport,passengercarwithinternalcombust..."	1	"0,0"	0	0	shell capital service product
"#transport,passengercoach"	1	"0,0"	0	0	shell capital service product
"#transport,passengers,aircraft,longhaul"	1	"0,0"	0	0	shell capital service product
"#transport,passengers,aircraft,mediumhaul"	1	"0,0"	0	0	shell capital service product
"#transport,passengers,aircraft,shorthaul"	1	"0,0"	0	0	shell capital service product
"#transport,passengers,aircraft,veryshorthaul"	1	"0,0"	0	0	shell capital service product
"#transport,passengertrain"	1	"0,0"	0	0	shell capital service product
"#transport,pipeline,longdistance,naturalgas"	1	"0,0"	0	0	shell capital service product
"#transport,pipeline,offshore,longdistance,..."	1	"0,0"	0	0	shell capital service product
"#transport,pipeline,offshore,petroleum"	1	"0,0"	0	0	shell capital service product
"#transport,pipeline,onshore,longdistance,n..."	1	"0,0"	0	0	shell capital service product
"#transport,pipeline,onshore,petroleum"	1	"0,0"	0	0	shell capital service product
"#transport,regularbus"	1	"0,0"	0	0	shell capital service product
"#transport,tractorandtrailer,agricultural"	1	"0,0"	0	0	shell capital service product
"#transport,tram"	1	"0,0"	0	0	shell capital service product
"#transport,trolleybus"	1	"0,0"	0	0	shell capital service product
"#trawler,steel"	1	"0,0"	0	0	No mass because all eol flows included - service product
"#trawlermaintenance,steel"	1	"0,0"	0	0	shell capital service product
"#treeseedling,forplanting"	0	"0,0.1"	0.01	0	
"#trellissystem,woodenpoles,softwood,tari..."	1	"0,0"	0	0	
"#triazine-compound,unspecified"	0	"0,0"	0	0	
#trichloroaceticacid	0	"0,0"	0	0	
#trichloroborane	0	"0,0"	0	0	
#trichloroethylene	0	"0,0"	0	0	
#trichloromethane	0	"0,0"	0	0	
#trichloropropane	0	"0,0"	0	0	
#triethanolamine	0	"0,0"	0	0	
#triethylamine	0	"0,0"	0	0	
#triethyleneglycol	0	"0,0"	0	0	
#trifluoroaceticacid	0	"0,0"	0	0	
#trifluoromethane	0	"0,0"	0	0	
#trimesoylchloride	0	"0,0"	0	0	
#trimethylamine	0	"0,0"	0	0	
#trimethylborate	0	"0,0"	0	0	
#triphenylphosphate	0	"0,0"	0	0	

"#tris2,4-ditert-butylphenylphosphite"	0	"0,0"	0	0	
#trisodiumphosphate	0	"0,0"	0	0	
#trout	0	"0,0.1"	0.01	0	
"#troutfeed,42%protein"	0	"0,0.1"	0.01	0	
"#tubeinsulation,elastomere"	0	"0,0"	0	0	shell capital service product
#tubeinsulationfactory	1		0.1	0	
#turpentine	0	"0,0"	0	0	
"#tyrewearemissions,lorry"	0	"0,0.1"	0.01	0	
"#tyrewearemissions,passengercar"	0	"0,0.1"	0.01	0	
#ultrafiltrationmodule	1		0.5	0	
#ultravioletlamp	0		0.1	0	
"#uranium,enriched3.0%,infuelelementforli..."	0	"0,0"	0	0	
"#uranium,enriched3.0%,perseparativeworkunit"	0	"0,0"	0	0	
"#uranium,enriched3.8%,infuelelementforli..."	0	"0,0"	0	0	
"#uranium,enriched3.8%,perseparativeworkunit"	0	"0,0"	0	0	
"#uranium,enriched3.9%,infuelelementforli..."	0	"0,0"	0	0	
"#uranium,enriched3.9%,perseparativeworkunit"	0	"0,0"	0	0	
"#uranium,enriched4%,infuelelementforligh..."	0	"0,0"	0	0	
"#uranium,enriched4.0%,perseparativeworkunit"	0	"0,0"	0	0	
"#uranium,enriched4.2%,infuelelementforli..."	0	"0,0"	0	0	
"#uranium,enriched4.2%,perseparativeworkunit"	0	"0,0"	0	0	
"#uranium,inyellowcake"	0	"0,0.1"	0.01	0	
#uraniumconversionfacility	1		0.1	0	
#uraniumenrichmentcentrifugefacility	1		0.1	0	
#uraniumenrichmentdiffusionfacility	1		0.1	0	
#uraniumhexafluoride	0	"0,0"	0	0	
#uraniummill	1		0.1	0	
"#uraniumore,asU"	0		0.1	0	
"#uraniumtailing,non-radioactiveemission"	0		0.1	0	
"#urea,asN"	0	"0,0"	0	0	
"#ureaformaldehydefoam,insitufoaming"	0	"0,0"	0	0	
"#ureaformaldehydefoamslab,hard"	0	"0,0"	0	0	
#ureaformaldehyderesin	0	"0,0"	0	0	
"#usedairdistributionterminalpanelsteel,12..."	1	"0.5,1"	0.7	0	
"#usedairfiltercentralunit,600m3/h"	1		0.5	0	
"#usedairfilterdecentralizedunit,180-250m3/h"	1		0.5	0	
"#usedairfilterdecentralizedunit,250m3/h"	1		0.5	0	

#usedairfilterinexhaustairvalve	1		0.5	0	
#usedbicycle	1		0.5	0	
#usedblowerandheatexchangeunitAventE97	1		0.5	0	
"#usedblowerandheatexchangeunitcentral,60..."	1		0.5	0	
#usedblowerandheatexchangeunitdecentraliz...	1		0.5	0	
#usedblowerandheatexchangeunitGE250RH	1		0.5	0	
#usedblowerandheatexchangeunitKWL250	1		0.5	0	
#usedblowerandheatexchangeunitKWLC1200	1		0.5	0	
#usedblowerandheatexchangeunitStorkairG90	1		0.5	0	
#usedblowerandheatexchangeunitTwl-700	1		0.5	0	
#usedbus	1		0.5	0	
#usedcable	0	"0,0"	0	0	
#usedcapacitor	0		0.5	0	
#usedcathoderaytubedisplay	0		0.5	0	
#useddesktopcomputer	1		0.5	0	
"#useddiesel-electricgeneratingset,18.5kW"	1		0.1	0	
#useddomesticrefrigerator	1		0.5	0	
"#useddoor,inner,glass-wood"	0		0.1	0	
"#useddoor,inner,wood"	0		0.1	0	
"#useddoor,outer,wood-aluminium"	0		0.1	0	
"#useddoor,outer,wood-glass"	0		0.1	0	
"#useddoubleglazing,U<1.1W/m2K"	0		0.1	0	
"#useddoubleglazing,U<1.1W/m2K,laminatedsaf..."	0		0.1	0	
#usedelectricbicycle	1		0.5	0	
"#usedexhaustairroofhoodsteel,DN400"	1	"0.5,1"	0.7	0	
"#usedexhaustairvalvein-wallhousing,plasti..."	1		0.5	0	
"#usedflexibleductaluminium/PET,DNof125"	1		0.1	0	
#usedfluorescentlamp	1		0.1	0	
"#usedglider,fromelectricscooter"	1		0.5	0	
"#usedglider,passengercar"	1		0.5	0	
#usedindustrialelectronicdevice	1		0.5	0	
"#usedinsulationspiral-seamductrockwool,DN400"	1		0.1	0	
"#usedintermodalshippingcontainer,20-foot"	1		0.5	0	
"#usedintermodalshippingcontainer,40-foot"	1		0.5	0	
"#usedintermodalshippingcontainer,40-foot,h..."	1		0.5	0	
"#usedintermodalshippingcontainer,45-foot,h..."	1		0.5	0	
"#usedinternalcombustionengine,frompassenge..."	1		0.5	0	

#usedITaccessory	1		0.5	0	
#usedlaptopcomputer	1		0.5	0	
#usedlightcommercialvehicle	1		0.5	0	
#usedLi-ionbattery	1		0.1	0	
#usedliquidcrystaldisplay	1		0.1	0	
#usedliquidcrystaldisplaymodule	1		0.1	0	
#usedlocomotive	1		0.5	0	
"#usedlongliner,steel"	1	"0.5,1"	0.7	0	
"#usedlorry,16metricton"	1		0.5	0	
"#usedlorry,28metricton"	1		0.5	0	
"#usedlorry,40metricton"	1		0.5	0	
"#usedlorrywithrefrigerationmachine,16metr..."	1		0.5	0	
#usedmotorscooter	1		0.5	0	
#usedNi-metalhydridebattery	1		0.1	0	
"#usednitratesalts,forsolarpowerapplication"	0	"0,0"	0	0	
"#usedoutsideairintakestainlesssteel,DN370"	1	"0.5,1"	0.7	0	
#usedperfluoropentane	0	"0,0"	0	0	
"#usedpowertrain,fromelectricscooter"	1		0.5	0	
"#usedpowertrainfromelectricpassengercar,m..."	1		0.5	0	
#usedprintedwiringboards	0		0.1	0	
"#usedprinter,laser"	1		0.1	0	
"#usedpurseseiner,steel"	0	"0.5,1"	0.7	0	
"#usedpurseseiner,wood"	0	"0,0.5"	0.01	0	
#usedrailwaytrack	1		0.5	0	
"#usedreefer,intermodalshippingcontainer,40..."	1		0.5	0	
#usedrefrigerantR-12	1		0.1	0	
#usedrefrigerantR134a	1		0.1	0	
#usedrefrigerantR-600a	1		0.1	0	
"#usedrefrigerationmachine,carbondioxide,li..."	1		0.5	0	
"#usedrefrigerationmachine,R134aasrefrigerant"	1		0.5	0	
"#usedroom-connectingoverflowelementsteel,a..."	1	"0.5,1"	0.7	0	
"#usedsealingtapealuminium/PE,50mmwide"	0	"0,0"	0	0	
"#usedsilencersteel,DN125"	1	"0.5,1"	0.7	0	
"#usedsilencersteel,DN315"	1	"0.5,1"	0.7	0	
"#usedtonermodule,laserprinter,black/white"	0		0.1	0	
"#usedtonermodule,laserprinter,colour"	0		0.1	0	
"#usedtrain,passenger,high-speed"	1		0.5	0	

"#usedtrain,passenger,long-distance"	1		0.5	0	
"#usedtrain,passenger,regional"	1		0.5	0	
#usedtram	1		0.5	0	
"#usedtrawler,steel"	1	"0.5,1"	0.5	0	
"#usedtripleglazing,U<0.5W/m2K"	1		0.1	0	
#usedtyre	0		0.1	0	
#usedvegetablecookingoil	1	"0,0"	0	0	
"#usedvegetablecookingoil,purified"	1	"0,0"	0	0	
#usedventilationcontrolandwiringcentralunit	1		0.5	0	
#usedventilationcontrolandwiringdecentrali...	1		0.5	0	
"#usedwindowframe,plastic"	0	"0,0.5"	0.2	0	
"#usedwindowframe,wood"	0	"0,0.5"	0.2	0	
"#usedwindowframe,wood-metal"	0		0.5	0	
#vacuumcleaner	1		0.1	0	
#vanilla	0	"0,0.1"	0.01	0	
"#vanillaseedling,forplanting"	0	"0,0.1"	0.01	0	
"#vegetableoil,refined"	0	"0,0"	0	0	
#vegetableoilesterificationfacility	1		0.1	0	
#vegetableoilmethylester	0	"0,0"	0	0	
#vegetableoilrefinery	1		0.1	0	
#ventilationcomponentsfactory	1		0.1	0	
"#ventilationcontrolandwiring,centralunit"	1		0.5	0	
"#ventilationcontrolandwiring,decentralized..."	1		0.5	0	
"#ventilationduct,connectionpiece,steel,100..."	1	"0.5,1"	0.7	0	
"#ventilationduct,elbow90°,steel,100x50mm"	1	"0.5,1"	0.7	0	
"#ventilationduct,steel,100x50mm"	1	"0.5,1"	0.7	0	
"#ventilationofdwellings,central,1x720m3/h"	1	"0,0"	0	0	shell capital service product
"#ventilationofdwellings,decentralized,6x1..."	1	"0,0"	0	0	shell capital service product
"#ventilationsystem,central,1x720m3/h,pol..."	1		0.5	0	
"#ventilationsystem,central,1x720m3/h,ste..."	1		0.5	0	
"#ventilationsystem,decentralized,6x120m3/..."	1		0.5	0	
"#ventilationsystem,decentralized,6x120m3/..."	1		0.5	0	
"#ventilationsystem,decentralized,6x120m3/..."	1		0.5	0	
"#ventilationsystem,decentralized,6x120m3/..."	1		0.5	0	
"#ventingofargon,crude,liquid"	0		0.1	0	
"#ventingofnitrogen,liquid"	0		0.1	0	
#vermiculite	0	"0,0"	0	0	

"#vinasse,fromfermentationofsugarbeet"	0	"0,0"	0	0	
"#vinasse,fromfermentationofsugarbeetmolasses"	0	"0,0"	0	0	
"#vinasse,fromfermentationofsugarcane"	0	"0,0"	0	0	
"#vinasse,fromfermentationofsweetsorghum"	0	"0,0"	0	0	
#vinylacetate	0	"0,0"	0	0	
#vinylchloride	0	"0,0"	0	0	
#vinylfluoride	0	"0,0"	0	0	
"#wafer,fabricated,forintegratedcircuit"	0		0.1	0	
#waferfactory	1		0.1	0	
"#washing,dryingandfinishinglaundry"	0	"0,0"	0	0	shell capital service product
#washingmachine	1	"0,0"	0	0	No mass because all eol flows included - service product
"#waste,electricalandelectroniccables"	0		0.5	0	
"#waste,fromsiliconwaferproduction"	0	"0,0"	0	0	
"#waste,fromsiliconwaferproduction,inorganic"	0		0.1	0	
"#waste,pneumatictyres"	0		0.1	0	
#wastealuminium	0	"0,0"	0	0	
#wasteasphalt	0	"0,0.045"	0.022	0	
#wastebitumen	0		0.1	0	
#wastebitumensheet	0		0.1	0	
#wastebrick	0		0.1	0	
"#wastebuildingwood,chromepreserved"	0	"0,0"	0	0	
"#wastebulkiron,excludingreinforcement"	0	"1,1"	1	0	
"#wastecement,hydrated"	0	"0,0.045"	0.03	0	
#wastecement-fibreslab	0	"0,0.045"	0.03	0	
"#wastecement-fibreslab,dismantled"	0	"0,0.045"	0.03	0	
#wastecementinconcreteandmortar	0	"0,0.045"	0.03	0	
"#wastecollectionlorry,21metricton"	1		0.5	0	
#wasteconcrete	0	"0,0.045"	0.022	0	
"#wasteconcrete,notreinforced"	0	"0,0.045"	0.022	0	
#wasteconcretegravel	0	"0,0.045"	0.022	0	
#wasteelectricandelectronicequipment	1		0.5	1	
#wasteelectricwiring	1		0.5	0	
#wasteemulsionpaint	0	"0,0"	0	0	
"#wasteemulsionpaint,onwall"	0	"0,0"	0	0	
"#wasteemulsionpaint,onwood"	0		0.1	0	
"#wasteemulsionpaint,separated"	0		0.1	0	
#wasteexpandedpolystyrene	0	"0,0"	0	0	

#wastefibreboard	0		0.1	0	
#wastefoundrysand	0	"0,0"	0	0	
#wastefritfromcathoderaytubeproduction	0		0.1	0	
#wasteglass	0	"0,0"	0	0	
#wasteglasspaneinburnableframe	0	"0,0"	0	0	
#wasteglasssheet	0	"0,0"	0	0	
#wastegraphicalpaper	0	"0,0"	0	0	
#wastegypsum	0	"0,0"	0	0	
#wastegypsumplasterboard	0	"0,0"	0	0	
#wastemineraloil	0		0.1	0	
#wastemineralplaster	0	"0,0"	0	0	
#wastemineralwool	0	"0,0"	0	0	
"#wastemineralwool,forfinaldisposal"	0	"0,0"	0	0	
"#wastenaturalgas,sour"	0	"0,0"	0	0	
"#wastenaturalgas,sweet"	0	"0,0"	0	0	
#wastenewspaper	0	"0,0"	0	0	
"#wastepackagingglass,unsorted"	0		0.1	0	
#wastepackagingpaper	0	"0,0"	0	0	
#wastepaint	0	"0,0"	0	0	
#wastepaintonmetal	0		0.1	0	
#wastepaintonwall	0	"0,0"	0	0	
#wastepaintonwood	0	"0,0"	0	0	
"#wastepaper,sorted"	0	"0,0"	0	0	
"#wastepaper,unsorted"	0	"0,0"	0	0	
#wastepaperboard	0	"0,0"	0	0	
"#wastepaperboard,sorted"	0	"0,0"	0	0	
"#wastepaperboard,unsorted"	0	"0,0"	0	0	
#wastepapersortingfacility	1		0.1	0	
#wasteplaster-cardboardsandwich	0		0.1	0	
"#wasteplastic,consumerelectronics"	0	"0,0"	0	1	
"#wasteplastic,consumerelectronics,sorted"	0	"0,0"	0	0	
"#wasteplastic,consumerelectronics,unsorted"	0	"0,0"	0	1	
"#wasteplastic,industrialelectronics"	0	"0,0"	0	1	
"#wasteplastic,mixture"	0	"0,0"	0	1	
#wasteplasticplaster	0	"0,0"	0	0	
"#wasteplasticplaster,forfinaldisposal"	0	"0,0"	0	0	
#wastepolyethylene	0	"0,0"	0	0	

"#wastepolyethylene,forrecycling,sorted"	0	"0,0"	0	0	
"#wastepolyethylene,forrecycling,unsorted"	0	"0,0"	0	0	
#wastepolyethylene/polypropyleneproduct	0	"0,0"	0	0	
#wastepolyethyleneterephthalate	0	"0,0"	0	0	
"#wastepolyethyleneterephthalate,forrecyclin..."	0	"0,0"	0	0	
"#wastepolyethyleneterephthalate,forrecyclin..."	0	"0,0"	0	0	
#wastepolypropylene	0	"0,0"	0	0	
#wastepolystyrene	0	"0,0"	0	0	
"#wastepolystyreneisolation,flame-retardant"	0	"0,0"	0	0	
#wastepolyurethane	0	"0,0"	0	0	
#wastepolyurethanefoam	0	"0,0"	0	0	
#wastepolyurethaneseal	0	"0,0"	0	0	
#wastepolyvinylchloride	0	"0,0"	0	0	
#wastepolyvinylchlorideproduct	0	"0,0"	0	0	
#wastepolyvinylfluoride	0	"0,0"	0	0	
#wastepreparationfacility	1		0.1	0	
#wasterefinerygas	0		0.1	0	
#wastereinforcedconcrete	0	"0,0.5"	0.25	0	
#wastereinforcedplasterboard	0		0.1	0	
#wastereinforcementsteel	0	"0.5,1"	0.7	0	
"#wasterubber,unspecified"	0	"0,0"	0	0	
"#wastesealingsheet,polyethylene"	0	"0,0"	0	0	
"#wastesealingsheet,polyvinylchloride"	0	"0,0"	0	0	
"#wastetextile,soiled"	0	"0,0"	0	0	
"#wastevapourbarrier,flame-retarded"	0	"0,0"	0	0	
"#wastewater,average"	0	"0,0.1"	0.01	1	
"#wastewater,fromresidence"	0	"0,0.1"	0.01	1	
"#wastewater,unpolluted"	0	"0,0"	0	0	
"#wastewater,unpolluted,fromresidence"	0	"0,0"	0	0	
#wastewaterfromanaerobicdigestionofwhey	0	"0,0"	0	0	
#wastewaterfromblackchromecoating	0	"0,0.1"	0.01	0	
#wastewaterfromcathoderaytubeproduction	0	"0,0.1"	0.01	0	
#wastewaterfromceramicproduction	0	"0,0"	0	0	
#wastewaterfromconcreteproduction	0	"0,0.1"	0.01	0	
#wastewaterfromglassproduction	0	"0,0.1"	0.01	0	
#wastewaterfromgrassrefinery	0	"0,0"	0	0	
#wastewaterfromgroundgranulatedblastfurnac...	0	"0,0.1"	0.01	0	

#wastewaterfromhardfibreboardproduction	0	"0,0.1"	0.01	0	
#wastewaterfromliquidcrystaldisplaybacklig...	0	"0,0.1"	0.01	0	
#wastewaterfromliquidcrystaldisplayproduction	0	"0,0.1"	0.01	0	
#wastewaterfromliquidcrystalproduction	0	"0,0.1"	0.01	0	
#wastewaterfromlorryproduction	0	"0,0.1"	0.01	0	
#wastewaterfrommaizestarchproduction	0	"0,0"	0	0	
#wastewaterfrommediumdensityboardproduction	0	"0,0.1"	0.01	0	
#wastewaterfromparticleboardproduction	0	"0,0.1"	0.01	0	
#wastewaterfrompigironproduction	0	"0,0.1"	0.01	0	
#wastewaterfromplywoodproduction	0	"0,0"	0	0	
#wastewaterfrompotatostarchproduction	0	"0,0"	0	0	
#wastewaterfromPVcellproduction	0	"0,0.1"	0.01	0	
#wastewaterfromsoftfibreboardproduction	0	"0,0.1"	0.01	0	
#wastewaterfromtextileproduction	0	"0,0.1"	0.01	0	
#wastewaterfromtubecollectorproduction	0	"0,0.1"	0.01	0	
#wastewaterfromvegetableoilrefinery	0	"0,0"	0	0	
#wastewaterfromwaferfabrication	0	"0,0.1"	0.01	0	
"#wastewatertreatmentfacility,capacity1.1E10..."	1		0.1	1	
"#wastewatertreatmentfacility,capacity1.6E8l..."	1		0.1	0	
"#wastewatertreatmentfacility,capacity1E9l/year"	1		0.1	1	
"#wastewatertreatmentfacility,capacity4.7E10..."	1		0.1	0	
"#wastewatertreatmentfacility,capacity5E9l/year"	1		0.1	1	
#wastewireplastic	0	"0,0"	0	0	
"#wastewood,post-consumer"	0	"0,0"	0	0	
"#wastewood,untreated"	0	"0,0"	0	0	
"#wastewoodpole,chromepreserved"	0	"0,0"	0	0	
#wastex-rayfilm	0		0.1	0	
#wasteyarnandwastetextile	0	"0,0"	0	0	
#wastezeolite	0	"0,0"	0	0	
"#water,completelysoftened"	0	"0,0"	0	0	
"#water,decarbonised"	0	"0,0"	0	0	
"#water,deionised"	0	"0,0"	0	0	
"#water,harvestedfromrainwater"	0	"0,0"	0	0	
"#water,ultrapure"	0	"0,0"	0	0	
#waterdischargefrompetroleum/naturalgasext...	0		0.01	0	
"#waterdischargefrompetroleumextraction,off..."	0		0.01	0	
"#waterpump,22kW"	1		0.5	0	

"#waterpumpoperation,diesel"	1		0.5	0	
"#waterpumpoperation,electric"	1		0.5	0	
#waterstorage	1		0.5	0	
#watersupplynetwork	1		0.5	0	
"#waterworks,capacity1.1E10l/year"	1		0.5	0	
"#waterworks,capacity6.23E10l/year"	1		0.5	0	
"#wax,lost-waxcasting"	0	"0,0"	0	0	
"#weanedcalves,liveweight"	0	"0,0"	0	0	
"#weanedheifers,liveweight"	0	"0,0"	0	0	
"#weaving,syntheticfibre"	0	"0,0"	0	0	
"#weedcontrol,bybrushcutter,pasture"	0		0.5	0	
"#welding,arc,aluminium"	0		0.5	0	
"#welding,arc,steel"	0		0.5	0	
"#welding,gas,steel"	0		0.5	0	
#wheatbran	0	"0,0.1"	0.01	0	
#wheatflour	0	"0,0.1"	0.01	0	
#wheatflourmix	0	"0,0.1"	0.01	0	
#wheatgrain	0	"0,0.1"	0.01	0	
"#wheatgrain,feed"	0	"0,0.1"	0.01	0	
"#wheatgrain,feed,organic"	0	"0,0.1"	0.01	0	
"#wheatgrain,feed,Swissintegratedproduction"	0	"0,0.1"	0.01	0	
"#wheatgrain,organic"	0	"0,0.1"	0.01	0	
"#wheatgrain,Swissintegratedproduction"	0	"0,0.1"	0.01	0	
"#wheatseed,forsowing"	0	"0,0.1"	0.01	0	
"#wheatseed,organic,forsowing"	0	"0,0.1"	0.01	0	
"#wheatseed,Swissintegratedproduction,fors..."	0	"0,0.1"	0.01	0	
#whey	0	"0,0.1"	0.01	0	
#whiteasparagus	0	"0,0.1"	0.01	0	
#whitespirit	0	"0,0"	0	0	
"#willowstemcutting,forplanting"	0	"0,0"	0	0	
"#windowframe,aluminium,U=1.6W/m2K"	0	"0,0.5"	0.2	0	
"#windowframe,polyvinylchloride,U=1.6W/m2K"	0	"0,0.5"	0.2	0	
"#windowframe,wood,U=1.5W/m2K"	0	"0,0.5"	0.2	0	
"#windowframe,wood-metal,U=1.6W/m2K"	0		0.5	0	
"#windpowerplant,2MW,offshore,fixedparts"	1		0.1	0	
"#windpowerplant,2MW,offshore,movingparts"	1		0.1	0	
"#windpowerplant,800kW,fixedparts"	1		0.1	0	

"#windpowerplant,800kW,movingparts"	1		0.1	0	
"#windturbine,2.3MW,onshore"	1		0.1	0	
"#windturbine,2MW,onshore"	1		0.1	0	
"#windturbine,4.5MW,onshore"	1		0.1	0	
"#windturbine,750kW,onshore"	1		0.1	0	
"#windturbinenetworkconnection,2MW,onshore"	1	"0,0"	0	0	shell capital service product
"#windturbinenetworkconnection,4.5MW,onshore"	1	"0,0"	0	0	shell capital service product
"#windturbinenetworkconnection,750kW,onshore"	1	"0,0"	0	0	shell capital service product
"#wiredrawing,copper"	1	"0,0"	0	0	shell capital service product
"#wiredrawing,steel"	1	"0,0"	0	0	shell capital service product
"#woodashmixture,pure"	0	"0,0"	0	0	
"#woodchipping,chipper,mobile,diesel,atfor..."	1	"0,0"	0	0	
"#woodchipping,forwarderwithterrainchipper,..."	1	"0,0"	0	0	
"#woodchipping,industrialresidualwood,stati..."	1	"0,0"	0	0	
"#woodchips,dry,measuredasdrymass"	0	"0,0"	0	0	
"#woodchips,frompost-consumerwood,measured..."	0	"0,0"	0	0	
"#woodchips,wet,measuredasdrymass"	0	"0,0"	0	0	
"#woodchipsandparticles,willow"	0	"0,0"	0	0	
"#woodcladding,softwood"	1	"0,0"	0	0	shell capital service product
"#woodenboardfactory,cementbondedboards"	1		0.1	0	
"#woodenboardfactory,organicbondedboards"	1		0.1	0	
"#woodpellet,measuredasdrymass"	0	"0,0"	0	0	
#woodpelletfactory	1		0.1	0	
"#woodpreservation,dipping/immersionmethod,o..."	1	"0,0"	0	0	shell capital service product
"#woodpreservation,dipping/immersionmethod,o..."	1	"0,0"	0	0	shell capital service product
"#woodpreservation,dipping/immersionmethod,o..."	1	"0,0"	0	0	shell capital service product
"#woodpreservation,dipping/immersionmethod,w..."	1	"0,0"	0	0	shell capital service product
"#woodpreservation,dipping/immersionmethod,w..."	1	"0,0"	0	0	shell capital service product
"#woodpreservation,dipping/immersionmethod,w..."	1	"0,0"	0	0	shell capital service product
"#woodpreservation,hot/colddipping,creosote,..."	1	"0,0"	0	0	shell capital service product
"#woodpreservation,oscillatingpressuremethod..."	1	"0,0"	0	0	shell capital service product
"#woodpreservation,oscillatingpressuremethod..."	1	"0,0"	0	0	shell capital service product
"#woodpreservation,pressurevessel,creosote,..."	1	"0,0"	0	0	shell capital service product
"#woodpreservation,spraytunnel/deluging,orga..."	1	"0,0"	0	0	shell capital service product
"#woodpreservation,spraytunnel/deluging,orga..."	1	"0,0"	0	0	shell capital service product
"#woodpreservation,spraytunnel/deluging,orga..."	1	"0,0"	0	0	shell capital service product
"#woodpreservation,spraytunnel/deluging,wate..."	1	"0,0"	0	0	shell capital service product

"#woodpreservation,spraytunnel/deluging,wate..."	1	"0,0"	0	0	shell capital service product
"#woodpreservation,spraytunnel/deluging,wate..."	1	"0,0"	0	0	shell capital service product
"#woodpreservation,vaccumpressuremethod,ino..."	1	"0,0"	0	0	shell capital service product
"#woodpreservation,vacuumpressuremethod,org..."	1	"0,0"	0	0	shell capital service product
"#woodpreservationfacility,dipping/immersion..."	1		0.1	0	
"#woodpreservationfacility,flowcoatingequip..."	1		0.1	0	
"#woodpreservationfacility,hot/colddippingtank"	1		0.1	0	
"#woodpreservationfacility,oscillatingpressu..."	1		0.1	0	
"#woodpreservationfacility,vacuumpressureme..."	1		0.1	0	
"#woodpreservative,creosote"	0	"0,0"	0	0	
"#woodpreservative,inorganicsalt,containingCr"	0	"0,0"	0	0	
"#woodpreservative,organic,indooruse,dry"	0	"0,0"	0	0	
"#woodpreservative,organic,indooruse,occasi..."	0	"0,0"	0	0	
"#woodpreservative,organic,outdooruse,nogr..."	0	"0,0"	0	0	
"#woodpreservative,organicsalt,Cr-free"	0	"0,0"	0	0	
"#woodpreservative,water-based,indooruse,dry"	0	"0,0"	0	0	
"#woodpreservative,water-based,indooruse,oc..."	0	"0,0"	0	0	
"#woodpreservative,water-based,outdooruse,n..."	0	"0,0"	0	0	
#woodwool	0	"0,0"	0	0	
"#woodwoolboards,cementbonded"	0		0.1	0	
"#xenon,gaseous"	0	"0,0"	0	0	
#xylene	0	"0,0"	0	0	
"#yarn,cotton"	0	"0,0"	0	0	
"#yarn,jute"	0	"0,0"	0	0	
"#yarn,kenaf"	0	"0,0"	0	0	
"#yarn,silk"	0	"0,0"	0	0	
"#yogurt,fromcowmilk"	0	"0,0.1"	0.01	0	
"#zeolite,powder"	0		0.1	0	
"#zeolite,slurry,withoutwater,in50%solutio..."	0	"0,0"	0	0	
#zinc	0	"0,0"	0	0	
"#zinccoat,coils"	0	"0,0"	0	0	
"#zinccoat,pieces"	0	"0,0"	0	0	
"#zinccoat,pieces,adjustmentpermicro-m"	0		0.1	0	
#zincconcentrate	0	"0,0"	0	0	
#zincincarshredderresidue	0		0.1	0	
#zincmonosulfate	0	"0,0"	0	0	
#zincoxide	0	"0,0.1"	0.01	0	

"#zincscrap,post-consumer"	0	"0,0"	0	0	
#zincslag	0	"0,0.2"	0.15	0	
#zincsulfide	0	"0,0"	0	0	
"#zircon,50%zirconium"	0	"0,0"	0	0	
#zirconiumoxide	0	"0,0"	0	0	
#zucchini	0	"0,0.1"	0.01	0	

Table D.2 Every natural resource in ecoinvent with in the second column the bounds to the iron content of the resource and in the third column the initial iron content guess

Name	Bounds	Guess
Actinium in ground	"0,0"	0
Aluminium 24% in bauxite 11% in crude ore in ground	"0,0"	0
Aluminium in ground	"0,0"	0
Anhydrite in ground	"0,0"	0
Antimony in ground	"0,0"	0
Argon-40	"0,0"	0
Arsenic in ground	"0,0"	0
Astatine in ground	"0,0"	0
Barite 15% in crude ore in ground	"0,0"	0
Barium in ground	"0,0"	0
Basalt in ground	"0,1"	0.01
Beryllium in ground	"0,0"	0
Bismuth in ground	"0,0"	0
Borax in ground	"0,0"	0
Boron in ground	"0,0"	0
Bromine 0.23% in water	"0,0"	0
Bromine in water	"0,0"	0
Cadmium 0.30% in sulfide Cd 0.18% Pb Zn Ag In in ground	"0,0"	0
Cadmium in ground	"0,0"	0
Caesium in ground	"0,0"	0
Calcite in ground	"0,0"	0
Calcium in ground	"0,0"	0
Carbon dioxide in air	"0,0"	0
Carbon organic in soil or biomass stock	"0,0"	0
Carnallite	"0,0"	0
Cerium 24% in bastnasite 2.4% in crude ore in ground	"0,0"	0
Cerium in ground	"0,0"	0
Chromium 25.5% in chromite 11.6% in crude ore in ground	"0,0"	0
Chromium in ground	"0,0"	0
Chrysotile in ground	"0,0"	0
Cinnabar in ground	"0,0"	0
Clay bentonite in ground	"0,1"	0.04
Clay unspecified in ground	"0,1"	0.04
Coal brown in ground	"0,1"	0.01
Coal hard unspecified in ground	"0,1"	0.01
Cobalt Co 5.0E-2% in mixed ore in ground	"0,0"	0
Cobalt in ground	"0,0"	0
Colemanite in ground	"0,0"	0
Copper 0.52% in sulfide Cu 0.27% and Mo 8.2E-3% in crude ore in ground	"0,0"	0
Copper 0.59% in sulfide Cu 0.22% and Mo 8.2E-3% in crude ore in ground	"0,0"	0
Copper 0.97% in sulfide Cu 0.36% and Mo 4.1E-2% in crude ore in ground	"0,0"	0
Copper 0.99% in sulfide Cu 0.36% and Mo 8.2E-3% in crude ore in ground	"0,0"	0
Copper 1.13% in sulfide Cu 0.76% and Ni 0.76% in crude ore in ground	"0,0"	0
Copper 1.18% in sulfide Cu 0.39% and Mo 8.2E-3% in crude ore in ground	"0,0"	0
Copper 1.25% in sulfide Cu 0.24% and Zn 01% in crude ore in ground	"0,0"	0
Copper 1.42% in sulfide Cu 0.81% and Mo 8.2E-3% in crude ore in ground	"0,0"	0
Copper 2.19% in sulfide Cu 1.83% and Mo 8.2E-3% in crude ore in ground	"0,0"	0
Copper Cu 0.2% in mixed ore in ground	"0,0"	0

Copper Cu 0.38% in mixed ore in ground	"0,0"	0
Copper Cu 6.8E-1% in mixed ore in ground	"0,0"	0
Copper in ground	"0,0"	0
Cu Cu 3.2E+0% Pt 2.5E-4% Pd 7.3E-4% Rh 2.0E-5% Ni 2.3E+0% in ore in ground	"0,0"	0
Cu Cu 5.2E-2% Pt 4.8E-4% Pd 2.0E-4% Rh 2.4E-5% Ni 3.7E-2% in ore in ground	"0,0"	0
Diatomite in ground	"0,1"	0.01
Dolomite in ground	"0,0"	0
Dysprosium in ground	"0,0"	0
Energy geothermal converted	"0,0"	0
Energy gross calorific value in biomass	"0,0"	0
Energy gross calorific value in biomass primary forest	"0,0"	0
Energy kinetic (in wind) converted	"0,0"	0
Energy potential (in hydropower reservoir) converted	"0,0"	0
Energy solar converted	"0,0"	0
Erbium in ground	"0,0"	0
Europium 0.06% in bastnasite 0.006% in crude ore in ground	"0,0"	0
Europium in ground	"0,0"	0
Feldspar in ground	"0,1"	0.15
Fish demersal in ocean	"0,1"	0.01
Fish pelagic in ocean	"0,1"	0.01
Fluorine 4.5% in apatite 1% in crude ore in ground	"0,0"	0
Fluorine 4.5% in apatite 3% in crude ore in ground	"0,0"	0
Fluorine in ground	"0,0"	0
Fluorspar 92% in ground	"0,0"	0
Fluorspar in ground	"0,0"	0
Gadolinium 0.15% in bastnasite 0.015% in crude ore in ground	"0,0"	0
Gadolinium in ground	"0,0"	0
Gallium 0.014% in bauxite in ground	"0,0"	0
Gallium in ground	"0,0"	0
Gangue bauxite in ground	"0,1"	0.01
Gangue in ground	"0,1"	0.05
Gas mine off-gas process coal mining	"0,1"	0.001
Gas natural in ground	"0,1"	0.001
Germanium in ground	"0,0"	0
Gold Au 1.0E-7% in mixed ore in ground	"0,0"	0
Gold Au 1.1E-4% Ag 4.2E-3% in ore in ground	"0,0"	0
Gold Au 1.3E-4% Ag 4.6E-5% in ore in ground	"0,0"	0
Gold Au 1.4E-4% in ore in ground	"0,0"	0
Gold Au 1.8E-4% in mixed ore in ground	"0,0"	0
Gold Au 2.1E-4% Ag 2.1E-4% in ore in ground	"0,0"	0
Gold Au 4.3E-4% in ore in ground	"0,0"	0
Gold Au 4.9E-5% in ore in ground	"0,0"	0
Gold Au 5.4E-4% Ag 1.5E-5% in ore in ground	"0,0"	0
Gold Au 6.7E-4% in ore in ground	"0,0"	0
Gold Au 6.8E-4% Ag 1.5E-4% in ore in ground	"0,0"	0
Gold Au 7.1E-4% in ore in ground	"0,0"	0
Gold Au 9.7E-4% in mixed ore in ground	"0,0"	0
Gold Au 9.7E-5% Ag 7.6E-5% in ore in ground	"0,0"	0
Gold in ground	"0,0"	0
Granite in ground	"0,1"	0.02
Gravel in ground	"0,1"	0.1
Gypsum in ground	"0,1"	0.01

Hafnium in ground	"0,0"	0
Helium 0.08% in natural gas in ground	"0,0"	0
Helium in natural gas in ground	"0,0"	0
Holmium in ground	"0,0"	0
Indium 0.005% in sulfide In 0.003% Pb Zn Ag Cd in ground	"0,0"	0
Indium in ground	"0,0"	0
Iodine 0.03% in water	"0,0"	0
Iodine in water	"0,0"	0
Iridium in ground	"0,0"	0
Iron 46% in ore 25% in crude ore in ground	"1,1"	1
Iron 72% in magnetite 14% in crude ore in ground	"1,1"	1
Iron in ground	"0.7,1"	1
Kaolinite 24% in crude ore in ground	"0,1"	0.01
Kaolinite in ground	"0,1"	0.01
Kieserite 25% in crude ore in ground	"0,0"	0
Kieserite in ground	"0,0"	0
Krypton in air	"0,0"	0
Lanthanum 7.2% in bastnasite 0.72% in crude ore in ground	"0,0"	0
Lanthanum in ground	"0,0"	0
Laterite in ground	"0,1"	0.5
Lead 5.0% in sulfide Pb 3.0% Zn Ag Cd In in ground	"0,0"	0
Lead Pb 0.014% in mixed ore in ground	"0,0"	0
Lead Pb 3.6E-1% in mixed ore in ground	"0,0"	0
Lead in ground	"0,0"	0
Lithium 0.15% in brine in ground	"0,0"	0
Lithium in ground	"0,0"	0
Lutetium in ground	"0,0"	0
Magnesite 60% in crude ore in ground	"0,1"	0.01
Magnesite in ground	"0,1"	0.01
Magnesium 0.13% in water	"0,0"	0
Magnesium in ground	"0,0"	0
Magnesium in water	"0,0"	0
Manganese 35.7% in sedimentary deposit 14.2% in crude ore in ground	"0,0"	0
Manganese in ground	"0,0"	0
Mercury in ground	"0,0"	0
Metamorphous rock graphite containing in ground	"0,1"	0.01
Molybdenum 0.010% in sulfide Mo 8.2E-3% and Cu 1.83% in crude ore in ground	"0,0"	0
Molybdenum 0.014% in sulfide Mo 8.2E-3% and Cu 0.81% in crude ore in ground	"0,0"	0
Molybdenum 0.016% in sulfide Mo 8.2E-3% and Cu 0.27% in crude ore in ground	"0,0"	0
Molybdenum 0.022% in sulfide Mo 8.2E-3% and Cu 0.22% in crude ore in ground	"0,0"	0
Molybdenum 0.022% in sulfide Mo 8.2E-3% and Cu 0.36% in crude ore in ground	"0,0"	0
Molybdenum 0.025% in sulfide Mo 8.2E-3% and Cu 0.39% in crude ore in ground	"0,0"	0
Molybdenum 0.11% in sulfide Mo 4.1E-2% and Cu 0.36% in crude ore in ground	"0,0"	0
Molybdenum in ground	"0,0"	0
Neodymium 4% in bastnasite 0.4% in crude ore in ground	"0,0"	0
Neodymium in ground	"0,0"	0
Ni Ni 2.3E+0% Pt 2.5E-4% Pd 7.3E-4% Rh 2.0E-5% Cu 3.2E+0% in ore in ground	"0,0"	0
Ni Ni 3.7E-2% Pt 4.8E-4% Pd 2.0E-4% Rh 2.4E-5% Cu 5.2E-2% in ore in ground	"0,0"	0
Nickel 1.13% in sulfide Ni 0.76% and Cu 0.76% in crude ore in ground	"0,0"	0
Nickel 1.98% in silicates 1.04% in crude ore in ground	"0,0"	0
Nickel Ni 2.5E+0% in mixed ore in ground	"0,0"	0
Nickel in ground	"0,0"	0

Niobium in ground	"0,0"	0
Nitrogen	"0,0"	0
Occupation annual crop	"0,0"	0
Occupation annual crop flooded crop	"0,0"	0
Occupation annual crop greenhouse	"0,0"	0
Occupation annual crop irrigated	"0,0"	0
Occupation annual crop irrigated extensive	"0,0"	0
Occupation annual crop irrigated intensive	"0,0"	0
Occupation annual crop non-irrigated	"0,0"	0
Occupation annual crop non-irrigated extensive	"0,0"	0
Occupation annual crop non-irrigated intensive	"0,0"	0
Occupation arable land unspecified use	"0,0"	0
Occupation arable conservation tillage (obsolete)	"0,0"	0
Occupation arable conventional tillage (obsolete)	"0,0"	0
Occupation arable reduced tillage (obsolete)	"0,0"	0
Occupation bare area (non-use)	"0,0"	0
Occupation construction site	"0,0"	0
Occupation cropland fallow (non-use)	"0,0"	0
Occupation dump site	"0,0"	0
Occupation field margin/hedgerow	"0,0"	0
Occupation forest extensive	"0,0"	0
Occupation forest intensive	"0,0"	0
Occupation forest primary (non-use)	"0,0"	0
Occupation forest secondary (non-use)	"0,0"	0
Occupation forest unspecified	"0,0"	0
Occupation grassland natural (non-use)	"0,0"	0
Occupation grassland natural for livestock grazing	"0,0"	0
Occupation heterogeneous agricultural	"0,0"	0
Occupation industrial area	"0,0"	0
Occupation inland waterbody unspecified	"0,0"	0
Occupation lake artificial	"0,0"	0
Occupation lake natural (non-use)	"0,0"	0
Occupation mineral extraction site	"0,0"	0
Occupation pasture man made	"0,0"	0
Occupation pasture man made extensive	"0,0"	0
Occupation pasture man made intensive	"0,0"	0
Occupation permanent crop	"0,0"	0
Occupation permanent crop irrigated	"0,0"	0
Occupation permanent crop irrigated extensive	"0,0"	0
Occupation permanent crop irrigated intensive	"0,0"	0
Occupation permanent crop non-irrigated	"0,0"	0
Occupation permanent crop non-irrigated extensive	"0,0"	0
Occupation permanent crop non-irrigated intensive	"0,0"	0
Occupation river artificial	"0,0"	0
Occupation river natural (non-use)	"0,0"	0
Occupation seabed drilling and mining	"0,0"	0
Occupation seabed infrastructure	"0,0"	0
Occupation seabed natural (non-use)	"0,0"	0
Occupation seabed unspecified	"0,0"	0
Occupation shrub land sclerophyllous	"0,0"	0
Occupation snow and ice (non-use)	"0,0"	0
Occupation traffic area rail network	"0,0"	0

Occupation traffic area rail/road embankment	"0,0"	0
Occupation traffic area road network	"0,0"	0
Occupation unspecified	"0,0"	0
Occupation unspecified natural (non-use)	"0,0"	0
Occupation urban continuously built	"0,0"	0
Occupation urban discontinuously built	"0,0"	0
Occupation urban green area	"0,0"	0
Occupation urban/industrial fallow (non-use)	"0,0"	0
Occupation wetland coastal (non-use)	"0,0"	0
Occupation wetland inland (non-use)	"0,0"	0
Oil crude in ground	"0,1"	0.01
Olivine in ground	"0,1"	0.3
Osmium in ground	"0,0"	0
Oxygen	"0,0"	0
Palladium Pd 1.6E-6% in mixed ore in ground	"0,0"	0
Palladium in ground	"0,0"	0
Pd Pd 2.0E-4% Pt 4.8E-4% Rh 2.4E-5% Ni 3.7E-2% Cu 5.2E-2% in ore in ground	"0,0"	0
Pd Pd 7.3E-4% Pt 2.5E-4% Rh 2.0E-5% Ni 2.3E+0% Cu 3.2E+0% in ore in ground	"0,0"	0
Peat in ground	"0,1"	0.01
Perlite in ground	"0,1"	0.01
Phosphorus 18% in apatite 12% in crude ore in ground	"0,0"	0
Phosphorus 18% in apatite 4% in crude ore in ground	"0,0"	0
Phosphorus in ground	"0,0"	0
Platinum Pt 4.7E-7% in mixed ore in ground	"0,0"	0
Platinum in ground	"0,0"	0
Polonium in ground	"0,0"	0
Potassium in ground	"0,0"	0
Praseodymium 0.42% in bastnasite 0.042% in crude ore in ground	"0,0"	0
Praseodymium in ground	"0,0"	0
Protactinium in ground	"0,0"	0
Pt Pt 2.5E-4% Pd 7.3E-4% Rh 2.0E-5% Ni 2.3E+0% Cu 3.2E+0% in ore in ground	"0,0"	0
Pt Pt 4.8E-4% Pd 2.0E-4% Rh 2.4E-5% Ni 3.7E-2% Cu 5.2E-2% in ore in ground	"0,0"	0
Pumice in ground	"0,1"	0.01
Pyrite in ground	"0,1"	0.46553305
Pyrolusite in ground	"0,0"	0
Radium in ground	"0,0"	0
Rh Rh 2.0E-5% Pt 2.5E-4% Pd 7.3E-4% Ni 2.3E+0% Cu 3.2E+0% in ore in ground	"0,0"	0
Rh Rh 2.4E-5% Pt 4.8E-4% Pd 2.0E-4% Ni 3.7E-2% Cu 5.2E-2% in ore in ground	"0,0"	0
Rhenium in crude ore in ground	"0,0"	0
Rhenium in ground	"0,0"	0
Rhodium Rh 1.6E-7% in mixed ore in ground	"0,0"	0
Rhodium in ground	"0,0"	0
Rubidium in ground	"0,0"	0
Ruthenium in ground	"0,0"	0
Samarium 0.3% in bastnasite 0.03% in crude ore in ground	"0,0"	0
Samarium in ground	"0,0"	0
Sand unspecified in ground	"0,1"	0.01
Scandium in ground	"0,0"	0
Selenium in ground	"0,0"	0
Shale in ground	"0,1"	0.01
Silicon in ground	"0,0"	0
Silver 0.007% in sulfide Ag 0.004% Pb Zn Cd In in ground	"0,0"	0

Silver 0.01% in crude ore in ground	"0,0"	0
Silver 3.2ppm in sulfide Ag 1.2ppm Cu and Te in crude ore in ground	"0,0"	0
Silver Ag 1.5E-4% Au 6.8E-4% in ore in ground	"0,0"	0
Silver Ag 1.5E-5% Au 5.4E-4% in ore in ground	"0,0"	0
Silver Ag 1.8E-6% in mixed ore in ground	"0,0"	0
Silver Ag 2.1E-4% Au 2.1E-4% in ore in ground	"0,0"	0
Silver Ag 4.2E-3% Au 1.1E-4% in ore in ground	"0,0"	0
Silver Ag 4.6E-5% Au 1.3E-4% in ore in ground	"0,0"	0
Silver Ag 5.4E-3% in mixed ore in ground	"0,0"	0
Silver Ag 7.6E-5% Au 9.7E-5% in ore in ground	"0,0"	0
Silver Ag 9.7E-4% in mixed ore in ground	"0,0"	0
Silver in ground	"0,0"	0
Sodium chloride in ground	"0,0"	0
Sodium nitrate in ground	"0,0"	0
Sodium sulphate various forms in ground	"0,0"	0
Sodium in ground	"0,0"	0
Spodumene in ground	"0,1"	0.01
Steatite in ground	"0,1"	0.01
Stibnite in ground	"0,0"	0
Strontium in ground	"0,0"	0
Sulfur in ground	"0,0"	0
Sylvite 25 % in sylvinite in ground	"0,0"	0
Sylvite in ground	"0,0"	0
Talc in ground	"0,1"	0.01
Tantalum 81.9% in tantalite 1.6E-4% in crude ore in ground	"0,0"	0
Tantalum in ground	"0,0"	0
Tellurium 0.5ppm in sulfide Te 0.2ppm Cu and Ag in crude ore in ground	"0,0"	0
Tellurium in ground	"0,0"	0
Terbium in ground	"0,0"	0
Thallium in ground	"0,0"	0
Thorium in ground	"0,0"	0
Thulium in ground	"0,0"	0
TiO2 54% in ilmenite 18% in crude ore in ground	"0,0"	0
TiO2 54% in ilmenite 2.6% in crude ore in ground	"0,0"	0
TiO2 95% in rutile 0.40% in crude ore in ground	"0,0"	0
Tin 79% in cassiterite 0.1% in crude ore in ground	"0,0"	0
Tin in ground	"0,0"	0
Titanium in ground	"0,0"	0
Transformation from annual crop	"0,0"	0
Transformation from annual crop flooded crop	"0,0"	0
Transformation from annual crop greenhouse	"0,0"	0
Transformation from annual crop irrigated	"0,0"	0
Transformation from annual crop irrigated extensive	"0,0"	0
Transformation from annual crop irrigated intensive	"0,0"	0
Transformation from annual crop non-irrigated	"0,0"	0
Transformation from annual crop non-irrigated extensive	"0,0"	0
Transformation from annual crop non-irrigated intensive	"0,0"	0
Transformation from arable land unspecified use	"0,0"	0
Transformation from bare area (non-use)	"0,0"	0
Transformation from cropland fallow (non-use)	"0,0"	0
Transformation from dump site	"0,0"	0
Transformation from dump site inert material landfill	"0,0"	0

Transformation from dump site residual material landfill	"0,0"	0
Transformation from dump site sanitary landfill	"0,0"	0
Transformation from dump site slag compartment	"0,0"	0
Transformation from field margin/hedgerow	"0,0"	0
Transformation from forest extensive	"0,0"	0
Transformation from forest intensive	"0,0"	0
Transformation from forest primary (non-use)	"0,0"	0
Transformation from forest secondary (non-use)	"0,0"	0
Transformation from forest unspecified	"0,0"	0
Transformation from grassland natural (non-use)	"0,0"	0
Transformation from grassland natural for livestock grazing	"0,0"	0
Transformation from heterogeneous agricultural	"0,0"	0
Transformation from industrial area	"0,0"	0
Transformation from inland waterbody unspecified	"0,0"	0
Transformation from lake artificial	"0,0"	0
Transformation from lake natural (non-use)	"0,0"	0
Transformation from mineral extraction site	"0,0"	0
Transformation from pasture man made	"0,0"	0
Transformation from pasture man made extensive	"0,0"	0
Transformation from pasture man made intensive	"0,0"	0
Transformation from permanent crop	"0,0"	0
Transformation from permanent crop irrigated	"0,0"	0
Transformation from permanent crop irrigated extensive	"0,0"	0
Transformation from permanent crop irrigated intensive	"0,0"	0
Transformation from permanent crop non-irrigated	"0,0"	0
Transformation from permanent crop non-irrigated extensive	"0,0"	0
Transformation from permanent crop non-irrigated intensive	"0,0"	0
Transformation from river artificial	"0,0"	0
Transformation from river natural (non-use)	"0,0"	0
Transformation from seabed drilling and mining	"0,0"	0
Transformation from seabed infrastructure	"0,0"	0
Transformation from seabed natural (non-use)	"0,0"	0
Transformation from seabed unspecified	"0,0"	0
Transformation from shrub land sclerophyllous	"0,0"	0
Transformation from snow and ice (non-use)	"0,0"	0
Transformation from traffic area rail network	"0,0"	0
Transformation from traffic area rail/road embankment	"0,0"	0
Transformation from traffic area road network	"0,0"	0
Transformation from unknown	"0,0"	0
Transformation from unspecified	"0,0"	0
Transformation from unspecified natural (non-use)	"0,0"	0
Transformation from urban continuously built	"0,0"	0
Transformation from urban discontinuously built	"0,0"	0
Transformation from urban green area	"0,0"	0
Transformation from urban/industrial fallow (non-use)	"0,0"	0
Transformation from wetland coastal (non-use)	"0,0"	0
Transformation from wetland inland (non-use)	"0,0"	0
Transformation to annual crop	"0,0"	0
Transformation to annual crop flooded crop	"0,0"	0
Transformation to annual crop greenhouse	"0,0"	0
Transformation to annual crop irrigated	"0,0"	0
Transformation to annual crop irrigated extensive	"0,0"	0

Transformation to annual crop irrigated intensive	"0,0"	0
Transformation to annual crop non-irrigated	"0,0"	0
Transformation to annual crop non-irrigated extensive	"0,0"	0
Transformation to annual crop non-irrigated intensive	"0,0"	0
Transformation to arable land unspecified use	"0,0"	0
Transformation to bare area (non-use)	"0,0"	0
Transformation to cropland fallow (non-use)	"0,0"	0
Transformation to dump site	"0,0"	0
Transformation to dump site inert material landfill	"0,0"	0
Transformation to dump site residual material landfill	"0,0"	0
Transformation to dump site sanitary landfill	"0,0"	0
Transformation to dump site slag compartment	"0,0"	0
Transformation to field margin/hedgerow	"0,0"	0
Transformation to forest extensive	"0,0"	0
Transformation to forest intensive	"0,0"	0
Transformation to forest primary (non-use)	"0,0"	0
Transformation to forest secondary (non-use)	"0,0"	0
Transformation to forest unspecified	"0,0"	0
Transformation to grassland natural (non-use)	"0,0"	0
Transformation to grassland natural for livestock grazing	"0,0"	0
Transformation to heterogeneous agricultural	"0,0"	0
Transformation to industrial area	"0,0"	0
Transformation to inland waterbody unspecified	"0,0"	0
Transformation to lake artificial	"0,0"	0
Transformation to lake natural (non-use)	"0,0"	0
Transformation to mineral extraction site	"0,0"	0
Transformation to pasture man made	"0,0"	0
Transformation to pasture man made extensive	"0,0"	0
Transformation to pasture man made intensive	"0,0"	0
Transformation to permanent crop	"0,0"	0
Transformation to permanent crop irrigated	"0,0"	0
Transformation to permanent crop irrigated extensive	"0,0"	0
Transformation to permanent crop irrigated intensive	"0,0"	0
Transformation to permanent crop non-irrigated	"0,0"	0
Transformation to permanent crop non-irrigated extensive	"0,0"	0
Transformation to permanent crop non-irrigated intensive	"0,0"	0
Transformation to river artificial	"0,0"	0
Transformation to river natural (non-use)	"0,0"	0
Transformation to seabed drilling and mining	"0,0"	0
Transformation to seabed infrastructure	"0,0"	0
Transformation to seabed natural (non-use)	"0,0"	0
Transformation to seabed unspecified	"0,0"	0
Transformation to shrub land sclerophyllous	"0,0"	0
Transformation to snow and ice (non-use)	"0,0"	0
Transformation to traffic area rail network	"0,0"	0
Transformation to traffic area rail/road embankment	"0,0"	0
Transformation to traffic area road network	"0,0"	0
Transformation to unknown	"0,0"	0
Transformation to unspecified	"0,0"	0
Transformation to unspecified natural (non-use)	"0,0"	0
Transformation to urban continuously built	"0,0"	0
Transformation to urban discontinuously built	"0,0"	0

Transformation to urban green area	"0,0"	0
Transformation to urban/industrial fallow (non-use)	"0,0"	0
Transformation to wetland coastal (non-use)	"0,0"	0
Transformation to wetland inland (non-use)	"0,0"	0
Tungsten in ground	"0,0"	0
Ulexite in ground	"0,0"	0
Uranium in ground	"0,0"	0
Vanadium in ground	"0,0"	0
Vermiculite in ground	"0,1"	0.01
Volume occupied final repository for low-active radioactive waste	"0,0"	0
Volume occupied final repository for radioactive waste	"0,0"	0
Volume occupied reservoir	"0,0"	0
Volume occupied underground deposit	"0,0"	0
Water cooling unspecified natural origin	"0,0"	0
Water in air	"0,1"	0.01
Water lake	"0,1"	0.01
Water river	"0,1"	0.01
Water salt ocean	"0,1"	0.01
Water salt sole	"0,1"	0.01
Water turbine use unspecified natural origin	"0,1"	0.01
Water unspecified natural origin	"0,1"	0.01
Water unspecified natural origin	"0,1"	0.01
Water unspecified natural origin	"0,1"	0.01
Water well in ground	"0,1"	0.01
Wood hard standing	"0,1"	0.01
Wood primary forest standing	"0,1"	0.01
Wood soft standing	"0,1"	0.01
Wood unspecified standing	"0,1"	0.01
Xenon in air	"0,0"	0
Ytterbium in ground	"0,0"	0
Yttrium in ground	"0,0"	0
Zinc 9.0% in sulfide Zn 5.3% Pb Ag Cd In in ground	"0,0"	0
Zinc Zn 0.63% in mixed ore in ground	"0,0"	0
Zinc Zn 3.1% in mixed ore in ground	"0,0"	0
Zinc in ground	"0,0"	0
Zirconia as baddeleyite in ground	"0,0"	0
Zirconium 50% in zircon 0.39% in crude ore in ground	"0,0"	0
Zirconium in ground	"0,0"	0

APPENDIX E DEMO PROBLEMS

Each demo problem has a V, U and F matrix on the left, accompanied by lay and lay_f matrices on the right.

V	steel_prod	tire_prod	rim_prod	wheel_prod	frame_prod	bike_prod	helmet_prod
steel	1						
tire		1					
rim			1				
wheel				1			
frame					1		
bike						1	
helmet							1

lay	iron	unit	min	max
steel	1	kg/kg	0	1
tire	0.05	kg/unit	0	
rim	1.2	kg/unit	0	
wheel	1.1	kg/unit	0	
frame	7	kg/unit	0	
bike	10	kg/unit	0	8
helmet	0.3	kg/unit	0.3	0.3

U	steel_prod	tire_prod	rim_prod	wheel_prod	frame_prod	bike_prod	helmet_prod
steel		0.1	1.2	0	6.6		0.3
tire				1			
rim				1			
wheel						2	
frame						1	
bike							
helmet							

F	steel_prod	tire_prod	rim_prod	wheel_prod	frame_prod	bike_prod	helmet_prod
iron ore	-1	0	0	0	0	0	0
coal	0	0	0	0	0	0	0

lay_f	iron	unit	min	max
iron ore	1	kg/kg	1	1
coal	0	kg/kg	0	0

Figure E.1 Imbalanced bike demo problem

V	steel_prod	paint_prod	wood_prod	cabin_prod	frame_prod	boat_prod	boat_EOL_prod
steel	1						
paint		1					
wood			1				
cabin				1			
frame					1		
boat						1	
boat EOL							1

lay	iron	unit	min	max
steel	1	kg/kg	0	1
paint	0	kg/l	0	
wood	0	kg/unit	0	
cabin	400	kg/unit	0	
frame	800	kg/unit	0	
boat	1200	kg/unit	1200	1200
boat EOL	1100	kg/unit	0	1100

U	steel_prod	paint_prod	wood_prod	cabin_prod	frame_prod	boat_prod	boat_EOL_prod
steel		0	0	400	800		
paint					50		
wood				400			
cabin						1	
frame						1	
boat							1
boat EOL							

F	steel_prod	paint_prod	wood_prod	cabin_prod	frame_prod	boat_prod	boat_EOL_prod
iron ore	-1	0	0	0	0	0	0
wood	0	0	-1	0	0	0	0

lay_f	iron	unit	min	max
iron ore	1	kg/kg	1	1
wood	0	kg/kg	0	0

Figure E.2 Imbalanced boat wear demo problem

V	r_steel_prod	sand_prod	cement_prod	gravel_prod	concrete_pro	wall_prod	floor_prod		lay	iron	unit	min	max
reinforced_st	1								reinforced_st	1	kg/kg	0	1
sand		1							sand	0	kg/kg	0	
cement			1						cement	0.03	kg/kg	0	
gravel				1					gravel	0	kg/kg	0	
concrete					1				concrete	0.03	kg/kg	0.008	0.03
wall						1			wall	30	kg/unit	0	
floor							1		floor	120	kg/unit	0	
U	r_steel_prod	sand_prod	cement_prod	gravel_prod	concrete_pro	wall_prod	floor_prod						
reinforced_steel			0.03		0.03								
sand			0.97		0.5								
cement					0.4								
gravel					0.07								
concrete						1000							
wall							4						
floor													
F	r_steel_prod	sand_prod	cement_prod	gravel_prod	concrete_pro	wall_prod	floor_prod		lay_f	iron	unit	min	max
iron ore	-1	0	0	0	0	0	0		iron ore	1	kg/kg	1	1
sand	0	-1	0	0	0	0	0		sand	0	kg/kg	0	0

Figure E.3 Imbalanced concrete range demo problem

V	r_steel_prod	flower_prod	flower_EOL_prod		lay	iron	unit	min	max
steel	1				steel	1	kg/kg	0	1
flower		1			flower	0.05	kg/unit	0.05	
flower_EOL			1		flower_EOL	0	kg/unit	0	0
U	r_steel_prod	flower_prod	flower_EOL_prod						
steel		0.05							
flower			1						
flower_EOL									
F	r_steel_prod	flower_prod	flower_EOL_prod		lay_f	iron	unit	min	max
iron ore	-1	0	0		iron ore	1	kg/kg	1	1
compost	0	0	1		compost	0	kg/kg	0	0

Figure E.4 Imbalanced alternative wear flower demo problem

V	steel_prod	rod_prod	plate_prod	extruded_can	melted_can_	evaporation_prod		lay	iron	unit	min	max
steel	1							steel	1	kg/kg	1	1
rod		1						rod	0.99	kg/unit	0	0.99
plate			1					plate	0.98	kg/unit	0	0.98
extruded_can				1				extruded_can	0.9	kg/unit	0	0.9
melted_can					1			melted_can	0.8	kg/unit	0	0.8
evaporation						1		evaporation	0	kg/unit	0	0
U	steel_prod	rod_prod	plate_prod	extruded_can	melted_can_	evaporation_prod						
steel		1										
rod			1									
plate				1								
extruded_can					1							
melted_can						1						
evaporation												
F	steel_prod	rod_prod	plate_prod	extruded_can	melted_can_	evaporation_prod		lay_f	iron	unit	min	max
iron ore	-1	0	0	0	0	0		iron ore	1	kg/kg	1	1
coal	0	0	0	0	0	0		coal	0	kg/kg	0	0

Figure E.5 Imbalanced transformation losses demo problem

V	steel_1_prod	steel_2_prod	steel_3_prod	steel_4_prod	steel_5_prod	steel_6_prod
steel_1	1					
steel_2		1				
steel_3			1			
steel_4				1		
steel_5					1	
steel_6						1
U	steel_1_prod	steel_2_prod	steel_3_prod	steel_4_prod	steel_5_prod	steel_6_prod
steel_1		1				
steel_2			1			
steel_3				1		
steel_4					1	
steel_5						1
steel_6						
F	steel_1_prod	steel_2_prod	steel_3_prod	steel_4_prod	steel_5_prod	steel_6_prod
iron ore	-1	-1	-1	-1	-1	-1
coal	0	0	0	0	0	0

lay	iron	unit	min	max
steel_1	1	kg/kg	0	1
steel_2	1	kg/unit	0	1
steel_3	1	kg/unit	0	1
steel_4	1	kg/unit	0	1
steel_5	1	kg/unit	0	1
steel_6	1	kg/unit	0	1
lay_f	iron	unit	min	max
iron ore	1	kg/kg	1	1
coal	0	kg/kg	0	0

Figure E.6 Imbalanced elementary flows demo problem

V	steel_1_prod	steel_2_prod	steel_3_prod	steel_4_prod	steel_5_prod	steel_6_prod
steel_1						
steel_2						
steel_3						
steel_4						
steel_5						
steel_6						
U	steel_1_prod	steel_2_prod	steel_3_prod	steel_4_prod	steel_5_prod	steel_6_prod
steel_1						
steel_2						
steel_3						
steel_4						
steel_5						
steel_6						
F	steel_1_prod	steel_2_prod	steel_3_prod	steel_4_prod	steel_5_prod	steel_6_prod
iron ore	0	0	0	0	0	0
coal	0	0	0	0	0	0

lay	iron	unit	min	max
steel_1	1	kg/kg	0	
steel_2	0	kg/unit	0	
steel_3	0	kg/unit	0	
steel_4	0	kg/unit	0	
steel_5	0	kg/unit	0	
steel_6	0	kg/unit	0	
lay_f	iron	unit	min	max
iron ore	0	kg/kg	0	
coal	0	kg/kg	0	

Figure E.7 Debug with all zero entries demo problem

V	steel_product	tire_prod	rim_prod	wheel_prod	frame_prod	bike_prod	helmet_prod	car_prod	factory_prod	transport	machine_pro	fuel_prod
steel	1											
tire		1										
rim			1									
wheel				1								
frame					1							
bike						1						
helmet							1					
car								1				
factory									1			
transport, car										1		
machine											1	
fuel												1
U	steel_product	tire_prod	rim_prod	wheel_prod	frame_prod	bike_prod	helmet_prod	car_prod	factory_prod	transport	machine_pro	fuel_prod
steel		0.1	1.2		6		0.3	800	100000		2400	
tire				1								
rim				1								
wheel				0.1		2		4				
frame						1						
bike												
helmet												
car										1.00E-15		
factory	1.00E-18					1.00E-15		1.00E-10			1.00E-11	
transport, car						1.00E-10						
machine	1.00E-10							1.00E-08	50			
fuel									30000	20	10	
F	steel_product	tire_prod	rim_prod	wheel_prod	frame_prod	bike_prod	helmet_prod	car_prod	factory_prod	transport	machine_pro	fuel_prod
iron ore	-10	0	0	0	0	0	0	0	0	0	0	0
coal	0	0	0	0	0	0	0	0	10000	12	15	9
polystyrene	0	0	0	0	0	0	-2	0	500	0	0	0

lay	iron	unit	min	max
steel	1	kg/kg	0	1
tire	0.05	kg/unit	0	
rim	1.2	kg/unit	0	
wheel	1.2	kg/unit	0	
frame	6	kg/unit	0	
bike	8	kg/unit	0	8
helmet	0	kg/unit	0.3	0.3
car	1000	kg/unit	800	1000
factory	500	unit	0	
transport, car	0	km	0	0
machine	40	kg/unit	0	
fuel	0.01	kg/unit	0	0.1
lay_f	iron	unit	min	max
iron ore	0.1	kg/kg	0.1	0.1
coal	0	kg/kg	0	0
polystyrene	0	kg/kg	0	0

Figure E.8 Combination of imbalances demo problem

APPENDIX F IRON CONTENT

Table F.1 Every product in ecoinvent (second column) with in the first column whether (number) or not (Original) it was disaggregated and how many times. The third column gives the name of the unit the product is expressed in, the fourth column gives the balanced iron content and the fifth column gives a comment if the iron content is different than expected

Disaggregated	productName	unitName	iron content	Comment
Original	solid unbleached board	kg	0.00040803210353895753	
Original	building, multi-storey	m3	1.341918692454491e-10	
Original	sawnwood, board, softwood, raw, dried (u=20\%)	m3	3.171167029086448e-06	
Original	aircraft, passenger, very short haul	unit	1481.2448913124385	
Original	heat and power co-generation unit, 1MWel, 6.4MWth	unit	11820.772756272416	
Original	inverter, 500kW	unit	1438.0719896286305	
Original	impact extrusion of steel, warm, 2 strokes	kg	0.0	shell capital service product
Original	heat pump, for heat and power co-generation un...	unit	1032.7782046087	
Original	gas motor, mini CHP plant	unit	11.257076431956731	
Original	operation, intermodal shipping container	kg*day	0.0	shell capital service product
Original	mowing, by motor mower	ha	0.0	shell capital service product
Original	road wear emissions, passenger car	kg	0.9999999870291373	
Original	palm date, conditioned and dried, organic	kg	8.781000233642563e-10	
Original	printed wiring board, mounted mainboard, lapto...	kg	0.10926262724751826	
Original	wood preservation, dipping/immersion method, w...	kg	0.0	shell capital service product
Original	residual wood, dry	m3	8.027094790416411e-05	
Original	transport, freight, sea, container ship with r...	metric ton*km	0.0	shell capital service product
Original	orange, processing grade	kg	3.2703411969695122e-09	
Original	impact extrusion of aluminium, 2 strokes	kg	0.0	shell capital service product
Original	transport, freight, lorry with refrigeration m...	metric ton*km	0.0	shell capital service product
Original	wheat grain	kg	5.8673258993792 15e-07	
Original	chromium steel removed by drilling, conventional	kg	0.6305351821298385	
Original	machine operation, diesel, >= 74.57 kW, high l...	hour	0.0	shell capital service product
Original	transport, freight, aircraft, very short haul	metric ton*km	0.0	shell capital service product
Original	onshore well, oil/gas	m	162.1675595032973	
Original	machine operation, diesel, >= 18.64 kW and < 7...	hour	0.0	shell capital service product
Original	three layered laminated board	m3	6.9176526448736636e-09	
Original	ground granulated blast furnace slag	kg	5.0279087380892355e-12	
Original	transport, freight, lorry 3.5-7.5 metric ton, ...	metric ton*km	0.0	shell capital service product
Original	tomato, processing grade	kg	4.2000277751581876e-10	
Original	fishmeal, 65-67\% protein	kg	1.6593454671384871e-09	
Original	impact extrusion of steel, cold, deformation s...	kg	0.0	shell capital service product
Original	barge tanker	unit	261986.48832193503	
0	sludge, pig iron production	kg	1.6982980063252556e-09	
1	sludge, pig iron production	kg	1.957504684826844e-06	
2	sludge, pig iron production	kg	0.45660526255870765	
5	sludge, pig iron production	kg	0.000119858535169501	
6	sludge, pig iron production	kg	0.00011985853516950099	
7	sludge, pig iron production	kg	0.914	
8	sludge, pig iron production	kg	0.9139999999999999	
9	sludge, pig iron production	kg	0.9139986759345693	
10	sludge, pig iron production	kg	0.00027863758119375267	
11	sludge, pig iron production	kg	1.6118954413537968e-06	
12	sludge, pig iron production	kg	0.00027863758119361204	

13	sludge, pig iron production	kg	0.9139986772321204	
14	sludge, pig iron production	kg	1.6118954413290645e-06	
15	sludge, pig iron production	kg	0.9140000000000001	
16	sludge, pig iron production	kg	7.4338561517795106e-09	
17	sludge, pig iron production	kg	7.4338561517795106e-09	
18	sludge, pig iron production	kg	9.04470748437377e-09	
19	sludge, pig iron production	kg	6.388591735660113e-07	
20	sludge, pig iron production	kg	2.0978824702569846e-09	
21	sludge, pig iron production	kg	0.9139999996089023	
22	sludge, pig iron production	kg	0.9139999996205475	
23	sludge, pig iron production	kg	0.9139999999532018	
Original	window frame, wood-metal, U=1.6 W/m2K	m2	5.120580313906677	
Original	drying of feed grain	l	0.0	shell capital service product
Original	inverter, for electric passenger car	kg	0.061182198308375964	
Original	mattress	unit	0.0027049625260172397	
Original	welding, arc, steel	m	0.053604677909743825	
Original	landed tuna, frozen, EPO	kg	5.810800379975616e-10	
Original	cork, raw	kg	5.724834437611979e-10	
Original	transport, freight, lorry with refrigeration m...	metric ton*km	0.0	shell capital service product
Original	transport, freight, inland waterways, barge	metric ton*km	0.0	shell capital service product
Original	protein pea, feed, Swiss integrated production	kg	1.0986709518358608e-10	
Original	waste x-ray film	kg	0.004429875766175056	
Original	cement, blast furnace slag 21-35\%	kg	5.250020474956076e-05	
Original	base oil	kg	1.3305701020386302e-08	
Original	intermodal shipping container, 40-foot	unit	1991.812216715481	
Original	drying of maize grain	l	0.0	shell capital service product
Original	chromium steel removed by turning, primarily d...	kg	0.6305351821298385	
Original	transport, freight, aircraft, short haul	metric ton*km	0.0	shell capital service product
Original	exhaust air roof hood, steel, DN 400	unit	16.99999999772654	
Original	transport, freight, lorry with refrigeration m...	metric ton*km	0.0	shell capital service product
Original	light emitting diode	kg	0.4507614371208133	
Original	operation, computer, desktop, office use	hour	0.0	shell capital service product
Original	building, upmarket hotel	unit	692.4050862272353	
Original	machine operation, diesel, >= 18.64 kW and < 7...	hour	0.0	shell capital service product
Original	cement, blast furnace slag 6-20\%	kg	5.2500158591183706e-05	
Original	transport, freight, light commercial vehicle	metric ton*km	0.0	shell capital service product
Original	process-specific burdens, slag landfill	kg	0.0	shell capital service product
Original	transport, passenger car, large size, natural ...	km	0.0	shell capital service product
Original	chromium steel removed by turning, primarily r...	kg	0.6305351821295496	
Original	photovoltaic facade installation, 3kWp, single...	unit	13.430439900198088	
Original	harvesting, sugarcane	ha	0.0	shell capital service product
Original	photovoltaic panel, multi-Si wafer	m2	3.773947929047009e-05	
Original	battery, NaCl	kg	0.3088340352447222	
Original	planting tree	unit	0.0	shell capital service product
Original	aubergine	kg	1.9507580269380887e-11	
Original	ion-exchanger for water treatment	unit	3756.1575994454925	
Original	hydropower plant, reservoir, alpine region	unit	3160000.2086815163	
Original	catalytic converter, three-way, mini CHP plant	unit	0.296332543649886	
Original	transport, freight train	metric ton*km	0.0	shell capital service product
Original	sawnwood, board, hardwood, raw, dried (u=20\%)	m3	4.026964974068112e-08	

Original	calcareous marl	kg	2.305663428913042e-12	
Original	furnace, logs, softwood storage area, 6kW	unit	104.00114677529976	
Original	establishing orchard	unit	3.172578039637441e-09	
Original	photovoltaic slanted-roof installation, 3kWp, ...	unit	4.921946620116864	
Original	copper concentrate, sulfide ore	kg	1.1304935167778386e-11	
Original	mandarin, fresh grade	kg	1.3730639055745672e-10	
Original	receiver system, solar tower power plant, 20 MW	unit	110652.74602936795	
Original	building, hostel	unit	354.26306699743276	
Original	printed wiring board, mounted mainboard, lapto...	kg	0.1092579381698512	
Original	planing mill	unit	750357.9389264656	
Original	sorting facility, for construction waste	unit	104527.95800722542	
Original	construction work, heat and power co-generatio...	unit	0.0	shell capital service product
Original	internet access, work, 0.2 Mbit/s	hour	0.0	shell capital service product
Original	transformer, low voltage use	kg	0.3550064499363549	
Original	excavation, hydraulic digger	m3	0.0	shell capital service product
Original	almond	kg	9.260650627913399e-11	
Original	transport, passenger, bicycle	person*km	0.0	shell capital service product
Original	wafer, fabricated, for integrated circuit	m2	0.6999998293072465	
Original	gas power plant, combined cycle, 400MW electrical	unit	7740019.434241127	
Original	hard coal	kg	8.353783766375169e-13	
Original	wastewater from concrete production	m3	0.04491387479171717	
Original	photovoltaic slanted-roof installation, 3kWp, ...	unit	13.430439900098662	
Original	barley grain, feed, organic	kg	4.1418829409609084e-10	
Original	planning, cogen unit mini CHP plant	unit	0.0	shell capital service product
0	wastewater treatment facility, capacity 5E9l/year	unit	1445475.4638527695	
1	wastewater treatment facility, capacity 5E9l/year	unit	4.717310921720246e-06	
2	wastewater treatment facility, capacity 5E9l/year	unit	4.717257527750846e-06	
3	wastewater treatment facility, capacity 5E9l/year	unit	1445475.4637591492	
Original	ventilation duct, elbow 90°, steel, 100x50 mm	unit	0.26999999969256233	
Original	protein pea	kg	5.780593732343343e-09	
Original	magnesium-alloy, AZ91	kg	1.6038943565614661e-10	
Original	sawnwood, board, softwood, dried (u=10\%), planed	m3	3.3281457077387416e-05	
Original	chassis, internet access equipment	kg	0.00199999993899008	
Original	aluminium hydroxide factory	unit	2676184.323957696	
Original	low level radioactive waste	m3	1.4633660360476703e-07	
Original	lorry with refrigeration machine, carbon dioxi...	unit	0.0	No mass because all eol flows included - servi...
Original	wastewater treatment facility, capacity 1.6E8l...	unit	48786.88055409512	
Original	process-specific burdens, residual material la...	kg	0.0	shell capital service product
Original	passenger car, petrol/natural gas	kg	0.1047470275510605	
Original	energy wood harvester	unit	5547.842056933138	
Original	cement, blast furnace slag 36-65\%	kg	0.00010999997978024809	
Original	spent catalytic converter NOx reduction	kg	2.071675924762582e-07	
Original	diode, glass-, for through-hole mounting	kg	0.4507614371207249	
Original	sawnwood, hardwood, raw, dried (u=20\%)	m3	4.224268293076629e-08	
Original	cable, network cable, category 5, without plugs	m	7.512622922013149e-11	
Original	ventilation of dwellings, central, 1 x 720 m3/h	m2*year	0.0	shell capital service product
Original	offshore platform, natural gas	unit	13100433.776582493	
Original	transport, freight, train with reefer, cooling	metric ton*km	0.0	shell capital service product
Original	photovoltaic plant, electric installation for ...	unit	12.441453883944114	
Original	diesel, burned in diesel-electric generating s...	MJ	3.490682645420914e-12	

Original	linseed seed, for sowing	kg	1.0688909519686897e-08	
Original	cement tile	kg	1.5899343320732783e-05	
Original	iron(III) sulfate, without water, in 12.5\% iro...	kg	0.3600000000204188	
Original	cement, blast furnace slag, 66-80\%	kg	0.00011000000365496957	
Original	containerboard, fluting medium	kg	1.1682170331012407e-10	
Original	operation, reefer, cooling	kg*day	0.0	shell capital service product
Original	transport, passenger car, medium size, diesel,...	km	0.0	shell capital service product
Original	tin plating, pieces	m2	0.0	shell capital service product
Original	electronics scrap	kg	1.2712298672926906e-06	
Original	transport, regular bus	person*km	0.0	shell capital service product
Original	sawnwood, beam, hardwood, raw, dried (u=20\%)	m3	3.996481499275152e-08	
Original	printing ink, offset, without solvent, in 47.5...	kg	0.00022509613211993033	
Original	printed wiring board mounting facility, throug...	unit	1135.4230067286778	
Original	cement, portland fly ash cement 6-20\%	kg	5.250000233689347e-05	
Original	sawnwood, lath, softwood, raw, dried (u=20\%)	m3	3.1711403545740415e-06	
Original	transport, freight, lorry with refrigeration m...	metric ton*km	0.0	shell capital service product
Original	maize seed, Swiss integrated production, for s...	kg	1.2039703467574289e-09	
Original	sawnwood, azobe from sustainable forest manage...	m3	6.207810624806204e-09	
Original	thermal storage system, solar tower power plan...	unit	4.2750366010857865e-06	
Original	nuclear power plant, pressure water reactor 10...	unit	8267400.050483266	
Original	controller, for electric scooter	kg	0.007755780171489756	
Original	electronics scrap from control units	kg	0.7366570852358197	
Original	potato	kg	8.131365790488903e-11	
Original	used powertrain from electric passenger car, m...	kg	0.15471431733200489	
Original	packing, clay product	kg	0.0	shell capital service product
Original	operation, computer, laptop, off mode	hour	0.0	shell capital service product
Original	used refrigeration machine, carbon dioxide, li...	unit	73.59249476912741	
Original	fodder beet, Swiss integrated production	kg	1.4455207245701495e-11	
Original	printed wiring board, mounted mainboard, deskt...	kg	0.10749118394613791	
Original	lorry, 16 metric ton	unit	0.0	No mass because all eol flows included - servi...
Original	tram	unit	0.0	No mass because all eol flows included - servi...
Original	maintenance, intermodal shipping container, 45...	unit	0.0	No mass because all eol flows included - servi...
Original	toner module, laser printer, colour	unit	0.29078506332550413	
Original	wind turbine, 2MW, onshore	unit	61206.78814792405	
Original	petroleum refinery	unit	4233585.774954701	
Original	dust collector, multicyclone	unit	214.24930493467102	
Original	cement, blast furnace slag 18-30\% and 18-30\% o...	kg	0.00011000000166952852	
Original	transport, freight, light commercial vehicle, ...	metric ton*km	0.0	shell capital service product
Original	aircraft, dedicated freight, medium haul	unit	6122.347535055144	
Original	printed wiring board, for power supply unit, d...	kg	0.016087737801815178	
Original	display, cathode ray tube, 17 inches	unit	3.95152943588772	
Original	palm oil, crude	kg	1.737509212779692e-08	
Original	dried roughage store, non ventilated	m3	3.2962119324309436e-11	
Original	battery, Li-ion, rechargeable, prismatic	kg	0.028671322203391424	
Original	water works, capacity 1.1E10l/year	unit	6806.366961078104	
Original	potato planting	ha	0.0	shell capital service product
Original	tea, dried	kg	2.122435670995474e-10	
Original	inverter, 0.5kW	unit	0.09321817641441996	
Original	onion	kg	4.6559903899686035e-12	
Original	used trawler, steel	kg	0.936938411948223	

Original	cast iron removed by milling, dressing	kg	1.0	
Original	impact extrusion of aluminium, 1 stroke	kg	0.0	shell capital service product
Original	nuclear power plant, pressure water reactor, 6...	unit	5167666.91066512	
Original	hard disk drive, for laptop computer	unit	0.017045926518616205	
Original	tillage, harrowing, by spring tine harrow	ha	0.0	shell capital service product
Original	planting, sugarcane	ha	0.0	shell capital service product
Original	hydraulic digger	unit	12380.803941652817	
Original	coconut, dehusked	kg	2.1873767281447226e-10	
Original	white asparagus	kg	1.9308712880234948e-11	
Original	operation, computer, desktop, with cathode ray...	hour	0.0	shell capital service product
Original	waste mineral oil	kg	4.444791630049119e-07	
Original	tillage, currying, by weeder	ha	0.0	shell capital service product
Original	used silencer steel, DN 315	unit	10.000000000000002	
Original	maintenance, container ship	unit	816158.8400996362	
Original	peanut seed, for sowing	kg	1.5482239877481344e-09	
Original	window frame, aluminium, U=1.6 W/m2K	m2	0.6754398005815941	
Original	deep drawing, steel, 3500 kN press, automode	kg	0.0	shell capital service product
Original	waste bulk iron, excluding reinforcement	kg	0.9999999999999999	
Original	photovoltaic cell, ribbon-Si	m2	2.8814469619099194e-10	
Original	mulberry leaves	kg	0.0004930985417899241	
Original	apple	kg	1.2676691625889073e-11	
Original	waste paper sorting facility	unit	381289.4828327376	
Original	wheat seed, organic, for sowing	kg	1.8421498956337142e-09	
Original	process-specific burdens, hazardous waste inci...	kg	0.0	shell capital service product
Original	land use change, annual crop	ha	0.0	shell capital service product
0	slag landfill	unit	4893.8231282852	
1	slag landfill	unit	4894.571998126936	
Original	transport, freight, sea, tanker for liquefied ...	metric ton*km	0.0	shell capital service product
Original	used lorry with refrigeration machine, 16 metr...	unit	4809.024305570246	
Original	air filter, decentralized unit, 250 m3/h	unit	8.323854920713258e-06	
Original	used tyre	kg	7.133550976444196e-11	
Original	laser machining, metal, with YAG-laser, 30W power	hour	0.0	shell capital service product
Original	operation, computer, laptop, video mode	hour	0.0	shell capital service product
Original	stretch blow moulding	kg	8.62791925991267e-10	
Original	furnace, logs, softwood storage area, 100kW	unit	1068.006420486395	
Original	chromium steel removed by milling, average	kg	0.6305351821295553	
Original	nuclear waste storage, interim, for low level ...	unit	744244.9367039751	
Original	machine operation, diesel, >= 74.57 kW, steady...	hour	0.0	shell capital service product
0	transmission network, electricity, high voltage	km	3743.163974139501	
1	transmission network, electricity, high voltage	km	7795.199970259327	
2	transmission network, electricity, high voltage	km	7422.449974788581	
Original	ferrosilicon	kg	3.663765815761466e-10	
Original	capacitor, film type, for through-hole mounting	kg	0.11692002899839744	
Original	hard disk drive, for desktop computer	unit	0.08086050561430688	
Original	rape oil, crude	kg	2.0497060799113627e-06	
Original	perlite	kg	0.0002981592748413684	
Original	power supply unit, for desktop computer	unit	0.5818462888190948	
Original	clinker	kg	7.467020795399807e-13	
0	clinker	kg	6.976225664573843e-13	
1	clinker	kg	9.634681938419795e-13	

2	clinker	kg	1.1817244830329956e-12	
3	clinker	kg	7.462536308718933e-13	
4	clinker	kg	7.462536308718933e-13	
5	clinker	kg	7.251388771455229e-13	
6	clinker	kg	4.726707667492236e-12	
7	clinker	kg	1.1430595462612625e-12	
8	clinker	kg	0.0032255556394466048	
9	clinker	kg	1.9626962616410282e-12	
Original	transport, passenger car, large size, natural ...	km	0.0	shell capital service product
Original	heat and power co-generation unit, 200kW elect...	unit	39.55166331165464	
Original	potato seed, for setting	kg	1.0664676025985838e-09	
Original	transport, pipeline, onshore, long distance, n...	metric ton*km	0.0	shell capital service product
Original	orange, fresh grade	kg	7.055218056626164e-12	
Original	sludge, NaCl electrolysis	kg	2.4683280952413463e-09	
Original	wood preservation, vaccum pressure method, ino...	kg	0.0	shell capital service product
Original	mobile cable yarder, trailer-mounted	unit	4040.7847934574993	
Original	jute plant, harvested	kg	6.756146549307364e-06	
Original	used intermodal shipping container, 45-foot, h...	unit	1472.280026100089	
Original	rolling mill	unit	57699.96409171154	
Original	aircraft, belly freight, long haul	unit	5499.365067689666	
Original	steel removed by drilling, conventional	kg	0.999999999901963	
Original	used intermodal shipping container, 40-foot	unit	1311.179232270324	
Original	sunflower seed	kg	5.492216899851986e-11	
Original	deep drawing, steel, 10000 kN press, single st...	kg	0.0	shell capital service product
Original	potato seed, at farm	kg	2.0392532444806297e-09	
Original	chimney	m	2.554875989584859e-11	
Original	steel removed by drilling, computer numerical ...	kg	0.9999999998969957	
Original	transport, freight, aircraft, medium haul	metric ton*km	0.0	shell capital service product
Original	soybean meal	kg	0.00012227668683337023	
Original	coriander	kg	1.9887636757233642e-10	
Original	waste asphalt	kg	5.932171722604963e-10	
Original	transistor, wired, small size, through-hole mo...	kg	0.11078000002297687	
Original	transport, freight, lorry 28 metric ton, veget...	metric ton*km	0.0	shell capital service product
Original	thermoforming, with calendering	kg	3.455810473801952e-10	
Original	sawnwood, paraná pine from sustainable forest ...	m3	0.012670256069364227	
Original	metallization paste, back side, aluminium	kg	3.042434474212859e-10	
Original	vacuum cleaner	unit	0.21870323110459214	
Original	wood preservation, dipping/immersion method, w...	kg	0.0	shell capital service product
Original	scrap lead acid battery	kg	0.1270008824525889	
Original	nickel, 99.5\%	kg	2.8296624543868886e-10	
0	inert waste, for final disposal	kg	0.7438093184355861	
1	inert waste, for final disposal	kg	0.7438093184355861	
2	inert waste, for final disposal	kg	0.14171755910311198	
3	inert waste, for final disposal	kg	0.1417175591031149	
4	inert waste, for final disposal	kg	0.14181687585165223	
5	inert waste, for final disposal	kg	0.14181687585164848	
6	inert waste, for final disposal	kg	0.14174661282865011	
7	inert waste, for final disposal	kg	0.14174661282865034	
8	inert waste, for final disposal	kg	0.14175908870181284	
9	inert waste, for final disposal	kg	0.14175908870181583	

10	inert waste, for final disposal	kg	0.14179054514410114	
11	inert waste, for final disposal	kg	0.1417905451441105	
12	inert waste, for final disposal	kg	0.14182037823059285	
13	inert waste, for final disposal	kg	0.14182037823059487	
14	inert waste, for final disposal	kg	0.1418146645602241	
15	inert waste, for final disposal	kg	0.14181466456022954	
16	inert waste, for final disposal	kg	0.008906141074803616	
17	inert waste, for final disposal	kg	0.8156800033464309	
18	inert waste, for final disposal	kg	0.8156800033464293	
19	inert waste, for final disposal	kg	0.0027611350645060716	
22	inert waste, for final disposal	kg	0.995	
23	inert waste, for final disposal	kg	0.9950000000000001	
24	inert waste, for final disposal	kg	0.9949999991043964	
25	inert waste, for final disposal	kg	4.699842631175061e-10	
26	inert waste, for final disposal	kg	7.1448897437890905e-06	
27	inert waste, for final disposal	kg	2.066549237463757e-09	
28	inert waste, for final disposal	kg	2.066549237463757e-09	
29	inert waste, for final disposal	kg	0.9949995487023168	
30	inert waste, for final disposal	kg	0.14130290665442427	
31	inert waste, for final disposal	kg	0.14130290665442427	
35	inert waste, for final disposal	kg	3.460768092160986e-08	
36	inert waste, for final disposal	kg	3.46076809302285e-08	
37	inert waste, for final disposal	kg	0.10046777317490356	
38	inert waste, for final disposal	kg	0.10046777317490357	
39	inert waste, for final disposal	kg	0.10046777317490357	
40	inert waste, for final disposal	kg	0.10046777317490357	
41	inert waste, for final disposal	kg	0.11381631116951037	
42	inert waste, for final disposal	kg	0.11381631116951041	
43	inert waste, for final disposal	kg	0.1138163111695104	
44	inert waste, for final disposal	kg	0.11381631116951041	
45	inert waste, for final disposal	kg	0.11381631116951041	
46	inert waste, for final disposal	kg	0.11381631116951041	
47	inert waste, for final disposal	kg	0.01338206358715849	
48	inert waste, for final disposal	kg	0.013382063587158486	
49	inert waste, for final disposal	kg	0.029149757230210356	
50	inert waste, for final disposal	kg	0.029149757230210356	
51	inert waste, for final disposal	kg	0.00017639438970521885	
52	inert waste, for final disposal	kg	0.00017639014401621593	
53	inert waste, for final disposal	kg	0.14197774751964035	
54	inert waste, for final disposal	kg	0.14197774751963976	
55	inert waste, for final disposal	kg	0.14213175655754712	
56	inert waste, for final disposal	kg	0.142131756557548	
57	inert waste, for final disposal	kg	4.570821494909575e-06	
58	inert waste, for final disposal	kg	2.9862393182902143e-05	
59	inert waste, for final disposal	kg	9.5110668138952e-09	
60	inert waste, for final disposal	kg	0.9949967804970231	
61	inert waste, for final disposal	kg	5.543486530039767e-07	
62	inert waste, for final disposal	kg	5.543486530039741e-07	
63	inert waste, for final disposal	kg	5.543519215241391e-07	
64	inert waste, for final disposal	kg	5.543519215241399e-07	

65	inert waste, for final disposal	kg	5.543519215267966e-07	
66	inert waste, for final disposal	kg	5.543519215267907e-07	
67	inert waste, for final disposal	kg	5.546375306090419e-07	
68	inert waste, for final disposal	kg	5.546375306090418e-07	
69	inert waste, for final disposal	kg	5.546370451734158e-07	
70	inert waste, for final disposal	kg	5.546370451734154e-07	
71	inert waste, for final disposal	kg	5.546370451734169e-07	
72	inert waste, for final disposal	kg	5.54583746756671e-07	
73	inert waste, for final disposal	kg	5.545837466940114e-07	
74	inert waste, for final disposal	kg	2.7649717868965e-07	
75	inert waste, for final disposal	kg	2.764971786896501e-07	
76	inert waste, for final disposal	kg	1.790398763629585e-08	
77	inert waste, for final disposal	kg	1.7903987638321807e-08	
78	inert waste, for final disposal	kg	3.870059683013919e-06	
85	inert waste, for final disposal	kg	0.14404591576834821	
86	inert waste, for final disposal	kg	0.008906141074803618	
88	inert waste, for final disposal	kg	3.870059683013919e-06	
91	inert waste, for final disposal	kg	4.570821494909575e-06	
92	inert waste, for final disposal	kg	2.9862393182902143e-05	
93	inert waste, for final disposal	kg	9.511066814466909e-09	
94	inert waste, for final disposal	kg	0.14118014692285344	
95	inert waste, for final disposal	kg	7.144889743789084e-06	
96	inert waste, for final disposal	kg	0.1402842681256121	
97	inert waste, for final disposal	kg	0.12514466414560133	
98	inert waste, for final disposal	kg	0.14052529666576452	
99	inert waste, for final disposal	kg	0.14001273563134284	
100	inert waste, for final disposal	kg	0.14048594064322337	
101	inert waste, for final disposal	kg	0.1368453396072057	
102	inert waste, for final disposal	kg	0.13733818208405477	
103	inert waste, for final disposal	kg	0.14130639280445423	
105	inert waste, for final disposal	kg	0.9949995487023248	
112	inert waste, for final disposal	kg	2.1890696187883904e-06	
113	inert waste, for final disposal	kg	1.0999832711141332e-05	
114	inert waste, for final disposal	kg	5.543519215241455e-07	
115	inert waste, for final disposal	kg	0.00037083789157766776	
116	inert waste, for final disposal	kg	0.002506541734666367	
117	inert waste, for final disposal	kg	0.14173100519372925	
118	inert waste, for final disposal	kg	6.43576866389798e-08	
119	inert waste, for final disposal	kg	6.435768343517203e-08	
120	inert waste, for final disposal	kg	5.070360719107609e-06	
121	inert waste, for final disposal	kg	5.070360719107609e-06	
122	inert waste, for final disposal	kg	3.209592287985098e-07	
123	inert waste, for final disposal	kg	3.209592287985098e-07	
124	inert waste, for final disposal	kg	8.018960284486271e-07	
125	inert waste, for final disposal	kg	8.018960284486267e-07	
126	inert waste, for final disposal	kg	8.018960284486267e-07	
127	inert waste, for final disposal	kg	8.018960284486267e-07	
128	inert waste, for final disposal	kg	0.0013465897489126012	
129	inert waste, for final disposal	kg	0.0013465897489126012	
130	inert waste, for final disposal	kg	5.0250560711225594e-05	

131	inert waste, for final disposal	kg	5.0250560711225594e-05	
132	inert waste, for final disposal	kg	8.018960284486267e-07	
133	inert waste, for final disposal	kg	1.7720570100027934e-06	
134	inert waste, for final disposal	kg	1.7720570100027946e-06	
135	inert waste, for final disposal	kg	8.604222836181842e-06	
136	inert waste, for final disposal	kg	8.604222836181842e-06	
137	inert waste, for final disposal	kg	8.018960284486267e-07	
138	inert waste, for final disposal	kg	8.018960284486262e-07	
141	inert waste, for final disposal	kg	0.09949999999999999	
142	inert waste, for final disposal	kg	3.6241474446451976e-10	
143	inert waste, for final disposal	kg	3.6241474446451976e-10	
144	inert waste, for final disposal	kg	0.0023868152817591625	
145	inert waste, for final disposal	kg	3.2092609767322e-05	
146	inert waste, for final disposal	kg	3.2092609767322e-05	
147	inert waste, for final disposal	kg	9.369158710093702e-06	
148	inert waste, for final disposal	kg	2.2220012684943335e-06	
149	inert waste, for final disposal	kg	0.0029803414177781468	
150	inert waste, for final disposal	kg	0.023997895489414875	
151	inert waste, for final disposal	kg	0.023998410424640782	
152	inert waste, for final disposal	kg	0.645183591388953	
153	inert waste, for final disposal	kg	0.995	
154	inert waste, for final disposal	kg	0.9950000000000001	
155	inert waste, for final disposal	kg	0.08024902523085542	
156	inert waste, for final disposal	kg	0.9950000000000001	
157	inert waste, for final disposal	kg	0.9950000000000001	
158	inert waste, for final disposal	kg	0.995	
159	inert waste, for final disposal	kg	0.9949999388834339	
160	inert waste, for final disposal	kg	0.9949999388802898	
161	inert waste, for final disposal	kg	0.8156800036294604	
162	inert waste, for final disposal	kg	9.61999773280927e-09	
163	inert waste, for final disposal	kg	1.1640903543259942e-08	
164	inert waste, for final disposal	kg	0.08024902643153009	
165	inert waste, for final disposal	kg	0.9949737471134751	
166	inert waste, for final disposal	kg	7.671548986394598e-07	
167	inert waste, for final disposal	kg	7.671548986394603e-07	
168	inert waste, for final disposal	kg	0.9949999991043964	
169	inert waste, for final disposal	kg	0.9949967804970455	
170	inert waste, for final disposal	kg	0.9949737471134803	
171	inert waste, for final disposal	kg	0.9804451145303272	
172	inert waste, for final disposal	kg	0.005320852624343052	
173	inert waste, for final disposal	kg	0.0995	
174	inert waste, for final disposal	kg	0.0037319691294417064	
175	inert waste, for final disposal	kg	0.005500088022422233	
176	inert waste, for final disposal	kg	0.9950000000000001	
177	inert waste, for final disposal	kg	0.9950000000000001	
178	inert waste, for final disposal	kg	0.9949999999999999	
179	inert waste, for final disposal	kg	1.3384818784179877e-08	
180	inert waste, for final disposal	kg	2.738271338963472e-07	
181	inert waste, for final disposal	kg	2.73827133896347e-07	
182	inert waste, for final disposal	kg	1.2646837788874906e-05	

183	inert waste, for final disposal	kg	1.2646857903027168e-05	
186	inert waste, for final disposal	kg	8.013208850321323e-07	
187	inert waste, for final disposal	kg	8.013208850321323e-07	
188	inert waste, for final disposal	kg	1.5907865880739667e-06	
189	inert waste, for final disposal	kg	1.5907865880739667e-06	
193	inert waste, for final disposal	kg	1.3418448803146124e-08	
194	inert waste, for final disposal	kg	1.890779099370829e-06	
195	inert waste, for final disposal	kg	1.890779099370829e-06	
196	inert waste, for final disposal	kg	1.3418446382691983e-08	
197	inert waste, for final disposal	kg	0.00010542669122962623	
198	inert waste, for final disposal	kg	0.00010546322848651443	
199	inert waste, for final disposal	kg	7.547227292353854e-09	
200	inert waste, for final disposal	kg	7.547227292353851e-09	
201	inert waste, for final disposal	kg	0.995	
202	inert waste, for final disposal	kg	0.9949999999999999	
203	inert waste, for final disposal	kg	0.9949999999999999	
210	inert waste, for final disposal	kg	0.0676041092756121	
211	inert waste, for final disposal	kg	0.06760410927561301	
212	inert waste, for final disposal	kg	0.9949999982784858	
213	inert waste, for final disposal	kg	0.13459788628545996	
214	inert waste, for final disposal	kg	0.9949999429448272	
215	inert waste, for final disposal	kg	0.9949999429448272	
216	inert waste, for final disposal	kg	0.9949999940571015	
217	inert waste, for final disposal	kg	0.9949999798145461	
218	inert waste, for final disposal	kg	0.5127332015681061	
219	inert waste, for final disposal	kg	0.512733201568106	
220	inert waste, for final disposal	kg	4.953691821617566e-08	
221	inert waste, for final disposal	kg	4.95369182161757e-08	
222	inert waste, for final disposal	kg	4.95369182161757e-08	
223	inert waste, for final disposal	kg	5.420563996577847e-07	
224	inert waste, for final disposal	kg	1.516405363165107e-06	
225	inert waste, for final disposal	kg	1.5024059642637835e-06	
226	inert waste, for final disposal	kg	5.050935627100633e-08	
227	inert waste, for final disposal	kg	4.95369182161757e-08	
228	inert waste, for final disposal	kg	7.484990918422584e-10	
229	inert waste, for final disposal	kg	7.484990926469317e-10	
230	inert waste, for final disposal	kg	9.634920328012836e-10	
231	inert waste, for final disposal	kg	9.634920328296816e-10	
232	inert waste, for final disposal	kg	0.1413063928044542	
233	inert waste, for final disposal	kg	3.790556607785526e-09	
234	inert waste, for final disposal	kg	3.682225359745565e-09	
235	inert waste, for final disposal	kg	3.7906138409291606e-09	
236	inert waste, for final disposal	kg	3.7906138409291606e-09	
237	inert waste, for final disposal	kg	3.832361713437789e-08	
238	inert waste, for final disposal	kg	3.7906138409291606e-09	
239	inert waste, for final disposal	kg	2.28468476260847e-09	
240	inert waste, for final disposal	kg	3.952863112923006e-09	
241	inert waste, for final disposal	kg	5.2195734222681515e-08	
242	inert waste, for final disposal	kg	2.5792512383366713e-09	
243	inert waste, for final disposal	kg	0.14052529666576452	

244	inert waste, for final disposal	kg	0.14028426812561207	
245	inert waste, for final disposal	kg	0.1251446641456014	
246	inert waste, for final disposal	kg	0.14001273167463818	
247	inert waste, for final disposal	kg	0.13684533960720574	
248	inert waste, for final disposal	kg	0.14048594064320155	
249	inert waste, for final disposal	kg	0.13733817430876522	
250	inert waste, for final disposal	kg	0.14118014692285344	
251	inert waste, for final disposal	kg	4.699842631175061e-10	
252	inert waste, for final disposal	kg	6.427174842570173e-08	
253	inert waste, for final disposal	kg	6.427174842570181e-08	
254	inert waste, for final disposal	kg	6.427174842570184e-08	
255	inert waste, for final disposal	kg	6.427174842570179e-08	
256	inert waste, for final disposal	kg	6.427174842570184e-08	
257	inert waste, for final disposal	kg	6.427174842570184e-08	
258	inert waste, for final disposal	kg	6.427174842570187e-08	
259	inert waste, for final disposal	kg	6.427174842570181e-08	
260	inert waste, for final disposal	kg	6.427174842570184e-08	
261	inert waste, for final disposal	kg	0.10840696138577961	
262	inert waste, for final disposal	kg	0.11030166174841922	
263	inert waste, for final disposal	kg	0.10840025898889986	
264	inert waste, for final disposal	kg	0.07505485768592263	
265	inert waste, for final disposal	kg	0.016997863847143097	
266	inert waste, for final disposal	kg	0.4064399848633788	
267	inert waste, for final disposal	kg	0.07505652537110061	
268	inert waste, for final disposal	kg	5.452067473074688e-10	
269	inert waste, for final disposal	kg	0.003969686621389739	
270	inert waste, for final disposal	kg	0.14769532609307737	
271	inert waste, for final disposal	kg	0.1417815076540157	
272	inert waste, for final disposal	kg	0.14158892926647126	
273	inert waste, for final disposal	kg	0.14158892855552538	
274	inert waste, for final disposal	kg	0.14147364738434706	
275	inert waste, for final disposal	kg	0.1415999401789171	
276	inert waste, for final disposal	kg	0.14214128476539006	
277	inert waste, for final disposal	kg	0.11141086064480965	
278	inert waste, for final disposal	kg	0.10273170644990942	
279	inert waste, for final disposal	kg	0.11141169874068621	
280	inert waste, for final disposal	kg	0.11141194709606352	
281	inert waste, for final disposal	kg	0.026950672918096674	
282	inert waste, for final disposal	kg	0.14163280027231534	
283	inert waste, for final disposal	kg	0.11141978992888744	
284	inert waste, for final disposal	kg	0.058644801396723956	
285	inert waste, for final disposal	kg	0.13545824008795007	
286	inert waste, for final disposal	kg	0.8160247193244168	
287	inert waste, for final disposal	kg	0.13033213444108083	
288	inert waste, for final disposal	kg	0.13033213444108085	
289	inert waste, for final disposal	kg	0.13033213444108088	
290	inert waste, for final disposal	kg	0.13033213444108083	
291	inert waste, for final disposal	kg	0.13033213444108085	
292	inert waste, for final disposal	kg	0.13033213444108083	
293	inert waste, for final disposal	kg	1.9257469274231036e-11	

294	inert waste, for final disposal	kg	1.9257469274231036e-11	
295	inert waste, for final disposal	kg	9.369158710093707e-06	
296	inert waste, for final disposal	kg	2.1890696187953974e-06	
297	inert waste, for final disposal	kg	1.0999832711141329e-05	
298	inert waste, for final disposal	kg	0.9808576428568241	
299	inert waste, for final disposal	kg	0.14159356702309828	
300	inert waste, for final disposal	kg	0.00037111738667085096	
301	inert waste, for final disposal	kg	0.0010119285096174058	
302	inert waste, for final disposal	kg	0.14085235052518233	
303	inert waste, for final disposal	kg	0.0027613724498293897	
304	inert waste, for final disposal	kg	0.0010119285096174056	
305	inert waste, for final disposal	kg	0.1408523505251823	
306	inert waste, for final disposal	kg	0.14126517510899209	
307	inert waste, for final disposal	kg	0.14126517510899222	
308	inert waste, for final disposal	kg	0.14126517510899209	
309	inert waste, for final disposal	kg	0.14126517510899209	
310	inert waste, for final disposal	kg	0.14126517510899214	
311	inert waste, for final disposal	kg	0.14126517510899209	
312	inert waste, for final disposal	kg	0.141265175108992	
313	inert waste, for final disposal	kg	0.14126517510899195	
314	inert waste, for final disposal	kg	0.14126517510899203	
315	inert waste, for final disposal	kg	0.9949993881922665	
316	inert waste, for final disposal	kg	0.9949993705268845	
317	inert waste, for final disposal	kg	0.9949993805105015	
318	inert waste, for final disposal	kg	0.9949993787161852	
319	inert waste, for final disposal	kg	0.9368986074488505	
320	inert waste, for final disposal	kg	0.9949993742143207	
321	inert waste, for final disposal	kg	0.9949993826105632	
322	inert waste, for final disposal	kg	0.9949993861552686	
323	inert waste, for final disposal	kg	1.3993499189939878e-07	
324	inert waste, for final disposal	kg	0.9949993749747931	
325	inert waste, for final disposal	kg	0.9949993873556966	
326	inert waste, for final disposal	kg	0.9949993848968351	
327	inert waste, for final disposal	kg	0.9949993873369118	
328	inert waste, for final disposal	kg	0.9949993841266458	
329	inert waste, for final disposal	kg	0.9949993822698627	
330	inert waste, for final disposal	kg	0.9949999932919131	
331	inert waste, for final disposal	kg	0.8669388066615763	
332	inert waste, for final disposal	kg	2.0255418794669349e-07	
333	inert waste, for final disposal	kg	1.978937893100465e-07	
334	inert waste, for final disposal	kg	1.9814448516857876e-07	
335	inert waste, for final disposal	kg	1.9820424305908245e-07	
336	inert waste, for final disposal	kg	1.0159000337084285e-07	
337	inert waste, for final disposal	kg	1.983466816540231e-07	
338	inert waste, for final disposal	kg	1.9807218345522995e-07	
339	inert waste, for final disposal	kg	1.9794380413577898e-07	
340	inert waste, for final disposal	kg	2.0706949443512888e-07	
341	inert waste, for final disposal	kg	1.983233220573725e-07	
342	inert waste, for final disposal	kg	1.9789837178102228e-07	
343	inert waste, for final disposal	kg	1.9799033613667074e-07	

344	inert waste, for final disposal	kg	1.9789908409522498e-07	
345	inert waste, for final disposal	kg	1.980182877099547e-07	
346	inert waste, for final disposal	kg	1.9808409486936533e-07	
347	inert waste, for final disposal	kg	1.9786607164974704e-07	
348	inert waste, for final disposal	kg	1.9845617068092936e-07	
349	inert waste, for final disposal	kg	0.9949999998691688	
350	inert waste, for final disposal	kg	0.9949999998730643	
351	inert waste, for final disposal	kg	0.9950000000000002	
Original	maintenance, train, passenger, long distance	unit	76909.34152064422	
Original	transport, passengers, aircraft, very short haul	person*km	0.0	shell capital service product
Original	electronics, for control units	kg	0.46779454970234513	
Original	used Ni-metal hydride battery	kg	0.14046565959620416	
Original	fish oil, from anchovy	kg	3.942837224304064e-09	
Original	transport, passenger car, small size, petrol, ...	km	0.0	shell capital service product
Original	pipeline, natural gas, long distance, low capa...	km	118213.50479064656	
Original	shed	m2	0.7268853440461337	
Original	transport, freight, lorry 7.5-16 metric ton, E...	metric ton*km	0.0	shell capital service product
Original	iceberg lettuce	kg	9.552811405641929e-11	
Original	metal working machine, unspecified	kg	0.6873363461790755	
Original	keyboard	unit	1.3023969653325183e-09	
Original	oat seed, Swiss integrated production, at farm	kg	5.755265095625092e-11	
Original	palm date	kg	1.6750719683099252e-09	
Original	used industrial electronic device	kg	8.525565887601504e-11	
Original	wood preservation, spray tunnel/deluging, orga...	kg	0.0	shell capital service product
Original	sawnwood, softwood, dried (u=20\%), planed	m3	10.058434217418707	
Original	harvesting/bundling, energy wood harvester	hour	0.0	shell capital service product
Original	refrigeration machine, R134a as refrigerant	unit	76.15594328215178	
Original	impact extrusion of steel, hot, deformation st...	kg	0.0	shell capital service product
Original	furnace, wood chips, with silo, 50kW	unit	208.21930137110866	
Original	hydrogen peroxide, without water, in 50\% solut...	kg	2.284997651481589e-09	
Original	conveyor belt	m	507.6504465968795	
Original	lightweight concrete block, polystyrene	kg	1.2961931479122742e-12	
Original	blower and heat exchange unit, KWL 250	unit	33.313482695273905	
Original	transport, freight, sea, container ship	metric ton*km	0.0	shell capital service product
Original	operation, dried roughage store, non ventilated	kg	0.0	shell capital service product
Original	roof tile	kg	0.00036721407256054875	
Original	packaging glass factory	unit	7526922.620786756	
Original	uranium, in yellowcake	kg	0.09999999929777792	
0	municipal solid waste	kg	0.09173320894224182	
1	municipal solid waste	kg	0.09173350915551517	
3	municipal solid waste	kg	1.1279652055677645e-08	
4	municipal solid waste	kg	1.1279650511079433e-08	
6	municipal solid waste	kg	9.129481425844185e-05	
7	municipal solid waste	kg	9.129481425844177e-05	
8	municipal solid waste	kg	4.6351827434167384e-05	
9	municipal solid waste	kg	4.6351843599473484e-05	
10	municipal solid waste	kg	8.06319820726005e-06	
11	municipal solid waste	kg	0.10920404677181623	
12	municipal solid waste	kg	0.10920404677181621	
19	municipal solid waste	kg	0.1098096907413084	

20	municipal solid waste	kg	0.10980969074130846	
21	municipal solid waste	kg	1.9939674433271O4e-06	
22	municipal solid waste	kg	3.2969866336391364e-07	
23	municipal solid waste	kg	9.325090817267978e-07	
24	municipal solid waste	kg	0.7710000000000002	
25	municipal solid waste	kg	0.771	
28	municipal solid waste	kg	0.7710000000000001	
29	municipal solid waste	kg	0.7710000000000001	
30	municipal solid waste	kg	0.005906145754886761	
31	municipal solid waste	kg	0.005906079134939401	
32	municipal solid waste	kg	6.058559623609998e-07	
33	municipal solid waste	kg	3.5456380373968743e-09	
34	municipal solid waste	kg	2.0739076034049387e-08	
35	municipal solid waste	kg	0.10983572534923301	
36	municipal solid waste	kg	0.10983572534920519	
37	municipal solid waste	kg	1.129923459017725e-06	
38	municipal solid waste	kg	1.129923459017725e-06	
39	municipal solid waste	kg	2.2916778249013795e-06	
40	municipal solid waste	kg	0.07710000000000002	
41	municipal solid waste	kg	4.277287636742427e-05	
42	municipal solid waste	kg	4.277287636742452e-05	
43	municipal solid waste	kg	0.770998672491223	
44	municipal solid waste	kg	0.770998672491223	
45	municipal solid waste	kg	0.003222919521032611	
46	municipal solid waste	kg	0.0032229195210326054	
47	municipal solid waste	kg	0.0021155580566540946	
48	municipal solid waste	kg	0.0021155580566540916	
49	municipal solid waste	kg	0.43478633877405853	
50	municipal solid waste	kg	0.43478633877405887	
51	municipal solid waste	kg	0.0025451712034621193	
52	municipal solid waste	kg	0.002545171203462119	
53	municipal solid waste	kg	0.00254763022465201	
54	municipal solid waste	kg	0.0025476302246520096	
55	municipal solid waste	kg	0.10976401735593187	
56	municipal solid waste	kg	0.10976401735593372	
57	municipal solid waste	kg	0.10975862660060477	
58	municipal solid waste	kg	0.10971109467909793	
59	municipal solid waste	kg	0.1098092523730351	
60	municipal solid waste	kg	1.0613378132629361e-06	
61	municipal solid waste	kg	1.0613379302450456e-06	
62	municipal solid waste	kg	1.3717693709090093e-08	
63	municipal solid waste	kg	4.544357953741567e-08	
64	municipal solid waste	kg	0.7709999943395625	
65	municipal solid waste	kg	0.0005823479540436346	
66	municipal solid waste	kg	0.0005823344450107419	
67	municipal solid waste	kg	0.030250162069438705	
68	municipal solid waste	kg	0.030195644246309737	
69	municipal solid waste	kg	2.8808137509892216e-09	
70	municipal solid waste	kg	2.8808137520392145e-09	
71	municipal solid waste	kg	0.037729158817284184	

72	municipal solid waste	kg	0.037729158817284184	
73	municipal solid waste	kg	0.10978274042969642	
74	municipal solid waste	kg	0.10978274042969641	
75	municipal solid waste	kg	0.034995908401633115	
76	municipal solid waste	kg	0.034995908401633136	
77	municipal solid waste	kg	0.10982790270581824	
78	municipal solid waste	kg	0.10982790270581824	
79	municipal solid waste	kg	1.3947382238453577e-06	
80	municipal solid waste	kg	1.3947382238453577e-06	
81	municipal solid waste	kg	0.5826677935666473	
82	municipal solid waste	kg	0.5826677935666473	
85	municipal solid waste	kg	0.10963294960118786	
86	municipal solid waste	kg	0.10963294960118786	
87	municipal solid waste	kg	2.547304696196573e-08	
88	municipal solid waste	kg	2.547304696493972e-08	
91	municipal solid waste	kg	0.6161909061160832	
92	municipal solid waste	kg	0.6161909061160832	
93	municipal solid waste	kg	0.034996626341752206	
94	municipal solid waste	kg	0.034996810523483496	
95	municipal solid waste	kg	0.20869072224066165	
96	municipal solid waste	kg	0.20869072224066165	
97	municipal solid waste	kg	1.3391792240961185e-07	
98	municipal solid waste	kg	0.00015358724713750692	
99	municipal solid waste	kg	2.5230753257860738e-08	
100	municipal solid waste	kg	1.1228672040499933e-08	
101	municipal solid waste	kg	0.24101749698783625	
102	municipal solid waste	kg	2.6421875524922965e-07	
103	municipal solid waste	kg	4.5443569827669e-08	
104	municipal solid waste	kg	1.3717693708246972e-08	
105	municipal solid waste	kg	9.325090817267978e-07	
106	municipal solid waste	kg	1.9939674433271047e-06	
107	municipal solid waste	kg	3.2969866336391374e-07	
108	municipal solid waste	kg	7.827176308630903e-07	
109	municipal solid waste	kg	3.218082919970696e-06	
110	municipal solid waste	kg	2.2916778249013795e-06	
111	municipal solid waste	kg	3.2180821319209957e-06	
112	municipal solid waste	kg	7.827168735982449e-07	
113	municipal solid waste	kg	4.76457119352432e-09	
114	municipal solid waste	kg	0.20607791099868208	
115	municipal solid waste	kg	4.9806238881618056e-08	
116	municipal solid waste	kg	1.4817935671869198e-07	
117	municipal solid waste	kg	1.7805733954119725e-07	
118	municipal solid waste	kg	0.005906079556155734	
119	municipal solid waste	kg	5.008200546724804e-08	
120	municipal solid waste	kg	0.023389887677750278	
121	municipal solid waste	kg	0.77099998538113977	
122	municipal solid waste	kg	0.77099998538113977	
123	municipal solid waste	kg	0.6161909059197352	
124	municipal solid waste	kg	0.6161909059197355	
125	municipal solid waste	kg	0.6161909059197352	

126	municipal solid waste	kg	0.6161909059197354	
127	municipal solid waste	kg	0.6161909059197354	
128	municipal solid waste	kg	0.6161909059197354	
129	municipal solid waste	kg	0.6161909059197354	
130	municipal solid waste	kg	0.6161909059197354	
131	municipal solid waste	kg	0.6161909059197354	
132	municipal solid waste	kg	0.6161909059197354	
133	municipal solid waste	kg	0.6161909059197352	
134	municipal solid waste	kg	0.6161909059197352	
135	municipal solid waste	kg	0.6161909059197352	
136	municipal solid waste	kg	0.6161909059197355	
137	municipal solid waste	kg	0.6161909059197355	
138	municipal solid waste	kg	0.6161909061160832	
139	municipal solid waste	kg	0.6161909060691473	
140	municipal solid waste	kg	0.6161909061160832	
141	municipal solid waste	kg	0.6161909060691472	
142	municipal solid waste	kg	0.6161909061160831	
143	municipal solid waste	kg	0.6161909060639559	
144	municipal solid waste	kg	0.6161909061160831	
145	municipal solid waste	kg	0.616190906063956	
146	municipal solid waste	kg	0.6161909061160831	
147	municipal solid waste	kg	0.6161909060639558	
148	municipal solid waste	kg	2.422140923884221e-07	
149	municipal solid waste	kg	2.4221409321625786e-07	
150	municipal solid waste	kg	0.10996285983454228	
151	municipal solid waste	kg	0.1099628598345416	
152	municipal solid waste	kg	0.1235262346500034	
153	municipal solid waste	kg	0.1235262346500034	
154	municipal solid waste	kg	2.840067669489332e-10	
155	municipal solid waste	kg	0.10720198003572468	
156	municipal solid waste	kg	0.1077241237697221	
157	municipal solid waste	kg	0.10772412376972225	
158	municipal solid waste	kg	2.840067669489332e-10	
159	municipal solid waste	kg	0.7709896977030033	
160	municipal solid waste	kg	2.1538806953504872e-07	
161	municipal solid waste	kg	0.05606654732629618	
162	municipal solid waste	kg	6.0642925860389095e-05	
163	municipal solid waste	kg	2.7474823520152913e-08	
164	municipal solid waste	kg	0.29200939082378624	
165	municipal solid waste	kg	0.11019121098195252	
166	municipal solid waste	kg	0.11019120899759513	
167	municipal solid waste	kg	0.7705653914388783	
168	municipal solid waste	kg	0.028223372799068624	
169	municipal solid waste	kg	0.06109142591285864	
170	municipal solid waste	kg	0.015232965301228649	
171	municipal solid waste	kg	0.0505366961850009	
172	municipal solid waste	kg	0.02598927044276478	
173	municipal solid waste	kg	0.06091910379487909	
174	municipal solid waste	kg	4.630299928605852e-09	
175	municipal solid waste	kg	0.2459683272600637	

176	municipal solid waste	kg	0.06415014741823172	
177	municipal solid waste	kg	0.06415014543389436	
178	municipal solid waste	kg	1.127965058370217e-08	
179	municipal solid waste	kg	9.129481425844187e-05	
180	municipal solid waste	kg	4.63518274341674e-05	
181	municipal solid waste	kg	4.630300017167587e-09	
182	municipal solid waste	kg	0.0059060791349394	
183	municipal solid waste	kg	1.0613379302449779e-06	
184	municipal solid waste	kg	1.799891009874278e-05	
185	municipal solid waste	kg	0.20607791099868208	
186	municipal solid waste	kg	2.8808137520392158e-09	
187	municipal solid waste	kg	0.10406187192755188	
188	municipal solid waste	kg	0.3268236985030414	
189	municipal solid waste	kg	4.277210718150011e-05	
190	municipal solid waste	kg	0.24258509372160245	
191	municipal solid waste	kg	0.24258799303280076	
192	municipal solid waste	kg	0.2145162087492719	
193	municipal solid waste	kg	0.21451620874927171	
194	municipal solid waste	kg	0.0062804453523093145	
195	municipal solid waste	kg	0.0062804453523093145	
196	municipal solid waste	kg	2.1924069443687614e-08	
197	municipal solid waste	kg	2.1923923097773245e-08	
198	municipal solid waste	kg	2.1850078601790097e-08	
199	municipal solid waste	kg	0.24258053605051727	
200	municipal solid waste	kg	0.2425851007939238	
201	municipal solid waste	kg	0.2145177754985223	
202	municipal solid waste	kg	0.21451620874926391	
203	municipal solid waste	kg	0.7705653914388814	
206	municipal solid waste	kg	4.1678500885184485e-07	
207	municipal solid waste	kg	0.09835321655756737	
208	municipal solid waste	kg	8.063372329537758e-06	
209	municipal solid waste	kg	3.3417460040292778e-09	
210	municipal solid waste	kg	3.3417460040292778e-09	
211	municipal solid waste	kg	3.894131233716205e-07	
212	municipal solid waste	kg	3.8941312336861417e-07	
213	municipal solid waste	kg	1.76642214180826e-07	
214	municipal solid waste	kg	0.20607791099868203	
215	municipal solid waste	kg	1.81454231884757e-08	
216	municipal solid waste	kg	1.814539078943647e-08	
217	municipal solid waste	kg	1.8108827467544523e-08	
218	municipal solid waste	kg	1.8108827467544533e-08	
219	municipal solid waste	kg	2.4111561787910345e-08	
220	municipal solid waste	kg	2.2323521112372858e-08	
221	municipal solid waste	kg	2.418270246145665e-08	
222	municipal solid waste	kg	2.4517794680997782e-08	
223	municipal solid waste	kg	2.4517794675745172e-08	
224	municipal solid waste	kg	2.451779468108123e-08	
225	municipal solid waste	kg	2.451779467574515e-08	
226	municipal solid waste	kg	2.4517794680997782e-08	
227	municipal solid waste	kg	2.4517794681081156e-08	

228	municipal solid waste	kg	2.451779468108123e-08	
229	municipal solid waste	kg	2.4517794681081202e-08	
230	municipal solid waste	kg	2.45177946809978e-08	
231	municipal solid waste	kg	2.451779467574513e-08	
232	municipal solid waste	kg	2.451779467574515e-08	
233	municipal solid waste	kg	2.2141641531113522e-08	
234	municipal solid waste	kg	2.455906036364233e-08	
235	municipal solid waste	kg	2.4559060368801584e-08	
236	municipal solid waste	kg	2.455906036880156e-08	
237	municipal solid waste	kg	2.2141641531113522e-08	
238	municipal solid waste	kg	2.214164153117222e-08	
239	municipal solid waste	kg	2.4311480207931507e-08	
240	municipal solid waste	kg	2.2344646801606854e-08	
241	municipal solid waste	kg	2.223259199536103e-08	
242	municipal solid waste	kg	2.2276477070658248e-08	
243	municipal solid waste	kg	2.4535579404214165e-08	
244	municipal solid waste	kg	2.387394894622908e-08	
245	municipal solid waste	kg	2.4499857854436113e-08	
246	municipal solid waste	kg	2.4616640234708954e-08	
247	municipal solid waste	kg	2.2276477070658208e-08	
248	municipal solid waste	kg	2.4376181107869637e-08	
249	municipal solid waste	kg	2.4559060368801584e-08	
250	municipal solid waste	kg	2.4438934101769265e-08	
251	municipal solid waste	kg	2.467268769805013e-08	
252	municipal solid waste	kg	2.4376181107958393e-08	
253	municipal solid waste	kg	2.4376181107958393e-08	
254	municipal solid waste	kg	2.3873948946229058e-08	
255	municipal solid waste	kg	2.4311480208022745e-08	
256	municipal solid waste	kg	2.2187664525745296e-08	
257	municipal solid waste	kg	2.4616640234708977e-08	
258	municipal solid waste	kg	2.403036138056154e-08	
259	municipal solid waste	kg	2.461664023478878e-08	
260	municipal solid waste	kg	2.4559060368801584e-08	
261	municipal solid waste	kg	2.4499857854352114e-08	
262	municipal solid waste	kg	2.4104310893566957e-08	
263	municipal solid waste	kg	2.443893409633274e-08	
264	municipal solid waste	kg	2.4616640229677105e-08	
265	municipal solid waste	kg	2.2075258708513805e-08	
266	municipal solid waste	kg	2.417560582631397e-08	
267	municipal solid waste	kg	2.4599531132298054e-08	
268	municipal solid waste	kg	1.1840370348341745e-07	
269	municipal solid waste	kg	2.4237994895682824e-08	
270	municipal solid waste	kg	2.4271670818801e-08	
271	municipal solid waste	kg	2.2136893244000967e-08	
272	municipal solid waste	kg	2.4656029298509368e-08	
273	municipal solid waste	kg	2.458218830465738e-08	
274	municipal solid waste	kg	0.7250635494074255	
275	municipal solid waste	kg	0.5056274106306107	
276	municipal solid waste	kg	2.45177946809978e-08	
277	municipal solid waste	kg	2.4311387801519173e-08	

278	municipal solid waste	kg	2.424460847583618e-08	
279	municipal solid waste	kg	2.3704625015039324e-08	
280	municipal solid waste	kg	2.4369800731419447e-08	
281	municipal solid waste	kg	2.4576406967846055e-08	
282	municipal solid waste	kg	1.999589131904616e-08	
283	municipal solid waste	kg	2.215093645921388e-08	
284	municipal solid waste	kg	2.2160269333456183e-08	
285	municipal solid waste	kg	2.4445013986336776e-08	
286	municipal solid waste	kg	2.4650447143823722e-08	
287	municipal solid waste	kg	2.39692229353026e-08	
288	municipal solid waste	kg	1.988308880222139e-08	
289	municipal solid waste	kg	0.11121210572600347	
290	municipal solid waste	kg	8.62191363478708e-09	
291	municipal solid waste	kg	2.45177946809978e-08	
292	municipal solid waste	kg	1.1855339076324858e-08	
293	municipal solid waste	kg	1.1855536771147902e-08	
294	municipal solid waste	kg	0.3733599458049327	
295	municipal solid waste	kg	8.06319820725921e-06	
296	municipal solid waste	kg	0.7710000000000002	
297	municipal solid waste	kg	0.771	
308	municipal solid waste	kg	2.456488982337712e-08	
309	municipal solid waste	kg	0.3733599458049271	
310	municipal solid waste	kg	0.770953177982161	
311	municipal solid waste	kg	2.2714853566123806e-09	
312	municipal solid waste	kg	3.621234005587068e-09	
313	municipal solid waste	kg	3.621234005587068e-09	
314	municipal solid waste	kg	0.10946875872533063	
315	municipal solid waste	kg	0.10946875872533016	
316	municipal solid waste	kg	0.10720198003572468	
317	municipal solid waste	kg	2.2335617289752817e-07	
318	municipal solid waste	kg	4.789548221547669e-09	
319	municipal solid waste	kg	0.7709999994339044	
320	municipal solid waste	kg	6.058559623572067e-07	
321	municipal solid waste	kg	3.5456380373919365e-09	
322	municipal solid waste	kg	2.0739076034049387e-08	
323	municipal solid waste	kg	0.7709531779821703	
324	municipal solid waste	kg	0.7709999815786285	
325	municipal solid waste	kg	0.3467567802092005	
326	municipal solid waste	kg	1.7345301661077568e-08	
327	municipal solid waste	kg	0.7709996965648666	
328	municipal solid waste	kg	0.2516675014417705	
329	municipal solid waste	kg	5.0861881006532074e-08	
330	municipal solid waste	kg	0.6732673701591128	
331	municipal solid waste	kg	0.21976601667276535	
332	municipal solid waste	kg	0.1957226944215173	
333	municipal solid waste	kg	2.236626139430474e-09	
334	municipal solid waste	kg	2.2714853566123806e-09	
335	municipal solid waste	kg	2.4517794680997776e-08	
336	municipal solid waste	kg	0.050273655428332835	
337	municipal solid waste	kg	0.05027365542833026	

338	municipal solid waste	kg	1.8947580971155647e-08	
339	municipal solid waste	kg	1.1841211922024777e-07	
340	municipal solid waste	kg	8.271521429382969e-08	
341	municipal solid waste	kg	1.8239557725960408e-08	
342	municipal solid waste	kg	1.846960229990874e-08	
343	municipal solid waste	kg	1.7996048604056262e-08	
344	municipal solid waste	kg	1.969482365678305e-08	
345	municipal solid waste	kg	1.9428552752068498e-08	
346	municipal solid waste	kg	1.9555809444635733e-08	
347	municipal solid waste	kg	1.9154752508777267e-08	
348	municipal solid waste	kg	1.9249702283470082e-08	
349	municipal solid waste	kg	1.9205455758892398e-08	
350	municipal solid waste	kg	1.9428495515120208e-08	
351	municipal solid waste	kg	1.877146867473498e-08	
352	municipal solid waste	kg	1.933905452905467e-08	
353	municipal solid waste	kg	8.283604958654675e-08	
354	municipal solid waste	kg	1.894758097117039e-08	
355	municipal solid waste	kg	2.052231124478854e-08	
356	municipal solid waste	kg	2.0631248313124527e-08	
357	municipal solid waste	kg	2.040592258029635e-08	
358	municipal solid waste	kg	2.2323605444574988e-08	
359	municipal solid waste	kg	2.2323605441186377e-08	
360	municipal solid waste	kg	1.894758097117039e-08	
361	municipal solid waste	kg	1.89475809711704e-08	
362	municipal solid waste	kg	1.8947580971155647e-08	
363	municipal solid waste	kg	2.2141641531113522e-08	
364	municipal solid waste	kg	0.13798309438699882	
365	municipal solid waste	kg	0.13798309438699874	
366	municipal solid waste	kg	9.221411654012037e-07	
367	municipal solid waste	kg	9.221411654012037e-07	
368	municipal solid waste	kg	8.649694613633688e-09	
369	municipal solid waste	kg	8.649694613633688e-09	
370	municipal solid waste	kg	8.649694613633688e-09	
371	municipal solid waste	kg	3.4513365019973847e-06	
372	municipal solid waste	kg	3.4513365019973847e-06	
373	municipal solid waste	kg	1.1882854241449305e-05	
374	municipal solid waste	kg	1.1882854241449305e-05	
375	municipal solid waste	kg	3.0562733892389846e-06	
376	municipal solid waste	kg	3.0562733892389846e-06	
377	municipal solid waste	kg	0.00016146948408305467	
378	municipal solid waste	kg	0.00016146948408305467	
379	municipal solid waste	kg	0.08044942080848276	
380	municipal solid waste	kg	0.0804494208084827	
381	municipal solid waste	kg	2.1698995773210736e-05	
382	municipal solid waste	kg	2.1698995773210736e-05	
383	municipal solid waste	kg	2.1698995773210736e-05	
384	municipal solid waste	kg	0.12351523624789788	
385	municipal solid waste	kg	0.00014678916638309595	
386	municipal solid waste	kg	0.00014678916638309597	
387	municipal solid waste	kg	0.12351523624789786	

388	municipal solid waste	kg	0.000637123119624746	
389	municipal solid waste	kg	0.0007216123546896545	
390	municipal solid waste	kg	0.0010798523047143484	
391	municipal solid waste	kg	8.749963315943402e-10	
392	municipal solid waste	kg	8.74996331445216e-10	
393	municipal solid waste	kg	3.534408076794765e-06	
394	municipal solid waste	kg	6.426396555260356e-05	
395	municipal solid waste	kg	2.3733907192006854e-05	
396	municipal solid waste	kg	4.746456790016982e-06	
399	municipal solid waste	kg	0.0007010403342164	
400	municipal solid waste	kg	5.250984210781802e-08	
401	municipal solid waste	kg	4.74645679001698e-06	
402	municipal solid waste	kg	0.0005200713597699889	
403	municipal solid waste	kg	0.022814887208939084	
404	municipal solid waste	kg	0.02281488383413306	
405	municipal solid waste	kg	0.022850063028845576	
406	municipal solid waste	kg	6.347401228332897e-05	
407	municipal solid waste	kg	6.148382432064119e-10	
408	municipal solid waste	kg	0.10544655018960492	
409	municipal solid waste	kg	2.3321560727040896e-05	
410	municipal solid waste	kg	0.0005178608973192713	
411	municipal solid waste	kg	0.059276174217778255	
412	municipal solid waste	kg	2.3321560894879085e-05	
413	municipal solid waste	kg	0.001219313744044328	
414	municipal solid waste	kg	2.332156072701064e-05	
417	municipal solid waste	kg	1.7118552050474666e-08	
418	municipal solid waste	kg	1.7118552050474666e-08	
419	municipal solid waste	kg	1.7118552050474666e-08	
420	municipal solid waste	kg	1.7118552050474666e-08	
421	municipal solid waste	kg	1.7118552050474666e-08	
422	municipal solid waste	kg	1.7118552050474666e-08	
423	municipal solid waste	kg	1.7118552050474672e-08	
424	municipal solid waste	kg	1.7118552050474666e-08	
425	municipal solid waste	kg	1.7118552050474656e-08	
426	municipal solid waste	kg	1.7118552050474666e-08	
427	municipal solid waste	kg	1.7118552050474666e-08	
428	municipal solid waste	kg	1.7118552050474666e-08	
429	municipal solid waste	kg	1.7118552050474672e-08	
430	municipal solid waste	kg	1.7118552050474666e-08	
431	municipal solid waste	kg	1.7118552050474666e-08	
432	municipal solid waste	kg	1.7118552050474666e-08	
433	municipal solid waste	kg	1.7118552050474666e-08	
434	municipal solid waste	kg	1.7118552050474656e-08	
435	municipal solid waste	kg	1.7118552050474666e-08	
436	municipal solid waste	kg	2.3401648625504172e-08	
437	municipal solid waste	kg	2.3401648625504163e-08	
438	municipal solid waste	kg	2.3401648625504172e-08	
439	municipal solid waste	kg	2.3401648625504172e-08	
440	municipal solid waste	kg	2.3401648625504172e-08	
441	municipal solid waste	kg	2.3401648625504172e-08	

442	municipal solid waste	kg	2.3401648625504163e-08	
443	municipal solid waste	kg	2.3401648625504163e-08	
444	municipal solid waste	kg	2.3401648625504172e-08	
445	municipal solid waste	kg	2.3401648625504172e-08	
446	municipal solid waste	kg	2.3401648625504172e-08	
447	municipal solid waste	kg	2.3401648625504172e-08	
448	municipal solid waste	kg	2.340164862550415e-08	
449	municipal solid waste	kg	2.3401648625504163e-08	
450	municipal solid waste	kg	2.3401648625504172e-08	
451	municipal solid waste	kg	2.3401648625504163e-08	
452	municipal solid waste	kg	2.3401648625504172e-08	
453	municipal solid waste	kg	2.340164862550415e-08	
454	municipal solid waste	kg	2.3401648625504172e-08	
455	municipal solid waste	kg	2.3401648625504172e-08	
456	municipal solid waste	kg	2.340164862550415e-08	
457	municipal solid waste	kg	2.340164862550415e-08	
458	municipal solid waste	kg	2.340164862550415e-08	
459	municipal solid waste	kg	2.3401648625504172e-08	
460	municipal solid waste	kg	2.340164862550415e-08	
461	municipal solid waste	kg	2.3401648625504186e-08	
462	municipal solid waste	kg	2.340164862550415e-08	
463	municipal solid waste	kg	2.3401648625504163e-08	
464	municipal solid waste	kg	2.340164862550415e-08	
465	municipal solid waste	kg	2.3401648625504163e-08	
466	municipal solid waste	kg	2.3401648625504172e-08	
467	municipal solid waste	kg	2.340164862550415e-08	
468	municipal solid waste	kg	2.3401648625504172e-08	
469	municipal solid waste	kg	2.340164862550415e-08	
470	municipal solid waste	kg	2.340164862550415e-08	
471	municipal solid waste	kg	2.340164862550415e-08	
472	municipal solid waste	kg	2.3401648625504163e-08	
473	municipal solid waste	kg	2.340164862550415e-08	
474	municipal solid waste	kg	2.340164862550415e-08	
475	municipal solid waste	kg	2.3401648625504163e-08	
476	municipal solid waste	kg	2.3401648625504172e-08	
477	municipal solid waste	kg	2.3401648625504163e-08	
478	municipal solid waste	kg	2.340164862550415e-08	
479	municipal solid waste	kg	2.3401648625504186e-08	
480	municipal solid waste	kg	2.3401648625504163e-08	
481	municipal solid waste	kg	2.3401648625504172e-08	
482	municipal solid waste	kg	2.3401648625504172e-08	
483	municipal solid waste	kg	2.3401648625504163e-08	
484	municipal solid waste	kg	2.340164862550415e-08	
485	municipal solid waste	kg	2.340164862550415e-08	
486	municipal solid waste	kg	2.3401648625504172e-08	
487	municipal solid waste	kg	2.3401648625504172e-08	
488	municipal solid waste	kg	2.3401648625504172e-08	
489	municipal solid waste	kg	2.3401648625504172e-08	
490	municipal solid waste	kg	2.3401648625504172e-08	
491	municipal solid waste	kg	2.720262394792783e-08	

492	municipal solid waste	kg	2.720262394792782e-08	
493	municipal solid waste	kg	2.256933030657147e-08	
494	municipal solid waste	kg	0.10696412623561419	
495	municipal solid waste	kg	1.4005461754466264e-08	
496	municipal solid waste	kg	4.99947133990169e-10	
497	municipal solid waste	kg	2.4231082787705208e-08	
498	municipal solid waste	kg	2.4779702146809943e-08	
499	municipal solid waste	kg	0.7709998985678697	
500	municipal solid waste	kg	0.7709998985678779	
501	municipal solid waste	kg	2.22567157467658e-08	
502	municipal solid waste	kg	2.22567157467658e-08	
503	municipal solid waste	kg	2.22567157467658e-08	
504	municipal solid waste	kg	2.225671574676586e-08	
505	municipal solid waste	kg	2.22567157467658e-08	
506	municipal solid waste	kg	0.7709999760948009	
507	municipal solid waste	kg	0.7709999188039256	
508	municipal solid waste	kg	1.9006498142321316e-08	
509	municipal solid waste	kg	3.955397985549899e-08	
510	municipal solid waste	kg	3.6052655332028005e-07	
511	municipal solid waste	kg	0.00014930618065523148	
512	municipal solid waste	kg	4.0572800753497086e-07	
513	municipal solid waste	kg	4.42789970196605e-05	
514	municipal solid waste	kg	4.72206071767072e-07	
515	municipal solid waste	kg	1.106138258053269e-05	
516	municipal solid waste	kg	4.267079777341748e-05	
517	municipal solid waste	kg	0.7709999791615622	
518	municipal solid waste	kg	0.3512933581237407	
519	municipal solid waste	kg	0.03825384846716723	
520	municipal solid waste	kg	0.19181829414115578	
521	municipal solid waste	kg	0.5666342048787185	
522	municipal solid waste	kg	0.7709999271061172	
523	municipal solid waste	kg	0.013292985484750552	
524	municipal solid waste	kg	0.7304533595726747	
525	municipal solid waste	kg	0.015427032008905047	
526	municipal solid waste	kg	0.15502985674872916	
527	municipal solid waste	kg	0.023389887677750278	
528	municipal solid waste	kg	3.6332546814019274e-09	
529	municipal solid waste	kg	0.03825384846716724	
530	municipal solid waste	kg	0.19181829414115578	
531	municipal solid waste	kg	3.633254685307853e-09	
532	municipal solid waste	kg	8.38690118012809e-09	
533	municipal solid waste	kg	8.38690117987848e-09	
534	municipal solid waste	kg	0.1424376537722152	
535	municipal solid waste	kg	0.14243687608463404	
536	municipal solid waste	kg	0.5666334015377159	
537	municipal solid waste	kg	0.013292985484750552	
538	municipal solid waste	kg	0.7304481499210893	
539	municipal solid waste	kg	0.15502985674872907	
540	municipal solid waste	kg	0.01864078628436416	
541	municipal solid waste	kg	0.018640786284364164	

542	municipal solid waste	kg	0.00012461271805055206	
543	municipal solid waste	kg	0.016439336208073998	
544	municipal solid waste	kg	0.019310848992443726	
545	municipal solid waste	kg	0.013445893965472168	
546	municipal solid waste	kg	0.019310848992443726	
547	municipal solid waste	kg	0.00045992791102606557	
548	municipal solid waste	kg	0.0015379934947767472	
549	municipal solid waste	kg	0.015426313630486794	
550	municipal solid waste	kg	0.7709999313728306	
551	municipal solid waste	kg	0.014739804118933013	
552	municipal solid waste	kg	0.014739804118933006	
553	municipal solid waste	kg	0.014739804118933015	
554	municipal solid waste	kg	0.016228941509606486	
555	municipal solid waste	kg	1.1838995326368606e-07	
556	municipal solid waste	kg	2.4499950918688697e-08	
557	municipal solid waste	kg	1.183985617229363e-07	
558	municipal solid waste	kg	4.2019777546025837e-07	
559	municipal solid waste	kg	1.1838842076284932e-07	
560	municipal solid waste	kg	2.43634932756836e-08	
561	municipal solid waste	kg	2.9777857124542385e-08	
562	municipal solid waste	kg	1.1842518167706123e-07	
563	municipal solid waste	kg	1.1839840828726934e-07	
564	municipal solid waste	kg	1.1839670214663252e-07	
565	municipal solid waste	kg	1.1839670518323807e-07	
566	municipal solid waste	kg	1.1839060477487618e-07	
567	municipal solid waste	kg	1.1853068716349656e-07	
568	municipal solid waste	kg	2.4376273674100435e-08	
569	municipal solid waste	kg	1.1839461167459835e-07	
570	municipal solid waste	kg	1.9335480874452977e-08	
571	municipal solid waste	kg	1.9335480874579675e-08	
572	municipal solid waste	kg	1.1839462461654617e-07	
573	municipal solid waste	kg	2.430499034049538e-08	
574	municipal solid waste	kg	1.1840244105374226e-07	
575	municipal solid waste	kg	1.1842198620488168e-07	
576	municipal solid waste	kg	2.2060806620879762e-08	
577	municipal solid waste	kg	1.1840082349957111e-07	
578	municipal solid waste	kg	1.1838412363094499e-07	
579	municipal solid waste	kg	4.2028166389802073e-07	
580	municipal solid waste	kg	2.4075140662256082e-08	
581	municipal solid waste	kg	1.1841882249525565e-07	
582	municipal solid waste	kg	1.1842521284250322e-07	
583	municipal solid waste	kg	4.1943495900745276e-07	
584	municipal solid waste	kg	1.6400353634729987e-08	
585	municipal solid waste	kg	1.1842591942216686e-07	
586	municipal solid waste	kg	1.184259839875767e-07	
587	municipal solid waste	kg	1.184117734896376e-07	
588	municipal solid waste	kg	1.1841105306246179e-07	
589	municipal solid waste	kg	1.1983476703233108e-07	
590	municipal solid waste	kg	1.1841402734621853e-07	
591	municipal solid waste	kg	1.8268957920382992e-08	

592	municipal solid waste	kg	1.9849951255395564e-08	
593	municipal solid waste	kg	1.8268957920383002e-08	
594	municipal solid waste	kg	1.1841021608657369e-07	
595	municipal solid waste	kg	1.184213858631834e-07	
596	municipal solid waste	kg	1.1840865710223273e-07	
597	municipal solid waste	kg	1.1842329581442011e-07	
598	municipal solid waste	kg	1.1843133623141837e-07	
599	municipal solid waste	kg	4.1943576367218574e-07	
600	municipal solid waste	kg	1.865763200775705e-08	
601	municipal solid waste	kg	0.2774412327776717	
602	municipal solid waste	kg	1.1840090339746181e-07	
603	municipal solid waste	kg	1.1839346795903167e-07	
604	municipal solid waste	kg	0.0466651486462429	
605	municipal solid waste	kg	0.04666514864624284	
606	municipal solid waste	kg	0.7709999790054375	
607	municipal solid waste	kg	0.35129335812374074	
608	municipal solid waste	kg	0.7709999845598251	
609	municipal solid waste	kg	0.7709999684969499	
610	municipal solid waste	kg	0.5668766804809062	
611	municipal solid waste	kg	0.7709999313728308	
612	municipal solid waste	kg	0.04666514864624291	
613	municipal solid waste	kg	0.08694167481050774	
614	municipal solid waste	kg	1.164760125892927e-07	
615	municipal solid waste	kg	3.7881027056249764e-09	
616	municipal solid waste	kg	0.08694162876510637	
617	municipal solid waste	kg	1.164760125892927e-07	
618	municipal solid waste	kg	3.7881027056249764e-09	
619	municipal solid waste	kg	0.7709986724912227	
620	municipal solid waste	kg	0.7305235997440118	
621	municipal solid waste	kg	0.7305235997440132	
622	municipal solid waste	kg	0.051167334930913494	
623	municipal solid waste	kg	0.0008380456283162237	
624	municipal solid waste	kg	0.002848974194420204	
625	municipal solid waste	kg	0.0028489765144773657	
626	municipal solid waste	kg	0.0351798072671711	
627	municipal solid waste	kg	0.03517981328355612	
628	municipal solid waste	kg	6.855291701885729e-10	
629	municipal solid waste	kg	0.7709999949585912	
630	municipal solid waste	kg	0.10696412623561419	
631	municipal solid waste	kg	0.7709090388227102	
632	municipal solid waste	kg	0.7709999958457161	
633	municipal solid waste	kg	6.24340483525912e-05	
634	municipal solid waste	kg	3.206299447380393e-09	
635	municipal solid waste	kg	3.206299447380393e-09	
636	municipal solid waste	kg	1.0626666646999362e-09	
637	municipal solid waste	kg	1.0626666646999362e-09	
638	municipal solid waste	kg	1.0626666646999362e-09	
639	municipal solid waste	kg	1.0626666646999362e-09	
640	municipal solid waste	kg	1.0626666646999362e-09	
641	municipal solid waste	kg	1.0626666646999362e-09	

642	municipal solid waste	kg	1.0626666646999362e-09	
643	municipal solid waste	kg	1.0626666646999362e-09	
644	municipal solid waste	kg	1.0626666646999362e-09	
645	municipal solid waste	kg	1.0626666646999362e-09	
646	municipal solid waste	kg	1.0626666646999362e-09	
647	municipal solid waste	kg	1.0626666646999362e-09	
648	municipal solid waste	kg	1.0626666646999362e-09	
649	municipal solid waste	kg	1.0626666646999362e-09	
650	municipal solid waste	kg	1.0626666646999362e-09	
651	municipal solid waste	kg	0.016944707593695197	
652	municipal solid waste	kg	0.01694360678249657	
653	municipal solid waste	kg	0.0022665472873441873	
654	municipal solid waste	kg	0.03723014855930723	
655	municipal solid waste	kg	0.03723014855930723	
656	municipal solid waste	kg	0.007010654231944497	
657	municipal solid waste	kg	0.0070106542319444964	
658	municipal solid waste	kg	0.04035467373558718	
659	municipal solid waste	kg	0.19572269442152168	
660	municipal solid waste	kg	2.236626139430474e-09	
661	municipal solid waste	kg	0.7250635494074256	
662	municipal solid waste	kg	0.5056274106306107	
663	municipal solid waste	kg	5.086188103823029e-08	
664	municipal solid waste	kg	0.6732673701591122	
665	municipal solid waste	kg	0.2197660166735801	
666	municipal solid waste	kg	0.7709999815786285	
667	municipal solid waste	kg	0.3467567802104536	
668	municipal solid waste	kg	1.7345298820627324e-08	
669	municipal solid waste	kg	0.7709996965648663	
670	municipal solid waste	kg	0.2516675014417706	
671	municipal solid waste	kg	0.013460328373224662	
672	municipal solid waste	kg	0.06435456445961645	
673	municipal solid waste	kg	8.618227376564999e-07	
674	municipal solid waste	kg	1.7664221418082614e-07	
675	municipal solid waste	kg	1.481793566659381e-07	
676	municipal solid waste	kg	1.780573395411973e-07	
677	municipal solid waste	kg	0.05116739049044078	
678	municipal solid waste	kg	8.621913887518324e-09	
679	municipal solid waste	kg	0.09835321655756735	
681	municipal solid waste	kg	0.1098168539704281	
682	municipal solid waste	kg	0.07709999999999997	
683	municipal solid waste	kg	5.875259007479199e-09	
684	municipal solid waste	kg	0.7710000000000001	
685	municipal solid waste	kg	0.10964716011227602	
686	municipal solid waste	kg	9.87131234776694e-07	
687	municipal solid waste	kg	0.10964716011227342	
688	municipal solid waste	kg	9.871312394566348e-07	
689	municipal solid waste	kg	1.0626666646999362e-09	
690	municipal solid waste	kg	0.05849834447992444	
691	municipal solid waste	kg	0.022823029981644122	
692	municipal solid waste	kg	0.10980925237303127	

693	municipal solid waste	kg	1.6978804014218873e-05	
694	municipal solid waste	kg	0.07709999999999999	
695	municipal solid waste	kg	1.1042285985926403e-08	
696	municipal solid waste	kg	4.447503424091412e-10	
697	municipal solid waste	kg	1.1042285985926403e-08	
Original	barley grain, feed, Swiss integrated production	kg	3.5081267672609807e-09	
Original	printed wiring board, for surface mounting, Pb...	m2	0.3788091983059701	
Original	zinc slag	kg	0.01838618871334297	
Original	used light commercial vehicle	unit	546.8141388840274	
Original	furnace, logs, softwood storage area, 30kW	unit	470.00311296821644	
Original	blast furnace	unit	1027225.6665475506	
Original	diesel	kg	1.0371833199211497e-11	
Original	field leveling, sugarcane	ha	0.0	shell capital service product
Original	mine infrastructure, open cast, peat	unit	13757412.855378905	
0	non-sulfidic tailing, off-site	kg	2.3881433206592430e-08	
1	non-sulfidic tailing, off-site	kg	1.9461008266953813e-08	
2	non-sulfidic tailing, off-site	kg	0.0005787852412293465	
3	non-sulfidic tailing, off-site	kg	0.00045741166810643786	
4	non-sulfidic tailing, off-site	kg	0.7000000000000001	
5	non-sulfidic tailing, off-site	kg	0.7000000000000001	
6	non-sulfidic tailing, off-site	kg	0.7000000000000001	
7	non-sulfidic tailing, off-site	kg	0.7	
8	non-sulfidic tailing, off-site	kg	3.7956007538501310e-05	
Original	rye seed, for sowing	kg	2.985589831692547e-05	
Original	water storage	unit	33851.304986001065	
Original	nuclear fuel element, for pressure water react...	kg	0.5675300524081871	
Original	fibre cement facing tile, small format	kg	0.0007964216648583923	
Original	petrol, 85\% ethanol by volume from biomass	kg	5.406049363079096e-05	
Original	natural stone plate, grounded	kg	3.010269939595186e-05	
Original	sheep for slaughtering, live weight	kg	0.002246932697990781	
Original	operation, dried roughage store, cold-air drie...	kg	0.0	shell capital service product
Original	refrigeration machine, carbon dioxide, liquid ...	unit	76.16513539913605	
Original	cement, pozzolana and fly ash 5-15\%	kg	0.00011000000122344847	
Original	sweet sorghum stem	kg	4.004745900127547e-06	
Original	rye seed, organic, for sowing	kg	1.4657113686069261e-09	
Original	aluminium electrolysis facility	unit	1389606.481891481	
Original	steel removed by turning, average, conventional	kg	0.999999999901963	
Original	collector field area, solar tower power plant,...	unit	838211.8899718917	
Original	printed wiring board, through-hole mounted, un...	kg	0.02004474084972269	
Original	cement, blast furnace slag 5-25\%	kg	0.00011000003011192465	
Original	basalt	kg	6.708254938798853e-12	
Original	building, budget hotel	unit	1.7583977504899953e-06	
Original	steel removed by milling, dressing	kg	0.999999999894069	
Original	sawnwood, lath, softwood, raw, dried (u=10\%)	m3	3.3092506668318806e-06	
Original	bark	kg	9.849907428312898e-12	
Original	red meat, live weight	kg	0.0014986025190213026	
Original	transport, freight, lorry with refrigeration m...	metric ton*km	0.0	shell capital service product
Original	base plaster	kg	6.936847132614299e-11	
Original	operation, computer, laptop, 68\% active work w...	hour	0.0	shell capital service product
0	hydropower plant, run-of-river	unit	419333440.3783873	

1	hydropower plant, run-of-river	unit	419333440.3783873	
2	hydropower plant, run-of-river	unit	399135192.0824222	
3	hydropower plant, run-of-river	unit	1097406474.2842145	
Original	wood preservation, dipping/immersion method, o...	kg	0.0	shell capital service product
Original	waste packaging glass, unsorted	kg	0.17452455249883986	
Original	wind turbine, 750kW, onshore	unit	28564.60901287358	
Original	chicken for slaughtering, live weight	kg	6.316386321839419e-05	
Original	wastewater from textile production	m3	0.013729288693903396	
Original	carrot seed, Swiss integrated production, at farm	kg	6.830085568755006e-09	
Original	wooden board factory, organic bonded boards	unit	13845821.21820869	
Original	nuclear waste storage, interim, for high level...	unit	744244.9367039752	
Original	photovoltaic laminate, ribbon-Si	m2	6.339816710581877e-05	
Original	furnace, wood chips, average storage area, 300kW	unit	2361.27495852436	
Original	dryer	unit	11.490604736611058	
Original	manual dismantling of used passenger car with ...	unit	0.0	shell capital service product
Original	shale brick	kg	4.019099274172585e-05	
Original	wood preservation, dipping/immersion method, o...	kg	0.0	shell capital service product
Original	glider, for electric scooter	kg	0.06459889768727264	
Original	tillage, harrowing, by offset disk harrow	ha	0.0	shell capital service product
Original	transport, freight, lorry with refrigeration m...	metric ton*km	0.0	shell capital service product
Original	impact extrusion of steel, hot, 5 strokes	kg	0.0	shell capital service product
Original	cumene	kg	3.945233889387274e-09	
Original	vegetable oil esterification facility	unit	491999.9999517738	
Original	power saw, with catalytic converter	unit	0.0	No mass because all eol flows included - servi...
Original	cement, limestone 6-10\%	kg	1.222910946382727e-13	
Original	collector field area, solar thermal parabolic ...	unit	1655991.10556854	
Original	pipeline, natural gas, long distance, high cap...	km	437035.2371062474	
Original	potato, Swiss integrated production	kg	3.8760200680447305e-11	
Original	heat and power co-generation unit, organic Ran...	unit	0.0	No mass because all eol flows included - servi...
Original	scrap preparation facility	unit	9298.002086954964	
Original	peach	kg	2.258237939042438e-11	
Original	heat pump, brine-water, 10kW	unit	76.2914574827698	
Original	battery cell, Li-ion	kg	1.9850129097823085e-11	
Original	sawnwood, beam, hardwood, dried (u=20\%), planed	m3	8.223804522994778e-08	
Original	fishmeal, 63-65\% protein	kg	1.6435776521442278e-09	
Original	tillage, ploughing	ha	0.0	shell capital service product
Original	nuclear fuel factory	unit	9639577.159231445	
Original	rye grain, feed, Swiss integrated production	kg	4.8192792902928016e-08	
Original	cast iron removed by drilling, computer numeri...	kg	1.0	
Original	cement, pozzolana and fly ash 15-50\%	kg	0.0008191073243448704	
Original	wood preservation facility, flow coating equip...	unit	140.8422206236262	
Original	ferry	unit	0.0447041018022916	
Original	laser machining, metal, with YAG-laser, 50W power	hour	0.0	shell capital service product
Original	agricultural trailer	kg	0.8063717740051592	
Original	passenger car maintenance	unit	7.647176690662628	
Original	transport, freight, aircraft, long haul	metric ton*km	0.0	shell capital service product
Original	transport, freight, lorry with refrigeration m...	metric ton*km	0.0	shell capital service product
Original	lithium brine, 6.7 \% Li	kg	4.424030735718701e-12	
Original	anaerobic digestion plant, agriculture, with m...	unit	6114.850768424678	
Original	transport, freight, lorry with refrigeration m...	metric ton*km	0.0	shell capital service product

Original	photovoltaic cell factory	unit	4.5951611459629877e-07	
Original	blower and heat exchange unit, Twl-700	unit	91.84286206539261	
Original	transistor, surface-mounted	kg	0.060320000013129704	
Original	cork slab	kg	3.694499354955701e-09	
Original	inductor, auxilliaries and energy use	kg	1.617364257290445e-08	
0	waste electric and electronic equipment	kg	0.49821494464334865	
1	waste electric and electronic equipment	kg	0.28653850767552347	
2	waste electric and electronic equipment	kg	9.267950923804543e-10	
3	waste electric and electronic equipment	kg	0.4962966286189877	
4	waste electric and electronic equipment	kg	0.4963602881169616	
5	waste electric and electronic equipment	kg	0.4963603012270192	
6	waste electric and electronic equipment	kg	0.4965664391761666	
7	waste electric and electronic equipment	kg	0.5114770214933905	
8	waste electric and electronic equipment	kg	0.49837718318106106	
9	waste electric and electronic equipment	kg	0.49896951850211385	
10	waste electric and electronic equipment	kg	0.4991250446177286	
11	waste electric and electronic equipment	kg	0.4997354795798059	
12	waste electric and electronic equipment	kg	0.4983187490162499	
13	waste electric and electronic equipment	kg	0.4954929385214957	
14	waste electric and electronic equipment	kg	0.4989538758484367	
15	waste electric and electronic equipment	kg	0.4986448295392608	
16	waste electric and electronic equipment	kg	0.49956809001156255	
17	waste electric and electronic equipment	kg	0.4987551757275455	
18	waste electric and electronic equipment	kg	0.4964050433001185	
19	waste electric and electronic equipment	kg	0.4948046046869724	
20	waste electric and electronic equipment	kg	0.49793751091969635	
21	waste electric and electronic equipment	kg	0.4985597698429726	
22	waste electric and electronic equipment	kg	0.49458398012199645	
Original	tomato, fresh grade	kg	8.304530499827877e-08	
Original	process-specific burdens, inert material landfill	kg	0.0	shell capital service product
Original	road	m*year	0.02022682865512567	
Original	coffee maker	unit	0.042846401485887406	
0	sewer grid, 4.7E10l/year, 583 km	km	58992.08318334189	
1	sewer grid, 4.7E10l/year, 583 km	km	58998.705651697644	
Original	impact extrusion of aluminium, 5 strokes	kg	0.0	shell capital service product
Original	palm date, conditioned and dried	kg	2.1210295023671505e-09	
Original	intermodal shipping container, 20-foot	unit	1808.260017136685	
Original	impact extrusion of steel, warm, deformation s...	kg	0.0	shell capital service product
Original	wastewater from hard fibreboard production	m3	0.00013581487863734447	
Original	transport, passenger coach	person*km	0.0	shell capital service product
Original	water pump operation, diesel	MJ	2.3637862161445164e-12	
Original	transport, pipeline, offshore, long distance, ...	metric ton*km	0.0	shell capital service product
Original	soil, contaminated	kg	5.813492224887224e-10	
Original	rape meal	kg	0.0006412503149003234	
Original	waste cement in concrete and mortar	kg	0.04499999999822606	
Original	concrete roof tile	kg	0.0032136331501480073	
Original	anode factory	unit	9.142795104805038e-07	
Original	display, liquid crystal, 17 inches	unit	0.31357827521474974	
Original	passenger car, diesel	kg	0.09836973508991834	
Original	gravel, crushed	kg	2.367288208404268e-05	

Original	used printed wiring boards	kg	1.4897450742782889e-08	
Original	cement, limestone 21-35\%	kg	2.6375498216252304e-12	
Original	diode, glass-, for surface-mounting	kg	2.1402726802525417e-05	
Original	fishmeal plant	unit	3.129282672382515e-11	
Original	oat grain	kg	3.898843687127858e-05	
Original	impact extrusion of steel, cold, 2 strokes	kg	0.0	shell capital service product
Original	mine infrastructure, open cast, uranium	unit	3378000.196009088	
Original	containerboard, linerboard	kg	8.033399773197995e-05	
Original	spoil from lignite mining	kg	8.344845595017936e-09	
Original	chromium steel pipe	kg	0.9999999919733142	
Original	copper cake	kg	2.640472361790714e-10	
Original	waste emulsion paint, separated	kg	0.133034163834961	
Original	dust collector, electrostatic precipitator, fo...	unit	209.39370383169165	
Original	transport, freight, lorry >32 metric ton, EURO2	metric ton*km	0.0	shell capital service product
Original	lignite dust factory	unit	5563524.496535523	
Original	transport, trolleybus	person*km	0.0	shell capital service product
0	inert waste	kg	0.9998843519200719	
1	inert waste	kg	4.672114572917435e-06	
2	inert waste	kg	6.4740029282432406e-06	
3	inert waste	kg	6.474002950355114e-06	
4	inert waste	kg	0.14245269604120667	
5	inert waste	kg	0.14245269604120664	
8	inert waste	kg	0.12249948179200211	
10	inert waste	kg	0.12249948179200211	
12	inert waste	kg	0.9999999984092204	
13	inert waste	kg	1.0145549033060476e-06	
14	inert waste	kg	5.809837755683777e-09	
15	inert waste	kg	1.0145549033055402e-06	
16	inert waste	kg	0.9999999984107792	
17	inert waste	kg	5.8098377555942175e-09	
18	inert waste	kg	0.1429528899573604	
19	inert waste	kg	0.14295288995736027	
20	inert waste	kg	0.9998843519200714	
22	inert waste	kg	1.3383383596204615e-08	
23	inert waste	kg	2.195218949565193e-08	
24	inert waste	kg	1.0957824794324356e-05	
25	inert waste	kg	1.0910432076280019e-05	
26	inert waste	kg	0.3099399993481807	
27	inert waste	kg	0.30993999934818073	
28	inert waste	kg	0.31018709156371627	
30	inert waste	kg	0.19864818287495284	
31	inert waste	kg	0.30993999937485317	
32	inert waste	kg	5.782392154568715e-11	
33	inert waste	kg	5.782392154568715e-11	
34	inert waste	kg	7.035386210619462e-11	
35	inert waste	kg	1.9636888580607684e-08	
36	inert waste	kg	1.0	
37	inert waste	kg	1.0	
38	inert waste	kg	0.1423235883432324	
39	inert waste	kg	0.1390237715862934	

40	inert waste	kg	0.17584630654318195	
41	inert waste	kg	1.3383779609349462e-08	
42	inert waste	kg	0.9999999603011008	
43	inert waste	kg	0.13319613536101427	
44	inert waste	kg	0.13319612101335743	
45	inert waste	kg	0.12657083451588005	
46	inert waste	kg	0.1205305360948766	
47	inert waste	kg	0.12657061459351973	
48	inert waste	kg	0.12657055281955268	
49	inert waste	kg	0.1322133436499849	
50	inert waste	kg	0.12652366260182513	
51	inert waste	kg	0.02741103482114143	
52	inert waste	kg	0.09522622470289663	
53	inert waste	kg	0.14777725167918607	
54	inert waste	kg	0.045653138494362346	
55	inert waste	kg	0.04565313849436235	
56	inert waste	kg	0.04565313849436235	
57	inert waste	kg	0.04565313849436237	
58	inert waste	kg	0.045653138494362346	
59	inert waste	kg	0.04565313849436236	
60	inert waste	kg	1.0	
61	inert waste	kg	1.0	
62	inert waste	kg	0.0014870660102139837	
63	inert waste	kg	0.0034374815503242185	
64	inert waste	kg	0.0034374815503242172	
65	inert waste	kg	0.005274219288828885	
66	inert waste	kg	0.005274219288828885	
67	inert waste	kg	0.009461910330223117	
68	inert waste	kg	0.19864818287495295	
69	inert waste	kg	0.4307533221351815	
70	inert waste	kg	0.01236288607192274	
71	inert waste	kg	0.012798504317215909	
72	inert waste	kg	0.011360374512132863	
73	inert waste	kg	0.042016482842044046	
74	inert waste	kg	4.370319030675687e-11	
75	inert waste	kg	4.3720654075786217e-07	
76	inert waste	kg	1.0000000000000002	
77	inert waste	kg	0.14241775896291545	
78	inert waste	kg	1.1807556618543406e-05	
79	inert waste	kg	0.1424177589629151	
80	inert waste	kg	1.1807556661682612e-05	
81	inert waste	kg	1.6281768353214103e-11	
82	inert waste	kg	0.14355685087961856	
83	inert waste	kg	1.0186331814049689e-09	
84	inert waste	kg	0.015586285212544721	
0	sewage sludge, dried	kg	0.13560276757019676	
1	sewage sludge, dried	kg	0.13560276757019676	
2	sewage sludge, dried	kg	3.105026558583815e-10	
3	sewage sludge, dried	kg	3.105026558583815e-10	
4	sewage sludge, dried	kg	3.7778587855620576e-10	

5	sewage sludge, dried	kg	8.363846010015791e-08	
6	sewage sludge, dried	kg	0.01235690838145746	
7	sewage sludge, dried	kg	0.01235690838145746	
8	sewage sludge, dried	kg	0.003546248927605613	
9	sewage sludge, dried	kg	0.0035462489276056153	
10	sewage sludge, dried	kg	8.67495759119747e-11	
11	sewage sludge, dried	kg	1.182527313190725e-09	
Original	electric motor, electric passenger car	kg	0.45903375791259976	
Original	dust, unalloyed electric arc furnace steel	kg	0.8459999994921494	
Original	photovoltaic laminate, single-Si wafer	m2	0.6084987771318094	
Original	iron(II) chloride	kg	0.45	
Original	reefer, intermodal shipping container, 40-foot...	unit	2081.1925913761092	
Original	offshore well, oil/gas	m	177.26926554029802	
Original	transport, passenger car, medium size, petrol,...	km	0.0	shell capital service product
Original	inductor, ring core choke type	kg	0.010244677956078323	
Original	lean concrete	m3	5.185394232932878e-10	
Original	cast iron removed by turning, primarily dressi...	kg	1.0	
Original	maintenance, train, passenger, high-speed	unit	33768.994582450854	
Original	tilapia	kg	5.449588925851388e-05	
Original	printer, laser, colour	unit	0.7875189533258771	
0	residual material landfill	unit	1489.9840754479867	
1	residual material landfill	unit	1490.1349671325152	
Original	aluminium casting facility	unit	0.0018200984700436382	
Original	cement, blast furnace slag 81-95\%	kg	0.00011000000418751029	
Original	transport, freight, lorry with reefer, cooling	metric ton*km	0.0	shell capital service product
Original	fish freezing, small fish	kg	0.0	shell capital service product
Original	transport, freight, lorry with reefer, freezing	metric ton*km	0.0	shell capital service product
Original	iron pellet	kg	1.0000000000000002	
Original	lorry, 40 metric ton	unit	0.0	No mass because all eol flows included - servi...
Original	battery separator	kg	0.07898534385912014	
Original	silencer, steel, DN 315, 50 mm	unit	18.548569828865908	
Original	chromium steel removed by turning, average, co...	kg	0.6305351822872262	
Original	decommissioned airport infrastructure, contami...	unit	67967.61947675484	
Original	transport, freight, lorry with refrigeration m...	metric ton*km	0.0	shell capital service product
Original	heat distribution equipment, hydronic radiant ...	unit	0.02047045484415293	
Original	brake wear emissions, lorry	kg	3.506670207279668e-07	
Original	transport, passenger car, large size, petrol, ...	km	0.0	shell capital service product
Original	banana	kg	5.794544554708961e-12	
Original	anaerobic digestion plant, for biowaste	unit	233165.19414421494	
Original	waste, from silicon wafer production, inorganic	kg	1.6054599945662104e-08	
Original	irrigation	m3	0.0	shell capital service product
Original	barley grain	kg	1.769272488640815e-06	
Original	oil mill	unit	737999.9999276607	
Original	non-ionic surfactant	kg	2.4581834120860244e-08	
Original	concrete, 25MPa	m3	0.03809603227039614	
Original	harvesting, by complete harvester, beets	ha	0.0	shell capital service product
Original	offshore platform, petroleum	unit	1137310.019845912	
Original	laser machining, metal, with CO2-laser, 2000W ...	hour	0.0	shell capital service product
Original	carton board box production, with offset printing	kg	5.879807809565666e-07	
Original	printed wiring board, through-hole mounted, un...	kg	0.020044740926137613	

Original	extrusion, plastic pipes	kg	0.0	shell capital service product
Original	tillage, harrowing, by rotary harrow	ha	0.0	shell capital service product
Original	photovoltaic laminate, CdTe	m2	0.1737668444212464	
Original	used toner module, laser printer, black/white	kg	0.38214211741369053	
Original	wooden board factory, cement bonded boards	unit	398561.8511717909	
Original	used glider, passenger car	kg	0.03531887490761963	
Original	transport, freight, aircraft with reefer, free...	metric ton*km	0.0	shell capital service product
Original	sawnwood, lath, hardwood, dried (u=20\%), planed	m3	7.536563786801007e-08	
Original	oat seed, for sowing	kg	8.137503136531513e-11	
Original	transport, freight, conveyor belt	metric ton*km	0.0	shell capital service product
Original	coffee, green bean	kg	0.0014271819611407883	
Original	casting, steel, lost-wax	kg	0.0	shell capital service product
Original	building operation, hostel	guest night	0.0	shell capital service product
Original	trawler maintenance, steel	kg	0.0	shell capital service product
Original	rye grain, feed, organic	kg	4.802909774622318e-10	
Original	soybean seed, organic, for sowing	kg	7.782884941427777e-10	
Original	wastewater from PV cell production	m3	6.663019090968266e-10	
Original	transport, passenger car, large size, petrol, ...	km	0.0	shell capital service product
Original	operation, housing system, pig, label-certifie...	unit	0.0	shell capital service product
Original	lead in car shredder residue	kg	3.942553532955999e-10	
Original	operation, dried roughage store, air dried, solar	kg	0.0	shell capital service product
Original	vanilla	kg	6.22735213997054e-11	
Original	laser machining, metal, with YAG-laser, 330W p...	hour	0.0	shell capital service product
Original	cast iron	kg	1.0	
Original	wire drawing, steel	kg	0.0	shell capital service product
Original	rape seed, Swiss integrated production	kg	8.630528176443154e-11	
0	distribution network, electricity, low voltage	km	2254.028667273125	
1	distribution network, electricity, low voltage	km	206.86516178247538	
2	distribution network, electricity, low voltage	km	2220.6406914880386	
Original	furnace, pellets, 25kW	unit	137.27360166005874	
Original	recultivation, bauxite mine	m2	0.0	shell capital service product
0	chipper, stationary, electric	unit	2354.631545018741	
1	chipper, stationary, electric	unit	1731.0134362328502	
Original	cement, alternative constituents 45\%	kg	3.182085958859345e-05	
Original	fibre cement facing tile	kg	0.044999999987097736	
Original	maintenance, bicycle	unit	0.3721696553346861	
Original	printed wiring board, mounted mainboard, deskt...	kg	0.10749383086971397	
Original	fuel cell, polymer electrolyte membrane, 2kW e...	unit	70.2519056197503	
Original	heat and power co-generation unit, organic Ran...	unit	0.0	No mass because all eol flows included - servi...
Original	transport, tram	person*km	0.0	shell capital service product
Original	sawnwood, lath, hardwood, raw, dried (u=20\%)	m3	3.9848358711822006e-08	
Original	fish canning, large fish	kg	0.0	shell capital service product
Original	laminating service, foil, with acrylic binder	m2	2.7410383895247306e-12	
Original	tree seedling, for planting	unit	3.953937189032817e-13	
Original	maintenance, reefer, intermodal shipping conta...	unit	0.0	No mass because all eol flows included - servi...
Original	purse seiner, wood	kg	0.0	No mass because all eol flows included - servi...
Original	wood preservation facility, oscillating pressu...	unit	8234.575364167129	
Original	potato starch	kg	1.1157676385665929e-10	
Original	chipper, mobile, diesel	unit	26099.999997441664	
0	transmission network, electricity, medium voltage	km	1057.7760099050772	

1	transmission network, electricity, medium voltage	km	1078.0681639855775	
2	transmission network, electricity, medium voltage	km	41.75574784165926	
Original	building, luxury hotel	unit	780.3126845664535	
Original	plasticiser, for concrete, based on sulfonated...	kg	3.719923050052829e-10	
Original	zucchini	kg	5.577634245509659e-11	
Original	ryegrass-red\	Egyptian clover-mixture silage	kg	4.285679631132171e-10
Original	operation, computer, desktop, home use	hour	0.0	shell capital service product
Original	maize seed, at farm	kg	1.3737355376053814e-09	
Original	power sawing, with catalytic converter	hour	0.0	shell capital service product
Original	mischmetal	kg	6.3228261588536125e-09	
Original	photovoltaic panel, a-Si	m2	3.1173159124882313	
Original	chromium steel removed by milling, small parts	kg	0.6305351821295553	
Original	operation, computer, desktop, with cathode ray...	hour	0.0	shell capital service product
Original	mowing, by rotary mower	ha	0.0	shell capital service product
Original	maintenance, motor scooter	unit	1.5698378675745068	
Original	cottonseed meal	kg	0.00059348855138800709	
Original	slab and siding, softwood, wet, measured as dr...	kg	2.3200525012403313e-12	
Original	lorry with refrigeration machine, R134a as ref...	unit	0.0	No mass because all eol flows included - servi...
Original	transport, freight, lorry with refrigeration m...	metric ton*km	0.0	shell capital service product
Original	strawberry	kg	9.151587150564101e-10	
Original	particleboard, uncoated	m3	4.347633962540727e-05	
Original	waste concrete, not reinforced	kg	1.4531740417691555e-05	
Original	sesame seed	kg	1.4043386680171805e-09	
Original	cattle for slaughtering, live weight	kg	9.398818942968105e-12	
Original	polishing powder	kg	2.2770167768717337e-07	
Original	wastewater from liquid crystal production	m3	1.6503498289048953e-05	
Original	process-specific burdens, sanitary landfill	kg	0.0	shell capital service product
Original	palm date, organic	kg	3.1474872388061897e-09	
Original	sawnwood, softwood, raw, dried (u=20\%)	m3	3.172051881733253e-06	
Original	poultry manure, fresh	kg	9.79412033289964e-10	
Original	forwarder	unit	3434.501570869297	
Original	peanut seed, at farm	kg	7.657763967699639e-10	
0	sewer grid, 5E9l/year, 110 km	km	58991.85178521509	
1	sewer grid, 5E9l/year, 110 km	km	58998.11099581367	
Original	green manure, organic, until February	ha	0.0	shell capital service product
Original	land tenure, arable land, measured as carbon n...	kg	0.0	shell capital service product
Original	insulated gate bipolar transistor, electric ve...	kg	4.701408675987829e-05	
Original	dairy	m3	0.050535205961324436	
Original	potato seed, Swiss integrated production, at farm	kg	3.243623670477054e-10	
Original	hoeing	ha	0.0	shell capital service product
Original	industrial machine, heavy, unspecified	kg	0.9807999999088693	
Original	cathode, for aluminium electrolysis	kg	0.2568064300583406	
Original	used motor scooter	unit	19.386588508589934	
Original	maize grain, feed, Swiss integrated production	kg	3.7641602192352146e-11	
Original	impact extrusion of steel, hot, tempering	kg	0.0	shell capital service product
Original	sawnwood, beam, softwood, raw, dried (u=10\%)	m3	3.3092963005201756e-06	
Original	natural gas processing plant	unit	3805333874.374758	
Original	machine operation, diesel, < 18.64 kW, low loa...	hour	0.0	shell capital service product
Original	barley seed, Swiss integrated production, for ...	kg	5.37490789709069e-07	

Original	used door, inner, wood	m2	4.689039109825353e-08	
Original	used bus	unit	2595.4446466954982	
Original	electronic component, passive, unspecified	kg	0.10845273772199143	
Original	anode, for metal electrolysis	kg	2.2198369644456646e-09	
Original	waste paint on metal	kg	3.000178738419031e-10	
Original	electric parts, heat and power co-generation u...	unit	39.551663311654586	
Original	drying, natural gas	m3	0.0	shell capital service product
Original	cabbage red	kg	7.782226669278884e-11	
Original	spent antifreezer liquid	kg	0.007181481772514837	
Original	maintenance, polymer electrolyte membrane fuel...	unit	0.7777020936386567	
Original	sawnwood, hardwood, raw	m3	3.7998659268759156e-08	
Original	funnel glass, for cathode ray tube display	kg	8.199005434293015e-05	
Original	transport, freight, lorry 16-32 metric ton, EURO1	metric ton*km	0.0	shell capital service product
Original	iron scrap, sorted, pressed	kg	0.9999999999999999	
Original	soybean, feed	kg	9.912370855167543e-05	
Original	sawnwood, hardwood, dried (u=20\%), planed	m3	3.9533371331509377e-07	
Original	assembly of liquid crystal display, auxilliari...	kg	1.8505427213176916e-11	
Original	cement, pozzolana and fly ash 6-14\%	kg	0.0005035920610483533	
Original	printed wiring board mounting facility	unit	251295.3844632457	
Original	tanker, for liquefied natural gas	unit	2041342.4417798817	
Original	pomegranate	kg	0.0012056666691758464	
Original	cast iron removed by turning, average, compute...	kg	1.0	
Original	capacitor, electrolyte type, < 2cm height	kg	0.08436002898066246	
Original	liquid packaging board container	kg	1.0130355099711197e-06	
Original	mango seedling, for planting	unit	4.016000002938176e-08	
Original	used railway track	m*year	3.4852551827989804	
Original	sawnwood, beam, softwood, dried (u=10\%), planed	m3	3.626628947081441e-06	
Original	cast iron removed by milling, large parts	kg	1.0	
Original	power distribution unit, for electric passenge...	kg	0.05887123468972595	
Original	impact extrusion of steel, cold, 5 strokes	kg	0.0	shell capital service product
Original	grass seed, organic, for sowing	kg	3.3262303932564497e-10	
Original	impact extrusion of steel, hot, 1 strokes	kg	0.0	shell capital service product
Original	onshore natural gas field infrastructure	unit	1125829.1345848432	
Original	protein pea, Swiss integrated production	kg	2.717612949577653e-10	
Original	iron (III) chloride, without water, in 40\% sol...	kg	0.4400000003563656	
Original	transport, freight, lorry 3.5-7.5 metric ton, ...	metric ton*km	0.0	shell capital service product
Original	laterite, mineral	kg	7.490389216390782e-11	
Original	rye grain, Swiss integrated production	kg	1.4147120943302145e-07	
Original	tillage, rolling	ha	0.0	shell capital service product
Original	wheat grain, feed, organic	kg	6.146241274002735e-10	
Original	furnace, logs, average storage area, 100kW	unit	1068.0064204863952	
Original	used purse seiner, wood	kg	0.10977036314747761	
Original	shavings, hardwood, measured as dry mass	kg	3.6462045064781096e-11	
Original	sweetening, natural gas	m3	0.0	shell capital service product
Original	industrial furnace, coal, 1-10MW	unit	29270.67992677481	
Original	used intermodal shipping container, 20-foot	unit	1133.629707272422	
Original	transport, freight, lorry >32 metric ton, EURO6	metric ton*km	0.0	shell capital service product
Original	transport, freight, lorry with refrigeration m...	metric ton*km	0.0	shell capital service product
Original	diesel, burned in diesel-electric generating s...	MJ	9.944964801768968e-12	
Original	waste reinforced concrete	kg	0.0110272958285908	

Original	potato seed, Swiss integrated production, for ...	kg	5.368628470471941e-10	
Original	hydropower plant, reservoir, non-alpine regions	unit	3160000.208681516	
Original	clover seed, Swiss integrated production, at farm	kg	3.586953472902365e-09	
Original	fertilising, by rig fertiliser, sugarcane	ha	0.0	shell capital service product
Original	transport, passenger car, small size, petrol, ...	km	0.0	shell capital service product
Original	ash from deinking sludge	kg	0.0013237873593229072	
Original	lime mortar	kg	0.00034516104262722697	
Original	infrastructure, for regional distribution of o...	unit	150124.1140196446	
Original	impact extrusion of steel, warm, 1 strokes	kg	0.0	shell capital service product
Original	wood preservation, oscillating pressure method...	kg	0.0	shell capital service product
Original	transport, freight, lorry 16-32 metric ton, EURO2	metric ton*km	0.0	shell capital service product
Original	green manure, organic, until March	ha	0.0	shell capital service product
Original	transport, freight, light commercial vehicle, ...	metric ton*km	0.0	shell capital service product
Original	cottonseed oil, refined	kg	8.6930903080504666e-07	
Original	wastewater from cathode ray tube production	m3	0.014414100797443768	
Original	iron-nickel-chromium alloy	kg	0.7012250023113041	
Original	furnace, logs, hardwood storage area, 6kW	unit	31.201123621077507	
Original	petrol, 4\% ETBE additive by volume, with ethan...	kg	0.00036363560454403285	
Original	stirling heat and power co-generation unit, 3k...	unit	269.0849836575237	
Original	uranium ore, as U	kg	0.09049609956095281	
Original	packaging, for pesticides	kg	0.0	shell capital service product
Original	planting	ha	0.0	shell capital service product
Original	transport, freight, inland waterways, barge ta...	metric ton*km	0.0	shell capital service product
Original	extrusion, co-extrusion	kg	0.0	shell capital service product
Original	machine operation, diesel, >= 74.57, undergrou...	hour	0.0	shell capital service product
Original	extrusion, plastic film	kg	0.0	shell capital service product
Original	dishwasher	unit	11.231693639108636	
Original	air compressor, screw-type compressor, 4kW	unit	80.11148098992673	
Original	coconut oil, crude	kg	7.560555689603788e-10	
Original	wood preservation, oscillating pressure method...	kg	0.0	shell capital service product
Original	decommissioned road	m*year	1.8374525097311606e-09	
Original	transport, freight, lorry with refrigeration m...	metric ton*km	0.0	shell capital service product
Original	wood preservation facility, dipping/immersion ...	unit	3119.134519830496	
Original	decommissioned pipeline, natural gas	kg	0.05546482258202228	
Original	toner, black, powder	kg	0.17586178202141967	
Original	cable, three-conductor cable	m	3.042614386388661e-10	
Original	impact extrusion of steel, cold, 3 strokes	kg	0.0	shell capital service product
Original	laser machining, metal, with YAG-laser, 40W power	hour	0.0	shell capital service product
Original	transport, passenger car, large size, petrol, ...	km	0.0	shell capital service product
Original	photovoltaic panel, ribbon-Si	m2	3.7781855112162465e-05	
Original	road, company, internal	m2*year	0.07795621356224272	
Original	lightweight concrete block, expanded perlite	kg	3.7866958999474834e-11	
Original	wheat grain, Swiss integrated production	kg	1.2032475176970283e-09	
0	hard coal power plant	unit	8756524.594134185	
1	hard coal power plant	unit	34082643.327764206	
Original	hay	kg	7.706582201557636e-05	
Original	marine electric motor	unit	132.93325250051112	
Original	sunflower seed, Swiss integrated production	kg	3.705640624221598e-10	
Original	wood preservation, spray tunnel/deluging, wate...	kg	0.0	shell capital service product
Original	cement, blast furnace slag 35-70\%	kg	6.328334908863069e-13	

Original	printed wiring board, for through-hole mountin...	m2	2.377656630952607e-09	
Original	mine infrastructure, open cast, lignite	unit	13757412.855378905	
Original	brake wear emissions, passenger car	kg	3.320327963143597e-08	
Original	concrete, 25-30MPa	m3	0.04074175815213676	
Original	transport, freight, aircraft with reefer, cooling	metric ton*km	0.0	shell capital service product
Original	wind turbine network connection, 750kW, onshore	unit	0.0	shell capital service product
Original	cleaning consumables, without water, in 13.6\% ...	kg	0.00044691908087655263	
Original	diesel-electric generating set, 10MW	unit	185674.81662152478	
Original	operation, computer, laptop, 68\% active work w...	hour	0.0	shell capital service product
Original	used room-connecting overflow element steel, a...	unit	0.55	
Original	spoil from hard coal mining	kg	7.231514264153571e-09	
Original	joist, engineered wood	m	9.937516400888244e-09	
Original	sand-lime brick	kg	0.0004515785870384014	
Original	transport, passenger train	person*km	0.0	shell capital service product
Original	metallization paste, front side	kg	8.319911608161484e-09	
Original	maize flour	kg	4.39611001514267e-05	
Original	oil boiler, 10kW	unit	117.72041240210011	
Original	cement, pozzolana and fly ash 15-40\%	kg	0.00011000000234086168	
Original	intermodal shipping container, 40-foot, high-cube	unit	2016.6433363448402	
Original	soybean beverage	l	2.368204583184828e-11	
Original	capacitor, electrolyte type, > 2cm height	kg	0.0296000289844829	
Original	maintenance, intermodal shipping container, 20...	unit	0.0	No mass because all eol flows included - servi...
Original	chromium steel removed by turning, primarily d...	kg	0.6305351821295498	
Original	fish curing, small fish	kg	0.0	shell capital service product
0	pipeline, natural gas, low pressure distributi...	km	3661.348983047633	
1	pipeline, natural gas, low pressure distributi...	km	2030.689000690514	
Original	wastewater from glass production	m3	0.10935620172226468	
Original	transport, freight, lorry with refrigeration m...	metric ton*km	0.0	shell capital service product
0	hazardous waste, for underground deposit	kg	0.12982166932685604	
1	hazardous waste, for underground deposit	kg	0.12982166932685602	
2	hazardous waste, for underground deposit	kg	0.0016857122253775658	
3	hazardous waste, for underground deposit	kg	0.0016857116403474405	
4	hazardous waste, for underground deposit	kg	0.11328905744855557	
5	hazardous waste, for underground deposit	kg	0.11093016437811247	
6	hazardous waste, for underground deposit	kg	0.11093196573318623	
7	hazardous waste, for underground deposit	kg	1.0375115337657114e-05	
8	hazardous waste, for underground deposit	kg	1.037510874877477e-05	
9	hazardous waste, for underground deposit	kg	0.12202873842613361	
10	hazardous waste, for underground deposit	kg	0.12203913988485765	
11	hazardous waste, for underground deposit	kg	0.1296379940965823	
12	hazardous waste, for underground deposit	kg	0.13039783625644216	
13	hazardous waste, for underground deposit	kg	4.906754207605029e-05	
14	hazardous waste, for underground deposit	kg	4.909824054727978e-05	
15	hazardous waste, for underground deposit	kg	0.05099190306752075	
16	hazardous waste, for underground deposit	kg	0.05099190306752075	
17	hazardous waste, for underground deposit	kg	0.052207838906948675	
18	hazardous waste, for underground deposit	kg	0.05220783890694867	
19	hazardous waste, for underground deposit	kg	0.05220679882171235	
20	hazardous waste, for underground deposit	kg	0.05220652256102729	
22	hazardous waste, for underground deposit	kg	0.11328905744855558	

23	hazardous waste, for underground deposit	kg	0.0011958232220818056	
24	hazardous waste, for underground deposit	kg	0.14244361770594452	
25	hazardous waste, for underground deposit	kg	0.12982166932685604	
26	hazardous waste, for underground deposit	kg	0.0016857122253775669	
27	hazardous waste, for underground deposit	kg	0.11093196573318624	
28	hazardous waste, for underground deposit	kg	1.037510874877477e-05	
29	hazardous waste, for underground deposit	kg	1.6752434262617978e-06	
30	hazardous waste, for underground deposit	kg	4.906754207605031e-05	
32	hazardous waste, for underground deposit	kg	7.754381234094195e-06	
33	hazardous waste, for underground deposit	kg	7.75438123403434e-06	
34	hazardous waste, for underground deposit	kg	0.9999999995672175	
35	hazardous waste, for underground deposit	kg	1.1548443770008401e-07	
36	hazardous waste, for underground deposit	kg	6.613107466791008e-10	
37	hazardous waste, for underground deposit	kg	1.15484437700026e-07	
38	hazardous waste, for underground deposit	kg	0.9999999995676417	
39	hazardous waste, for underground deposit	kg	6.613107466689053e-10	
40	hazardous waste, for underground deposit	kg	0.1471935241688249	
41	hazardous waste, for underground deposit	kg	0.14719352416882486	
42	hazardous waste, for underground deposit	kg	0.9999919736431802	
43	hazardous waste, for underground deposit	kg	8.526033174228453e-08	
44	hazardous waste, for underground deposit	kg	8.526042890394953e-08	
45	hazardous waste, for underground deposit	kg	0.006390041652553404	
46	hazardous waste, for underground deposit	kg	0.006390815151102743	
47	hazardous waste, for underground deposit	kg	3.179833033033111e-05	
48	hazardous waste, for underground deposit	kg	4.747691574507969e-05	
49	hazardous waste, for underground deposit	kg	0.00038353491318633194	
50	hazardous waste, for underground deposit	kg	4.692454799518405e-05	
51	hazardous waste, for underground deposit	kg	4.655175989313434e-09	
52	hazardous waste, for underground deposit	kg	0.0003819803477231379	
53	hazardous waste, for underground deposit	kg	0.04839186134705096	
54	hazardous waste, for underground deposit	kg	0.0009661060872959478	
55	hazardous waste, for underground deposit	kg	1.2490071642462302e-05	
56	hazardous waste, for underground deposit	kg	1.249007148744079e-05	
57	hazardous waste, for underground deposit	kg	0.000787228047827041	
58	hazardous waste, for underground deposit	kg	0.0006167741833613106	
59	hazardous waste, for underground deposit	kg	0.000787646626603751	
60	hazardous waste, for underground deposit	kg	0.0006168454273167045	
61	hazardous waste, for underground deposit	kg	9.517904461093997e-08	
62	hazardous waste, for underground deposit	kg	9.51790446109401e-08	
63	hazardous waste, for underground deposit	kg	1.0	
64	hazardous waste, for underground deposit	kg	1.0	
65	hazardous waste, for underground deposit	kg	0.13801090691684126	
66	hazardous waste, for underground deposit	kg	0.14706552389206248	
67	hazardous waste, for underground deposit	kg	0.23916820944650694	
68	hazardous waste, for underground deposit	kg	0.9999998906590383	
69	hazardous waste, for underground deposit	kg	0.14193215088475233	
70	hazardous waste, for underground deposit	kg	0.2472064124143343	
71	hazardous waste, for underground deposit	kg	0.13863507695275298	
72	hazardous waste, for underground deposit	kg	0.14341425688666673	
73	hazardous waste, for underground deposit	kg	0.14706552389206248	

74	hazardous waste, for underground deposit	kg	0.13801090691684154	
75	hazardous waste, for underground deposit	kg	0.14665837040330548	
76	hazardous waste, for underground deposit	kg	0.14666862747096426	
77	hazardous waste, for underground deposit	kg	0.23917383283342425	
78	hazardous waste, for underground deposit	kg	0.14193215088475233	
79	hazardous waste, for underground deposit	kg	0.24725720651728758	
80	hazardous waste, for underground deposit	kg	0.14341425688666673	
81	hazardous waste, for underground deposit	kg	0.002481815221284527	
82	hazardous waste, for underground deposit	kg	0.008560219116058792	
83	hazardous waste, for underground deposit	kg	0.13866500149108926	
84	hazardous waste, for underground deposit	kg	0.9999998970591065	
85	hazardous waste, for underground deposit	kg	0.23747088023109408	
86	hazardous waste, for underground deposit	kg	0.9999998970591066	
87	hazardous waste, for underground deposit	kg	5.670347011258275e-10	
88	hazardous waste, for underground deposit	kg	0.027931715302833116	
89	hazardous waste, for underground deposit	kg	0.05088600476897035	
90	hazardous waste, for underground deposit	kg	0.002169025803624023	
91	hazardous waste, for underground deposit	kg	0.0020941343826812583	
92	hazardous waste, for underground deposit	kg	0.001975926415155394	
93	hazardous waste, for underground deposit	kg	0.0021706172538614016	
94	hazardous waste, for underground deposit	kg	0.0023158403874841073	
95	hazardous waste, for underground deposit	kg	0.001276112065266048	
96	hazardous waste, for underground deposit	kg	0.0009871294766482055	
97	hazardous waste, for underground deposit	kg	0.0012811716476742732	
98	hazardous waste, for underground deposit	kg	0.002398887447876694	
99	hazardous waste, for underground deposit	kg	0.08695325509178058	
100	hazardous waste, for underground deposit	kg	0.0004105063024655715	
101	hazardous waste, for underground deposit	kg	0.08722264790052925	
102	hazardous waste, for underground deposit	kg	0.02151567771374637	
103	hazardous waste, for underground deposit	kg	0.0006167740097016534	
104	hazardous waste, for underground deposit	kg	0.0007385992277806224	
105	hazardous waste, for underground deposit	kg	0.0006718744063565599	
106	hazardous waste, for underground deposit	kg	0.0006168452480432331	
107	hazardous waste, for underground deposit	kg	0.0011807853231239156	
108	hazardous waste, for underground deposit	kg	0.08698546750552454	
109	hazardous waste, for underground deposit	kg	0.0002900845836338057	
110	hazardous waste, for underground deposit	kg	0.08725560476097172	
111	hazardous waste, for underground deposit	kg	0.018597802409566568	
112	hazardous waste, for underground deposit	kg	0.00021349394323754329	
113	hazardous waste, for underground deposit	kg	0.0002906408452999776	
114	hazardous waste, for underground deposit	kg	0.00030477672833864567	
115	hazardous waste, for underground deposit	kg	0.0002135012208597074	
116	hazardous waste, for underground deposit	kg	0.0003883726510307945	
117	hazardous waste, for underground deposit	kg	0.09799417745251875	
118	hazardous waste, for underground deposit	kg	0.005976768767982727	
119	hazardous waste, for underground deposit	kg	0.004918525708576132	
120	hazardous waste, for underground deposit	kg	0.003948620334857629	
121	hazardous waste, for underground deposit	kg	0.00599967503665865	
122	hazardous waste, for underground deposit	kg	0.007826515781306704	
123	hazardous waste, for underground deposit	kg	0.027749823686807052	

124	hazardous waste, for underground deposit	kg	0.024435072874349838	
125	hazardous waste, for underground deposit	kg	0.0191513417066863	
126	hazardous waste, for underground deposit	kg	0.0007016867383370817	
127	hazardous waste, for underground deposit	kg	0.0004971197784931435	
128	hazardous waste, for underground deposit	kg	0.0007593733220292828	
129	hazardous waste, for underground deposit	kg	0.0004972069184571657	
130	hazardous waste, for underground deposit	kg	0.0005705007104781284	
131	hazardous waste, for underground deposit	kg	0.0007016779767827319	
132	hazardous waste, for underground deposit	kg	0.0004971149243861026	
133	hazardous waste, for underground deposit	kg	0.0007593644871473094	
134	hazardous waste, for underground deposit	kg	0.005259449787938608	
135	hazardous waste, for underground deposit	kg	0.004265568032395452	
136	hazardous waste, for underground deposit	kg	0.003397542831185703	
137	hazardous waste, for underground deposit	kg	0.005278319892003318	
138	hazardous waste, for underground deposit	kg	0.006731073016386186	
139	hazardous waste, for underground deposit	kg	8.3770804213491e-05	
140	hazardous waste, for underground deposit	kg	7.962056727702315e-05	
141	hazardous waste, for underground deposit	kg	7.620457340706997e-05	
142	hazardous waste, for underground deposit	kg	8.377137422240259e-05	
143	hazardous waste, for underground deposit	kg	8.350031101898175e-05	
144	hazardous waste, for underground deposit	kg	0.0004841221916644788	
145	hazardous waste, for underground deposit	kg	0.0005474558278546658	
146	hazardous waste, for underground deposit	kg	0.0006615821896020937	
147	hazardous waste, for underground deposit	kg	0.00048310174290465516	
148	hazardous waste, for underground deposit	kg	0.0007134609116977002	
149	hazardous waste, for underground deposit	kg	0.0004971901683622738	
150	hazardous waste, for underground deposit	kg	0.0005704825576039256	
151	hazardous waste, for underground deposit	kg	0.0007016566263374201	
152	hazardous waste, for underground deposit	kg	0.0004970982966488298	
153	hazardous waste, for underground deposit	kg	0.0007593390416737765	
154	hazardous waste, for underground deposit	kg	0.0008872528948386266	
155	hazardous waste, for underground deposit	kg	0.0008897208347802371	
156	hazardous waste, for underground deposit	kg	0.003488804351571197	
157	hazardous waste, for underground deposit	kg	0.002941264514905555	
158	hazardous waste, for underground deposit	kg	0.002485211821643045	
159	hazardous waste, for underground deposit	kg	0.0034907085367568208	
160	hazardous waste, for underground deposit	kg	0.003908825089501002	
161	hazardous waste, for underground deposit	kg	0.002169025841767772	
162	hazardous waste, for underground deposit	kg	0.0021984288429854034	
163	hazardous waste, for underground deposit	kg	0.0021929243584969437	
164	hazardous waste, for underground deposit	kg	0.002170617252527895	
165	hazardous waste, for underground deposit	kg	0.002252256767232935	
166	hazardous waste, for underground deposit	kg	0.0004972120854467904	
167	hazardous waste, for underground deposit	kg	0.0005705075921280047	
168	hazardous waste, for underground deposit	kg	0.001390559413702475	
169	hazardous waste, for underground deposit	kg	0.0006716475364358022	
170	hazardous waste, for underground deposit	kg	8.215439783305861e-05	
171	hazardous waste, for underground deposit	kg	0.0022559757125131604	
172	hazardous waste, for underground deposit	kg	0.09746868455416265	
173	hazardous waste, for underground deposit	kg	0.003687424602189454	

174	hazardous waste, for underground deposit	kg	0.0011338955555654437	
175	hazardous waste, for underground deposit	kg	0.0006716551261852866	
176	hazardous waste, for underground deposit	kg	0.00688974502916007	
177	hazardous waste, for underground deposit	kg	0.000999223549895765	
178	hazardous waste, for underground deposit	kg	0.002250357871907755	
179	hazardous waste, for underground deposit	kg	0.0015841109502959872	
180	hazardous waste, for underground deposit	kg	0.001186153772900904	
181	hazardous waste, for underground deposit	kg	0.0015613196865035396	
182	hazardous waste, for underground deposit	kg	0.04009825990600428	
183	hazardous waste, for underground deposit	kg	0.0006716252277869443	
184	hazardous waste, for underground deposit	kg	0.005953290673626857	
185	hazardous waste, for underground deposit	kg	0.00035882669666704466	
186	hazardous waste, for underground deposit	kg	0.0006437940433237991	
187	hazardous waste, for underground deposit	kg	0.0008951643271509368	
188	hazardous waste, for underground deposit	kg	0.0001997183812407236	
189	hazardous waste, for underground deposit	kg	0.0002144453135902602	
190	hazardous waste, for underground deposit	kg	0.0008995336971766476	
191	hazardous waste, for underground deposit	kg	0.006889745029160073	
192	hazardous waste, for underground deposit	kg	0.0400982599060043	
193	hazardous waste, for underground deposit	kg	0.0011338955555654437	
194	hazardous waste, for underground deposit	kg	0.002250357820865422	
195	hazardous waste, for underground deposit	kg	0.0015841109502959879	
196	hazardous waste, for underground deposit	kg	0.0015613196865035396	
197	hazardous waste, for underground deposit	kg	8.215439783305861e-05	
198	hazardous waste, for underground deposit	kg	0.0006437940433237997	
199	hazardous waste, for underground deposit	kg	0.0006716252277869443	
200	hazardous waste, for underground deposit	kg	0.0008951643359418861	
201	hazardous waste, for underground deposit	kg	0.003687425437422755	
202	hazardous waste, for underground deposit	kg	0.0022559757279263385	
203	hazardous waste, for underground deposit	kg	0.0006716551261852863	
204	hazardous waste, for underground deposit	kg	0.0006716475364358026	
205	hazardous waste, for underground deposit	kg	0.0009992235866606786	
206	hazardous waste, for underground deposit	kg	0.001186153772900904	
207	hazardous waste, for underground deposit	kg	0.00035882669666704466	
208	hazardous waste, for underground deposit	kg	0.09746868455416265	
209	hazardous waste, for underground deposit	kg	8.644347891285115e-08	
210	hazardous waste, for underground deposit	kg	1.0	
211	hazardous waste, for underground deposit	kg	0.005953290673626852	
212	hazardous waste, for underground deposit	kg	0.0475595721703162	
213	hazardous waste, for underground deposit	kg	0.005991158540700625	
Original	cottonseed oil, crude	kg	8.34269736784354e-07	
Original	maintenance, goods wagon	unit	3509.9992763711275	
Original	coal stove, 5-15kW	unit	258.8785985681811	
Original	steel removed by turning, primarily roughing, ...	kg	0.9999999998969957	
Original	furnace, pellets, with silo, 300kW	unit	782.747235328901	
Original	ventilation of dwellings, decentralized, 6 x 1...	m2*year	0.0	shell capital service product
Original	tillage, cultivating, chiselling	ha	0.0	shell capital service product
Original	fuel cell, stack polymer electrolyte membrane,...	unit	0.12610703642425405	
Original	uranium mill	unit	21181903.839897163	
Original	single-Si wafer, for electronics	m2	0.48530568782483996	

Original	ventilation control and wiring, central unit	unit	0.280676729821407	
Original	printed wiring board mounting facility, surfac...	unit	15806.839793417312	
Original	green manure, Swiss integrated production, unt...	ha	0.0	shell capital service product
Original	impact extrusion of aluminium, cold, tempering	kg	0.0	shell capital service product
Original	storage, 10'000 l	unit	1331.2927282207934	
Original	residual softwood, wet	m3	0.005332206666925568	
Original	capacitor, auxilliaries and energy use	kg	2.8978243502972854e-08	
Original	packing, cement	kg	0.0	shell capital service product
Original	lead smelter slag	kg	0.12070843120724652	
Original	housing system, pig, fully-slatted floor, per ...	unit	0.0	No mass because all eol flows included - servi...
Original	tractor, 4-wheel, agricultural	kg	0.8977576986165827	
Original	transport, freight, lorry with refrigeration m...	metric ton*km	0.0	shell capital service product
Original	optical brighteners, for paper production	kg	1.7008271958080939e-09	
Original	slag from metallurgical grade silicon production	kg	7.477511156822484e-08	
Original	sawnwood, board, hardwood, dried (u=10\%), planed	m3	8.355373603268302e-08	
0	sewage sludge	m3	0.8116691771741522	
1	sewage sludge	m3	0.8116694386487204	
2	sewage sludge	m3	0.016546570934578838	
3	sewage sludge	m3	0.016546570934578845	
4	sewage sludge	m3	0.016546570934578834	
Original	machine operation, diesel, < 18.64 kW, generators	hour	0.0	shell capital service product
Original	transport, freight, lorry 7.5-16 metric ton, E...	metric ton*km	0.0	shell capital service product
0	sulfidic tailings, from gold mine operation	kg	0.014481720000287012	
1	sulfidic tailings, from gold mine operation	kg	0.014481720001658082	
2	sulfidic tailings, from gold mine operation	kg	0.014481720000097589	
3	sulfidic tailings, from gold mine operation	kg	0.014481720000786924	
4	sulfidic tailings, from gold mine operation	kg	0.014481720000686241	
5	sulfidic tailings, from gold mine operation	kg	0.014481720000111073	
6	sulfidic tailings, from gold mine operation	kg	0.014481720000146721	
7	sulfidic tailings, from gold mine operation	kg	0.014481720000042183	
8	sulfidic tailings, from gold mine operation	kg	0.014481720000111286	
9	sulfidic tailings, from gold mine operation	kg	0.014481720000330317	
10	sulfidic tailings, from gold mine operation	kg	0.014481720000244159	
11	sulfidic tailings, from gold mine operation	kg	0.014481720000244159	
Original	transport, passenger, electric bicycle, label-...	person*km	0.0	shell capital service product
Original	photovoltaic slanted-roof installation, 3kWp, ...	unit	44.9041599568909	
Original	recultivation, limestone mine	m2	0.0	shell capital service product
Original	transport, passenger car	km	0.0	shell capital service product
Original	integrated circuit, memory type	kg	0.0075809999924367115	
Original	limestone, crushed, washed	kg	1.7859991114332047e-08	
Original	wastewater from pig iron production	m3	0.033747608106446364	
Original	solder, paste, Sn95.5Ag3.9Cu0.6, for electroni...	kg	5.735439783276429e-08	
Original	liquid manure tank trailer	kg	1.0	
Original	transport, freight, lorry 16-32 metric ton, un...	metric ton*km	0.0	shell capital service product
Original	wood cladding, softwood	m2	0.0	shell capital service product
Original	transport, pipeline, onshore, petroleum	metric ton*km	0.0	shell capital service product
Original	operation, computer, laptop, 68\% active work, ...	hour	0.0	shell capital service product
Original	printed wiring board, for surface mounting, Pb...	m2	0.378785036520701	
Original	drying of grass	l	0.0	shell capital service product
Original	transport, passenger car, small size, diesel, ...	km	0.0	shell capital service product

Original	mounting, through-hole technology, Pb-free solder	m2	0.0	shell capital service product
Original	green liquor dregs	kg	1.90814024765916e-09	
Original	nuclear waste storage, final repository for lo...	unit	3792085.690127941	
0	agricultural machinery, unspecified	kg	1.0	
1	agricultural machinery, unspecified	kg	1.0	
2	fly ash and scrubber sludge	kg	0.00602329843850584	
3	fly ash and scrubber sludge	kg	0.006024834504983097	
4	fly ash and scrubber sludge	kg	0.00602329843850584	
7	fly ash and scrubber sludge	kg	9.247541101650156e-08	
8	fly ash and scrubber sludge	kg	9.204682177324083e-08	
9	fly ash and scrubber sludge	kg	9.197536294848549e-08	
10	fly ash and scrubber sludge	kg	9.19966013230204e-08	
11	fly ash and scrubber sludge	kg	9.201639537898133e-08	
12	fly ash and scrubber sludge	kg	9.182352479743286e-08	
13	fly ash and scrubber sludge	kg	9.172368416209741e-08	
14	fly ash and scrubber sludge	kg	9.198449464624035e-08	
15	fly ash and scrubber sludge	kg	9.203920291160256e-08	
16	fly ash and scrubber sludge	kg	9.20076146997608e-08	
17	fly ash and scrubber sludge	kg	9.173629718490008e-08	
18	fly ash and scrubber sludge	kg	9.168225301390351e-08	
19	fly ash and scrubber sludge	kg	9.206823748352133e-08	
20	fly ash and scrubber sludge	kg	9.193068540047432e-08	
21	fly ash and scrubber sludge	kg	9.185037125198705e-08	
22	fly ash and scrubber sludge	kg	9.196050529111354e-08	
23	fly ash and scrubber sludge	kg	9.199392780635068e-08	
24	fly ash and scrubber sludge	kg	9.185680180822168e-08	
25	fly ash and scrubber sludge	kg	9.19157019790329e-08	
26	fly ash and scrubber sludge	kg	9.264332588908442e-08	
27	fly ash and scrubber sludge	kg	9.21368777573359e-08	
28	fly ash and scrubber sludge	kg	1.371997802793116e-07	
29	fly ash and scrubber sludge	kg	1.2702582448442747e-07	
30	fly ash and scrubber sludge	kg	1.3760456958052694e-07	
31	fly ash and scrubber sludge	kg	1.3951123609848097e-07	
32	fly ash and scrubber sludge	kg	1.3951123625800313e-07	
33	fly ash and scrubber sludge	kg	1.395112360983948e-07	
34	fly ash and scrubber sludge	kg	1.3951123625800326e-07	
35	fly ash and scrubber sludge	kg	1.3951123609848097e-07	
36	fly ash and scrubber sludge	kg	1.3951123609839454e-07	
37	fly ash and scrubber sludge	kg	1.395112360983948e-07	
38	fly ash and scrubber sludge	kg	1.3951123609839491e-07	
39	fly ash and scrubber sludge	kg	1.395112360984811e-07	
40	fly ash and scrubber sludge	kg	1.3951123625800326e-07	
41	fly ash and scrubber sludge	kg	1.3951123625800326e-07	
42	fly ash and scrubber sludge	kg	1.2599092452266054e-07	
43	fly ash and scrubber sludge	kg	1.3974603684913826e-07	
44	fly ash and scrubber sludge	kg	1.3974603669245127e-07	
45	fly ash and scrubber sludge	kg	1.397460366924514e-07	
46	fly ash and scrubber sludge	kg	1.2599092452266054e-07	
47	fly ash and scrubber sludge	kg	1.2599092452259974e-07	
48	fly ash and scrubber sludge	kg	1.383373119846992e-07	

49	fly ash and scrubber sludge	kg	1.2714603006539115e-07	
50	fly ash and scrubber sludge	kg	1.2650843527571174e-07	
51	fly ash and scrubber sludge	kg	1.2675814254260 51e-07	
52	fly ash and scrubber sludge	kg	1.3961243067447642e-07	
53	fly ash and scrubber sludge	kg	1.3584776684628717e-07	
54	fly ash and scrubber sludge	kg	1.3940917605050726e-07	
55	fly ash and scrubber sludge	kg	1.4007366442951345e-07	
56	fly ash and scrubber sludge	kg	1.2675814254260477e-07	
57	fly ash and scrubber sludge	kg	1.387054585721262e-07	
58	fly ash and scrubber sludge	kg	1.3974603669245127e-07	
59	fly ash and scrubber sludge	kg	1.390625215248231e-07	
60	fly ash and scrubber sludge	kg	1.4039257276472568e-07	
61	fly ash and scrubber sludge	kg	1.3870545857203467e-07	
62	fly ash and scrubber sludge	kg	1.387054585720348e-07	
63	fly ash and scrubber sludge	kg	1.358477668462869e-07	
64	fly ash and scrubber sludge	kg	1.3833731198460456e-07	
65	fly ash and scrubber sludge	kg	1.2625279683911378e-07	
66	fly ash and scrubber sludge	kg	1.4007366442951359e-07	
67	fly ash and scrubber sludge	kg	1.3673775135656253e-07	
68	fly ash and scrubber sludge	kg	1.4007366442943081e-07	
69	fly ash and scrubber sludge	kg	1.397460366924514e-07	
70	fly ash and scrubber sludge	kg	1.394091760505941e-07	
71	fly ash and scrubber sludge	kg	1.371585228214252e-07	
72	fly ash and scrubber sludge	kg	1.3906252168992095e-07	
73	fly ash and scrubber sludge	kg	1.4007366458233733e-07	
74	fly ash and scrubber sludge	kg	1.2561320422950093e-07	
75	fly ash and scrubber sludge	kg	1.3756418964678528e-07	
76	fly ash and scrubber sludge	kg	1.3997631414963267e-07	
77	fly ash and scrubber sludge	kg	7.354014011941831e-07	
78	fly ash and scrubber sludge	kg	1.3791918217805247e-07	
79	fly ash and scrubber sludge	kg	1.38110797453577e-07	
80	fly ash and scrubber sludge	kg	1.2596390662714894e-07	
81	fly ash and scrubber sludge	kg	1.4029778699407881e-07	
82	fly ash and scrubber sludge	kg	1.398776339741624e-07	
83	fly ash and scrubber sludge	kg	0.09999996929347285	
84	fly ash and scrubber sludge	kg	0.09999996953010078	
85	fly ash and scrubber sludge	kg	0.09999996955450731	
86	fly ash and scrubber sludge	kg	0.09999996941822896	
87	fly ash and scrubber sludge	kg	0.09999996946324695	
88	fly ash and scrubber sludge	kg	0.0999999692900634	
89	fly ash and scrubber sludge	kg	0.09999996941524884	
90	fly ash and scrubber sludge	kg	0.09999996941841072	
91	fly ash and scrubber sludge	kg	0.0999999694287613	
92	fly ash and scrubber sludge	kg	0.0999999691501775	
93	fly ash and scrubber sludge	kg	0.0999999695475363	
94	fly ash and scrubber sludge	kg	0.09999996942876119	
95	fly ash and scrubber sludge	kg	0.09999996942271767	
96	fly ash and scrubber sludge	kg	0.09999996941841072	
97	fly ash and scrubber sludge	kg	0.09999996932295248	
98	fly ash and scrubber sludge	kg	4.9195420905776e-06	

99	fly ash and scrubber sludge	kg	1.395112360984811e-07	
100	fly ash and scrubber sludge	kg	1.3833678619433095e-07	
101	fly ash and scrubber sludge	kg	1.3795681330860855e-07	
102	fly ash and scrubber sludge	kg	1.3488431544311905e-07	
103	fly ash and scrubber sludge	kg	1.3866915438576624e-07	
104	fly ash and scrubber sludge	kg	1.3984473852184908e-07	
105	fly ash and scrubber sludge	kg	1.1378148523402983e-07	
106	fly ash and scrubber sludge	kg	1.260438130724612e-07	
107	fly ash and scrubber sludge	kg	1.2609691726916834e-07	
108	fly ash and scrubber sludge	kg	1.3909711590968428e-07	
109	fly ash and scrubber sludge	kg	1.4026602470742958e-07	
110	fly ash and scrubber sludge	kg	1.3638987454877604e-07	
111	fly ash and scrubber sludge	kg	1.1313962973378801e-07	
112	fly ash and scrubber sludge	kg	0.09999998393465155	
113	fly ash and scrubber sludge	kg	1.3951123609848097e-07	
114	fly ash and scrubber sludge	kg	9.202473180258723e-08	
115	fly ash and scrubber sludge	kg	4.919533919919997e-06	
116	fly ash and scrubber sludge	kg	0.09999996941842089	
117	fly ash and scrubber sludge	kg	4.919533920024338e-06	
118	fly ash and scrubber sludge	kg	1.397792061204801e-07	
119	fly ash and scrubber sludge	kg	9.189404633203188e-08	
120	fly ash and scrubber sludge	kg	9.187306315581943e-08	
121	fly ash and scrubber sludge	kg	9.197421942265647e-08	
122	fly ash and scrubber sludge	kg	4.919571158336955e-06	
123	fly ash and scrubber sludge	kg	1.3951123609848083e-07	
124	fly ash and scrubber sludge	kg	9.181922377446908e-08	
125	fly ash and scrubber sludge	kg	7.354523967967399e-07	
126	fly ash and scrubber sludge	kg	4.769096345367399e-07	
127	fly ash and scrubber sludge	kg	8.838867883609649e-08	
128	fly ash and scrubber sludge	kg	8.950330103686265e-08	
129	fly ash and scrubber sludge	kg	8.720881753947047e-08	
130	fly ash and scrubber sludge	kg	9.543979170657609e-08	
131	fly ash and scrubber sludge	kg	9.414964688919112e-08	
132	fly ash and scrubber sludge	kg	9.476623544636115e-08	
133	fly ash and scrubber sludge	kg	9.282301963613156e-08	
134	fly ash and scrubber sludge	kg	9.328307395312319e-08	
135	fly ash and scrubber sludge	kg	9.3068688995195e-08	
136	fly ash and scrubber sludge	kg	9.414936953752259e-08	
137	fly ash and scrubber sludge	kg	9.096591712493643e-08	
138	fly ash and scrubber sludge	kg	9.371600681073451e-08	
139	fly ash and scrubber sludge	kg	4.776059836587990e-07	
140	fly ash and scrubber sludge	kg	9.181922377445836e-08	
141	fly ash and scrubber sludge	kg	1.167768542748397e-07	
142	fly ash and scrubber sludge	kg	1.1739671432056844e-07	
143	fly ash and scrubber sludge	kg	1.1611459459449765e-07	
144	fly ash and scrubber sludge	kg	0.09999996857761	
145	fly ash and scrubber sludge	kg	1.2702630421457884e-07	
146	fly ash and scrubber sludge	kg	1.2702630431752076e-07	
147	fly ash and scrubber sludge	kg	4.919536947023161e-06	
148	fly ash and scrubber sludge	kg	4.919755713290543e-06	

149	fly ash and scrubber sludge	kg	4.91954897673796e-06	
150	fly ash and scrubber sludge	kg	4.919571158421988e-06	
151	fly ash and scrubber sludge	kg	4.9195701060707654e-06	
152	fly ash and scrubber sludge	kg	9.181922377445841e-08	
153	fly ash and scrubber sludge	kg	9.181922377445808e-08	
154	fly ash and scrubber sludge	kg	9.181922377446913e-08	
155	fly ash and scrubber sludge	kg	4.91957010566828e-06	
156	fly ash and scrubber sludge	kg	1.2599092452266043e-07	
157	fly ash and scrubber sludge	kg	0.09999996851944302	
158	fly ash and scrubber sludge	kg	0.005548383500815643	
159	fly ash and scrubber sludge	kg	0.005546519911551244	
160	fly ash and scrubber sludge	kg	1.3787985242940148e-07	
161	fly ash and scrubber sludge	kg	1.2664570008026906e-07	
162	fly ash and scrubber sludge	kg	1.2664570008026898e-07	
163	fly ash and scrubber sludge	kg	1.2664570008026906e-07	
164	fly ash and scrubber sludge	kg	1.2664570008026932e-07	
165	fly ash and scrubber sludge	kg	1.2664570008026898e-07	
166	fly ash and scrubber sludge	kg	4.9194279812497736e-06	
167	fly ash and scrubber sludge	kg	1.0815148127418043e-07	
168	fly ash and scrubber sludge	kg	2.2506406655317216e-07	
169	fly ash and scrubber sludge	kg	0.09999996953010097	
170	fly ash and scrubber sludge	kg	1.4108672982543537e-05	
171	fly ash and scrubber sludge	kg	8.901835654987413e-09	
172	fly ash and scrubber sludge	kg	8.73678347713704e-09	
173	fly ash and scrubber sludge	kg	7.35318219210448e-07	
174	fly ash and scrubber sludge	kg	1.3940970558411722e-07	
175	fly ash and scrubber sludge	kg	7.353702757428344e-07	
176	fly ash and scrubber sludge	kg	1.9363491225748627e-06	
177	fly ash and scrubber sludge	kg	7.353089592237202e-07	
178	fly ash and scrubber sludge	kg	1.386332651155357e-07	
179	fly ash and scrubber sludge	kg	7.3553167162880466e-07	
180	fly ash and scrubber sludge	kg	7.3536934729638882e-07	
181	fly ash and scrubber sludge	kg	7.35359024816524e-07	
182	fly ash and scrubber sludge	kg	7.353590431861927e-07	
183	fly ash and scrubber sludge	kg	7.353221565724073e-07	
184	fly ash and scrubber sludge	kg	7.361766104682742e-07	
185	fly ash and scrubber sludge	kg	1.3870598527171408e-07	
186	fly ash and scrubber sludge	kg	7.353463807180853e-07	
187	fly ash and scrubber sludge	kg	1.1002369031462357e-07	
188	fly ash and scrubber sludge	kg	1.1002369031449262e-07	
189	fly ash and scrubber sludge	kg	7.35346458984257e-07	
190	fly ash and scrubber sludge	kg	1.3830038478725815e-07	
191	fly ash and scrubber sludge	kg	7.3539375690032666e-07	
192	fly ash and scrubber sludge	kg	7.355122651815105e-07	
193	fly ash and scrubber sludge	kg	1.2553097153297215e-07	
194	fly ash and scrubber sludge	kg	7.353839643585533e-07	
195	fly ash and scrubber sludge	kg	7.352830060697531e-07	
196	fly ash and scrubber sludge	kg	1.3699254471995678e-07	
197	fly ash and scrubber sludge	kg	7.354930601250665e-07	
198	fly ash and scrubber sludge	kg	7.355318609420001e-07	

199	fly ash and scrubber sludge	kg	1.936240164485945e-06	
200	fly ash and scrubber sludge	kg	7.355361532482624e-07	
201	fly ash and scrubber sludge	kg	7.355365454887509e-07	
202	fly ash and scrubber sludge	kg	7.354503005890381e-07	
203	fly ash and scrubber sludge	kg	7.354459328864475e-07	
204	fly ash and scrubber sludge	kg	7.442907707300582e-07	
205	fly ash and scrubber sludge	kg	7.35463967882104e-07	
206	fly ash and scrubber sludge	kg	8.853112997223187e-08	
207	fly ash and scrubber sludge	kg	9.6191420721461e-08	
208	fly ash and scrubber sludge	kg	8.853112997223182e-08	
209	fly ash and scrubber sludge	kg	7.354408591622563e-07	
210	fly ash and scrubber sludge	kg	7.355086202004745e-07	
211	fly ash and scrubber sludge	kg	7.354314102918689e-07	
212	fly ash and scrubber sludge	kg	7.355202175448654e-07	
213	fly ash and scrubber sludge	kg	7.355690728040219e-07	
214	fly ash and scrubber sludge	kg	9.041435079888078e-08	
215	fly ash and scrubber sludge	kg	7.353844479980819e-07	
216	fly ash and scrubber sludge	kg	7.353394647353817e-07	
217	fly ash and scrubber sludge	kg	9.572169635081628e-08	
218	fly ash and scrubber sludge	kg	9.572169635081624e-08	
219	fly ash and scrubber sludge	kg	9.572169635081618e-08	
220	fly ash and scrubber sludge	kg	9.57216963508162e-08	
221	fly ash and scrubber sludge	kg	9.572169635081612e-08	
222	fly ash and scrubber sludge	kg	9.572169635081624e-08	
223	fly ash and scrubber sludge	kg	9.572169635081624e-08	
224	fly ash and scrubber sludge	kg	9.57216963508161e-08	
225	fly ash and scrubber sludge	kg	9.572169635081624e-08	
226	fly ash and scrubber sludge	kg	0.014243887754893377	
227	fly ash and scrubber sludge	kg	0.014243708362544938	
228	fly ash and scrubber sludge	kg	0.018408726841638776	
229	fly ash and scrubber sludge	kg	0.014243181940357376	
230	fly ash and scrubber sludge	kg	0.014216186014445043	
231	fly ash and scrubber sludge	kg	0.014243181205679587	
232	fly ash and scrubber sludge	kg	3.0145275346654244e-07	
233	fly ash and scrubber sludge	kg	0.01423146974604317	
234	fly ash and scrubber sludge	kg	0.01424459530915635	
235	fly ash and scrubber sludge	kg	8.257040670416816e-10	
236	fly ash and scrubber sludge	kg	8.257040670416816e-10	
237	fly ash and scrubber sludge	kg	8.257040670416816e-10	
238	fly ash and scrubber sludge	kg	8.257040670416816e-10	
239	fly ash and scrubber sludge	kg	8.257040670416816e-10	
240	fly ash and scrubber sludge	kg	8.257040683058471e-10	
241	fly ash and scrubber sludge	kg	8.257040670416816e-10	
242	fly ash and scrubber sludge	kg	8.257040670416816e-10	
243	fly ash and scrubber sludge	kg	8.257040670416816e-10	
244	fly ash and scrubber sludge	kg	8.257040670416816e-10	
245	fly ash and scrubber sludge	kg	8.257040670416816e-10	
246	fly ash and scrubber sludge	kg	8.257040683058471e-10	
247	fly ash and scrubber sludge	kg	8.257040670416816e-10	
248	fly ash and scrubber sludge	kg	8.257040670416816e-10	

249	fly ash and scrubber sludge	kg	8.257040670416816e-10	
250	fly ash and scrubber sludge	kg	8.257040670416816e-10	
Original	green manure, organic, until April	ha	0.0	shell capital service product
Original	yogurt, from cow milk	kg	8.391126662683154e-06	
Original	maintenance, lorry 28 metric ton	unit	795.5862915170092	
Original	photovoltaic module, building-integrated, for ...	m2	0.20046999988622857	
Original	electric connector, wire clamp	kg	7.616884719932475e-10	
Original	average incineration residue	kg	0.9999999821169251	
Original	transport, freight, lorry with refrigeration m...	metric ton*km	0.0	shell capital service product
Original	aircraft, dedicated freight, long haul	unit	6770.818621100498	
Original	chromite ore concentrate	kg	2.10808911517935e-11	
Original	ultraviolet lamp	unit	0.004302199999883323	
Original	catalytic converter, selective catalytic reduc...	unit	156.11942737042995	
Original	grape	kg	0.0001982511745428333	
Original	iron ore, crude ore, 46\% Fe	kg	0.4500000000330185	
Original	air compressor, screw-type compressor, 300kW	unit	3957.6567134063857	
Original	haying, by rotary tedder	ha	0.0	shell capital service product
Original	mine infrastructure, open cast, hard coal	unit	2476280.6946874326	
Original	sheet rolling, chromium steel	kg	0.01270420278515905	
Original	injection moulding	kg	0.0	shell capital service product
Original	transport, freight, lorry with refrigeration m...	metric ton*km	0.0	shell capital service product
Original	drawing of pipe, steel	kg	0.5	
Original	sawnwood, beam, softwood, dried (u=20\%), planed	m3	3.395955369909856e-06	
Original	ash from paper production sludge	kg	0.00964080280920873	
Original	transport, passenger car, medium size, natural...	km	0.0	shell capital service product
Original	straw, organic	kg	1.1739789087466702e-10	
Original	sweet sorghum grain	kg	0.00013407935610374312	
Original	laser machining, metal, with YAG-laser, 200W p...	hour	0.0	shell capital service product
Original	heat and power co-generation unit, 50kW electr...	unit	16.37438861102503	
Original	foam glass, electricity, label-certified	kg	0.019381277514668123	
Original	spent catalyst base from ethyleneoxide production	kg	6.2725225358324750e-06	
Original	land tenure, arable land, measured as carbon n...	kg	0.0	shell capital service product
Original	grass fibre	kg	3.16507285658811e-07	
0	sewer grid, 1.1E10l/year, 242 km	km	58992.03723653003	
1	sewer grid, 1.1E10l/year, 242 km	km	58998.50601891138	
Original	selective coat, copper sheet, physical vapour ...	m2	2.061618824871251e-11	
Original	computer, laptop	unit	0.3123535238966503	
Original	furnace, logs, average storage area, 30kW	unit	470.0031129682164	
Original	phosphoric acid factory, fertiliser grade	unit	195664.21352518533	
Original	contouring, bronze	kg	0.0	shell capital service product
Original	waste electric wiring	kg	0.003308970278950317	
Original	seawater reverse osmosis module	m2	2.0927293460367757e-10	
Original	transport, freight, lorry with refrigeration m...	metric ton*km	0.0	shell capital service product
Original	diesel-electric generating set, 18.5kW	unit	362.74405532302006	
Original	transport, passenger car, large size, diesel, ...	km	0.0	shell capital service product
Original	synthetic gas factory	unit	20909.90138141469	
Original	gas turbine, 10MW electrical	unit	37229.19263526958	
Original	sowing	ha	0.0	shell capital service product
Original	manure, liquid, swine	kg	3.062847504242126e-11	
Original	bark chips, wet, measured as dry mass	kg	1.1204645073927301e-10	

Original	fibre cement corrugated slab	kg	0.0015885139683253695	
Original	cast iron removed by turning, primarily roughi...	kg	1.0	
Original	cement plaster	m3	0.02749997038020447	
Original	chilli	kg	4.825627155006935e-10	
Original	palm fruit bunch	kg	4.07896792311016e-06	
Original	furnace, wood chips, with silo, 300kW	unit	1340.0995774547264	
0	refinery sludge	kg	5.2034893580756935e-08	
1	refinery sludge	kg	5.2034893580756935e-08	
2	refinery sludge	kg	8.983226509181195e-09	
3	refinery sludge	kg	1.5037510717317453e-08	
8	refinery sludge	kg	0.0001405572053269345	
9	refinery sludge	kg	0.00013763337206471637	
10	refinery sludge	kg	0.000140582124329024	
11	refinery sludge	kg	0.00013763512098121023	
12	refinery sludge	kg	6.294771694270565e-05	
13	refinery sludge	kg	5.608879423146345e-05	
14	refinery sludge	kg	0.00013944283518839353	
15	refinery sludge	kg	0.00013341075428034558	
16	refinery sludge	kg	0.00012359097618201839	
17	refinery sludge	kg	0.00013944962134200087	
18	refinery sludge	kg	0.0001450841549243281	
19	refinery sludge	kg	0.00015246314498672286	
20	refinery sludge	kg	2.6950757615861998e-05	
21	refinery sludge	kg	0.0001525268903563795	
22	refinery sludge	kg	0.000152746436543346	
23	refinery sludge	kg	0.0001422859021518649	
24	refinery sludge	kg	0.000153295747199234	
25	refinery sludge	kg	0.00014246466462303908	
26	refinery sludge	kg	0.00015785570162104686	
27	refinery sludge	kg	0.00013763357079266	
28	refinery sludge	kg	0.00012864164703306155	
29	refinery sludge	kg	0.00011339655831970661	
30	refinery sludge	kg	0.00013763529914328354	
31	refinery sludge	kg	0.00014285916567500386	
32	refinery sludge	kg	0.0001422441530588477	
33	refinery sludge	kg	0.00014675495186880974	
34	refinery sludge	kg	0.00014242269962063043	
35	refinery sludge	kg	0.0001604562343459904	
36	refinery sludge	kg	0.00013516600113938772	
37	refinery sludge	kg	0.0001260906210015928	
38	refinery sludge	kg	0.00011424662886279939	
39	refinery sludge	kg	0.00013516858815044818	
40	refinery sludge	kg	0.00013774880959324713	
41	refinery sludge	kg	0.00013540049293551092	
42	refinery sludge	kg	1.5922269255063457e-05	
43	refinery sludge	kg	1.536685291671313e-05	
44	refinery sludge	kg	1.4838162461227882e-05	
45	refinery sludge	kg	1.592390149982805e-05	
46	refinery sludge	kg	1.5823226075893253e-05	
47	refinery sludge	kg	6.302091692982448e-05	

48	refinery sludge	kg	6.305956204310445e-05	
49	refinery sludge	kg	6.415191939386039e-05	
50	refinery sludge	kg	0.00011191110826353104	
51	refinery sludge	kg	0.00013983428374506553	
52	refinery sludge	kg	0.00013927774888150592	
53	refinery sludge	kg	0.00013983123992214377	
54	refinery sludge	kg	0.000125601200730633	
55	refinery sludge	kg	0.00011191043868634457	
56	refinery sludge	kg	0.0001398326540097812	
57	refinery sludge	kg	0.00013927678398121203	
58	refinery sludge	kg	1.5284209376438402e-05	
59	refinery sludge	kg	1.4644928185791408e-05	
60	refinery sludge	kg	1.4075253992082662e-05	
61	refinery sludge	kg	1.5286503390009925e-05	
62	refinery sludge	kg	1.526753453380032e-05	
63	refinery sludge	kg	0.00015590738617061122	
64	refinery sludge	kg	0.00014033132338319945	
65	refinery sludge	kg	0.00012764043272376965	
66	refinery sludge	kg	0.0001559093180577311	
67	refinery sludge	kg	0.0001550824848767735	
68	refinery sludge	kg	0.0001263526734465173	
69	refinery sludge	kg	0.00010882061778375131	
70	refinery sludge	kg	8.791804536143379e-05	
71	refinery sludge	kg	0.0001263196645199882	
72	refinery sludge	kg	0.0001256618551535951	
73	refinery sludge	kg	0.00013982719784100137	
74	refinery sludge	kg	0.0001255971189140679	
75	refinery sludge	kg	0.00011190664215173987	
76	refinery sludge	kg	0.00013982866965079073	
77	refinery sludge	kg	0.0001392725251047958	
78	refinery sludge	kg	1.3205249576046078e-05	
79	refinery sludge	kg	1.337612463773377e-05	
80	refinery sludge	kg	0.00016660048235295894	
81	refinery sludge	kg	0.00013391063983297344	
82	refinery sludge	kg	0.00010754093676112751	
83	refinery sludge	kg	0.00016660685996876484	
84	refinery sludge	kg	0.0001648096087883673	
85	refinery sludge	kg	0.0001394428337517353	
86	refinery sludge	kg	0.00014251663121134342	
87	refinery sludge	kg	0.00014248903377636355	
88	refinery sludge	kg	0.00013944961675058893	
89	refinery sludge	kg	0.00014367208402705467	
90	refinery sludge	kg	0.00013983263692578737	
91	refinery sludge	kg	0.00012560206019053582	
92	refinery sludge	kg	0.000143706622913952	
93	refinery sludge	kg	0.0001360218443731604	
94	refinery sludge	kg	0.0001394596960525215	
95	refinery sludge	kg	0.00014382416257011573	
96	refinery sludge	kg	0.00013489826050704632	
97	refinery sludge	kg	0.0001554483366670308	

98	refinery sludge	kg	0.0001426404342989259	
99	refinery sludge	kg	0.00013602285860035384	
100	refinery sludge	kg	1.5765593882466668e-05	
101	refinery sludge	kg	0.00013895773156081187	
102	refinery sludge	kg	0.0001420907464029423	
103	refinery sludge	kg	7.016256226443902e-05	
104	refinery sludge	kg	0.00016317162349431652	
105	refinery sludge	kg	0.00016542841128318689	
106	refinery sludge	kg	5.836413029796634e-05	
107	refinery sludge	kg	0.0001360177332510907	
108	refinery sludge	kg	1.5143199175211264e-05	
109	refinery sludge	kg	0.00013475932495539698	
110	refinery sludge	kg	0.00012114138557502773	
111	refinery sludge	kg	1.3368363272715679e-05	
112	refinery sludge	kg	0.00013782509724984785	
113	refinery sludge	kg	0.00013970258925099846	
114	refinery sludge	kg	2.1485250687947074e-05	
115	refinery sludge	kg	1.5765593882466678e-05	
116	refinery sludge	kg	5.836413029796638e-05	
117	refinery sludge	kg	0.0001426404342989259	
118	refinery sludge	kg	0.00014209074318032304	
119	refinery sludge	kg	7.01625622644391e-05	
120	refinery sludge	kg	0.00016542841128318675	
121	refinery sludge	kg	0.00013945969605252146	
122	refinery sludge	kg	0.00012114138557502792	
123	refinery sludge	kg	0.0001360177332510906	
124	refinery sludge	kg	1.336836320816567e-05	
125	refinery sludge	kg	0.00015544832049704362	
126	refinery sludge	kg	0.0001438241627608709	
127	refinery sludge	kg	0.00013602285860035397	
128	refinery sludge	kg	0.00013602184437316048	
129	refinery sludge	kg	0.00013895773668847608	
130	refinery sludge	kg	0.0001631716234943166	
131	refinery sludge	kg	0.0001347593249553969	
132	refinery sludge	kg	0.00013489826050704632	
133	refinery sludge	kg	0.014748333215022833	
134	refinery sludge	kg	0.014748333215022847	
135	refinery sludge	kg	1.5143199175211264e-05	
136	refinery sludge	kg	1.0306151211873443e-08	
137	refinery sludge	kg	1.0306136003307943e-08	
Original	limestone, crushed, for mill	kg	1.7172391349267135e-13	
Original	nuclear spent fuel conditioning facility	unit	3151.950623523317	
Original	light mortar	kg	6.907120243374265e-11	
Original	ferrochromium, high-carbon, 68\% Cr	kg	0.9999999999465035	
Original	aircraft, dedicated freight, very short haul	unit	5600.201723340389	
Original	palm kernel meal	kg	3.2076189347897756e-05	
Original	transport, pipeline, long distance, natural gas	metric ton*km	0.0	shell capital service product
Original	slag, unalloyed electric arc furnace steel	kg	0.9999999999441196	
Original	cable, connector for computer, without plugs	m	2.697082019164377e-12	
Original	fava bean, Swiss integrated production	kg	1.8103832150496704e-10	

Original	pulpwood, softwood, measured as solid wood und...	m3	0.0005142178671419991	
Original	light commercial vehicle	unit	585.4196538200073	
Original	selective coat, copper sheet, black majic	m2	6.370609960606616e-11	
Original	solder, bar, Sn63Pb37, for electronics industry	kg	9.584653794265886e-09	
Original	used purse seiner, steel	kg	0.8583519242175793	
Original	hard coal briquettes factory	unit	5563524.496535521	
Original	landed hake, fresh	kg	1.0365908442998306e-10	
Original	transistor, auxilliaries and energy use	kg	1.2744399795035303e-08	
Original	used train, passenger, long-distance	unit	41631.14158076081	
Original	transport, passenger car, electric	km	0.0	shell capital service product
Original	machine operation, diesel, < 18.64 kW, steady-...	hour	0.0	shell capital service product
Original	geothermal power plant, undefined type	unit	419199.9975725825	
Original	lorry, 28 metric ton	unit	0.0	No mass because all eol flows included - servi...
Original	wind power plant, 800kW, moving parts	unit	4098.999096246221	
Original	recultivation, ilmenite mine	m2	0.0	shell capital service product
Original	catalytic converter, three-way, 19.1l	unit	41.6126544919863	
Original	used door, inner, glass-wood	m2	2.1575107127006	
Original	whey	kg	5.599243172294072e-11	
Original	impact extrusion of steel, cold, tempering	kg	0.0	shell capital service product
Original	ferronickel, 25\% Ni	kg	0.7125609119608562	
Original	lignite briquettes factory	unit	5563524.496535523	
Original	transport, freight, inland waterways, barge wi...	metric ton*km	0.0	shell capital service product
Original	ferromanganese, high-coal, 74.5\% Mn	kg	0.009361746618946579	
Original	air distribution terminal panel, steel, 120 m3/h	unit	9.499999999865018	
Original	transport, freight, light commercial vehicle, ...	metric ton*km	0.0	shell capital service product
Original	aircraft, passenger, medium haul	unit	2027.2895561039254	
Original	ethanol fermentation plant	unit	645233.6621609317	
Original	operation, housing system, cattle, tied, per a...	unit	0.0	shell capital service product
Original	waste fibreboard	kg	2.07637791093721e-12	
Original	limestone residue	kg	3.573659406037872e-11	
Original	transport, freight, lorry 7.5-16 metric ton, E...	metric ton*km	0.0	shell capital service product
Original	inductor, low value multilayer chip	kg	2.5604164858947273e-06	
Original	chemical, inorganic	kg	0.019150711709360557	
0	chemical, inorganic	kg	1.470558275812852e-09	
Original	spent nuclear fuel	kg	5.6312206947905 46e-11	
Original	concentrated solar power plant, solar tower, 2...	unit	619.4067906813704	
Original	forwarding, forwarder	hour	0.0	shell capital service product
Original	copper slag	kg	0.003806703553535574	
Original	enriched uranium, 4.2\%	kg	2.225660545915842e-07	
Original	uranium enrichment diffusion facility	unit	279610866.99951065	
Original	fertilising, by broadcaster	ha	0.0	shell capital service product
Original	stone wool, packed	kg	5.3925080864795945e-12	
Original	transport, freight, train with reefer, freezing	metric ton*km	0.0	shell capital service product
Original	cabbage white	kg	9.514343243833216e-12	
Original	land use change, forest, intensive	ha	0.0	shell capital service product
Original	tin slag	kg	0.060241518881834696	
Original	capacitor, tantalum-, for through-hole mounting	kg	0.08703980258851879	
Original	concrete, 50MPa	m3	0.037148269522450095	
Original	selective coat, aluminium sheet, nickel pigmen...	m2	5.405429779574156e-08	
Original	hard coal ash	kg	2.376818547277905e-12	

Original	cladding, crossbar-pole, aluminium	m2	21.920708262527388	
Original	antifouling paint emissions	kg	3.507362650484111e-08	
Original	casting, brass	kg	0.0	shell capital service product
Original	tillage, hoeing and earthing-up, potatoes	ha	0.0	shell capital service product
Original	transport, freight, sea, tanker for petroleum	metric ton*km	0.0	shell capital service product
Original	natural gas service station	unit	3526.4660237450466	
Original	glider, passenger car	kg	0.1415748448894152	
Original	toner, colour, powder	kg	0.0008617820270211272	
Original	fava bean, organic	kg	3.128178601926564e-08	
Original	fuel cell, solid oxide, with micro gas turbine...	unit	9514.292713030298	
Original	zinc oxide	kg	0.09999999931652773	
Original	maintenance, train, passenger, regional	unit	3816.110912219293	
Original	wastewater from medium density board production	m3	2.750151557420795e-07	
Original	potato, organic	kg	9.66775917231373e-08	
Original	machine operation, diesel, < 18.64 kW, high lo...	hour	0.0	shell capital service product
Original	petrol, 5\% ethanol by volume from biomass	kg	0.00035877197832076936	
Original	permanent magnet, for electric motor	kg	0.6845518023623248	
Original	land use change, paddy rice	ha	0.0	shell capital service product
Original	indium rich leaching residues, from zinc produ...	kg	2.017659844873174e-14	
Original	evaporation of milk	kg	0.0	shell capital service product
Original	heat pump, for mini CHP plant	unit	21.879884597162267	
Original	deep drawing, steel, 38000 kN press, single st...	kg	0.0	shell capital service product
Original	greenhouse, plastic walls and roof	m2*year	0.0	No mass because all eol flows included - servi...
Original	synthetic gas	m3	3.707831003334353e-12	
Original	metal working, average for steel product manuf...	kg	0.22699999997774928	
Original	diesel, burned in fishing vessel	MJ	2.4290007492298597e-13	
Original	cocoa bean	kg	2.1724994083019658e-10	
Original	dried roughage store, cold-air dried, conventi...	m3	4.633862522137983e-11	
Original	acrylic binder, without water, in 34\% solution...	kg	2.7001551524534718e-11	
Original	used silencer steel, DN 125	unit	4.15	
Original	wastewater from liquid crystal display production	m3	1.2112107373911468e-10	
Original	cottonseed, organic, for sowing	kg	3.478986622517102e-07	
Original	impact extrusion of steel, warm, 4 strokes	kg	0.0	shell capital service product
Original	cement, alternative constituents 6-20\%	kg	0.0001085915050048805	
Original	aircraft, belly freight, medium haul	unit	2545.8836762297815	
Original	building, hall, steel construction	m2	2.6581915368452446e-10	
Original	aluminium oxide factory	unit	777206.8731427952	
Original	grass silage, Swiss integrated production	kg	0.0	shell capital service product
Original	petrol, 15\% ETBE additive by volume, with etha...	kg	0.0003219690249290371	
Original	packaging, for fertilisers	kg	0.0	shell capital service product
Original	barley seed, organic, for sowing	kg	1.2821862932632452e-09	
Original	geothermal power plant, Hot-Dry-Rock	unit	52399.99969657281	
Original	lime, hydraulic	kg	0.0032872479356132666	
Original	cast iron removed by turning, primarily roughi...	kg	1.0	
Original	plug, inlet and outlet, for network cable	unit	1.6871192417977578e-12	
Original	blast oxygen furnace converter	unit	0.04653644056869029	
Original	energy and auxilliary inputs, metal working ma...	kg	5.756913968869882e-12	
Original	packing, lime product	kg	0.0	shell capital service product
0	sulfidic tailings, from copper mine operation	kg	0.014623290000859003	
1	sulfidic tailings, from copper mine operation	kg	0.01462329000115755	

2	sulfidic tailings, from copper mine operation	kg	0.014623290000615415	
3	sulfidic tailings, from copper mine operation	kg	0.0146232900045588	
4	sulfidic tailings, from copper mine operation	kg	0.014623290000482509	
5	sulfidic tailings, from copper mine operation	kg	0.01462329000061141	
6	sulfidic tailings, from copper mine operation	kg	0.01462329000067684	
7	sulfidic tailings, from copper mine operation	kg	0.014623290000076436	
Original	transport, freight, lorry with refrigeration m...	metric ton*km	0.0	shell capital service product
Original	energy feed, gross	MJ	1.8375213747613532e-06	
Original	fava bean, feed, Swiss integrated production	kg	8.660596593149043e-11	
Original	impact extrusion of steel, hot, initial warming	kg	0.0	shell capital service product
Original	sawnwood, beam, hardwood, dried (u=10\%), planed	m3	9.806447091560224e-08	
Original	operation, computer, laptop, 23\% active work	hour	0.0	shell capital service product
Original	transport, passenger car, EURO 4	km	0.0	shell capital service product
Original	spiral-seam duct, steel, DN 400	m	5.9999999999207	
Original	chromium steel removed by milling, large parts	kg	0.6305351821295553	
Original	transport, passenger car, large size, natural ...	km	0.0	shell capital service product
Original	degreasing, metal part in alkaline bath	m2	0.0	shell capital service product
Original	wood preservation, vacuum pressure method, org...	kg	0.0	shell capital service product
Original	concrete, 20MPa	m3	0.03556485018117719	
Original	transport, pipeline, offshore, petroleum	metric ton*km	0.0	shell capital service product
Original	pipeline, petroleum, offshore	km	309566.3834278501	
Original	thermo-mechanical pulp	kg	3.4361156773228824e-05	
Original	floating hexagonal metal cage	m	93.18599919572613	
Original	rape seed, for sowing	kg	2.245959729872572e-09	
Original	floating collar cage	m	112.71599999982844	
Original	impact extrusion of steel, hot, 4 strokes	kg	0.0	shell capital service product
Original	concrete, sole plate and foundation	m3	0.018003576227781516	
Original	dried roughage store, air dried, solar	m3	1.8902571593740828e-10	
Original	used locomotive	unit	43863.787339063325	
Original	waste cement, hydrated	kg	1.7996221661457638e-12	
Original	laser machining, metal, with CO2-laser, 4000W ...	hour	0.0	shell capital service product
Original	furnace, logs, hardwood storage area, 100kW	unit	1068.0064204863954	
Original	mounting, surface mount technology, Pb-contain...	m2	0.0	shell capital service product
Original	transport, freight, lorry with refrigeration m...	metric ton*km	0.0	shell capital service product
Original	furnace, wood chips, hardwood storage area, 10...	unit	6347.132585502109	
Original	used window frame, wood-metal	m2	62.247848499087304	
Original	heat and power co-generation unit, 6400kW ther...	unit	15290.347755449338	
Original	rape seed, organic	kg	1.5162118730546274e-09	
Original	oil boiler, 100kW	unit	500.1017177571142	
Original	anaerobic digestion plant, agricultural	unit	3380.9371859314897	
Original	used outside air intake stainless steel, DN 370	unit	16.0	
Original	steel, low-alloyed	kg	0.9999999999985845	
Original	wastewater from black chrome coating	m3	3.2711303731176663e-06	
Original	dross from Al electrolysis	kg	5.8085680234068814e-11	
Original	concrete slab	m3	60.08335119547982	
Original	transport, freight, sea, ferry	metric ton*km	0.0	shell capital service product
Original	filter dust from Al electrolysis	kg	2.1249723870909268e-10	
Original	natural stone plate, cut	kg	2.7779757261843434e-05	
0	sulfidic tailings, from zinc-lead mine operation	kg	0.029814806767220085	
1	sulfidic tailings, from zinc-lead mine operation	kg	0.03041413	

Original	trout	kg	3.866646887246253e-05	
Original	coconut husk	kg	2.6895686771687696e-10	
Original	milking	kg	0.0	shell capital service product
Original	hard coal coke factory	unit	111270457.9556819	
Original	furnace, wood chips, average storage area, 1000kW	unit	6347.372239799894	
Original	air input/output unit, heat and power co-gener...	unit	216.1475171678864	
Original	steel removed by turning, primarily dressing, ...	kg	0.999999999901963	
Original	train, passenger, long-distance	unit	0.0	No mass because all eol flows included - servi...
Original	tilapia feed, 24-28\% protein	kg	4.0169316968424606e-05	
0	agricultural machinery, tillage	kg	0.9999999999999999	
1	agricultural machinery, tillage	kg	0.9999999999999999	
Original	medium density fibreboard	m3	0.00032849025209932325	
Original	land use change, pasture, man made	ha	0.0	shell capital service product
Original	power sawing, without catalytic converter	hour	0.0	shell capital service product
Original	printed wiring board, surface mounted, unspeci...	kg	0.0913042847309369	
Original	transport, passenger car, medium size, diesel,...	km	0.0	shell capital service product
Original	sawnwood, hardwood, raw, dried (u=10\%)	m3	5.293162099984615e-08	
Original	absorption chiller, 100kW	unit	2703.228617553597	
Original	transport, passenger car, EURO 5	km	0.0	shell capital service product
Original	battery, NiMH, rechargeable, prismatic	kg	0.022813554196616972	
Original	green manure, Swiss integrated production, unt...	ha	0.0	shell capital service product
Original	barge	unit	218372.07314671867	
Original	soybean oil, refined	kg	3.0882996896758633e-09	
Original	packing, fibre cement product	kg	0.0	shell capital service product
Original	manual dismantling of used electric passenger car	unit	0.0	shell capital service product
Original	indium rich leaching residues, from zinc produ...	kg	3.4444089987667895e-06	
Original	photovoltaic mounting system, for flat-roof in...	m2	0.26677999961980153	
Original	sawnwood, softwood, raw	m3	3.0440452334145266e-06	
Original	blower and heat exchange unit, GE 250 RH	unit	40.372797102929496	
Original	plaster mixing	kg	0.0	shell capital service product
Original	inductor, miniature radio frequency chip	kg	3.277977272082451e-09	
Original	transport, freight, aircraft, unspecified	metric ton*km	0.0	shell capital service product
Original	furnace, wood chips, average storage area, 50kW	unit	629.7859219302889	
Original	electric motor, for electric scooter	kg	0.4050641421782309	
Original	tofu	kg	5.577753623127163e-11	
Original	furnace, logs, 6kW	unit	5.7857070906138865	
Original	heat and power co-generation unit, organic Ran...	unit	0.0	No mass because all eol flows included - servi...
Original	window frame, poly vinyl chloride, U=1.6 W/m2K	m2	29.999999997059252	
Original	cover plaster, mineral	kg	2.842561916779297e-10	
Original	power block, solar tower power plant, 20 MW	unit	232969.42181666847	
Original	assembly of generator and motor, auxilliaries ...	unit	420.2868651856965	
Original	waste frit from cathode ray tube production	kg	0.14244091158624594	
Original	blower and heat exchange unit, KWLC 1200	unit	128.18576412487056	
Original	land tenure, arable land, measured as carbon n...	kg	0.0	shell capital service product
Original	diode, auxilliaries and energy use	kg	4.632715401103117e-09	
Original	purse seiner maintenance, wood	kg	0.0	shell capital service product
Original	petrol, low-sulfur	kg	0.00037878708797816734	
Original	rye seed, Swiss integrated production, for sowing	kg	7.570079620124343e-06	
Original	kenaf plant, harvested	kg	9.18265803721602e-12	
0	inert material landfill	unit	1115.0871475036097	

1	inert material landfill	unit	1115.162593345874	
Original	harvester	kg	0.9999999999912879	
Original	operation, computer, desktop, with liquid crys...	hour	0.0	shell capital service product
Original	cauliflower	kg	1.5301715003888928e-10	
Original	particle board, for indoor use	m3	7.538966246094231	
Original	section bar rolling, steel	kg	0.0	shell capital service product
Original	maintenance, bus	unit	35.14316673697309	
Original	maintenance, bulk carrier, for dry goods	unit	525291.8604260968	
Original	maintenance, tanker, for liquefied natural gas	unit	406496.0927478644	
Original	operation, computer, laptop, videoconference, ...	hour	0.0	shell capital service product
Original	glazing, triple, U<0.5 W/m2K	m2	2.887655677115941	
Original	transport, freight, lorry with refrigeration m...	metric ton*km	0.0	shell capital service product
Original	concrete, high exacting requirements	m3	0.012513427563557219	
Original	cable, unspecified	kg	3.452056387303093e-11	
Original	metal working, average for aluminium product m...	kg	0.0	shell capital service product
Original	maintenance, mini CHP plant	unit	150.10245185203445	
Original	wood pellet factory	unit	86460.32334331266	
Original	laminated timber element, transversally prestr...	m3	52.299973634982855	
Original	steel, low-alloyed, hot rolled	kg	0.9999999999019792	
Original	stibnite ore, 70\% stibnite	kg	6.482121101359118e-10	
Original	fish canning plant	unit	0.44774114023282324	
Original	tillage, rotary cultivator	ha	0.0	shell capital service product
Original	chemical factory	kg	0.6012213859016396	
Original	furnace, logs, average storage area, 6kW	unit	104.0011467752998	
Original	catalytic converter, oxidation, 20 litre	unit	44.134633509985626	
Original	deinking emulsion, in paper production	kg	1.235616416888238e-09	
Original	green manure, organic, until January	ha	0.0	shell capital service product
Original	washing machine	unit	0.0	No mass because all eol flows included - servi...
Original	green manure, Swiss integrated production, unt...	ha	0.0	shell capital service product
0	sulfidic tailing, off-site, high gold content	kg	4.95270942414844e-13	
Original	transport, passenger car, large size, diesel, ...	km	0.0	shell capital service product
Original	laser machining, metal, with CO2-laser, 2700W ...	hour	0.0	shell capital service product
Original	transport, freight, lorry >32 metric ton, EURO1	metric ton*km	0.0	shell capital service product
Original	transport, passengers, aircraft, short haul	person*km	0.0	shell capital service product
Original	impact extrusion of aluminium, deformation stroke	kg	0.0	shell capital service product
Original	photovoltaic laminate, a-Si	m2	0.937315912674033	
Original	sawnwood, board, hardwood, raw, dried (u=10\%)	m3	4.1875342458537116e-08	
Original	powertrain, for electric scooter	kg	0.11667975639726216	
Original	laser machining, metal, with CO2-laser, 3200W ...	hour	0.0	shell capital service product
Original	fruit tree seedling, for planting	unit	2.0743391484854286e-10	
Original	linseed seed, at farm	kg	4.6094072717350705e-10	
Original	transport, passenger car, small size, natural ...	km	0.0	shell capital service product
Original	castor bean	kg	4.823391499602521e-09	
Original	locomotive	unit	0.0	No mass because all eol flows included - servi...
Original	used lorry, 40 metric ton	unit	11077.585837571161	
Original	maintenance, barge	unit	0.0	No mass because all eol flows included - servi...
Original	refrigerator	unit	10.663421144345945	
Original	nuclear fuel element, for pressure water react...	kg	5.32975750169292e-08	
Original	fibre cement roof slate	kg	0.0019821383103612537	
Original	maintenance, electric bicycle	unit	2.1715245466558145e-10	

Original	wastewater treatment facility, capacity 4.7E10...	unit	9413174.75092825	
Original	deep drawing, steel, 650 kN press, automode	kg	0.0	shell capital service product
Original	lightweight concrete block, pumice	kg	0.03224075967672972	
Original	furnace, wood chips, hardwood storage area, 50kW	unit	629.6559059275219	
Original	welding, arc, aluminium	m	4.677945498166102e-06	
Original	impact extrusion of steel, cold, 1 strokes	kg	0.0	shell capital service product
Original	granulated blast furnace slag	kg	1.453298346334119e-11	
Original	used glider, from electric scooter	kg	0.03192141851956495	
Original	maintenance, electric scooter, without battery	unit	0.0	No mass because all eol flows included - servi...
Original	transport, freight, lorry with refrigeration m...	metric ton*km	0.0	shell capital service product
Original	wastewater from liquid crystal display backlig...	m3	0.014127961812691318	
Original	clefting of energy wood	hour	0.0	shell capital service product
Original	folding boxboard/chipboard	kg	0.0011263230458610461	
Original	wind turbine network connection, 4.5MW, onshore	unit	0.0	shell capital service product
Original	bentonite quarry infrastructure	unit	923571.5140349449	
Original	operation, computer, laptop, 68\% active work	hour	0.0	shell capital service product
Original	waste preparation facility	unit	8210.106184301478	
Original	lignite power plant	unit	41352654.7034158	
Original	maize seed, Swiss integrated production, at farm	kg	4.705491693578222e-10	
Original	rice, non-basmati	kg	2.966911800981404e-10	
Original	transport, passengers, aircraft, medium haul	person*km	0.0	shell capital service product
Original	glazing, double, U<1.1 W/m2K, laminated safety...	m2	2.3946181770054427	
Original	steel removed by milling, large parts	kg	0.9999999998940688	
Original	fodder loading, by self-loading trailer	m3	7.718994229591893e-11	
Original	resistor, metal film type, through-hole mounting	kg	0.20053749906870727	
Original	used desktop computer	kg	0.3368238638551036	
Original	generator, 200kW electrical	unit	594.9655774397353	
Original	selective coat, copper sheet, sputter deposition	m2	3.2745253290357346e-12	
Original	cement, alternative constituents 21-35\%	kg	3.544612540795194e-05	
Original	micro gas turbine, 100kW electrical	unit	3269.0370059548304	
Original	maintenance, locomotive	unit	22839.08510866355	
Original	photovoltaic cell, single-Si wafer	m2	0.666739995362193	
Original	lime, packed	kg	0.01408418941889539	
Original	motor scooter, 50 cubic cm engine	unit	20.675036787957094	
Original	transport, freight, lorry >32 metric ton, EURO5	metric ton*km	0.0	shell capital service product
Original	transport, passenger car, small size, natural ...	km	0.0	shell capital service product
Original	residue from rutile production, synthetic, 56\%...	kg	3.2182246220641334e-07	
Original	sugar refinery	unit	717257.8356209924	
Original	electric bicycle	unit	8.88842719632159	
Original	selective coat, copper sheet, black chrome	m2	3.276978985469759e-06	
Original	single-Si wafer, photovoltaic	m2	0.6289999998166333	
Original	used toner module, laser printer, colour	kg	0.3304375719608005	
Original	onion seedling, for planting	unit	1.9927763933046162e-13	
Original	used tram	unit	12609.1596715996	
Original	powder coat, aluminium sheet	m2	5.211411976431327e-12	
Original	skidder	unit	4077.4892224483797	
Original	solar collector glass tube, with silver mirror	kg	0.014448378399160718	
Original	harvesting, by complete harvester, ground crops	ha	0.0	shell capital service product
Original	window frame, wood, U=1.5 W/m2K	m2	5.18062792943628	
Original	cement, blast furnace slag 31-50\% and 31-50\% o...	kg	0.00011000000191122432	

Original	chromium steel removed by drilling, computer n...	kg	0.6305351821295498	
Original	sawnwood, hardwood, dried (u=10\%), planed	m3	1.3007659170548784e-07	
Original	industrial furnace, 1MW, oil	unit	4534.849230843615	
Original	maintenance, heat and power co-generation unit...	unit	2251.536777780517	
Original	sunn hemp plant, harvested	kg	1.1112819066197106e-11	
Original	laser machining, metal, with CO2-laser, 5000W ...	hour	0.0	shell capital service product
Original	electric connector, peripheral component inter...	kg	2.5964479700291436e-09	
Original	grass, Swiss integrated production	kg	2.8966253611394555e-11	
Original	photovoltaic panel, single-Si wafer	m2	0.6183032995861271	
Original	maintenance, refrigeration machine	unit	0.0	No mass because all eol flows included - servi...
Original	used long liner, steel	kg	0.9421947349790385	
Original	bell pepper	kg	8.180661184317582e-06	
Original	lemon	kg	1.579220726788805e-11	
Original	washing, drying and finishing laundry	kg	0.0	shell capital service product
Original	intermodal shipping container, 45-foot, high-cube	unit	2767.978644701816	
Original	blast furnace slag	kg	1.466061702747746e-11	
Original	residue from Na-dichromate production	kg	0.002389174394383937	
Original	potato seed, organic, for setting	kg	7.790446768368278e-07	
Original	grass seed, Swiss integrated production, for s...	kg	1.3340774437851043e-08	
Original	transport, freight, lorry 3.5-7.5 metric ton, ...	metric ton*km	0.0	shell capital service product
Original	power block, solar thermal parabolic trough, 5...	unit	265523.8171967936	
Original	door, outer, wood-aluminium	m2	8.192705253272909	
Original	transport, freight, lorry 7.5-16 metric ton, E...	metric ton*km	0.0	shell capital service product
Original	building operation, upmarket hotel	guest night	0.0	shell capital service product
Original	disk drive, CD/DVD, ROM, for desktop computer	unit	0.5810037126056696	
Original	power saw, without catalytic converter	unit	0.0	No mass because all eol flows included - servi...
Original	heat and power co-generation unit, organic Ran...	unit	0.0	No mass because all eol flows included - servi...
Original	steel removed by turning, average, computer nu...	kg	0.9999999998969957	
Original	waste reinforcement steel	kg	0.6966482903137979	
Original	air filter, central unit, 600 m3/h	unit	0.3801400000002825	
Original	oil power plant, 500MW	unit	22902766.67888689	
Original	copper telluride cement	kg	2.2246303765171922e-07	
Original	onshore petroleum field infrastructure	unit	540342.472600725	
Original	carton board box production, with gravure prin...	kg	1.5781184886814786e-06	
Original	cottonseed	kg	0.00014830786570880027	
Original	land tenure, arable land, measured as carbon n...	kg	0.0	shell capital service product
Original	reinforcing steel	kg	0.7505527563898955	
Original	transport, freight, lorry with refrigeration m...	metric ton*km	0.0	shell capital service product
Original	inverter, 2.5kW	unit	9.871990501962914	
Original	landed anchovy, fresh	kg	5.88544666294616e-10	
Original	paper machine	unit	2965777.2450500974	
Original	mandarin	kg	2.3226601975747604e-10	
Original	aluminium alloy, metal matrix composite	kg	7.0975693265144424e-06	
Original	seed-cotton	kg	9.191386711553301e-05	
Original	sawnwood, lath, hardwood, raw, dried (u=10\%)	m3	4.1870623339248025e-08	
Original	used door, outer, wood-glass	m2	4.795151552121258	
Original	packaging, for fertilisers or pesticides	kg	0.0	shell capital service product
Original	electric connector, peripheral type buss	kg	0.7309999999283466	
0	sewer grid, 1E9l/year, 30 km	km	58991.78015043602	
1	sewer grid, 1E9l/year, 30 km	km	58997.75993198997	

Original	delimbing/sorting, excavator-based processor	hour	0.0	shell capital service product
Original	sawnwood, softwood, dried (u=10\%), planed	m3	0.0029759701851904147	
Original	linseed	kg	5.770741414999548e-10	
Original	transformer, high voltage use	kg	0.2878163999488069	
Original	sawnwood, lath, hardwood, dried (u=10\%), planed	m3	8.959190889217226e-08	
Original	transport, passenger, aircraft, unspecified	person*km	0.0	shell capital service product
Original	EUR-flat pallet	unit	0.19500296283309893	
Original	heat and power co-generation unit, 6400kW ther...	unit	13261.711020463805	
Original	oil storage, 3000l	unit	458.0043776303064	
Original	wastewater from particle board production	m3	1.1116900702120474e-07	
Original	transport, passenger car, medium size, natural...	km	0.0	shell capital service product
Original	canal	m*year	6.516424670728916	
0	steel in car shredder residue	kg	0.7380404454283753	
1	steel in car shredder residue	kg	0.738040445428375	
2	steel in car shredder residue	kg	0.7481917069828257	
3	steel in car shredder residue	kg	0.7481917069828254	
4	steel in car shredder residue	kg	0.9999999995998126	
5	steel in car shredder residue	kg	0.9999999995998126	
Original	powertrain, for electric passenger car	kg	0.15471419294755906	
Original	train, passenger, high speed	unit	0.0	No mass because all eol flows included - servi...
Original	palm oil, refined	kg	1.8162955964470384e-08	
Original	lime	kg	0.0023694291225808822	
Original	heating and sanitary equipment, mini CHP plant	unit	63.793035822993104	
Original	recultivation, bentonite mine	m2	0.0	shell capital service product
0	wastewater treatment facility, capacity 1E9l/year	unit	318618.0560743089	
1	wastewater treatment facility, capacity 1E9l/year	unit	3.1124675541476303e-06	
2	wastewater treatment facility, capacity 1E9l/year	unit	3.1124766484121445e-06	
3	wastewater treatment facility, capacity 1E9l/year	unit	318618.0560536877	
Original	maintenance, solid oxide fuel cell, 125kW elec...	unit	116.2478786633224	
Original	municipal waste incineration facility	unit	2438931.090174798	
Original	solder, paste, Sn63Pb37, for electronics industry	kg	6.875249854304697e-08	
Original	titanium, primary	kg	0.003500472609984216	
Original	soybean oil, crude	kg	2.9567684896727e-09	
Original	sawnwood, beam, softwood, raw, dried (u=20\%)	m3	3.1711763764608445e-06	
Original	steel removed by milling, small parts	kg	0.999999999894069	
Original	redmud from bauxite digestion	kg	1.1009381911644961e-10	
Original	terrain chipper on forwarder	unit	18758.935412981915	
Original	liquid manure spreading, by vacuum tanker	m3	1.6008160893083935e-10	
Original	barley grain, Swiss integrated production	kg	9.584270423079267e-09	
Original	maintenance, intermodal shipping container, 40...	unit	0.0	No mass because all eol flows included - servi...
Original	nuclear fuel element, for boiling water reacto...	kg	1.3428230159438456e-08	
Original	steel, unalloyed	kg	0.9800000000019896	
Original	transport, passenger car, large size, diesel, ...	km	0.0	shell capital service product
Original	chromium steel removed by milling, dressing	kg	0.6305351821295553	
Original	pipeline, natural gas, long distance, high cap...	km	207531.4222360768	
Original	cow milk	kg	2.9052595959583846e-05	
Original	operation, reefer, freezing	kg*day	0.0	shell capital service product
Original	fish, marine	kg	6.015397861795053e-10	
Original	glazing, double, U<1.1 W/m2K	m2	1.919317237215699	
Original	sheet rolling, aluminium	kg	0.0	shell capital service product

Original	trawler, steel	kg	0.0	No mass because all eol flows included - servi...
Original	heat and power co-generation unit, organic Ran...	unit	0.0	No mass because all eol flows included - servi...
Original	precious metal refinery	unit	4218.827615408185	
Original	peanut	kg	1.0490025214857035e-10	
Original	metal working, average for chromium steel prod...	kg	0.14313148634347334	
0	sewer grid, 1.6E8l/year, 6 km	km	58991.929149154625	
1	sewer grid, 1.6E8l/year, 6 km	km	58997.5037585738	
Original	zinc coat, pieces, adjustment per micro-m	m2	4.26720569649241e-12	
Original	pig iron	kg	1.0	
Original	transport, freight, lorry with refrigeration m...	metric ton*km	0.0	shell capital service product
Original	maintenance, tanker, for petroleum	unit	399131.5905490846	
Original	furnace, wood chips, softwood storage area, 50kW	unit	629.8366221988047	
Original	maintenance, intermodal shipping container, 40...	unit	0.0	No mass because all eol flows included - servi...
Original	cottonseed, organic	kg	3.478339155380923e-07	
Original	wind power plant, 800kW, fixed parts	unit	29858.17964237095	
Original	gravel/sand quarry infrastructure	unit	1.5055738517196758e-07	
Original	peat moss	m3	3.0187981657625696e-06	
Original	exhaust air valve, in-wall housing, plastic/st...	unit	0.44545999999924224	
Original	transport, freight, lorry 7.5-16 metric ton, u...	metric ton*km	0.0	shell capital service product
Original	photovoltaic mounting system, for slanted-roof...	m2	1.4998999997659	
Original	transport, freight, lorry with refrigeration m...	metric ton*km	0.0	shell capital service product
Original	fish canning, small fish	kg	0.0	shell capital service product
Original	microwave oven	unit	2.415507289513006	
Original	tube insulation, elastomere	kg	0.0	shell capital service product
Original	metal working, average for metal product manuf...	kg	0.18981849224579064	
Original	nickel ore, beneficiated, 16\%	kg	8.868695285664312e-11	
Original	flat glass, coated	kg	0.09999999998873843	
Original	strawberry seedling, for planting	unit	9.056125826318154e-10	
Original	auxiliary heating unit, electric, 5kW	unit	0.9872833485215241	
Original	impact extrusion of aluminium, 4 strokes	kg	0.0	shell capital service product
Original	gold, unrefined	kg	0.0019501101358156234	
Original	shavings, softwood, loose, measured as dry mass	kg	3.8157198101556704e-11	
Original	transport, freight, inland waterways, barge wi...	metric ton*km	0.0	shell capital service product
Original	goods wagon	unit	20999.999997941737	
Original	wood preservation, spray tunnel/deluging, orga...	kg	0.0	shell capital service product
Original	wood preservation, dipping/immersion method, o...	kg	0.0	shell capital service product
Original	deep drawing, steel, 650 kN press, single stroke	kg	0.0	shell capital service product
Original	waste refinery gas	MJ	0.000306647310029642	
Original	transport, passenger car, small size, petrol, ...	km	0.0	shell capital service product
Original	machine operation, diesel, >= 18.64 kW and < 7...	hour	0.0	shell capital service product
Original	cable, printer cable, without plugs	m	1.389342027790666e-12	
Original	cottonseed, for sowing	kg	0.00014830786556153532	
Original	operation, housing system, cattle, loose, per ...	unit	0.0	shell capital service product
Original	transport, freight, lorry with refrigeration m...	metric ton*km	0.0	shell capital service product
Original	wind power plant, 2MW, offshore, fixed parts	unit	113209.53261531287	
Original	cast iron removed by drilling, conventional	kg	1.0	
Original	furrow covering, sugarcane	ha	0.0	shell capital service product
Original	carrot seed, for sowing	kg	4.0861058244788164e-07	
Original	retention aid, for paper production	kg	0.8328505894309903	
Original	tanker, for petroleum	unit	2004354.6252672519	

Original	outside air intake, stainless steel, DN 370	unit	20.94167270505904	
Original	wastewater from wafer fabrication	m3	0.0021594146880845556	
Original	mounting, through-hole technology, Pb-containi...	m2	0.0	shell capital service product
Original	ferrochromium, high carbon, 55\% Cr	kg	0.36713500000000004	
Original	mulching	ha	0.0	shell capital service product
Original	mango, conditioned	kg	2.9606261672082237e-05	
Original	integrated circuit, logic type	kg	0.012599997017812444	
Original	manure, liquid, cattle	kg	3.000371138592484e-11	
Original	cement, limestone 6-20\%	kg	5.250025532210901e-05	
Original	palm kernel oil, crude	kg	8.650480723354877e-10	
Original	nickel smelter slag	kg	0.011702182489394839	
Original	soybean, organic	kg	4.75139829304504e-10	
Original	machine operation, diesel, >= 18.64 kW and < 7...	hour	0.0	shell capital service product
Original	mobile cable yarder, truck-mounted, incl. proc...	unit	11150.972716265333	
Original	lignite briquettes	MJ	2.353888668917566e-12	
Original	maize seed, organic, for sowing	kg	2.7371006520114545e-07	
Original	transport, freight, lorry 7.5-16 metric ton, E...	metric ton*km	0.0	shell capital service product
Original	nuclear power plant, boiling water reactor 1000MW	unit	10748744.068148179	
Original	impact extrusion of steel, cold, initial surfa...	kg	0.0	shell capital service product
Original	titania slag, 85\% titanium dioxide	kg	1.0	
Original	residential sewer grid, 0.087 km	km	5132.31430384477	
Original	barley grain, feed	kg	4.6035165139939337e-07	
Original	solid manure loading and spreading, by hydraul...	kg	2.5119608884812047e-13	
Original	tomato seedling, for planting	unit	9.055457120114186e-10	
Original	pulpwood, hardwood, measured as solid wood und...	m3	0.0003915471927481756	
Original	maize grain, feed	kg	2.9657594273905074e-05	
Original	dust, alloyed electric arc furnace steel	kg	5.6452054503581746e-09	
Original	cement, blast furnace 40-70\%	kg	0.00011000000196198186	
Original	furnace, logs, hardwood storage area, 30kW	unit	470.0031129682163	
Original	portachrom	kg	1.0859696411396175e-08	
Original	heat and power co-generation unit, 500kW elect...	unit	67.2378276298129	
Original	lime, hydrated, packed	kg	2.0845894698048675e-10	
Original	tyre wear emissions, lorry	kg	2.9747655664456685e-08	
Original	supply air inlet, steel/SS, DN 75	unit	2.199999998638524	
Original	water pump operation, electric	MJ	8.373933115688983e-13	
Original	tram track	m*year	6.04571391967318	
Original	diesel, burned in building machine	MJ	1.1416412053000211e-11	
Original	impact extrusion of aluminium, 3 strokes	kg	0.0	shell capital service product
Original	mine infrastructure, underground, uranium	unit	2190246.043829314	
Original	explosive, tovex	kg	0.0029460796118958403	
Original	furnace, wood chips, hardwood storage area, 300kW	unit	2361.062998316169	
Original	plug, inlet and outlet, for computer cable	unit	6.12439838116419e-12	
Original	train, passenger, regional	unit	0.0	No mass because all eol flows included - servi...
Original	reefer, intermodal shipping container, 40-foot...	unit	2081.1925913761092	
Original	hot rolling, steel	kg	0.0	shell capital service product
Original	MOX fuel element, for light water reactor	kg	4.1583802090514074e-07	
Original	water discharge from petroleum/natural gas ext...	kg	4.0144082048667915e-10	
Original	concrete, 35MPa	m3	0.0355321743775686	
Original	waste concrete gravel	kg	0.00016393443444818505	
Original	used printer, laser	kg	0.07178161494503732	

Original	wastewater from lorry production	m3	0.01277445996886748	
Original	fodder beet seed, for sowing	kg	8.451442326777164e-08	
Original	internet access equipment	unit	0.0016398753492889006	
Original	green manure, Swiss integrated production, unt...	ha	0.0	shell capital service product
Original	waste bitumen sheet	kg	0.12512247729149995	
Original	cathode-ray tube, cathode ray tube display	kg	0.12564294392867995	
Original	cement, pozzolana and fly ash 36-55\%	kg	2.365716147653007e-12	
Original	heat transport fluid system, solar thermal par...	unit	57460.8473286125	
Original	printed wiring board, surface mounted, unspeci...	kg	0.09130989670434228	
Original	operation, computer, laptop, video mode, label...	hour	0.0	shell capital service product
Original	chopping, maize	ha	0.0	shell capital service product
Original	used laptop computer	kg	0.0991344425730835	
Original	maize grain, feed, organic	kg	3.0663369405707425e-10	
Original	impact extrusion of steel, hot, 2 strokes	kg	0.0	shell capital service product
Original	section bar extrusion, aluminium	kg	0.0	shell capital service product
Original	housing system, pig, label-certified, per pig ...	unit	0.0	No mass because all eol flows included - servi...
Original	sanitary landfill facility	unit	22423.00844495649	
Original	uranium enrichment centrifuge facility	unit	32585240.306752313	
Original	sound insulation, heat and power co-generation...	unit	1440.9836727699633	
Original	transport, freight, sea, tanker for liquid goo...	metric ton*km	0.0	shell capital service product
Original	aircraft, belly freight, very short haul	unit	1806.44144939062	
Original	iron(III) chloride, without water, in 14\% iron...	kg	0.44000000056040084	
Original	elevator, hydraulic	unit	661.7784900256069	
Original	steel removed by turning, primarily dressing, ...	kg	0.9999999998969957	
Original	used lorry, 28 metric ton	unit	7774.639079465836	
Original	liquid manure storage and processing facility	m3	7.116310144672543	
Original	sunflower seed, for sowing	kg	1.7637927313958174e-09	
Original	heat and power co-generation unit, 200kW elect...	unit	2940.027178780207	
Original	tanker, for liquid goods other than petroleum ...	unit	4930452.759828226	
Original	door, inner, glass-wood	m2	1.5854631268261021	
Original	used train, passenger, regional	unit	86273.01955793431	
Original	sawnwood, softwood, raw, dried (u=10\%)	m3	3.330745265053543e-06	
Original	wastewater from ground granulated blast furnac...	m3	0.015779812076377304	
Original	wheat seed, for sowing	kg	5.86724086533188e-07	
Original	petrol, two-stroke blend	kg	8.781960790944154e-09	
Original	sawnwood, beam, hardwood, raw, dried (u=10\%)	m3	4.21014850592377e-08	
Original	wheat flour mix	kg	4.5029029624246015e-10	
Original	chromium steel removed by turning, primarily r...	kg	0.6305351821298385	
0	scrap tin sheet	kg	4.959869474223482e-07	
1	scrap tin sheet	kg	1.8470144305789123e-08	
2	scrap tin sheet	kg	4.89634032301024e-06	
3	scrap tin sheet	kg	4.875294883669216e-06	
4	scrap tin sheet	kg	4.282168697786046e-06	
5	scrap tin sheet	kg	4.273254396935159e-06	
6	scrap tin sheet	kg	5.726610640822914e-07	
7	scrap tin sheet	kg	0.6305352696733695	
8	scrap tin sheet	kg	0.5505702730239348	
9	scrap tin sheet	kg	0.6305352696733695	
10	scrap tin sheet	kg	0.6305351794111593	
11	scrap tin sheet	kg	0.6305351794111593	

12	scrap tin sheet	kg	0.5505702730239348	
13	scrap tin sheet	kg	1.3554378230536496e-09	
Original	magnesium-alloy, AZ91, diecast	kg	9.596259698739393e-10	
Original	lightweight concrete block, expanded vermiculite	kg	2.2160240349463165e-13	
Original	internal combustion engine, for passenger car	kg	0.17534221531671149	
Original	spray-drying of milk	kg	0.0	shell capital service product
Original	diesel, low-sulfur	kg	5.025183105635132e-10	
Original	resistor, surface-mounted	kg	0.02891366335171562	
Original	transistor, wired, big size, through-hole moun...	kg	0.13812161569992798	
Original	light fuel oil	kg	2.5218711540472383e-12	
Original	adhesive mortar	kg	0.0012547949570332366	
Original	ventilation duct, connection piece, steel, 100...	unit	0.19999999970988186	
Original	iron(III) chloride, without water, in a 12\% ir...	kg	0.4400000001346205	
Original	harvesting, forestry harvester	hour	0.0	shell capital service product
Original	transport, freight, lorry >32 metric ton, EURO3	metric ton*km	0.0	shell capital service product
Original	recultivation, shale quarry	m2	0.0	shell capital service product
Original	internet access, videoconference, 0.7 Mbit/s	hour	0.0	shell capital service product
Original	nuclear waste storage, final repository for hi...	unit	6949411.363734181	
Original	cellulose fibre, inclusive blowing in	kg	0.0005218265126575145	
Original	packaging glass sorting facility	unit	190144.6247985673	
Original	transport, tractor and trailer, agricultural	metric ton*km	0.0	shell capital service product
Original	fan, for power supply unit, desktop computer	kg	0.003133594340623718	
Original	cement cast plaster floor	kg	3.786333419504136e-13	
Original	resistor, auxilliaries and energy use	kg	1.4407618227812545e-09	
Original	bale loading	unit	0.0	shell capital service product
Original	hazardous waste incineration facility	unit	877467.6482644684	
Original	electron gun, for cathode ray tube display	kg	0.44137462749088685	
Original	cast iron removed by milling, average	kg	0.9999999999999999	
Original	baling	unit	0.0	shell capital service product
0	hydropower plant, reservoir	unit	3160000.2255245117	
1	hydropower plant, reservoir	unit	0.12179714823521487	
2	hydropower plant, reservoir	unit	1190697640.2958996	
Original	magnetite	kg	0.9999999999685618	
Original	borehole heat exchanger, 150m	unit	10.505139998536452	
Original	charger, for electric scooter	kg	0.01002295440764084	
Original	mango	kg	2.8196439687668835e-05	
Original	wastewater from soft fibreboard production	m3	2.241339109920112e-07	
Original	transport, passengers, aircraft, long haul	person*km	0.0	shell capital service product
Original	long liner maintenance, steel	kg	0.5086280108455133	
Original	heat and power co-generation unit, 1MW electri...	unit	103.22984124341862	
Original	aluminium around steel bi-metal stranded cable...	m	0.17658311874162638	
Original	manual dismantling of electric scooter	unit	0.0	shell capital service product
Original	transport, freight, lorry 3.5-7.5 metric ton, ...	metric ton*km	0.0	shell capital service product
Original	waste brick	kg	2.167418025497981e-12	
Original	fish residues	kg	5.04442851568398e-10	
Original	residual hardwood, wet	m3	1.5633338988665274e-07	
Original	heat and power co-generation unit, organic Ran...	unit	0.0	No mass because all eol flows included - servi...
Original	laser machining, metal, with CO2-laser, 6000W ...	hour	0.0	shell capital service product
0	drilling waste	kg	0.028500000000000004	
1	drilling waste	kg	0.03980499075496784	

2	drilling waste	kg	0.039803960602642706	
3	drilling waste	kg	0.04056296856490861	
4	drilling waste	kg	0.04056296856490866	
5	drilling waste	kg	0.040562968564908715	
6	drilling waste	kg	0.040562968564908645	
7	drilling waste	kg	0.040562968564908645	
8	drilling waste	kg	0.04056296856490859	
9	drilling waste	kg	0.04056296856490866	
10	drilling waste	kg	0.04056296856490866	
11	drilling waste	kg	0.04056296856490859	
12	drilling waste	kg	0.040562968564908555	
13	drilling waste	kg	0.04056296856490866	
14	drilling waste	kg	0.04056296856490868	
15	drilling waste	kg	0.0405629685649087	
16	drilling waste	kg	0.0405629685649086	
17	drilling waste	kg	0.040562968564908694	
18	drilling waste	kg	0.040562968564908625	
19	drilling waste	kg	0.04056296856490865	
20	drilling waste	kg	0.040562968564908666	
21	drilling waste	kg	0.04056296856490872	
22	drilling waste	kg	0.04056296856490854	
23	drilling waste	kg	0.04056296856490863	
Original	deep well, drilled, for geothermal power	m	213.51988392176946	
Original	casting, bronze	kg	0.0	shell capital service product
Original	maize grain, Swiss integrated production	kg	4.690837906543569e-11	
Original	transport, passenger car, medium size, petrol,...	km	0.0	shell capital service product
Original	fertilising, by stool splitter, sugarcane	ha	0.0	shell capital service product
Original	rape seed, organic, for sowing	kg	4.131246566789945e-09	
Original	sawnwood, lath, softwood, dried (u=20\%), planed	m3	3.7663721592053644e-06	
Original	aluminium around steel bi-metal wire, 3.67mm e...	m	0.05836686677517895	
Original	blower and heat exchange unit, decentralized, ...	unit	25.594161290651808	
Original	apricot	kg	1.4275106958118074e-11	
Original	machine operation, diesel, < 18.64 kW, undergr...	hour	0.0	shell capital service product
Original	composting facility, open	unit	29508.471734780112	
Original	router, internet	unit	0.006835522732395044	
Original	cable yarder with sled winch	unit	2350.33595806244	
Original	used air distribution terminal panel steel, 12...	unit	4.75	
Original	transport, freight, lorry 3.5-7.5 metric ton, ...	metric ton*km	0.0	shell capital service product
Original	heat and power co-generation unit, 200kW elect...	unit	39.55166331165466	
Original	drying of bread grain, seed and legumes	l	0.0	shell capital service product
Original	furnace, wood chips, softwood storage area, 300kW	unit	2361.361942984919	
Original	fuel cell, stack solid oxide, 125kW electrical...	unit	1.0335896159524 31e-07	
Original	potato haulm cutting	ha	0.0	shell capital service product
Original	pointing device, optical mouse, with cable	unit	8.166877603680861e-11	
Original	rice seed, for sowing	kg	3.985010734121343e-10	
Original	sawnwood, board, hardwood, dried (u=20\%), planed	m3	8.518079756553747e-07	
Original	energy saving	MJ	0.0	shell capital service product
Original	operation, computer, laptop, active mode	hour	0.0	shell capital service product
Original	pumice	kg	0.023041593191431207	
Original	transport, freight, lorry with refrigeration m...	metric ton*km	0.0	shell capital service product

Original	exhaust air outlet, steel/aluminium, 85x365 mm	unit	2.2858000000016925	
Original	furnace, wood chips, with silo, 1000kW	unit	5293.672668183661	
Original	maintenance, stirling heat and power co-genera...	unit	2.552750621371062	
Original	electric arc furnace converter	unit	0.025997906592454757	
Original	cement, blast furnace slag 25-70\%	kg	0.0001100000004034783	
Original	thermal storage system, solar thermal paraboli...	unit	46912.71337396918	
Original	transport, passenger, electric scooter	km	0.0	shell capital service product
Original	steel, chromium steel 18/8	kg	0.9999999919822022	
Original	platinum group metal concentrate	kg	0.18810000003656857	
Original	maintenance, ferry	unit	165615.02912556776	
Original	transport, freight, lorry with refrigeration m...	metric ton*km	0.0	shell capital service product
Original	fava bean seed, organic, for sowing	kg	5.510048634381272e-07	
Original	vanilla seedling, for planting	unit	8.246802725504025e-11	
Original	assembly of generator and motor, auxilliaries ...	unit	7.505122592601722	
Original	maintenance, tanker for liquid goods other tha...	unit	981810.0021282998	
Original	thermoforming of plastic sheets	kg	0.0	shell capital service product
Original	nuclear fuel element, for pressure water react...	kg	2.3890988556370304e-07	
Original	sponge iron	kg	0.8000000000122752	
Original	cast iron removed by turning, average, convent...	kg	1.0	
Original	impact extrusion of steel, hot, 3 strokes	kg	0.0	shell capital service product
Original	maize starch	kg	2.3377321746323926e-11	
Original	transport, freight, lorry with refrigeration m...	metric ton*km	0.0	shell capital service product
Original	steel, chromium steel 18/8, hot rolled	kg	0.6305351821298384	
Original	cement, Portland	kg	7.424716062396879e-13	
Original	maize seed, organic, at farm	kg	2.016632417047152e-09	
Original	extrusion of plastic sheets and thermoforming,...	kg	0.0	shell capital service product
Original	shavings, hardwood, loose, measured as dry mass	kg	1.195741992452474e-10	
Original	pump, 40W	unit	1.7800923675594515	
Original	frozen fish sticks, hake	kg	1.5774620350151155e-10	
Original	heat and power co-generation unit, 160kW elect...	unit	39.55166331165465	
Original	wood preservation facility, vacuum pressure me...	unit	3251.987313122364	
Original	operation, computer, laptop, standby/sleep mode	hour	0.0	shell capital service product
Original	iron sulfate	kg	0.36999999992578303	
Original	wind power plant, 2MW, offshore, moving parts	unit	16449.730409248255	
Original	aircraft, belly freight, short haul	unit	1963.037577933626	
Original	housing system, cattle, tied, per animal unit	unit	0.0	No mass because all eol flows included - servi...
Original	transport, freight, lorry 16-32 metric ton, EURO6	metric ton*km	0.0	shell capital service product
Original	process-specific burdens, municipal waste inci...	kg	0.0	shell capital service product
Original	road maintenance	m*year	4.995077774384783e-05	
Original	drying of maize straw and whole-plant	l	0.0	shell capital service product
Original	cable, data cable in infrastructure	m	1.602804225418735e-11	
Original	salt tailing from potash mine	kg	1.11250256040825e-08	
Original	pump station	unit	9822.027728868952	
Original	wind turbine, 4.5MW, onshore	unit	246912.4046189109	
Original	transport, helicopter	hour	0.0	shell capital service product
Original	wheat flour	kg	5.602968564132877e-10	
Original	transport, passenger, motor scooter	person*km	0.0	shell capital service product
Original	transport, passenger car with internal combust...	km	0.0	shell capital service product
Original	process-specific burdens, import of copper to ...	kg	0.0	shell capital service product
Original	chickpea	kg	1.1988109048200224e-09	

Original	printed wiring board, for power supply unit, d...	kg	0.016087737736918552	
Original	transport, passenger car, small size, natural ...	km	0.0	shell capital service product
Original	capacitor, for surface-mounting	kg	0.00021804050947708277	
Original	transmission network, long-distance	km	156801.7684670552	
Original	heat storage, 2000l	unit	328.2654089929	
Original	greenhouse, glass walls and roof	m2*year	0.0	No mass because all eol flows included - servi...
Original	mounting, surface mount technology, Pb-free so...	m2	0.0	shell capital service product
Original	photovoltaic plant, electric installation for ...	unit	0.15861893175411457	
Original	long liner, steel	kg	0.0	No mass because all eol flows included - servi...
Original	used lorry, 16 metric ton	unit	4809.0243067589045	
Original	cast iron removed by milling, small parts	kg	1.0	
0	digester sludge	kg	0.00044878651893122623	
1	digester sludge	kg	0.0004487583770841054	
2	digester sludge	kg	0.00597132858773554	
3	digester sludge	kg	0.004013985601503092	
4	digester sludge	kg	0.004013985601503093	
5	digester sludge	kg	0.012813465523433785	
6	digester sludge	kg	3.115069933120479e-10	
7	digester sludge	kg	3.1150699331204805e-10	
Original	rape seed	kg	1.1787348724580806e-09	
Original	iron ore, beneficiated, 65\% Fe	kg	0.6564999999999002	
Original	railway track	m*year	7.221263576081397	
Original	tin plated chromium steel sheet, 2 mm	m2	9.836348849258389	
Original	deep drawing, steel, 38000 kN press, automode	kg	0.0	shell capital service product
Original	mine infrastructure, underground, hard coal	unit	14261201.089580182	
Original	photovoltaic mounting system, for 570kWp open ...	m2	0.9947046082199392	
Original	metallization paste, back side	kg	8.994586238272887e-09	
Original	residue from cooling tower	kg	1.0125386139924429e-10	
Original	packaging box factory	unit	430494.01891049393	
Original	transport, helicopter, LTO cycle	unit	0.0	shell capital service product
Original	seed-cotton, organic	kg	1.9792174946710175e-07	
Original	building machine	unit	8253.86929443521	
Original	flat plate solar collector, Cu absorber	m2	2.610298850601179	
Original	machine operation, diesel, >= 18.64 kW and < 7...	hour	0.0	shell capital service product
Original	transport, freight, lorry 3.5-7.5 metric ton, ...	metric ton*km	0.0	shell capital service product
Original	fava bean seed, for sowing	kg	1.2090918484508764e-09	
Original	ventilation duct, steel, 100x50 mm	m	1.4999999983267653	
Original	tillage, subsoiling, by subsoiler plow	ha	0.0	shell capital service product
Original	expanded perlite	kg	4.157154761562545e-06	
Original	clover seed, Swiss integrated production, for ...	kg	1.1346166229490877e-07	
Original	wire drawing, copper	kg	0.0	shell capital service product
Original	demersal fish, fresh	kg	6.495998997416966e-10	
Original	maize grain, organic	kg	8.928734305164791e-10	
Original	charger, electric passenger car	kg	0.12728478238848723	
Original	impact extrusion of steel, cold, 4 strokes	kg	0.0	shell capital service product
Original	expansion vessel, 25l	unit	4.726799999536675	
Original	fish freezing plant	unit	0.024019346792246484	
Original	printed wiring board, for through-hole mountin...	m2	1.0581909827999798e-09	
Original	operation, computer, desktop, with liquid crys...	hour	0.0	shell capital service product
Original	transport, freight, lorry 3.5-7.5 metric ton, ...	metric ton*km	0.0	shell capital service product

Original	cookstove	unit	14.510873100743208	
Original	combine harvesting	ha	0.0	shell capital service product
Original	transport, freight, lorry with refrigeration m...	metric ton*km	0.0	shell capital service product
Original	limestone, unprocessed	kg	3.677045106850489e-12	
Original	silencer, steel, DN 125	unit	7.254483560402224	
0	spent solvent mixture	kg	2.408847272179408e-05	
1	spent solvent mixture	kg	1.1742305412785879e-09	
2	spent solvent mixture	kg	0.0999992513598566	
3	spent solvent mixture	kg	0.01411960282833433	
4	spent solvent mixture	kg	0.01411959853371923	
5	spent solvent mixture	kg	1.3912005381901946e-08	
6	spent solvent mixture	kg	4.406853041201754e-07	
7	spent solvent mixture	kg	2.488236024323829e-08	
8	spent solvent mixture	kg	2.1790933991628405e-08	
9	spent solvent mixture	kg	9.69784354683384e-09	
10	spent solvent mixture	kg	2.6331721898892987e-08	
11	spent solvent mixture	kg	8.280944986509428e-11	
12	spent solvent mixture	kg	0.014244365840906027	
13	spent solvent mixture	kg	0.014795489093598898	
14	spent solvent mixture	kg	1.3861787387490717e-10	
15	spent solvent mixture	kg	3.3726405862803384e-08	
16	spent solvent mixture	kg	0.0013910941099769443	
17	spent solvent mixture	kg	4.27839468427103260e-07	
18	spent solvent mixture	kg	4.2783946842710326e-07	
19	spent solvent mixture	kg	0.014238487400005119	
20	spent solvent mixture	kg	2.408807436029288e-05	
27	spent solvent mixture	kg	0.014238487400005276	
30	spent solvent mixture	kg	2.408847272179159e-05	
32	spent solvent mixture	kg	0.0999992516961241	
33	spent solvent mixture	kg	0.051955269952839195	
34	spent solvent mixture	kg	1.4185412603414741e-05	
35	spent solvent mixture	kg	1.9089992061961463e-05	
36	spent solvent mixture	kg	1.9089992061961463e-05	
39	spent solvent mixture	kg	0.0007035751655405565	
40	spent solvent mixture	kg	0.0007036461608948486	
41	spent solvent mixture	kg	2.8960940311465784e-06	
42	spent solvent mixture	kg	0.013397072100170953	
43	spent solvent mixture	kg	1.2330845851243385e-06	
44	spent solvent mixture	kg	0.014244370235527616	
45	spent solvent mixture	kg	3.1262936377658286e-10	
46	spent solvent mixture	kg	3.1262936377658286e-10	
47	spent solvent mixture	kg	3.803734196017281e-10	
48	spent solvent mixture	kg	0.09999500748781058	
49	spent solvent mixture	kg	0.014208019595683699	
52	spent solvent mixture	kg	0.01425410319471618	
53	spent solvent mixture	kg	0.09999496989119033	
54	spent solvent mixture	kg	0.09999631186459851	
55	spent solvent mixture	kg	0.01407087600659348	
56	spent solvent mixture	kg	0.014070557070431158	
57	spent solvent mixture	kg	0.014243208792830173	

58	spent solvent mixture	kg	0.014243208792830173	
59	spent solvent mixture	kg	0.009669505308777464	
60	spent solvent mixture	kg	0.009669505308777464	
61	spent solvent mixture	kg	0.0043977201946137235	
62	spent solvent mixture	kg	0.0043977201946137235	
63	spent solvent mixture	kg	0.01626851845750778	
64	spent solvent mixture	kg	0.01626851845750778	
65	spent solvent mixture	kg	0.001663759724045036	
66	spent solvent mixture	kg	0.001663759724045036	
67	spent solvent mixture	kg	5.4781508054052404e-05	
68	spent solvent mixture	kg	5.4781508054052404e-05	
69	spent solvent mixture	kg	0.01373448376588582	
70	spent solvent mixture	kg	0.013734482986963085	
71	spent solvent mixture	kg	0.013923236847848802	
72	spent solvent mixture	kg	0.013923236847848802	
73	spent solvent mixture	kg	3.2987908993859042e-09	
74	spent solvent mixture	kg	3.298790250529784e-09	
75	spent solvent mixture	kg	0.014242994994630172	
76	spent solvent mixture	kg	0.014345317950024472	
77	spent solvent mixture	kg	0.0013910941099769445	
78	spent solvent mixture	kg	8.822602185490189e-11	
79	spent solvent mixture	kg	0.09999999999999999	
80	spent solvent mixture	kg	0.09999999999999999	
Original	skimmed milk, from cow milk	kg	3.320402198283585e-05	
Original	transport, freight, lorry, unspecified	metric ton*km	0.0	shell capital service product
Original	maintenance, lorry 40 metric ton	unit	930.685937875576	
Original	potato grading	kg	0.0	shell capital service product
Original	wastewater from tube collector production	m3	0.012763527976032328	
Original	blower and heat exchange unit, Avent E 97	unit	13.294020136410046	
Original	deep well closure	m	0.0003491303678959836	
Original	blow moulding	kg	0.0	shell capital service product
Original	maize seed, for sowing	kg	1.501580222716691e-09	
Original	impact extrusion of steel, warm, 5 strokes	kg	0.0	shell capital service product
Original	particle board, for outdoor use	m3	0.0002441528610995484	
Original	sawnwood, board, softwood, raw, dried (u=10\%)	m3	3.3097896804989667e-06	
Original	wheat seed, Swiss integrated production, for s...	kg	4.5119222155881644e-08	
Original	laser machining, metal, with YAG-laser, 120W p...	hour	0.0	shell capital service product
Original	air filter, decentralized unit, 180-250 m3/h	unit	4.161927459491517e-05	
Original	chromium steel removed by turning, average, co...	kg	0.6305351821295496	
Original	forestry harvester	unit	5644.18679689877	
Original	powder coat, steel	m2	3.691596159207062e-12	
0	scrap steel	kg	0.5000005605787732	
1	scrap steel	kg	0.5000005605787732	
2	scrap steel	kg	0.6843614405161814	
3	scrap steel	kg	0.5989239536447345	
4	scrap steel	kg	0.6966192569951236	
5	scrap steel	kg	0.5751469042100944	
6	scrap steel	kg	0.694748321703142	
7	scrap steel	kg	0.6949860593330898	
8	scrap steel	kg	0.6953901522092986	

9	scrap steel	kg	0.6840059822593069	
10	scrap steel	kg	0.6867688091779989	
11	scrap steel	kg	0.9731137386722639	
12	scrap steel	kg	0.6560404083002591	
13	scrap steel	kg	0.6576561283485758	
14	scrap steel	kg	0.6590621946514781	
15	scrap steel	kg	0.7278458453116953	
16	scrap steel	kg	0.6120325179609621	
17	scrap steel	kg	0.6714398668635391	
18	scrap steel	kg	0.6013560815553971	
19	scrap steel	kg	0.5000000000338368	
20	scrap steel	kg	0.5000000003409635	
21	scrap steel	kg	0.5000000007514502	
22	scrap steel	kg	0.5000000000192365	
23	scrap steel	kg	0.6400457447232757	
24	scrap steel	kg	0.9448450666038662	
25	scrap steel	kg	0.6176207458368845	
26	scrap steel	kg	0.7	
27	scrap steel	kg	0.6217879125392598	
28	scrap steel	kg	0.6833893052656949	
29	scrap steel	kg	0.5906031769298186	
30	scrap steel	kg	0.9775540256800914	
31	scrap steel	kg	0.6714398668635391	
32	scrap steel	kg	0.500000000381018	
33	scrap steel	kg	0.500000000381018	
34	scrap steel	kg	0.500000000099265	
35	scrap steel	kg	0.500000000098132	
36	scrap steel	kg	0.5000000000965332	
37	scrap steel	kg	0.5000000000981318	
38	scrap steel	kg	0.500000000099265	
39	scrap steel	kg	0.5000000000965332	
40	scrap steel	kg	0.5000000000974225	
41	scrap steel	kg	0.5000000000974225	
42	scrap steel	kg	0.6503764637875129	
43	scrap steel	kg	0.650376463787513	
44	scrap steel	kg	0.5000000192716537	
45	scrap steel	kg	0.7275543933407689	
46	scrap steel	kg	0.727554393340769	
47	scrap steel	kg	0.7051891978389261	
48	scrap steel	kg	0.9908616657188724	
49	scrap steel	kg	0.9908606435111295	
50	scrap steel	kg	0.5117364874092045	
51	scrap steel	kg	0.9820994959750703	
52	scrap steel	kg	0.800626115180745	
53	scrap steel	kg	0.8006261151807467	
54	scrap steel	kg	0.9820994959750703	
55	scrap steel	kg	0.5117364874092046	
56	scrap steel	kg	0.9875375532372229	
57	scrap steel	kg	0.6611903909812838	
58	scrap steel	kg	0.9349731525057122	

59	scrap steel	kg	0.9908632726131836	
60	scrap steel	kg	0.9908616632253895	
61	scrap steel	kg	0.9820986716099124	
62	scrap steel	kg	0.9820994959750691	
63	scrap steel	kg	0.5117364874091992	
64	scrap steel	kg	0.8006261151807462	
65	scrap steel	kg	0.7	
66	scrap steel	kg	0.7000002226367529	
67	scrap steel	kg	0.700000222636753	
68	scrap steel	kg	0.5000000215145505	
69	scrap steel	kg	0.5000000215145505	
70	scrap steel	kg	0.5000018611406984	
71	scrap steel	kg	0.5000018611406984	
72	scrap steel	kg	0.9999999990942247	
73	scrap steel	kg	0.999999999295035	
74	scrap steel	kg	0.9999999993317454	
75	scrap steel	kg	0.9999999993318166	
76	scrap steel	kg	0.9999999989472941	
77	scrap steel	kg	0.7435458080670586	
78	scrap steel	kg	0.639958697184448	
79	scrap steel	kg	0.6399532573197143	
80	scrap steel	kg	0.7051891978389261	
81	scrap steel	kg	0.7453508051460036	
82	scrap steel	kg	0.6693856216158156	
83	scrap steel	kg	0.6693856169629482	
84	scrap steel	kg	0.5	
85	scrap steel	kg	0.6233626498374877	
86	scrap steel	kg	0.7000000000000001	
87	scrap steel	kg	0.688357271086661	
88	scrap steel	kg	0.6769926948523649	
89	scrap steel	kg	0.6238201858716618	
90	scrap steel	kg	0.6219869790632846	
91	scrap steel	kg	0.7004429602226795	
92	scrap steel	kg	0.6986456478286733	
93	scrap steel	kg	0.887913058627459	
94	scrap steel	kg	0.887913058627459	
95	scrap steel	kg	0.6897428557731692	
96	scrap steel	kg	0.6896792113636349	
97	scrap steel	kg	0.5313794897413998	
98	scrap steel	kg	0.5000000000156626	
99	scrap steel	kg	0.8856345754115548	
100	scrap steel	kg	0.9999999997135077	
101	scrap steel	kg	0.9999999994351522	
102	scrap steel	kg	0.9999999994351522	
103	scrap steel	kg	0.6317591937397717	
104	scrap steel	kg	0.5412755709264618	
105	scrap steel	kg	0.9999999927695247	
106	scrap steel	kg	0.7064002984071914	
107	scrap steel	kg	0.5000000057512048	
108	scrap steel	kg	0.9999999935435678	

109	scrap steel	kg	0.9999999935370224	
110	scrap steel	kg	0.6331776945573052	
111	scrap steel	kg	0.9999999936208633	
112	scrap steel	kg	0.5000000080987365	
113	scrap steel	kg	0.9999999926223708	
114	scrap steel	kg	0.9999999934158198	
115	scrap steel	kg	0.9997092871430577	
116	scrap steel	kg	0.9997092871430484	
117	scrap steel	kg	0.5	
118	scrap steel	kg	0.5000000048192241	
119	scrap steel	kg	0.5845025909984785	
120	scrap steel	kg	0.999999990658488	
121	scrap steel	kg	0.9999999899237573	
122	scrap steel	kg	0.9999999915057508	
123	scrap steel	kg	0.5854552597253591	
124	scrap steel	kg	0.5854546159205782	
125	scrap steel	kg	0.5000000163743303	
126	scrap steel	kg	0.500000020449309	
127	scrap steel	kg	0.9999999914232768	
128	scrap steel	kg	0.9999999874358947	
129	scrap steel	kg	0.999999971521249	
130	scrap steel	kg	0.9999998721296823	
131	scrap steel	kg	0.9999999994814441	
132	scrap steel	kg	0.5000000001812003	
133	scrap steel	kg	0.5000000068916186	
134	scrap steel	kg	0.9999994346492378	
135	scrap steel	kg	0.9999982679940354	
136	scrap steel	kg	0.9997164039380505	
137	scrap steel	kg	0.999717689811261	
138	scrap steel	kg	0.9997172703787279	
139	scrap steel	kg	0.9997200101088694	
140	scrap steel	kg	0.5000000002826493	
141	scrap steel	kg	0.9997746991051808	
142	scrap steel	kg	0.5491729124389261	
143	scrap steel	kg	0.6590803042274815	
144	scrap steel	kg	0.6672050331868207	
145	scrap steel	kg	0.6535455571104885	
146	scrap steel	kg	0.671721710179918	
147	scrap steel	kg	0.6762405334943624	
148	scrap steel	kg	0.6585247790280175	
149	scrap steel	kg	0.6607704757879538	
150	scrap steel	kg	0.6722187462096333	
151	scrap steel	kg	0.6741771026813039	
152	scrap steel	kg	0.6896762400142752	
153	scrap steel	kg	0.639873286564797	
154	scrap steel	kg	0.6251330310863475	
155	scrap steel	kg	0.6269080292055423	
156	scrap steel	kg	0.6266916654854632	
157	scrap steel	kg	0.6670073108303469	
158	scrap steel	kg	0.6670036401838172	

159	scrap steel	kg	0.6670058951063416	
160	scrap steel	kg	0.6670043527082453	
161	scrap steel	kg	0.6670023796939049	
162	scrap steel	kg	0.6669125985923077	
163	scrap steel	kg	0.6669924900255603	
164	scrap steel	kg	0.6669128134869221	
165	scrap steel	kg	0.6669126229479593	
166	scrap steel	kg	0.6669816759771244	
167	scrap steel	kg	0.6669968588408816	
168	scrap steel	kg	0.6669234416701251	
169	scrap steel	kg	0.6560404083002591	
170	scrap steel	kg	0.6576561283485758	
171	scrap steel	kg	0.694748321703142	
172	scrap steel	kg	0.5989239536447344	
173	scrap steel	kg	0.6966193031640222	
174	scrap steel	kg	0.5751469042100944	
175	scrap steel	kg	0.6949859667231902	
176	scrap steel	kg	0.6840059822593068	
177	scrap steel	kg	0.6953901522093022	
178	scrap steel	kg	0.6867687511520634	
179	scrap steel	kg	0.6843614405161814	
180	scrap steel	kg	0.9731137386722637	
181	scrap steel	kg	0.6676712081670287	
182	scrap steel	kg	0.6953832909612624	
183	scrap steel	kg	0.6953840448103735	
184	scrap steel	kg	0.5000000013954965	
185	scrap steel	kg	0.5000000013953907	
186	scrap steel	kg	0.606550874866633	
187	scrap steel	kg	0.606550874866633	
188	scrap steel	kg	0.6997581563790906	
189	scrap steel	kg	0.6997581563790906	
190	scrap steel	kg	0.7361434401256611	
191	scrap steel	kg	0.5000000161772656	
192	scrap steel	kg	0.5000000171366336	
193	scrap steel	kg	0.7361444534800536	
194	scrap steel	kg	0.5000000161772656	
195	scrap steel	kg	0.5000000171366336	
196	scrap steel	kg	0.7346785927553232	
197	scrap steel	kg	0.5	
198	scrap steel	kg	0.7163102246941148	
199	scrap steel	kg	0.7144457695718859	
200	scrap steel	kg	0.7163069469794631	
201	scrap steel	kg	0.6885214399585381	
202	scrap steel	kg	0.6591408396309579	
203	scrap steel	kg	0.8753731982692278	
204	scrap steel	kg	0.688510079501113	
205	scrap steel	kg	0.5000000067473194	
206	scrap steel	kg	0.5140896500194109	
207	scrap steel	kg	0.7414605013660092	
208	scrap steel	kg	0.6627331881951275	

209	scrap steel	kg	0.6627329739946706	
210	scrap steel	kg	0.6627332317355745	
211	scrap steel	kg	0.6630762929600539	
212	scrap steel	kg	0.9226153108175831	
213	scrap steel	kg	0.6071760541951337	
214	scrap steel	kg	0.5958300518878409	
215	scrap steel	kg	0.6071753516383707	
216	scrap steel	kg	0.6071751415633132	
217	scrap steel	kg	0.5763105739208775	
218	scrap steel	kg	0.6855264429889775	
219	scrap steel	kg	0.6071934417356948	
220	scrap steel	kg	0.538377432449961	
221	scrap steel	kg	0.5955477087881513	
222	scrap steel	kg	0.9849052756978229	
223	scrap steel	kg	0.5998516469581143	
224	scrap steel	kg	0.5998516469581143	
225	scrap steel	kg	0.5998516469581143	
226	scrap steel	kg	0.5998516469581143	
227	scrap steel	kg	0.5998516469581144	
228	scrap steel	kg	0.5998516469581143	
229	scrap steel	kg	0.5313794897413998	
230	scrap steel	kg	0.9999999997135077	
231	scrap steel	kg	0.5000000087036225	
232	scrap steel	kg	0.5000000087036225	
233	scrap steel	kg	0.5000000087036225	
234	scrap steel	kg	0.5000000087036225	
235	scrap steel	kg	0.5000000087036225	
236	scrap steel	kg	0.5000000087036225	
237	scrap steel	kg	0.5000000087036225	
238	scrap steel	kg	0.5000000087036225	
239	scrap steel	kg	0.5000000087036225	
240	scrap steel	kg	0.5000000087036225	
241	scrap steel	kg	0.5000000087036225	
242	scrap steel	kg	0.5000000087036225	
243	scrap steel	kg	0.5000000087036225	
244	scrap steel	kg	0.5000000087036225	
245	scrap steel	kg	0.5000000087036225	
246	scrap steel	kg	0.999999991508534	
247	scrap steel	kg	0.5845025909990398	
248	scrap steel	kg	0.5854546159229089	
249	scrap steel	kg	0.5854552596322921	
250	scrap steel	kg	0.5000000163743316	
251	scrap steel	kg	0.9999999714799193	
252	scrap steel	kg	0.500000020449122	
253	scrap steel	kg	0.5000000048192241	
254	scrap steel	kg	0.999999991410345	
255	scrap steel	kg	0.9999999915057508	
256	scrap steel	kg	0.999999990658488	
257	scrap steel	kg	0.9999999899237573	
258	scrap steel	kg	0.5000000057512048	

259	scrap steel	kg	0.6317591937397725	
260	scrap steel	kg	0.5412755709264596	
261	scrap steel	kg	0.9999999935435678	
262	scrap steel	kg	0.9999999935370224	
263	scrap steel	kg	0.9999999927695247	
264	scrap steel	kg	0.5000000080987365	
265	scrap steel	kg	0.7064002984071918	
266	scrap steel	kg	0.6331776945573064	
267	scrap steel	kg	0.9999999936208633	
268	scrap steel	kg	0.9999999934158198	
269	scrap steel	kg	0.9999999926223708	
270	scrap steel	kg	0.9999982681729035	
271	scrap steel	kg	0.9997172703787279	
272	scrap steel	kg	0.9997164039380507	
273	scrap steel	kg	0.999717689811261	
274	scrap steel	kg	0.9999992547854718	
275	scrap steel	kg	0.6585858762155465	
276	scrap steel	kg	0.6644845916735674	
277	scrap steel	kg	0.6629194032631831	
278	scrap steel	kg	0.6642579644507364	
279	scrap steel	kg	0.5863085482404442	
280	scrap steel	kg	0.6986456478286733	
281	scrap steel	kg	0.604392449275467	
282	scrap steel	kg	0.7346757729822078	
283	scrap steel	kg	0.6568246453706966	
284	scrap steel	kg	0.6557196847653978	
285	scrap steel	kg	0.6629483462132985	
286	scrap steel	kg	0.6580803063208595	
287	scrap steel	kg	0.9999999924803685	
288	scrap steel	kg	0.7464947735607032	
289	scrap steel	kg	0.6619157558961585	
290	scrap steel	kg	0.6663310070041206	
291	scrap steel	kg	0.667203817451057	
292	scrap steel	kg	0.666996828824226	
293	scrap steel	kg	0.6662715612796929	
294	scrap steel	kg	0.5906545854908344	
295	scrap steel	kg	0.7507554634052712	
296	scrap steel	kg	0.7464947735606997	
297	scrap steel	kg	0.7507554634052712	
298	scrap steel	kg	0.9933321306002457	
299	scrap steel	kg	0.7004479171494864	
300	scrap steel	kg	0.5000000087036225	
301	scrap steel	kg	0.9999994346492458	
302	scrap steel	kg	0.9999999933341321	
303	scrap steel	kg	0.5000000105460874	
304	scrap steel	kg	0.6677116894724352	
305	scrap steel	kg	0.9751730991227278	
306	scrap steel	kg	0.5000000014230903	
307	scrap steel	kg	0.9999999888485303	
308	scrap steel	kg	0.9999999888485303	

309	scrap steel	kg	0.9999999888485303	
310	scrap steel	kg	0.5000000144929821	
311	scrap steel	kg	0.5000000144929821	
312	scrap steel	kg	0.7	
313	scrap steel	kg	0.6999999999999998	
Original	sludge from steel rolling	kg	0.7999999999921719	
Original	electronic component, active, unspecified	kg	0.016852913121993166	
0	sulfidic tailings, from silver mine operation	kg	0.013823370000145475	
1	sulfidic tailings, from silver mine operation	kg	0.013823370000145474	
2	sulfidic tailings, from silver mine operation	kg	0.013823370010072812	
3	sulfidic tailings, from silver mine operation	kg	0.013823370010072812	
Original	purse seiner, steel	kg	0.0	No mass because all eol flows included - servi...
Original	furnace, wood chips, softwood storage area, 10...	unit	6347.4592242604485	
Original	wind turbine network connection, 2MW, onshore	unit	0.0	shell capital service product
Original	lettuce	kg	6.755198553184006e-12	
Original	photovoltaic slanted-roof installation, 3kWp, ...	unit	0.0016325054054599389	
Original	used diesel-electric generating set, 18.5kW	unit	109.02890947860028	
Original	broccoli	kg	1.6606032738555098e-10	
Original	hair dryer	unit	0.01779316414035579	
Original	fish curing plant	unit	0.5244421939893593	
Original	tyre wear emissions, passenger car	kg	0.09999999778177056	
Original	soybean seed, for sowing	kg	0.00010043498147932015	
Original	lightweight concrete block, expanded clay	kg	1.4196784552324044e-13	
Original	waste bitumen	kg	5.611312011124446e-12	
Original	solder, bar, Sn95.5Ag3.9Cu0.6, for electronics...	kg	3.497644686989265e-10	
Original	cement mortar	kg	1.8641551943219173e-05	
Original	sinter, iron	kg	1.0	
Original	disk drive, CD/DVD, ROM, for laptop computer	unit	0.14669097750642882	
Original	purse seiner maintenance, steel	kg	0.0	shell capital service product
Original	concrete block	kg	1.3679325722820978e-05	
Original	plug, inlet and outlet, for printer cable	unit	0.013182696824228016	
Original	fodder yeast	kg	3.269710847081419e-09	
Original	machine operation, diesel, >= 74.57 kW, low lo...	hour	0.0	shell capital service product
Original	bus	unit	2850.712984994555	
Original	cucumber	kg	3.6437205998826006e-11	
Original	cement, pozzolana and fly ash 25-35\%	kg	0.00010999988152060794	
Original	grass, organic	kg	1.9653308765292513e-13	
Original	excavation, skid-steer loader	m3	0.0	shell capital service product
Original	heat pump, diffusion absorption, 4kW, future	unit	142.93898415655497	
Original	transport, passenger car, medium size, liquefi...	km	0.0	shell capital service product
Original	iron scrap, unsorted	kg	0.9999999999999999	
0	iron scrap, unsorted	kg	1.0	
1	iron scrap, unsorted	kg	1.0	
2	iron scrap, unsorted	kg	1.0	
3	iron scrap, unsorted	kg	1.0	
4	iron scrap, unsorted	kg	1.0	
5	iron scrap, unsorted	kg	1.0	
6	iron scrap, unsorted	kg	1.0	
7	iron scrap, unsorted	kg	1.0	
8	iron scrap, unsorted	kg	0.9999999999999998	

9	iron scrap, unsorted	kg	1.0	
10	iron scrap, unsorted	kg	1.0	
11	iron scrap, unsorted	kg	1.0	
12	iron scrap, unsorted	kg	1.0	
13	iron scrap, unsorted	kg	0.9999999999999999	
14	iron scrap, unsorted	kg	1.0	
15	iron scrap, unsorted	kg	1.0	
16	iron scrap, unsorted	kg	1.0	
17	iron scrap, unsorted	kg	1.0	
18	iron scrap, unsorted	kg	0.9999999999999999	
19	iron scrap, unsorted	kg	1.0	
20	iron scrap, unsorted	kg	1.0	
21	iron scrap, unsorted	kg	1.0	
22	iron scrap, unsorted	kg	1.0000000000000002	
23	iron scrap, unsorted	kg	1.0	
24	iron scrap, unsorted	kg	0.9999999999999999	
25	iron scrap, unsorted	kg	1.0	
26	iron scrap, unsorted	kg	1.0000000000000002	
27	iron scrap, unsorted	kg	0.9999999999999999	
28	iron scrap, unsorted	kg	1.0000000000000002	
29	iron scrap, unsorted	kg	1.0000000000000002	
30	iron scrap, unsorted	kg	1.0	
31	iron scrap, unsorted	kg	1.0	
32	iron scrap, unsorted	kg	0.9999999999999999	
33	iron scrap, unsorted	kg	0.9999999999999999	
34	iron scrap, unsorted	kg	1.0	
35	iron scrap, unsorted	kg	1.0	
36	iron scrap, unsorted	kg	1.0	
37	iron scrap, unsorted	kg	1.0	
38	iron scrap, unsorted	kg	1.0	
39	iron scrap, unsorted	kg	1.0	
40	iron scrap, unsorted	kg	1.0	
41	iron scrap, unsorted	kg	1.0	
42	iron scrap, unsorted	kg	1.0	
43	iron scrap, unsorted	kg	1.0	
44	iron scrap, unsorted	kg	0.9999999999999999	
45	iron scrap, unsorted	kg	1.0	
46	iron scrap, unsorted	kg	0.9999999999999999	
47	iron scrap, unsorted	kg	1.0	
48	iron scrap, unsorted	kg	1.0	
49	iron scrap, unsorted	kg	1.0	
50	iron scrap, unsorted	kg	1.0	
51	iron scrap, unsorted	kg	1.0	
52	iron scrap, unsorted	kg	1.0	
53	iron scrap, unsorted	kg	0.9999999999999998	
54	iron scrap, unsorted	kg	0.9999999999999998	
55	iron scrap, unsorted	kg	0.9999999999999998	
56	iron scrap, unsorted	kg	0.9999999999999998	
57	iron scrap, unsorted	kg	1.0	
58	iron scrap, unsorted	kg	1.0	

59	iron scrap, unsorted	kg	1.0	
60	iron scrap, unsorted	kg	1.0	
61	iron scrap, unsorted	kg	1.0	
62	iron scrap, unsorted	kg	1.0	
63	iron scrap, unsorted	kg	1.0	
64	iron scrap, unsorted	kg	1.0	
65	iron scrap, unsorted	kg	0.9999999999999999	
66	iron scrap, unsorted	kg	1.0000000000000002	
67	iron scrap, unsorted	kg	1.0	
68	iron scrap, unsorted	kg	1.0	
69	iron scrap, unsorted	kg	1.0	
70	iron scrap, unsorted	kg	1.0	
71	iron scrap, unsorted	kg	1.0	
72	iron scrap, unsorted	kg	1.0	
73	iron scrap, unsorted	kg	1.0	
74	iron scrap, unsorted	kg	1.0	
75	iron scrap, unsorted	kg	1.0	
76	iron scrap, unsorted	kg	1.0	
77	iron scrap, unsorted	kg	1.0	
78	iron scrap, unsorted	kg	1.0	
79	iron scrap, unsorted	kg	1.0	
80	iron scrap, unsorted	kg	1.0	
81	iron scrap, unsorted	kg	1.0	
82	iron scrap, unsorted	kg	1.0	
83	iron scrap, unsorted	kg	1.0	
84	iron scrap, unsorted	kg	0.9999999999999999	
85	iron scrap, unsorted	kg	1.0	
86	iron scrap, unsorted	kg	1.0	
87	iron scrap, unsorted	kg	0.9999999999999999	
88	iron scrap, unsorted	kg	1.0	
89	iron scrap, unsorted	kg	1.0	
90	iron scrap, unsorted	kg	0.9999999999999999	
91	iron scrap, unsorted	kg	1.0	
92	iron scrap, unsorted	kg	1.0	
93	iron scrap, unsorted	kg	1.0	
94	iron scrap, unsorted	kg	1.0	
95	iron scrap, unsorted	kg	1.0	
96	iron scrap, unsorted	kg	1.0	
97	iron scrap, unsorted	kg	1.0	
98	iron scrap, unsorted	kg	1.0	
99	iron scrap, unsorted	kg	1.0	
100	iron scrap, unsorted	kg	1.0	
101	iron scrap, unsorted	kg	1.0	
102	iron scrap, unsorted	kg	1.0	
103	iron scrap, unsorted	kg	1.0	
104	iron scrap, unsorted	kg	1.0	
105	iron scrap, unsorted	kg	1.0	
106	iron scrap, unsorted	kg	1.0	
107	iron scrap, unsorted	kg	0.9999999999999999	
108	iron scrap, unsorted	kg	1.0000000000000002	

109	iron scrap, unsorted	kg	1.0	
110	iron scrap, unsorted	kg	1.0	
111	iron scrap, unsorted	kg	1.0	
112	iron scrap, unsorted	kg	1.0	
113	iron scrap, unsorted	kg	1.0	
114	iron scrap, unsorted	kg	0.9999999999999999	
115	iron scrap, unsorted	kg	1.0	
116	iron scrap, unsorted	kg	0.9999999999999999	
117	iron scrap, unsorted	kg	1.0	
118	iron scrap, unsorted	kg	0.9999999999999999	
119	iron scrap, unsorted	kg	1.0	
120	iron scrap, unsorted	kg	1.0	
121	iron scrap, unsorted	kg	0.9999999999999999	
122	iron scrap, unsorted	kg	1.0	
123	iron scrap, unsorted	kg	0.9999999999999999	
124	iron scrap, unsorted	kg	1.0	
125	iron scrap, unsorted	kg	1.0	
126	iron scrap, unsorted	kg	0.9999999999999999	
127	iron scrap, unsorted	kg	1.0	
128	iron scrap, unsorted	kg	1.0	
129	iron scrap, unsorted	kg	1.0	
130	iron scrap, unsorted	kg	1.0	
131	iron scrap, unsorted	kg	1.0	
132	iron scrap, unsorted	kg	1.0	
133	iron scrap, unsorted	kg	1.0	
134	iron scrap, unsorted	kg	1.0	
135	iron scrap, unsorted	kg	1.0	
136	iron scrap, unsorted	kg	1.0	
137	iron scrap, unsorted	kg	1.0	
138	iron scrap, unsorted	kg	1.0	
139	iron scrap, unsorted	kg	1.0	
140	iron scrap, unsorted	kg	1.0	
141	iron scrap, unsorted	kg	1.0	
142	iron scrap, unsorted	kg	1.0	
143	iron scrap, unsorted	kg	1.0	
144	iron scrap, unsorted	kg	1.0	
145	iron scrap, unsorted	kg	1.0	
146	iron scrap, unsorted	kg	0.9999999999999999	
147	iron scrap, unsorted	kg	1.0	
148	iron scrap, unsorted	kg	0.9999999999999999	
149	iron scrap, unsorted	kg	0.9999999999999999	
Original	impact extrusion of steel, warm, 3 strokes	kg	0.0	shell capital service product
Original	molybdenum trioxide	kg	0.009999962365778313	
Original	technical wood drying facility	unit	3.056089106840497e-08	
Original	skidding, skidder	hour	0.0	shell capital service product
Original	straw	kg	2.6855856115962925e-10	
Original	rare earth concentrate, 70\% REO, from bastnäsite	kg	2.106249913257112e-08	
Original	steel removed by milling, average	kg	0.9999999998923239	
Original	sweet corn	kg	2.4877935109409156e-11	
Original	container ship	unit	4758575.5359888235	

Original	uranium conversion facility	unit	2998480.3155520023	
Original	airport	unit	67970.58998370587	
Original	celery	kg	1.036426143983625e-10	
Original	insulation spiral-seam duct, rockwool, DN 400,...	m	3.299999998907401	
Original	low level radioactive waste for final repository	m3	139.43688098946515	
Original	cement, blast furnace slag 70-100\%	kg	0.00011000000549708543	
Original	transport, freight, lorry with refrigeration m...	metric ton*km	0.0	shell capital service product
Original	transport, freight, lorry 7.5-16 metric ton, E...	metric ton*km	0.0	shell capital service product
Original	maize grain	kg	3.087698869859778e-05	
Original	fibre-reinforced concrete	m3	18.780594581850185	
Original	resistor, wirewound, through-hole mounting	kg	0.2021929207738462	
Original	activated bentonite	kg	0.9999999999961899	
Original	converter, for electric passenger car	kg	0.10968131652134368	
Original	lead concentrate stockpiling	kg	3.4444089983131072e-06	
Original	cement, pozzolana and fly ash 11-35\%	kg	0.00011000000113092702	
Original	expansion vessel, 80l	unit	12.253599998798895	
Original	wheat grain, feed, Swiss integrated production	kg	4.1039348309497144e-10	
Original	potentiometer, unspecified	kg	0.08413200143411793	
Original	sawnwood, lath, softwood, dried (u=10\%), planed	m3	3.978787520746969e-06	
Original	potato seed, organic, at farm	kg	1.452014107410016e-07	
Original	zeolite, powder	kg	1.389994393525597e-06	
Original	steel removed by turning, primarily roughing, ...	kg	0.999999999901963	
Original	used insulation spiral-seam duct rockwool, DN 400	m	1.4359604846440152e-10	
Original	supplementary cementitious materials	kg	2.3890341293770206e-13	
Original	passenger car, electric, without battery	kg	0.12920620178737266	
Original	breadcrumbs	kg	5.049020475788636e-10	
Original	autoclaved aerated concrete block	kg	8.671893669903984e-13	
Original	wood preservation, dipping/immersion method, w...	kg	0.0	shell capital service product
Original	foaming agent	kg	5.8887024790798985e-09	
Original	used IT accessory	kg	0.11205817891805027	
Original	transport, freight, lorry with refrigeration m...	metric ton*km	0.0	shell capital service product
Original	liquid crystal display, minor components, auxi...	kg	1.2100507750752597e-10	
Original	cement, blast furnace slag 6-34\%	kg	1.1589406630542787e-13	
Original	wood preservation, spray tunnel/deluging, orga...	kg	0.0	shell capital service product
Original	used reefer, intermodal shipping container, 40...	unit	951.240993850186	
Original	cast iron removed by turning, primarily dressi...	kg	1.0	
Original	soybean	kg	0.00010043797252917835	
Original	laser machining, metal, with YAG-laser, 60W power	hour	0.0	shell capital service product
Original	cerium concentrate, 60\% cerium oxide	kg	1.0146155626200447e-08	
Original	wood preservation facility, hot/cold dipping tank	unit	5911.679952525687	
Original	bicycle	unit	2.772617673133382	
Original	sheet rolling, copper	kg	0.0	shell capital service product
Original	cement, sulphate resistant	kg	0.0014042166069750844	
Original	operation, internet access equipment, label-ce...	hour	0.0	shell capital service product
Original	used triple glazing, U<0.5W/m2K	m2	4.5632311736730555	
Original	transport, freight, lorry with refrigeration m...	metric ton*km	0.0	shell capital service product
Original	used train, passenger, high-speed	unit	266929.82391510264	
Original	road wear emissions, lorry	kg	1.932602118083263e-07	
Original	transport, passenger car, small size, diesel, ...	km	0.0	shell capital service product
Original	deep well, for geothermal power, onshore, 6000m	m	162.16796513404282	

Original	foam glass	kg	0.019381277559928405	
Original	poultry manure, dried	kg	2.2199672507314303e-10	
Original	furnace, pellet, 50kW	unit	614.2723885836455	
Original	spent anion exchange resin from potable water ...	kg	0.09999999858118815	
Original	grass silage, organic	kg	0.0	shell capital service product
Original	transport, passenger car, medium size, petrol,...	km	0.0	shell capital service product
Original	evacuated tube collector	m2	2.4942311181249663	
Original	building operation, budget hotel	guest night	0.0	shell capital service product
Original	aluminium melting furnace	unit	4.412822278284872e-08	
Original	cream, from cow milk	kg	4.334436059575823e-05	
Original	concrete, 30-32MPa	m3	0.03940286079705156	
Original	shed, large, wood, non-insulated, fire-unprote...	m2	2.0543219799607484	
Original	sheet rolling, steel	kg	0.0618029690795685	
Original	sugarcane	kg	3.206128991842113e-06	
Original	steam generation system, solar tower power pla...	unit	11638.01775801378	
Original	geothermal power plant, 5.5MWel	unit	191611.2189472645	
Original	cheese, from cow milk, fresh, unripened	kg	0.0031003086164561404	
0	pipeline, natural gas, high pressure distribut...	km	3107.9637887950844	
1	pipeline, natural gas, high pressure distribut...	km	10159.835726529238	
2	pipeline, natural gas, high pressure distribut...	km	7748.168358078381	
Original	fuel cell, solid oxide, 125kW electrical, future	unit	9514.292713285422	
Original	used Li-ion battery	kg	0.0807230222210777	
Original	transport, passenger, electric bicycle	person*km	0.0	shell capital service product
Original	lime, hydrated, loose weight	kg	5.438768069052023e-11	
Original	maize chop	kg	5.338839020681096e-09	
Original	pipeline, petroleum	km	108560.02782147817	
8	hazardous waste, for incineration	kg	0.10672411994016456	
9	hazardous waste, for incineration	kg	0.10672411994016504	
10	hazardous waste, for incineration	kg	0.07536600979189587	
11	hazardous waste, for incineration	kg	0.7499999999999999	
14	hazardous waste, for incineration	kg	3.640968037454052e-07	
15	hazardous waste, for incineration	kg	3.640968037454052e-07	
16	hazardous waste, for incineration	kg	0.1068178282848076	
17	hazardous waste, for incineration	kg	0.10681782828480436	
18	hazardous waste, for incineration	kg	0.10679190212394629	
19	hazardous waste, for incineration	kg	0.10679190212394699	
20	hazardous waste, for incineration	kg	0.10678990949403269	
21	hazardous waste, for incineration	kg	0.10675643204275782	
22	hazardous waste, for incineration	kg	0.10682041398300861	
23	hazardous waste, for incineration	kg	8.202590283968129e-11	
24	hazardous waste, for incineration	kg	8.202590285444628e-11	
25	hazardous waste, for incineration	kg	2.3874900590771284e-10	
26	hazardous waste, for incineration	kg	2.3874900590771284e-10	
27	hazardous waste, for incineration	kg	1.1104426899712285e-09	
28	hazardous waste, for incineration	kg	1.110442689928615e-09	
29	hazardous waste, for incineration	kg	9.721939394343586e-07	
30	hazardous waste, for incineration	kg	9.721939394343586e-07	
31	hazardous waste, for incineration	kg	0.10540301435796802	
32	hazardous waste, for incineration	kg	0.10540301435796802	
33	hazardous waste, for incineration	kg	5.03685476964046e-10	

34	hazardous waste, for incineration	kg	5.805953920551894e-07	
35	hazardous waste, for incineration	kg	1.2118494953838236e-09	
36	hazardous waste, for incineration	kg	5.39320184722164e-10	
41	hazardous waste, for incineration	kg	0.026539432032009078	
42	hazardous waste, for incineration	kg	0.007270565952333498	
43	hazardous waste, for incineration	kg	0.14463828648761515	
44	hazardous waste, for incineration	kg	0.1057802976901677	
47	hazardous waste, for incineration	kg	0.10564375850437766	
48	hazardous waste, for incineration	kg	0.07500000000000001	
49	hazardous waste, for incineration	kg	0.10676460380834249	
50	hazardous waste, for incineration	kg	0.10676487447551518	
51	hazardous waste, for incineration	kg	1.6024306090655168e-06	
52	hazardous waste, for incineration	kg	1.1441692361860607e-06	
53	hazardous waste, for incineration	kg	0.14463828648761512	
54	hazardous waste, for incineration	kg	1.1104426899712285e-09	
55	hazardous waste, for incineration	kg	4.2788030736254635e-07	
56	hazardous waste, for incineration	kg	4.2788030736254635e-07	
57	hazardous waste, for incineration	kg	2.822854779316651e-07	
58	hazardous waste, for incineration	kg	0.0010316519075863402	
61	hazardous waste, for incineration	kg	0.0035549638048827732	
62	hazardous waste, for incineration	kg	0.0034679946379219495	
63	hazardous waste, for incineration	kg	0.02724100955880022	
64	hazardous waste, for incineration	kg	0.0034679946379219465	
65	hazardous waste, for incineration	kg	0.14463828648761515	
66	hazardous waste, for incineration	kg	2.0878896651598927e-07	
67	hazardous waste, for incineration	kg	2.0782122822861827e-07	
68	hazardous waste, for incineration	kg	2.0765988734751672e-07	
69	hazardous waste, for incineration	kg	2.07707846379746e-07	
70	hazardous waste, for incineration	kg	2.0775254968565808e-07	
71	hazardous waste, for incineration	kg	2.0731707976184576e-07	
72	hazardous waste, for incineration	kg	2.0709170674006098e-07	
73	hazardous waste, for incineration	kg	2.0768051765348162e-07	
74	hazardous waste, for incineration	kg	2.0780408765461313e-07	
75	hazardous waste, for incineration	kg	2.077327111389826e-07	
76	hazardous waste, for incineration	kg	2.0712016060788107e-07	
77	hazardous waste, for incineration	kg	2.069981584481072e-07	
78	hazardous waste, for incineration	kg	2.078696301842144e-07	
79	hazardous waste, for incineration	kg	2.075590499708599e-07	
80	hazardous waste, for incineration	kg	2.073776909098693e-07	
81	hazardous waste, for incineration	kg	2.0762639509558996e-07	
82	hazardous waste, for incineration	kg	2.0770181351555396e-07	
83	hazardous waste, for incineration	kg	2.0739223333122314e-07	
84	hazardous waste, for incineration	kg	2.075252284735638e-07	
85	hazardous waste, for incineration	kg	2.091680042113414e-07	
86	hazardous waste, for incineration	kg	2.08024597910124e-07	
87	hazardous waste, for incineration	kg	0.7499999307094767	
88	hazardous waste, for incineration	kg	0.7499999312434359	
89	hazardous waste, for incineration	kg	0.7499999312985076	
90	hazardous waste, for incineration	kg	0.7499999309909736	
91	hazardous waste, for incineration	kg	0.7499999310925708	

92	hazardous waste, for incineration	kg	0.7499999307017833	
93	hazardous waste, for incineration	kg	0.7499999309842598	
94	hazardous waste, for incineration	kg	0.7499999309913837	
95	hazardous waste, for incineration	kg	0.7499999310147407	
96	hazardous waste, for incineration	kg	0.7499999303861381	
97	hazardous waste, for incineration	kg	0.7499999312827775	
98	hazardous waste, for incineration	kg	0.7499999310147405	
99	hazardous waste, for incineration	kg	0.7499999310011023	
100	hazardous waste, for incineration	kg	0.7499999309913837	
101	hazardous waste, for incineration	kg	0.74999993077597	
102	hazardous waste, for incineration	kg	1.1112305353382682e-05	
103	hazardous waste, for incineration	kg	0.749999963870889	
104	hazardous waste, for incineration	kg	0.07536600979189587	
105	hazardous waste, for incineration	kg	0.7499999999999999	
106	hazardous waste, for incineration	kg	2.077714780075463e-07	
107	hazardous waste, for incineration	kg	1.11122868646155e-05	
108	hazardous waste, for incineration	kg	0.7499999309914066	
109	hazardous waste, for incineration	kg	1.1441692361860612e-06	
110	hazardous waste, for incineration	kg	1.6024306090655168e-06	
111	hazardous waste, for incineration	kg	1.1112286864851316e-05	
122	hazardous waste, for incineration	kg	2.0747631399530545e-07	
123	hazardous waste, for incineration	kg	2.074289597498128e-07	
124	hazardous waste, for incineration	kg	2.0765733676603613e-07	
125	hazardous waste, for incineration	kg	1.1112370981319735e-05	
126	hazardous waste, for incineration	kg	1.6024306090655176e-06	
127	hazardous waste, for incineration	kg	1.1441692361860618e-06	
128	hazardous waste, for incineration	kg	0.7499999290941419	
129	hazardous waste, for incineration	kg	1.1112293709429646e-05	
130	hazardous waste, for incineration	kg	1.1112787769280414e-05	
131	hazardous waste, for incineration	kg	1.1112320877416122e-05	
132	hazardous waste, for incineration	kg	1.1112370981512123e-05	
133	hazardous waste, for incineration	kg	1.1112368598559925e-05	
134	hazardous waste, for incineration	kg	1.1112368597650548e-05	
135	hazardous waste, for incineration	kg	0.749999928962894	
136	hazardous waste, for incineration	kg	6.587887707993965e-06	
137	hazardous waste, for incineration	kg	6.587887707993969e-06	
138	hazardous waste, for incineration	kg	0.75	
139	hazardous waste, for incineration	kg	0.75	
140	hazardous waste, for incineration	kg	0.0011135283760028902	
141	hazardous waste, for incineration	kg	0.001113698205814272	
142	hazardous waste, for incineration	kg	3.4837049010246665e-08	
143	hazardous waste, for incineration	kg	3.4837049010246665e-08	
144	hazardous waste, for incineration	kg	3.4837049010246665e-08	
145	hazardous waste, for incineration	kg	0.00026779537467628726	
146	hazardous waste, for incineration	kg	0.00027062413194399313	
147	hazardous waste, for incineration	kg	0.00026779065862459286	
148	hazardous waste, for incineration	kg	0.00027062253278425555	
149	hazardous waste, for incineration	kg	1.1112047841096857e-05	
150	hazardous waste, for incineration	kg	0.7499935601408889	
151	hazardous waste, for incineration	kg	0.1057802976901677	

152	hazardous waste, for incineration	kg	4.7632755135858326e-08	
153	hazardous waste, for incineration	kg	4.763275518706578e-08	
154	hazardous waste, for incineration	kg	1.1114255809899388e-07	
155	hazardous waste, for incineration	kg	1.1114255800409705e-07	
156	hazardous waste, for incineration	kg	0.10683229544240337	
157	hazardous waste, for incineration	kg	0.7499999312434362	
158	hazardous waste, for incineration	kg	3.186618854462733e-05	
159	hazardous waste, for incineration	kg	1.9985525815687913e-08	
160	hazardous waste, for incineration	kg	1.973060032035e-08	
161	hazardous waste, for incineration	kg	0.1072559264010845	
162	hazardous waste, for incineration	kg	0.7499935118532549	
163	hazardous waste, for incineration	kg	0.749995237555854	
164	hazardous waste, for incineration	kg	0.0005968993947304034	
165	hazardous waste, for incineration	kg	0.0005968993947304039	
166	hazardous waste, for incineration	kg	0.002760727856149021	
167	hazardous waste, for incineration	kg	0.002760727856149021	
168	hazardous waste, for incineration	kg	0.2126800486575346	
169	hazardous waste, for incineration	kg	0.2126800486575346	
170	hazardous waste, for incineration	kg	0.001115599929043403	
171	hazardous waste, for incineration	kg	0.001115599929043403	
172	hazardous waste, for incineration	kg	0.0009239447284596021	
173	hazardous waste, for incineration	kg	0.0009239447284596022	
174	hazardous waste, for incineration	kg	1.7315681101913424e-05	
175	hazardous waste, for incineration	kg	1.7315681101913424e-05	
176	hazardous waste, for incineration	kg	0.02846660189188195	
177	hazardous waste, for incineration	kg	0.0284665921413414	
178	hazardous waste, for incineration	kg	0.017193637867298012	
179	hazardous waste, for incineration	kg	0.017193637867298005	
180	hazardous waste, for incineration	kg	0.05983100876783622	
181	hazardous waste, for incineration	kg	0.05983095826108482	
182	hazardous waste, for incineration	kg	0.00023582646287060368	
183	hazardous waste, for incineration	kg	0.00021031712068220242	
184	hazardous waste, for incineration	kg	0.0002652650196586726	
185	hazardous waste, for incineration	kg	0.0002592329030688434	
186	hazardous waste, for incineration	kg	0.00025193773072078475	
187	hazardous waste, for incineration	kg	0.00026526898283699054	
188	hazardous waste, for incineration	kg	0.0002658604785933335	
189	hazardous waste, for incineration	kg	0.0002652521808291469	
190	hazardous waste, for incineration	kg	0.00010901430210541655	
191	hazardous waste, for incineration	kg	0.0002652430699434757	
192	hazardous waste, for incineration	kg	0.0002664885430945851	
193	hazardous waste, for incineration	kg	0.00022769405656613653	
194	hazardous waste, for incineration	kg	0.00027443954393069846	
195	hazardous waste, for incineration	kg	0.0002279604568518383	
196	hazardous waste, for incineration	kg	0.0002586442205815016	
197	hazardous waste, for incineration	kg	0.00027062397943218786	
198	hazardous waste, for incineration	kg	0.0002610712046032936	
199	hazardous waste, for incineration	kg	0.00025094804470301177	
200	hazardous waste, for incineration	kg	0.0002706224075651919	
201	hazardous waste, for incineration	kg	0.0002651179208395214	

202	hazardous waste, for incineration	kg	0.00022763310214823755	
203	hazardous waste, for incineration	kg	0.0002825886581586985	
204	hazardous waste, for incineration	kg	0.00022789759794201441	
205	hazardous waste, for incineration	kg	0.00026336891649056144	
206	hazardous waste, for incineration	kg	0.00030322922841114375	
207	hazardous waste, for incineration	kg	0.0002802981865611918	
208	hazardous waste, for incineration	kg	0.00026909874107628617	
209	hazardous waste, for incineration	kg	0.0003032273119455824	
210	hazardous waste, for incineration	kg	0.0002796789756765233	
211	hazardous waste, for incineration	kg	0.00023984619028456154	
212	hazardous waste, for incineration	kg	0.0002677836446935435	
213	hazardous waste, for incineration	kg	0.0002470601639890044	
214	hazardous waste, for incineration	kg	0.00022729463711093325	
215	hazardous waste, for incineration	kg	0.00026779328022118236	
216	hazardous waste, for incineration	kg	0.00026679772071567213	
217	hazardous waste, for incineration	kg	0.00023610025560980675	
218	hazardous waste, for incineration	kg	0.00023855901359261713	
219	hazardous waste, for incineration	kg	0.0002442945740708732	
220	hazardous waste, for incineration	kg	0.0002529862407610882	
221	hazardous waste, for incineration	kg	0.0002742343400606024	
222	hazardous waste, for incineration	kg	0.00026811262394041695	
223	hazardous waste, for incineration	kg	0.0002742281555862944	
224	hazardous waste, for incineration	kg	0.00026436569140297385	
225	hazardous waste, for incineration	kg	0.0002529830689840361	
226	hazardous waste, for incineration	kg	0.00027423173521250025	
227	hazardous waste, for incineration	kg	0.00026810916013767763	
228	hazardous waste, for incineration	kg	0.00025392928186844597	
229	hazardous waste, for incineration	kg	0.00023116797402164747	
230	hazardous waste, for incineration	kg	0.00021047129627901833	
231	hazardous waste, for incineration	kg	0.00025395029095112226	
232	hazardous waste, for incineration	kg	0.0002543446514101439	
233	hazardous waste, for incineration	kg	0.0004309518440779604	
234	hazardous waste, for incineration	kg	0.0004311857479720919	
235	hazardous waste, for incineration	kg	0.00042958503548212154	
236	hazardous waste, for incineration	kg	0.00043094984277792045	
237	hazardous waste, for incineration	kg	0.0004318992185489124	
238	hazardous waste, for incineration	kg	0.00027374971148386726	
239	hazardous waste, for incineration	kg	0.00026055004446497203	
240	hazardous waste, for incineration	kg	0.00024166753840353886	
241	hazardous waste, for incineration	kg	0.0002737881859233901	
242	hazardous waste, for incineration	kg	0.00026779874172161146	
243	hazardous waste, for incineration	kg	0.0002742189711715876	
244	hazardous waste, for incineration	kg	0.00026435698514676076	
245	hazardous waste, for incineration	kg	0.00025297484605327913	
246	hazardous waste, for incineration	kg	0.0002742223547696354	
247	hazardous waste, for incineration	kg	0.0002680999426925668	
248	hazardous waste, for incineration	kg	6.205818212492948e-05	
249	hazardous waste, for incineration	kg	6.265689577989509e-05	
250	hazardous waste, for incineration	kg	0.0002709518139807073	
251	hazardous waste, for incineration	kg	0.00025960135070212883	

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253	hazardous waste, for incineration	kg	0.00027095938272055076	
254	hazardous waste, for incineration	kg	0.0002724056374141275	
255	hazardous waste, for incineration	kg	0.00026526501795940034	
256	hazardous waste, for incineration	kg	0.00026545568539275215	
257	hazardous waste, for incineration	kg	0.000265441605338739	
258	hazardous waste, for incineration	kg	0.0002652689914515001	
259	hazardous waste, for incineration	kg	0.00026563618966777457	
260	hazardous waste, for incineration	kg	0.0002742310207841391	
261	hazardous waste, for incineration	kg	0.00026436893542095116	
262	hazardous waste, for incineration	kg	0.00026470478960265934	
263	hazardous waste, for incineration	kg	8.451323326153073e-09	
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265	hazardous waste, for incineration	kg	8.451323326153073e-09	
266	hazardous waste, for incineration	kg	8.451323326153073e-09	
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268	hazardous waste, for incineration	kg	8.451323326153078e-09	
269	hazardous waste, for incineration	kg	8.451323326153073e-09	
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271	hazardous waste, for incineration	kg	8.451323326153073e-09	
272	hazardous waste, for incineration	kg	8.451323326153073e-09	
273	hazardous waste, for incineration	kg	8.451323326153073e-09	
274	hazardous waste, for incineration	kg	8.451323326153078e-09	
275	hazardous waste, for incineration	kg	8.451323326153073e-09	
276	hazardous waste, for incineration	kg	8.451323326153073e-09	
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278	hazardous waste, for incineration	kg	0.00026776498224761287	
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281	hazardous waste, for incineration	kg	0.00023900881618715692	
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283	hazardous waste, for incineration	kg	0.00026527849123738045	
284	hazardous waste, for incineration	kg	0.0002677682825016126	
285	hazardous waste, for incineration	kg	0.00026243745258367027	
286	hazardous waste, for incineration	kg	0.0002640986736056332	
287	hazardous waste, for incineration	kg	0.00026425026451314	
288	hazardous waste, for incineration	kg	0.000193565719136329	
289	hazardous waste, for incineration	kg	0.00026452700007549145	
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292	hazardous waste, for incineration	kg	0.0002677558670909696	
293	hazardous waste, for incineration	kg	0.00024859911795315366	
294	hazardous waste, for incineration	kg	0.00027979136469653777	
295	hazardous waste, for incineration	kg	0.00026616234062117175	
296	hazardous waste, for incineration	kg	6.249405631381239e-05	
297	hazardous waste, for incineration	kg	0.00029642723731857206	
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306	hazardous waste, for incineration	kg	0.00043152595595063564	
307	hazardous waste, for incineration	kg	0.00026616234062117186	
308	hazardous waste, for incineration	kg	0.00026775586709096993	
309	hazardous waste, for incineration	kg	6.249405601347339e-05	
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313	hazardous waste, for incineration	kg	0.00026776498224761303	
314	hazardous waste, for incineration	kg	0.0002640986546037935	
315	hazardous waste, for incineration	kg	0.0002645270000754916	
316	hazardous waste, for incineration	kg	0.00027979136469653777	
317	hazardous waste, for incineration	kg	0.00023900881618715692	
318	hazardous waste, for incineration	kg	0.0889720123750359	
319	hazardous waste, for incineration	kg	0.08899245508464583	
320	hazardous waste, for incineration	kg	0.09224249941674029	
321	hazardous waste, for incineration	kg	0.09224249941674027	
322	hazardous waste, for incineration	kg	0.04737722263940143	
323	hazardous waste, for incineration	kg	0.04737722263940143	
324	hazardous waste, for incineration	kg	0.1066467581495133	
325	hazardous waste, for incineration	kg	0.10677304446785206	
327	hazardous waste, for incineration	kg	2.170753594330233e-06	
333	hazardous waste, for incineration	kg	0.003554963804882773	
334	hazardous waste, for incineration	kg	0.0034679946379219564	
335	hazardous waste, for incineration	kg	2.822854779316648e-07	
336	hazardous waste, for incineration	kg	0.027241009558800225	
337	hazardous waste, for incineration	kg	0.0010316519075863402	
338	hazardous waste, for incineration	kg	0.10682567851691845	
339	hazardous waste, for incineration	kg	0.075	
340	hazardous waste, for incineration	kg	2.7918738802814156e-07	
341	hazardous waste, for incineration	kg	0.7499999999999999	
342	hazardous waste, for incineration	kg	0.10683272804953255	
343	hazardous waste, for incineration	kg	0.00254677999935648	
344	hazardous waste, for incineration	kg	0.10683272804953255	
345	hazardous waste, for incineration	kg	0.0025467799774884143	
346	hazardous waste, for incineration	kg	8.451323326153073e-09	
347	hazardous waste, for incineration	kg	0.0002485991179531535	
348	hazardous waste, for incineration	kg	1.8266657382839522e-11	
349	hazardous waste, for incineration	kg	0.1068314260618816	
350	hazardous waste, for incineration	kg	0.1068314260620099	
351	hazardous waste, for incineration	kg	0.10672394528189962	
352	hazardous waste, for incineration	kg	0.10672394528189973	
353	hazardous waste, for incineration	kg	0.10680251391028936	
354	hazardous waste, for incineration	kg	0.10680251391030955	
355	hazardous waste, for incineration	kg	0.10682033070865432	
356	hazardous waste, for incineration	kg	0.10682033070857586	
357	hazardous waste, for incineration	kg	0.10683265258415885	

358	hazardous waste, for incineration	kg	0.10683265258513495	
359	hazardous waste, for incineration	kg	0.024552281169002575	
360	hazardous waste, for incineration	kg	0.02455228116900259	
361	hazardous waste, for incineration	kg	1.8266672091347032e-11	
364	hazardous waste, for incineration	kg	0.10682041398300537	
365	hazardous waste, for incineration	kg	0.07500000000000001	
366	hazardous waste, for incineration	kg	0.75	
367	hazardous waste, for incineration	kg	0.75	
Original	olive	kg	5.285394861863982e-11	
Original	landed anchovy by-catch, fresh	kg	5.74204817624149e-10	
Original	cable, ribbon cable, 20-pin, with plugs	kg	5.769905763949434e-10	
Original	operation, housing system, pig, fully-slatted ...	unit	0.0	shell capital service product
Original	tailing, from uranium milling	m3	3.617370710090898e-07	
Original	impact extrusion of steel, warm, initial warming	kg	0.0	shell capital service product
Original	heating and sanitary equipment, heat and power...	unit	264.9308140197976	
Original	electronic component machinery, unspecified	unit	2041.8895083741727	
0	sulfidic tailings, generic	kg	0.01522026005691581	
1	sulfidic tailings, generic	kg	0.015220260056915812	
2	sulfidic tailings, generic	kg	0.015220265020200591	
3	sulfidic tailings, generic	kg	0.015220265020200591	
4	sulfidic tailings, generic	kg	0.015220260003528536	
5	sulfidic tailings, generic	kg	0.015220260003528536	
6	sulfidic tailings, generic	kg	0.015220260003528536	
7	sulfidic tailings, generic	kg	0.015220260001938785	
8	sulfidic tailings, generic	kg	0.015220260000675343	
9	sulfidic tailings, generic	kg	0.015220260000675343	
10	sulfidic tailings, generic	kg	0.015220260002017847	
11	sulfidic tailings, generic	kg	0.015220260002017847	
12	sulfidic tailings, generic	kg	0.015220260001910754	
13	sulfidic tailings, generic	kg	0.015220260003436074	
14	sulfidic tailings, generic	kg	0.015220260003436074	
Original	petroleum	kg	2.1127540147284192e-07	
0	sulfidic tailings, from nickel mine operation	kg	0.015220260015204153	
1	sulfidic tailings, from nickel mine operation	kg	0.015220260015204153	
2	sulfidic tailings, from nickel mine operation	kg	0.015220260006933791	
Original	polymer foaming	kg	0.0	shell capital service product
Original	stone wool factory	unit	1.5065984696163007e-07	
Original	transport, passenger car, small size, diesel, ...	km	0.0	shell capital service product
Original	methanol factory	unit	7754529.718803293	
Original	transport, freight, sea, container ship with r...	metric ton*km	0.0	shell capital service product
0	wastewater treatment facility, capacity 1.1E10...	unit	3863482.071097435	
1	wastewater treatment facility, capacity 1.1E10...	unit	5.782990125801412e-06	
2	wastewater treatment facility, capacity 1.1E10...	unit	5.782959578651083e-06	
3	wastewater treatment facility, capacity 1.1E10...	unit	3863482.070847781	
Original	railway track, for high-speed train	m*year	6.688290628105826	
Original	used internal combustion engine, from passenge...	kg	0.17534221531671149	
Original	tempering, flat glass	kg	1.9157154109480903e-05	
Original	transport, freight, lorry with refrigeration m...	metric ton*km	0.0	shell capital service product
Original	photovoltaic cell, multi-Si wafer	m2	2.915685071207388e-10	
Original	used refrigeration machine, R134a as refrigerant	unit	73.6016868258566	

0	wastewater, average	m3	0.012785869133935566	
1	wastewater, average	m3	0.01278586897809001	
4	wastewater, average	m3	0.00015991347012704892	
7	wastewater, average	m3	0.012865807929578458	
8	wastewater, average	m3	0.012865807929578458	
17	wastewater, average	m3	4.533943203165879e-06	
22	wastewater, average	m3	1.3026639458558904e-06	
23	wastewater, average	m3	1.3026639458558904e-06	
24	wastewater, average	m3	0.012525164310936976	
25	wastewater, average	m3	0.012865814652511316	
26	wastewater, average	m3	0.012865814652519634	
27	wastewater, average	m3	0.012869990340273285	
28	wastewater, average	m3	0.012869990340301615	
29	wastewater, average	m3	0.012865699981097283	
31	wastewater, average	m3	1.573063099960465e-05	
32	wastewater, average	m3	1.9767803506345487e-06	
33	wastewater, average	m3	5.744914055037235e-06	
34	wastewater, average	m3	0.03468366515034586	
35	wastewater, average	m3	2.4380774757976663e-05	
36	wastewater, average	m3	0.002454727846305527	
37	wastewater, average	m3	7.322813351884241e-05	
38	wastewater, average	m3	3.0951692835941697e-05	
39	wastewater, average	m3	2.088756907952224e-05	
40	wastewater, average	m3	1.6198020174135853e-08	
41	wastewater, average	m3	2.1771450182601652e-06	
42	wastewater, average	m3	6.879336739005701e-08	
43	wastewater, average	m3	1.0781140333274839e-07	
44	wastewater, average	m3	1.1409192897502495e-07	
45	wastewater, average	m3	0.012865699981093902	
46	wastewater, average	m3	0.012525164310936978	
48	wastewater, average	m3	2.1111714531338846e-05	
49	wastewater, average	m3	0.0001599134701270489	
50	wastewater, average	m3	1.573063099960464e-05	
51	wastewater, average	m3	1.9767803506345487e-06	
52	wastewater, average	m3	5.744914055037229e-06	
53	wastewater, average	m3	2.4380774757976663e-05	
54	wastewater, average	m3	0.0024547278463055273	
55	wastewater, average	m3	3.0951692835941676e-05	
56	wastewater, average	m3	2.088756907952221e-05	
57	wastewater, average	m3	0.012865757438795096	
58	wastewater, average	m3	0.012865757438807314	
59	wastewater, average	m3	0.012865908511647827	
60	wastewater, average	m3	0.012865908511627163	
61	wastewater, average	m3	0.012865978288500831	
62	wastewater, average	m3	0.01286597828847773	
63	wastewater, average	m3	0.012866288024746863	
64	wastewater, average	m3	0.012866288024719478	
65	wastewater, average	m3	6.371544007399865e-05	
68	wastewater, average	m3	0.034683651237189916	
69	wastewater, average	m3	2.661217150619612e-08	

70	wastewater, average	m3	5.428229067567063e-08	
71	wastewater, average	m3	5.458282070680097e-08	
72	wastewater, average	m3	0.012865831336569789	
73	wastewater, average	m3	0.012865831336569789	
74	wastewater, average	m3	0.03464225463560648	
75	wastewater, average	m3	8.967623992542245e-07	
76	wastewater, average	m3	0.03468365468627029	
77	wastewater, average	m3	0.030792840893975135	
78	wastewater, average	m3	2.5825796194182452e-08	
79	wastewater, average	m3	2.5862169575643205e-08	
80	wastewater, average	m3	4.554641479208994e-08	
81	wastewater, average	m3	2.5861981002387992e-08	
82	wastewater, average	m3	7.322813351884241e-05	
83	wastewater, average	m3	0.03468367746012889	
84	wastewater, average	m3	1.7922450554482412e-06	
85	wastewater, average	m3	0.012865797375594092	
86	wastewater, average	m3	0.011806145423964604	
87	wastewater, average	m3	0.012865797375594092	
88	wastewater, average	m3	0.0118061454239646	
89	wastewater, average	m3	6.732640167055311e-05	
90	wastewater, average	m3	6.263685310485297e-05	
91	wastewater, average	m3	0.03468367746012889	
92	wastewater, average	m3	0.034683677460128896	
93	wastewater, average	m3	1.3948563407488743e-07	
94	wastewater, average	m3	0.030792840893986442	
97	wastewater, average	m3	8.779086960212423e-08	
98	wastewater, average	m3	8.779086960212423e-08	
99	wastewater, average	m3	1.733640482576862e-06	
100	wastewater, average	m3	3.027135201880799e-08	
101	wastewater, average	m3	3.027135201880799e-08	
102	wastewater, average	m3	2.1111714531338836e-05	
103	wastewater, average	m3	0.034683633953662196	
104	wastewater, average	m3	0.012864944729205128	
105	wastewater, average	m3	0.012864944729205128	
112	wastewater, average	m3	6.532674233069186e-08	
113	wastewater, average	m3	6.532662569698976e-08	
114	wastewater, average	m3	6.519500092253242e-08	
115	wastewater, average	m3	6.519500092253242e-08	
116	wastewater, average	m3	0.03458532391356953	
117	wastewater, average	m3	0.015136823857581949	
118	wastewater, average	m3	0.03444527576714588	
119	wastewater, average	m3	0.015136823857581956	
120	wastewater, average	m3	0.03208921285238775	
121	wastewater, average	m3	0.03444527576714589	
122	wastewater, average	m3	6.737755681243231e-08	
123	wastewater, average	m3	6.737755681243227e-08	
124	wastewater, average	m3	0.0128659832700696	
125	wastewater, average	m3	0.012865983270055762	
126	wastewater, average	m3	0.000126417979743448	
127	wastewater, average	m3	0.03468367724749234	

128	wastewater, average	m3	2.1566352411057924e-06	
129	wastewater, average	m3	4.147655668489757e-09	
130	wastewater, average	m3	2.15663524110471e-06	
131	wastewater, average	m3	0.03468367724770074	
132	wastewater, average	m3	4.147655668425851e-09	
133	wastewater, average	m3	0.012865806654475355	
134	wastewater, average	m3	0.012865806654475355	
135	wastewater, average	m3	1.4837238088724907e-07	
136	wastewater, average	m3	0.00532132599471246	
138	wastewater, average	m3	0.00532132599471246	
146	wastewater, average	m3	6.676291980260347e-07	
147	wastewater, average	m3	1.6101397729644788e-06	
148	wastewater, average	m3	9.299122078179095e-07	
149	wastewater, average	m3	2.6751620641685074e-08	
150	wastewater, average	m3	0.03468366514921872	
151	wastewater, average	m3	0.012840364397304047	
152	wastewater, average	m3	0.012767706866722484	
153	wastewater, average	m3	0.01276770686675341	
154	wastewater, average	m3	0.03468360905518402	
155	wastewater, average	m3	0.01286600773038555	
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157	wastewater, average	m3	0.03208921285238918	
158	wastewater, average	m3	0.012840364397335874	
159	wastewater, average	m3	0.034585323913566696	
160	wastewater, average	m3	0.012886829933445665	
161	wastewater, average	m3	0.012886829933445665	
162	wastewater, average	m3	0.03245168061775764	
163	wastewater, average	m3	0.03245168061775764	
164	wastewater, average	m3	0.034032373849851666	
165	wastewater, average	m3	0.01335369474866777	
166	wastewater, average	m3	0.01644894957328925	
167	wastewater, average	m3	0.01644894957328925	
168	wastewater, average	m3	0.013209182260399086	
169	wastewater, average	m3	0.013209182260399086	
170	wastewater, average	m3	0.015515207094124824	
171	wastewater, average	m3	0.015515207094124822	
172	wastewater, average	m3	0.013121179434342134	
173	wastewater, average	m3	0.013121179434342134	
174	wastewater, average	m3	0.008849007343807436	
175	wastewater, average	m3	0.016463534109303103	
176	wastewater, average	m3	0.013664633900604519	
177	wastewater, average	m3	0.013664633900604519	
178	wastewater, average	m3	0.012960358828829541	
179	wastewater, average	m3	0.012960358828829541	
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182	wastewater, average	m3	0.016421270484865937	
183	wastewater, average	m3	0.016421270484865937	
184	wastewater, average	m3	0.013381042797066948	
185	wastewater, average	m3	0.013381042797066948	

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191	wastewater, average	m3	0.01386072654995453	
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193	wastewater, average	m3	0.016512295119410637	
194	wastewater, average	m3	0.009348025780186299	
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196	wastewater, average	m3	0.013296168616246891	
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203	wastewater, average	m3	0.016508441759827023	
204	wastewater, average	m3	0.016491518628997694	
205	wastewater, average	m3	0.016491518628997694	
206	wastewater, average	m3	0.014386084607459467	
207	wastewater, average	m3	0.014386084607459467	
208	wastewater, average	m3	0.01646150716987506	
209	wastewater, average	m3	0.01646150716987506	
210	wastewater, average	m3	0.012958449324349966	
211	wastewater, average	m3	0.012958449324349966	
212	wastewater, average	m3	0.012967578045532622	
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215	wastewater, average	m3	0.013239148361240991	
216	wastewater, average	m3	0.013989976181805797	
217	wastewater, average	m3	0.013989976181805797	
218	wastewater, average	m3	0.0128776709904995	
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223	wastewater, average	m3	0.01562981771977691	
224	wastewater, average	m3	0.01562981771977691	
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229	wastewater, average	m3	0.011121696456860281	
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236	wastewater, average	m3	0.016446910238433816	
237	wastewater, average	m3	0.015325719817521646	
238	wastewater, average	m3	0.013232140563949375	
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240	wastewater, average	m3	0.01381363948837788	
241	wastewater, average	m3	0.01300144703351025	
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263	wastewater, average	m3	0.01357291093555828	
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265	wastewater, average	m3	0.016525220721729513	
266	wastewater, average	m3	0.016525220721729517	
267	wastewater, average	m3	0.016747147687962326	
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269	wastewater, average	m3	0.01289336699863396	
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271	wastewater, average	m3	0.01648368856326345	
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274	wastewater, average	m3	0.016510873294858393	
275	wastewater, average	m3	0.01559216117509063	
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277	wastewater, average	m3	0.015477959605894374	
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279	wastewater, average	m3	0.012930100055813572	
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284	wastewater, average	m3	0.01328390817389194	
285	wastewater, average	m3	0.01647002323215017	

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291	wastewater, average	m3	0.01572488635252516	
292	wastewater, average	m3	0.012869804511533385	
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294	wastewater, average	m3	0.016386506283845036	
295	wastewater, average	m3	0.02961574981255971	
296	wastewater, average	m3	0.02961574981255971	
297	wastewater, average	m3	0.015956785110958032	
298	wastewater, average	m3	0.013203675338476434	
299	wastewater, average	m3	0.018050441937393927	
300	wastewater, average	m3	0.016486851510408646	
301	wastewater, average	m3	0.01651133628486683	
302	wastewater, average	m3	0.01623606342323431	
303	wastewater, average	m3	0.01611372596932174	
304	wastewater, average	m3	0.012874957489827695	
305	wastewater, average	m3	0.016054047703594407	
306	wastewater, average	m3	0.012959001153707088	
307	wastewater, average	m3	0.013934426499433218	
308	wastewater, average	m3	0.0011601903296397298	
309	wastewater, average	m3	0.0011599501832518762	
310	wastewater, average	m3	0.012418254247400116	
311	wastewater, average	m3	0.012472654471814091	
312	wastewater, average	m3	0.011631611908058215	
313	wastewater, average	m3	4.874530140365639e-07	
314	wastewater, average	m3	4.87453014618266e-07	
315	wastewater, average	m3	0.016500208123362125	
316	wastewater, average	m3	2.7847128559299894e-08	
317	wastewater, average	m3	0.00034091305978218797	
318	wastewater, average	m3	7.50761418899198e-05	
321	wastewater, average	m3	0.012458729160999238	
322	wastewater, average	m3	2.6926804245764074e-05	
323	wastewater, average	m3	7.507614188991981e-05	
324	wastewater, average	m3	0.011204720450589315	
325	wastewater, average	m3	0.011204720450589315	
326	wastewater, average	m3	0.01299932363984991	
327	wastewater, average	m3	0.01299932363984991	
328	wastewater, average	m3	0.013165442562548256	
329	wastewater, average	m3	0.01630569495592619	
330	wastewater, average	m3	0.01630569495592619	
331	wastewater, average	m3	0.013232140563949375	
332	wastewater, average	m3	0.013123175206722681	
333	wastewater, average	m3	0.013123175206722681	
334	wastewater, average	m3	0.014309048457069921	
335	wastewater, average	m3	0.014309048457069921	
336	wastewater, average	m3	7.133975511308544e-08	
337	wastewater, average	m3	7.133975511308541e-08	

338	wastewater, average	m3	7.133975511308541e-08	
339	wastewater, average	m3	7.133975511308544e-08	
340	wastewater, average	m3	7.133975511308544e-08	
341	wastewater, average	m3	7.133975511308541e-08	
342	wastewater, average	m3	7.133975511308541e-08	
343	wastewater, average	m3	7.133975511308541e-08	
344	wastewater, average	m3	7.133975511308541e-08	
345	wastewater, average	m3	7.133975511308544e-08	
346	wastewater, average	m3	7.133975511308541e-08	
347	wastewater, average	m3	7.133975511308541e-08	
348	wastewater, average	m3	7.133975511308541e-08	
349	wastewater, average	m3	7.133975511308544e-08	
350	wastewater, average	m3	7.133975511308544e-08	
351	wastewater, average	m3	7.133975511308541e-08	
352	wastewater, average	m3	7.133975511308544e-08	
353	wastewater, average	m3	7.133975511308541e-08	
354	wastewater, average	m3	7.133975511308544e-08	
355	wastewater, average	m3	9.752099254440478e-08	
356	wastewater, average	m3	9.752099254440463e-08	
357	wastewater, average	m3	9.752099254440478e-08	
358	wastewater, average	m3	9.752099254440478e-08	
359	wastewater, average	m3	9.752099254440478e-08	
360	wastewater, average	m3	9.752099254440478e-08	
361	wastewater, average	m3	9.752099254440463e-08	
362	wastewater, average	m3	9.752099254440463e-08	
363	wastewater, average	m3	9.752099254440478e-08	
364	wastewater, average	m3	9.752099254440478e-08	
365	wastewater, average	m3	9.752099254440478e-08	
366	wastewater, average	m3	9.752099254440478e-08	
367	wastewater, average	m3	9.752099254440473e-08	
368	wastewater, average	m3	9.752099254440473e-08	
369	wastewater, average	m3	9.752099254440483e-08	
370	wastewater, average	m3	9.752099254440473e-08	
371	wastewater, average	m3	9.752099254440483e-08	
372	wastewater, average	m3	9.752099254440478e-08	
373	wastewater, average	m3	9.752099254440483e-08	
374	wastewater, average	m3	9.752099254440483e-08	
375	wastewater, average	m3	9.752099254440478e-08	
376	wastewater, average	m3	9.752099254440478e-08	
377	wastewater, average	m3	9.752099254440478e-08	
378	wastewater, average	m3	9.752099254440473e-08	
379	wastewater, average	m3	9.752099254440478e-08	
380	wastewater, average	m3	9.752099254440478e-08	
381	wastewater, average	m3	9.752099254440473e-08	
382	wastewater, average	m3	9.752099254440473e-08	
383	wastewater, average	m3	9.752099254440473e-08	
384	wastewater, average	m3	9.752099254440467e-08	
385	wastewater, average	m3	9.752099254440483e-08	
386	wastewater, average	m3	9.752099254440478e-08	
387	wastewater, average	m3	9.752099254440483e-08	

388	wastewater, average	m3	9.752099254440478e-08	
389	wastewater, average	m3	9.752099254440473e-08	
390	wastewater, average	m3	9.752099254440473e-08	
391	wastewater, average	m3	9.752099254440467e-08	
392	wastewater, average	m3	9.752099254440473e-08	
393	wastewater, average	m3	9.752099254440473e-08	
394	wastewater, average	m3	9.752099254440473e-08	
395	wastewater, average	m3	9.752099254440483e-08	
396	wastewater, average	m3	9.752099254440473e-08	
397	wastewater, average	m3	9.752099254440473e-08	
398	wastewater, average	m3	9.752099254440478e-08	
399	wastewater, average	m3	9.752099254440467e-08	
400	wastewater, average	m3	9.752099254440483e-08	
401	wastewater, average	m3	9.752099254440473e-08	
402	wastewater, average	m3	9.752099254440467e-08	
403	wastewater, average	m3	9.752099254440473e-08	
404	wastewater, average	m3	9.752099254440473e-08	
405	wastewater, average	m3	9.752099254440473e-08	
406	wastewater, average	m3	9.752099254440483e-08	
407	wastewater, average	m3	9.752099254440483e-08	
408	wastewater, average	m3	9.752099254440483e-08	
409	wastewater, average	m3	9.752099254440473e-08	
410	wastewater, average	m3	1.1335863779631376e-07	
411	wastewater, average	m3	1.1335863779631372e-07	
412	wastewater, average	m3	9.405286823450119e-08	
413	wastewater, average	m3	0.034683677460128896	
414	wastewater, average	m3	2.0510659174218604e-11	
415	wastewater, average	m3	5.146147278834619e-07	
416	wastewater, average	m3	0.016451819699438288	
417	wastewater, average	m3	0.016451819699438285	
418	wastewater, average	m3	0.034683677460128896	
419	wastewater, average	m3	0.034683677460128896	
420	wastewater, average	m3	0.03463977044524147	
421	wastewater, average	m3	2.0742084098401043e-08	
422	wastewater, average	m3	2.0742084098401033e-08	
423	wastewater, average	m3	6.015074507481282e-05	
424	wastewater, average	m3	6.015074507481282e-05	
425	wastewater, average	m3	3.297265049513313e-05	
426	wastewater, average	m3	3.297265049513322e-05	
427	wastewater, average	m3	0.03468354212873088	
428	wastewater, average	m3	0.012744616433788063	
429	wastewater, average	m3	2.3720784135061704e-10	
430	wastewater, average	m3	3.3733519257604827e-07	
431	wastewater, average	m3	0.034656616840127386	
432	wastewater, average	m3	0.03460454576448743	
433	wastewater, average	m3	0.017172519346822058	
434	wastewater, average	m3	0.017112268047404833	
435	wastewater, average	m3	0.01712798958625282	
436	wastewater, average	m3	0.017012728810771104	
437	wastewater, average	m3	5.0436283386077124e-08	

438	wastewater, average	m3	0.012862578341184273	
439	wastewater, average	m3	0.012865431407931118	
440	wastewater, average	m3	0.012865500887449203	
441	wastewater, average	m3	3.979992299711227e-06	
442	wastewater, average	m3	0.009848464590661273	
443	wastewater, average	m3	6.664510945804472e-06	
444	wastewater, average	m3	0.0019364545081350635	
445	wastewater, average	m3	3.878766674455411e-05	
446	wastewater, average	m3	0.0001230568000390365	
447	wastewater, average	m3	0.00015740200195619018	
448	wastewater, average	m3	0.012908792203875315	
449	wastewater, average	m3	0.0011250888982648223	
452	wastewater, average	m3	0.012908792203875315	
453	wastewater, average	m3	0.013049210458203658	
454	wastewater, average	m3	0.013049210458203658	
455	wastewater, average	m3	0.007489618300079542	
456	wastewater, average	m3	0.016511322675485954	
457	wastewater, average	m3	0.016474115598469317	
458	wastewater, average	m3	0.007410707968501428	
459	wastewater, average	m3	0.006760771703085124	
460	wastewater, average	m3	0.0007966385034219254	
461	wastewater, average	m3	0.0007966300709619177	
462	wastewater, average	m3	0.012911363872345366	
463	wastewater, average	m3	0.012911363872345366	
464	wastewater, average	m3	0.003575335802927916	
465	wastewater, average	m3	0.0035753358029279167	
466	wastewater, average	m3	0.002268124634577338	
467	wastewater, average	m3	0.002268124634577338	
468	wastewater, average	m3	0.012974825704000274	
469	wastewater, average	m3	0.012974825704000274	
470	wastewater, average	m3	0.0010500618971680349	
471	wastewater, average	m3	0.0010500618971680349	
472	wastewater, average	m3	0.000146904092092051	
473	wastewater, average	m3	0.000146904092092051	
474	wastewater, average	m3	5.801904631405811e-05	
475	wastewater, average	m3	5.8019046314058127e-05	
476	wastewater, average	m3	0.0020501967703975936	
477	wastewater, average	m3	0.0020501959821216196	
478	wastewater, average	m3	0.00029456332050096633	
479	wastewater, average	m3	0.00029456332050096644	
480	wastewater, average	m3	0.0005044878819763424	
481	wastewater, average	m3	0.0005044880415598533	
482	wastewater, average	m3	0.012844874437862506	
483	wastewater, average	m3	0.01286600773038555	
484	wastewater, average	m3	0.01286600773038555	
485	wastewater, average	m3	0.01286600773038555	
486	wastewater, average	m3	0.01286600773038555	
487	wastewater, average	m3	0.01286600773038555	
488	wastewater, average	m3	0.01286600773038555	
489	wastewater, average	m3	0.01286600773038555	

490	wastewater, average	m3	0.01286600773038555	
491	wastewater, average	m3	0.01286600773038555	
492	wastewater, average	m3	0.01286600773038555	
493	wastewater, average	m3	0.01286600773038555	
494	wastewater, average	m3	0.01286600773038555	
495	wastewater, average	m3	0.01286600773038555	
496	wastewater, average	m3	0.01286600773038555	
497	wastewater, average	m3	0.01286600773038555	
498	wastewater, average	m3	0.03460455437022993	
499	wastewater, average	m3	0.01712798958625206	
500	wastewater, average	m3	0.017172519346822696	
501	wastewater, average	m3	0.01711226804740482	
502	wastewater, average	m3	0.01624805577982107	
503	wastewater, average	m3	0.012943108615992733	
504	wastewater, average	m3	0.012943108615992733	
505	wastewater, average	m3	0.016503354294410494	
506	wastewater, average	m3	0.016503354294410494	
507	wastewater, average	m3	0.01286600773038555	
508	wastewater, average	m3	0.01286600773038555	
509	wastewater, average	m3	0.01286600773038555	
510	wastewater, average	m3	0.01286600773038555	
511	wastewater, average	m3	0.012865380084074896	
512	wastewater, average	m3	0.012865704598044717	
513	wastewater, average	m3	0.01286572067971299	
514	wastewater, average	m3	0.012865761387626747	
515	wastewater, average	m3	0.012865759399752296	
516	wastewater, average	m3	0.01286564910849402	
517	wastewater, average	m3	0.012865465151594818	
518	wastewater, average	m3	0.012865713211735104	
519	wastewater, average	m3	0.012865308980070841	
520	wastewater, average	m3	0.013624376944994595	
521	wastewater, average	m3	0.012856536840800594	
522	wastewater, average	m3	0.012896348864052642	
523	wastewater, average	m3	0.012919830253524119	
524	wastewater, average	m3	0.012502868628924533	
525	wastewater, average	m3	0.012282513192830519	
526	wastewater, average	m3	0.012845636790776474	
527	wastewater, average	m3	2.574514242038067e-09	
528	wastewater, average	m3	4.533943203165879e-06	
529	wastewater, average	m3	2.0066281730995616e-05	
530	wastewater, average	m3	0.012865750791421028	
531	wastewater, average	m3	0.012865750791421028	
532	wastewater, average	m3	3.2972728576326306e-05	
533	wastewater, average	m3	3.2972728576326306e-05	
534	wastewater, average	m3	4.5546435929577743e-08	
535	wastewater, average	m3	0.034656616840510385	
536	wastewater, average	m3	0.03468335114793501	
537	wastewater, average	m3	5.852226965862122e-07	
538	wastewater, average	m3	0.01286557610077166	
539	wastewater, average	m3	0.012866553341139718	

540	wastewater, average	m3	0.034683072940837986	
541	wastewater, average	m3	0.012751708548449708	
542	wastewater, average	m3	0.03468367746012889	
543	wastewater, average	m3	1.207560323080319e-07	
544	wastewater, average	m3	0.034683677460128896	
545	wastewater, average	m3	0.03468365977240174	
548	wastewater, average	m3	0.0007918134881881793	
549	wastewater, average	m3	0.0007918134881881793	
Original	eucalyptus seedling, for planting	unit	3.5354807072722636e-13	
Original	water supply network	km	25434.578185224083	
Original	wood preservation, hot/cold dipping, creosote,...	kg	0.0	shell capital service product
Original	building operation, luxury hotel	guest night	0.0	shell capital service product
Original	computer, desktop, without screen	unit	3.126153584675823	
Original	water works, capacity 6.23E10l/year	unit	528308.2993351894	
Original	planning, heat and power co-generation unit, 1...	unit	0.0	shell capital service product
Original	flat glass, uncoated	kg	0.09820267351027773	
Original	cement, portland fly ash cement 21-35\%	kg	7.549163315556065e-14	
Original	machine, for treatment of waste electric and e...	unit	29657.695305169447	
Original	grass seed, Swiss integrated production, at farm	kg	1.1631542017541647e-09	
Original	iron ore, crude ore, 63\% Fe	kg	0.64	
Original	port facilities	unit	558036.539134654	
Original	heat and power co-generation unit, organic Ran...	unit	0.0	No mass because all eol flows included - servi...
Original	waste concrete	kg	5.6903167686524760e-06	
0	mine infrastructure, phosphate rock	unit	649999.9999362864	
1	mine infrastructure, phosphate rock	unit	389999.9999617719	
2	mine infrastructure, phosphate rock	unit	909999.9999108012	
Original	polarizer, liquid crystals and colour filters,...	kg	3.6330394945872654e-08	
Original	lubricating oil	kg	4.444035091654734e-07	
Original	rye grain, organic	kg	1.3958377762013474e-09	
Original	blister-copper conversion facility	unit	5.846254907692964e-06	
Original	recultivation, iron mine	m2	0.0	shell capital service product
Original	waste cement-fibre slab	kg	8.055125813739916e-12	
Original	concrete, medium strength	m3	0.012513425108106237	
Original	used bicycle	unit	2.747923739274867	
Original	basic oxygen furnace waste	kg	0.9999999999623522	
Original	petroleum coke	kg	9.83409524720004e-11	
Original	used window frame, wood	m2	1.2663356433823199e-08	
Original	switch, toggle type	kg	0.2519999999754149	
Original	enamelling	m2	0.00017345710511282433	
Original	nuclear fuel element, for pressure water react...	kg	2.6395170720395030e-07	
Original	furnace, wood chips, with silo, 5000kW	unit	17024.00834333058	
Original	portafer	kg	0.9999999999897949	
Original	stimulation, deep well	m3	2.637812533802439e-05	
Original	housing system, cattle, loose, per animal unit	unit	0.0	No mass because all eol flows included - servi...
Original	used powertrain, from electric scooter	kg	0.1167910424034861	
Original	metal working, average for copper product manu...	kg	0.0	shell capital service product
Original	electrode, negative, Ni	kg	4.044019887638946e-10	
Original	cement, unspecified	kg	6.823408119401407e-05	
Original	slab and siding, hardwood, wet, measured as dr...	kg	2.1619586375200817e-13	
Original	used door, outer, wood-aluminium	m2	1.9619500861653347e-08	

Original	mandarin, processing grade	kg	1.01708413060134e-09	
Original	backlight, for liquid crystal display	kg	0.013681443113512869	
Original	sawmill	unit	0.0	No mass because all eol flows included - servi...
Original	printer, laser, black/white	unit	0.8330189533244206	
Original	rock crushing	kg	7.00000019998158e-06	
Original	liquid crystal display, unmounted	kg	0.07407611704057136	
Original	peat	kg	1.4683102451989686e-12	
Original	alfalfa-grass mixture, Swiss integrated produc...	kg	1.3772860673630744e-10	
Original	used intermodal shipping container, 40-foot, h...	unit	1326.0164003667826	
Original	barley seed, for sowing	kg	1.7693887867439149e-06	
Original	vegetable oil refinery	unit	717257.8356209924	
Original	carrot	kg	5.458250211631184e-11	
Original	manure, solid, cattle	kg	6.120685210703429e-12	
Original	transport, passenger car, medium size, diesel,...	km	0.0	shell capital service product
Original	storage, 650 l mini CHP plant	unit	208.43847456763325	
Original	rye grain	kg	2.9855905006123754e-05	
Original	finishing, textile, woven cotton	kg	0.0	shell capital service product
Original	tillage, harrowing, by offset leveling disc ha...	ha	0.0	shell capital service product
Original	pyrite ash	kg	1.3789647565154354e-10	
Original	wood preservation, pressure vessel, creosote, ...	kg	0.0	shell capital service product
Original	furnace, pellets, 9kW	unit	4.26127017389056	
Original	generator, mini CHP plant	unit	6.003936085562484	
Original	welding, gas, steel	m	0.053599999994746135	
Original	maintenance, lorry 16 metric ton	unit	431.56818155892717	
Original	maintenance, light commercial vehicle	unit	21.999999997843563	
Original	transport, freight, sea, bulk carrier for dry ...	metric ton*km	0.0	shell capital service product
Original	wheat bran	kg	7.497651851052493e-10	
0	raw sewage sludge	kg	7.34440856970191e-08	
1	raw sewage sludge	kg	7.710419958837616e-08	
2	raw sewage sludge	kg	7.706222292539464e-08	
3	raw sewage sludge	kg	0.00738188139159294	
4	raw sewage sludge	kg	0.00738188139159294	
5	raw sewage sludge	kg	7.706222292539471e-08	
6	raw sewage sludge	kg	7.34440856703789e-08	
7	raw sewage sludge	kg	7.710419958837617e-08	
Original	condensate from light oil boiler	m3	9.388242455457588e-08	
Original	decommissioned tram track	m*year	6.121394898042588	
Original	transport, freight, lorry >32 metric ton, unre...	metric ton*km	0.0	shell capital service product
Original	concrete, normal	m3	0.03197502849895526	
Original	door, outer, wood-glass	m2	9.083927041867963	
Original	spent cation exchange resin from potable water...	kg	0.09999999935736015	
Original	contouring, brass	kg	0.0	shell capital service product
Original	transport, passenger car, medium size, natural...	km	0.0	shell capital service product
Original	television	unit	1.7381418801463477	
Original	ilmenite, 54\% titanium dioxide	kg	5.803237995612748e-07	
Original	pea seed, organic, for sowing	kg	5.726540971976431e-07	
Original	blower and heat exchange unit, Storkair G 90	unit	23.600574058482078	
Original	water discharge from petroleum extraction, off...	kg	1.1262923878197463e-06	
Original	particle board, cement bonded	m3	179.01221528637652	
Original	electric kettle	unit	0.1732878064221425	

Original	filter cake, from sugarcane juice filtration	kg	0.00010368580784984974	
Original	blower and heat exchange unit, central, 600-12...	unit	108.48998746642664	
Original	deep drawing, steel, 10000 kN press, automode	kg	0.0	shell capital service product
Original	spiral-seam duct, steel, DN 125	m	1.8999999998280983	
Original	flux, for wave soldering	kg	2.0614618666388752e-08	
Original	concentrated solar power plant, solar thermal ...	unit	1810.9006972521368	
Original	photovoltaic mounting system, for facade insta...	m2	1.7970999997950692	
Original	ryegrass silage	kg	1.2698027462315962e-10	
Original	aircraft, passenger, long haul	unit	5198.776956285323	
Original	rice, basmati	kg	1.8029055971639557e-08	
Original	hot water tank, 600l	unit	245.85061453711	
Original	mastic asphalt	kg	0.0036618892489128077	
Original	control cabinet, heat and power co-generation ...	unit	207.14085034369575	
Original	anaerobic digestion plant, for sewage sludge	unit	10150.192975709235	
Original	gas motor, 206kW	unit	1338.0520978507564	
0	wastewater, from residence	m3	0.033747605699557925	
1	wastewater, from residence	m3	0.033747605699556225	
3	wastewater, from residence	m3	0.0023735521842636895	
4	wastewater, from residence	m3	0.002373547855400319	
5	wastewater, from residence	m3	0.033580372301489865	
6	wastewater, from residence	m3	0.03310625420808153	
7	wastewater, from residence	m3	0.012774801434155113	
8	wastewater, from residence	m3	0.012774660237121597	
9	wastewater, from residence	m3	0.012774660237121599	
10	wastewater, from residence	m3	2.9217430509769877e-06	
11	wastewater, from residence	m3	0.012774571335680619	
12	wastewater, from residence	m3	0.012774571335674209	
13	wastewater, from residence	m3	0.0337453915974189	
14	wastewater, from residence	m3	0.03374758728142741	
15	wastewater, from residence	m3	0.012774865058425608	
16	wastewater, from residence	m3	0.012774892496681138	
17	wastewater, from residence	m3	0.012774661434540917	
18	wastewater, from residence	m3	1.8763198850183653e-07	
19	wastewater, from residence	m3	1.8763198850183674e-07	
20	wastewater, from residence	m3	0.012774672954787058	
21	wastewater, from residence	m3	0.004528716702303068	
22	wastewater, from residence	m3	0.004528716702303068	
23	wastewater, from residence	m3	0.003111008991932978	
24	wastewater, from residence	m3	0.003111008991932978	
25	wastewater, from residence	m3	0.015303831315440289	
26	wastewater, from residence	m3	0.015303831315440284	
27	wastewater, from residence	m3	0.0037109477540742102	
28	wastewater, from residence	m3	0.003710947754074202	
29	wastewater, from residence	m3	0.0037054911323604117	
30	wastewater, from residence	m3	0.003705491132360414	
31	wastewater, from residence	m3	0.0127738676253267	
32	wastewater, from residence	m3	0.012773867625326714	
33	wastewater, from residence	m3	4.327360505227423e-08	
34	wastewater, from residence	m3	4.327360491342665e-08	
35	wastewater, from residence	m3	0.033743671775683624	

38	wastewater, from residence	m3	2.9217430509769877e-06	
39	wastewater, from residence	m3	0.0002840913766488671	
40	wastewater, from residence	m3	0.033747536837042444	
41	wastewater, from residence	m3	0.03374753683704224	
42	wastewater, from residence	m3	0.006701451448125588	
43	wastewater, from residence	m3	0.006699389331549663	
44	wastewater, from residence	m3	0.012774989396253905	
45	wastewater, from residence	m3	0.012774989396253905	
46	wastewater, from residence	m3	2.2031906435139905e-08	
47	wastewater, from residence	m3	2.2031906435139905e-08	
48	wastewater, from residence	m3	0.03369861526698316	
49	wastewater, from residence	m3	0.03350687894345987	
52	wastewater, from residence	m3	2.335737139546975e-05	
53	wastewater, from residence	m3	2.335737259195851e-05	
54	wastewater, from residence	m3	0.006701451448125588	
55	wastewater, from residence	m3	4.327360491342672e-08	
56	wastewater, from residence	m3	0.03374730322028977	
57	wastewater, from residence	m3	0.03374730322029494	
58	wastewater, from residence	m3	3.708571449687519e-08	
61	wastewater, from residence	m3	0.00028409137087530783	
279	wastewater, from residence	m3	0.012774865058449138	
280	wastewater, from residence	m3	0.012774892496698097	
281	wastewater, from residence	m3	0.012774661434560677	
282	wastewater, from residence	m3	0.012774672954790948	
283	wastewater, from residence	m3	0.01277480143410885	
284	wastewater, from residence	m3	0.009369990912678688	
285	wastewater, from residence	m3	5.3547325608781886e-08	
286	wastewater, from residence	m3	0.03374539159743771	
287	wastewater, from residence	m3	0.033747587281427245	
288	wastewater, from residence	m3	0.0337436717757111	
309	wastewater, from residence	m3	2.222343586541147e-06	
368	wastewater, from residence	m3	1.8514122600585194e-05	
369	wastewater, from residence	m3	1.8514122600585208e-05	
371	wastewater, from residence	m3	2.2716984411153613e-08	
374	wastewater, from residence	m3	2.22227771740169e-06	
376	wastewater, from residence	m3	0.011941217102918322	
377	wastewater, from residence	m3	0.011941217102918322	
378	wastewater, from residence	m3	1.0525543158629904e-07	
379	wastewater, from residence	m3	0.012799639168325397	
380	wastewater, from residence	m3	0.012799639168451817	
Original	wheat grain, feed	kg	1.1536898264771175e-08	
Original	land use change, perennial crop	ha	0.0	shell capital service product
Original	room-connecting overflow element, steel, appro...	unit	0.9232200000007929	
Original	bilge oil	kg	1.3300339371687264e-09	
Original	nuclear spent fuel reprocessing facility	unit	151495589.18008164	
Original	wood preservation, spray tunnel/deluging, wate...	kg	0.0	shell capital service product
Original	compost	kg	3.749268126797396e-13	
Original	gas power plant, 300MW electrical	unit	1238586.3119510738	
Original	wheat grain, organic	kg	1.7818254195554377e-09	
Original	barley grain, organic	kg	1.203612954703522e-09	

Original	transport, passenger car, EURO 3	km	0.0	shell capital service product
Original	transport, freight, lorry 16-32 metric ton, EURO5	metric ton*km	0.0	shell capital service product
Original	mini CHP plant, components for electricity only	unit	25.59238772148172	
Original	electric parts, mini CHP plant	unit	25.59238772148158	
Original	fibre cement facing tile, large format	kg	0.001342780867626508	
Original	maintenance, passenger car, electric, without ...	unit	0.0	No mass because all eol flows included - servi...
Original	ryegrass-Egyptian\	Persian clover-mixture silage	kg	8.62070230927237e-10
Original	maintenance, tram	unit	0.0	No mass because all eol flows included - servi...
Original	laser machining, metal, with YAG-laser, 500W p...	hour	0.0	shell capital service product
Original	planting with starter fertiliser, by no till p...	ha	0.0	shell capital service product
Original	furnace, logs, 30kW	unit	159.068758466051	
Original	nuclear fuel element, for pressure water react...	kg	4.9195918957956424e-08	
Original	machine operation, diesel, >= 74.57 kW, genera...	hour	0.0	shell capital service product
Original	operation, internet access equipment	hour	0.0	shell capital service product
Original	furrowing, sugarcane	ha	0.0	shell capital service product
Original	green asparagus	kg	9.304468700932528e-10	
Original	door, inner, wood	m2	0.7538868455590295	
Original	concrete, for de-icing salt contact	m3	0.019415012127824108	
Original	ventilation control and wiring, decentralized ...	unit	0.2806767298214071	
Original	oat grain, feed	kg	3.850050314768256e-05	
Original	gas power plant, 100MW electrical	unit	412862.2105671196	
Original	bulk carrier, for dry goods	unit	2919875.9206385654	
Original	solar glass, low-iron	kg	6.163523439630534e-11	
Original	pitch despergents, in paper production	kg	1.3961351971723468e-09	
Original	furnace, pellet, 15kW	unit	512.116737940607	
Original	aircraft, passenger, short haul	unit	1668.7987427193023	
Original	transport, freight, lorry 16-32 metric ton, EURO3	metric ton*km	0.0	shell capital service product
Original	soybean, Swiss integrated production	kg	3.767092559469614e-06	
Original	natural stone plate, polished	kg	3.0414537782588054e-05	
Original	finishing, textile, knit cotton	kg	0.0	shell capital service product
Original	ferrite	kg	0.564999999898707	
Original	cashew	kg	3.994000201214617e-09	
Original	protein pea, organic	kg	5.204091607330482e-08	
Original	electric motor, vehicle	kg	0.7499999999264845	
Original	toner module, laser printer, black/white	unit	0.3362850633240475	
Original	pear	kg	1.5042921106895704e-11	
Original	transport, freight, lorry 16-32 metric ton, EURO4	metric ton*km	0.0	shell capital service product
Original	aircraft, dedicated freight, short haul	unit	5896.62976194693	
Original	used exhaust air roof hood steel, DN 400	unit	8.5	
Original	electric scooter, without battery	kg	0.057357511819999325	
Original	operation, computer, desktop, with liquid crys...	hour	0.0	shell capital service product
Original	flexible duct, aluminium/PET, DN of 125	m	0.021999999997843536	
Original	pea seed, for sowing	kg	3.522556798403895e-09	
Original	trout feed, 42\% protein	kg	2.7422849976529413e-05	
Original	mineral supplement, for beef cattle	kg	8.022549332678207e-05	
Original	power adapter, for laptop	unit	0.05315969519458871	
Original	anode refinery	unit	1353172.6806558978	
Original	impact extrusion of aluminium, cold, initial s...	kg	0.0	shell capital service product
Original	deep drawing, steel, 3500 kN press, single stroke	kg	0.0	shell capital service product

Original	sawnwood, board, softwood, dried (u=20\%), planed	m3	1.2658650199743958e-05	
Original	operation, liquid manure storage and processin...	m3	0.0	shell capital service product
Original	gravel, round	kg	1.5681996177102388e-05	
Original	helicopter	unit	375.2763781949478	
Original	wind turbine, 2.3MW, onshore	unit	40388.57498391753	
Original	transport, freight, lorry with refrigeration m...	metric ton*km	0.0	shell capital service product
Original	wood preservation, spray tunnel/deluging, wate...	kg	0.0	shell capital service product
Original	operation, computer, desktop, with cathode ray...	hour	0.0	shell capital service product
Original	forging, steel	kg	0.500000000016923	
Original	electronic component factory	unit	27271075.859224763	
Original	transport, freight, lorry >32 metric ton, EURO4	metric ton*km	0.0	shell capital service product
Original	diesel, burned in agricultural machinery	MJ	2.304851822044695e-13	
Original	operation, computer, laptop, videoconference	hour	0.0	shell capital service product
Original	shavings, softwood, measured as dry mass	kg	4.1018162936148795e-11	