

Development of Inventory Database (IDEA) based on Process Analysis

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ABSTRACT

The inventory database is indispensable for implementing an LCA efficiently. However, the inventory database based on process analysis is still insufficient to meet demands from LCA practitioners. Hence, we have started to develop the inventory database (Inventory Database for Environmental Assessment: IDEA) based on process analysis. Firstly, primary inventory data are estimated on each statistical classification to assure high exhaustiveness. Secondly, detailed inventory data of various products and activities are calculated in more detailed classification class from literature, theoretical figure and process data of factory. Finally, all inventory data are evaluated on data quality with uniformed method and compiled to the inventory database. An LCA practitioner can find an intended inventory data from the detailed data or the primary data. The database can be utilized not only for LCA, but also for carbon footprint calculation.

INTRODUCTION

A Life Cycle Assessment is widely used to calculate environmental influence for products and services, so that appropriate inventory data are essential. In Japan, development of inventory database has been performed under the LCA project of five years from 1998 to 2003 with the support of METI. An LCA project's database has about 300 data which were collected by industry association, and about 280 data which were collected from survey and literature. Members of Life Cycle Assessment Society of Japan (JLCA) can use the inventory database system on a web page. The inventory data of industrial association have high reliability as those data were gathered from actual factories of each industry and were calculated from industry average. So, we can use it as the background data which are common in Japan. However, many of these data were set gate to gate as a system boundary. Accordingly, it is necessary to confirm the data being connected to the upstream inventory data. If the data could not connect upstream inventory data, we would use reference data or background data of LCA software. In addition, some industrial association collected inventory data with related companies separately from the LCA project. For other database, there are our databases which are a basic database and an optional data package of AIST-LCA Ver.4 (JEMAI-LCA Pro). There are about 400 data in the basic database and about 1,300 inventory data in the optional one. However, data of the basic database were collected during evaluation of a refrigerator, so they are

general data but limited. In addition, the optional data pack database is confined to chemical substances, iron and steel products and waste treatment technology data. Then, databases are not exhaustive for all sectors. On the other hand, there is about 400 classifications inventory data using Input-Output Table analysis. As I-O table shows money flow among the industrial sectors, indirect environment load with production activity can be calculated. These I-O table data have superior exhaustiveness because all the national activities are included to some classifications. Therefore, the data are suitable for macro analysis, but unsuitable for detailed inventory analysis.

In Japan, it has not so much been discussed about data quality. The low quality data is prone to small environmental load, and when we use background data (database), small environmental load data was inclined to be chosen. So as the result we chose low quality data. Moreover, when there are no background data, we ignore the data out of necessity, and we have no choice but to use substitute data. In the future, it will be important to evaluate data quality, because the carbon foot print and LCA carry out product comparison using background data.

Therefore, the purpose of this database development is to build the database with high exhaustiveness, high completeness, high representativeness, and high transparency, which can bear the full-scale enforcement of minute LCA analysis and carbon foot print in the future. Also, it is added to evaluate data quality easily.

CONCEPT

Exhaustiveness: All economic activities in Japan are compiled in statistics according to Japan Standard Industrial Classification (JSIC). As for statistical data in Japan, statistics of manufacturing industry are published with the industrial statistics and current survey of industrial production, and a statistics of data non-manufacturing industry with various statistics. Therefore, the classification for IDEA was prepared based upon classification by industry and commodity. By coding and managing all products with this IDEA classification, it is expected to provide the exhaustive database conveniently. As illustrated in Figure 1, if inventory data of a product classified by 6 digit commodity classification of industrial statistics are prepared using statistics, the database will be more exhaustive for the product as background data. In this method, the inventory data is of meat products with 6 digit code, but often there is a demand for the inventory data on ham and sausage in actual LCA. For minute inventory of products with 9 digit code, those inventory data will be prepared by hearing or surveying on process data, and reviewing existing data. Consequently, IDEA has a hierarchical structure, where the inventory data with exhaustiveness are due to statistics of 6 digit coded products and the more important inventory data are collected by using ordinal process data.

Data quality evaluation: About data quality such as completeness, representativeness, collection degree (data coverage), norm that a user can evaluate will be introduce. Information on applicability of the inventory will be also provided.

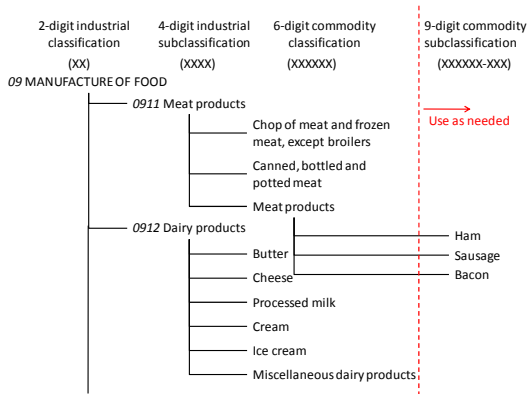


Figure 1 Hierarchical structure of IDEA

METHOD

Development of IDEA is carried out according to the following three items:

1. Inventory data by statistics

In Japan, several statistics on energy consumption of manufacturing and commerce are published as “The

structural survey of energy consumption in commerce and manufacturing (~2001)”, “Statistics of energy consumption (2008~) and “Current survey of energy consumption”. Moreover, statistics on production and raw materials consumption for specific industry such as resources and energy, chemicals, iron and steel, machinery etc. are also published. It is possible to make inventory data using these energy and materials consumption. For implementing LCA, exhaustive inventory data on materials are very useful. The obtained are examined on its calculation process, result and applicability, and then are taken into IDEA. As for inventory of non-manufacturing of which energy consumption has not been published, the inventory is estimated by using various statistics related energy. For affairs sector such as commerce and service, they are out of scope except some sector.

2. Inventory data by process analysis method

Firstly a map of existing inventory data was made and the maintenance situation of data was grasped. Necessary fields and products for data maintenance were extracted from an inventory map and a strategy of inventory making was devised. On the products of high priority, data are collected by interviewing and surveying. Obtained data are examined and incorporated in IDEA.

3. Inventory data by existing inventory data

Data of AIST-LCA Ver.4 (JEMAI-LCA Pro) standard data, optional data pack, an eco-leaf database, a JLCA database, and data from literature are targeted. Inventory data are classified and coded for examination. Comprehensive evaluation on data quality including possibility of investigation of omission data is carried out and its adaption is decided by expert judgment.

CONCLUSION

As shown in Figure 2, the inventory data from process analysis, existing database data are integrated into the IDEA. The IDEA is a database to secure exhaustiveness and to enable data quality, and also has compatibility with a database in each country. The IDEA is expected not only in future development of LCA but also a carbon foot print.

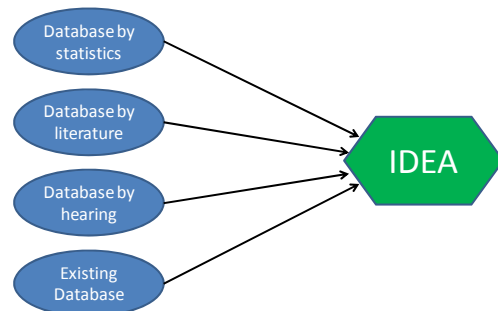


Figure 2 Integration of Japanese LCI database (IDEA)