

Development of Inventory Data-base for Infrastructure LCA

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1. Introduction

National Institute for Land and Infrastructure Management (NILIM) is a national institute as a part of Ministry of Land, Infrastructure, Transport and Tourism (MLIT). NILIM is developing Inventory Data-Base for Infrastructure LCA (Infra.-LCA-IDB). This is a progress report on development of Infra.-LCA-IDB.

2. Purpose of Infra.-LCA-IDB

We are developing Life Cycle Assessment System for Infrastructure (Infra.-LCA), as a top priority research project of MLIT.

We are going to utilize Infra.-LCA as evaluation tool for selection of designated procurement item in government green procurement system. We are also trying to utilize Infra.-LCA for administration as following evaluations.

- Strategic Environment Assessment of infrastructure project
- Sustainability Evaluation of structure infrastructure design
- Rating in comprehensive evaluation bidding system

Infra.-LCA includes two parts. The first is calculation methodology for Infra.-LCA. The second is Infra.-LCA-IDB.

2. Basic Concept of Infra.-LCA-IDB

2.1. Requirement for Infra.-LCA-IDB

Before making Infra.-LCA-IDB model, we have clarified requirements for this model, as followings.

- i) Target is to realize sustainability of infrastructure. Sustainability means mainly greenhouse gas, waste materials, and natural resources.
- ii) It is possible to utilize the model as evaluation tool for sustainability of policies. The model is not only for evaluation of individual infrastructure projects, but also for review of environmental policies.
- iii) The model can keep consistency from mining to scrap. All assessment in life stages are to same direction.
- iv) There is little exception or no exception in the model. Total consistency is very important.

2.1.1. Problems of existing Inventory Data-base

We checked existing Inventory Data-base for LCA and found following problems, according to the requirements.

- i) Data is too old to evaluate green items. Most of green items are newly developed. Technology development in environment is very rapid. Data is to be up-dated, as soon as possible.
- ii) Item classification is too rough to evaluate infrastructure. Green items are variation of items. The system have to compare sustainability among variations.

2.2. IO method and BU method

There are two types of methodology to make Inventory Data-base for LCA. They are so called the input-output method (IO method) and the build-up method (BU method). The purpose of this research is to evaluate these two methods and to make new model as Infra.-LCA-IDB by harmonizing these two methods.

2.2.1. Comparison of IO method and BU method

We have analyzed IO method and BU method. We have tried to clarify their differences in boundary conditions, possibility of up dating, detailed classifications, etc.. We have compared obtained data and calculated results of infrastructure main materials, such as cement, gravel, iron, sand, etc.. We have made evaluation table as reveal the differences and the consistencies between the two methods, followed by overall comparison and review (Table 1).

2.2.2. Harmonization of IO method and BU method

We have checked applicability of method previously recommended by the Japan Society of Civil Engineers (JSCE) and other recently proposed classification methods.

We have proposed harmonizing method, utilizing their advantages of the two methods. We have regarded that the harmonized method enhances calculation accuracy as refracting the actual data by BU method, and ensures consistencies of boundary conditions by IO method (Figure 1).

Table 1 Evaluation of IO method and BU method

	IO method	BU method
Calculating way	Allocate total environmental load among 500 industrial sectors by inter-industry input-output table	Build up environmental loads from containing materials and related activities.
Consistency	Good :Same as among industrial sectors	Bad :Arbitrarily defined by evaluators, Different conditions and boundary among industrial sectors
Strictness	Bad :500 sectors are not enough for Infra.-LCA-IDB, Only related to monetary activities not to technical activities, Too long renewal period, 5 years	Good :possible to analyze according to various characteristics of materials and activities, Clearly related to materials, energies, etc. Possible to renew according to up dated figure
Transparency	Good :According to official statistics data	Bad :Tend to be based on closed data
Comprehensiveness	Good :Monetary activities covers widely Consist with national environmental load	Bad :impossible to build up all processes
Evaluate technology	Bad :Hard to evaluate technology development	Good :Easy to evaluate technology development

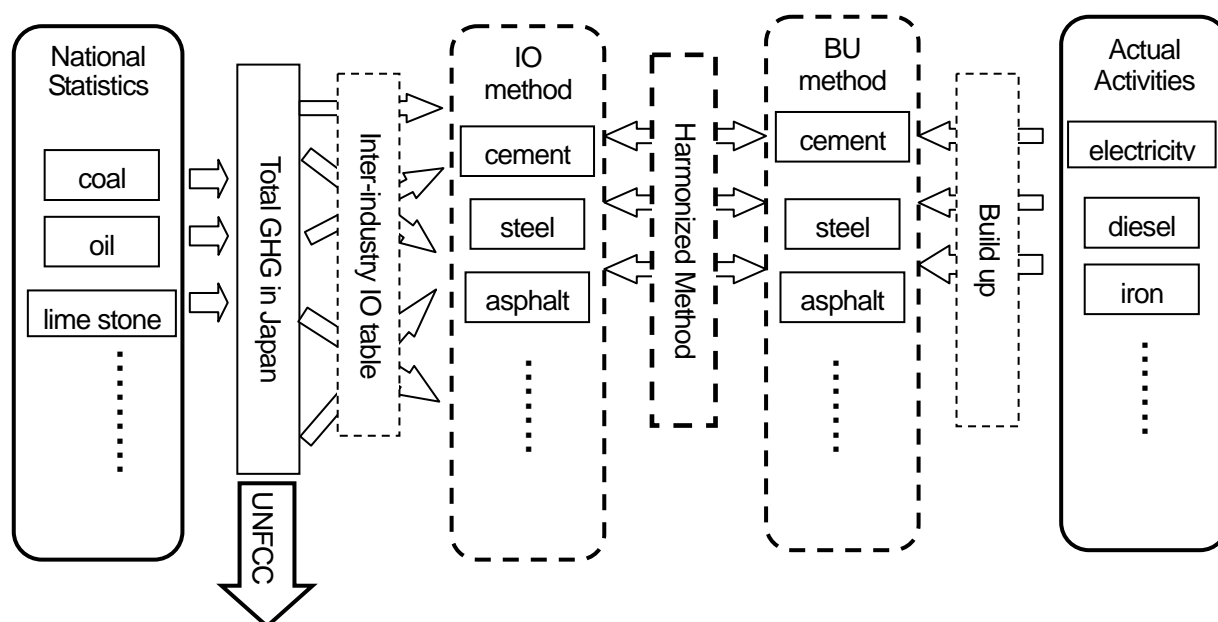


Figure 1 Harmonization of IO method and BU method

3. Case study in cement

Focusing CO₂, we have done case-study in cement to check applicability of the harmonized method. The model offers IO model boundary conditions as default, and amends data as BU method, using national statistics by Association of Cement Industry in Japan.

The study shows that CO₂ emissions associated with those domestically produced construction materials were generally large in consumption stage. Concerning activities that are subject to calculation as a trigger of environmental burden in IO method, but not in BU method, include indirect material costs, some of other indirect costs and head office activity. CO₂ emissions due to the input at head offices accounted only for 0.5% of the whole process to produce the targeted materials,

indicating that there is little need for data gathering on the CO₂ emissions from head offices.

4. Conclusions

Infra.-LCA research project is in FY2009-FY2011. We show brief outline of development of Infra.-LCA-IDB. We will hold symposium, cooperated by JSCE, to review progress report of this research project, and to accumulate opinions and knowledge. We hope to hear a lot of information through these symposium.

Development of Infra.-LCA-IDB is key element of this project. We will improve and apply the harmonizing method as Infra.-LCA-IDB until FY2011.