10th 日本の最新事例紹介/
Sharing the latest research

Toward the Promotion of Green Procurement using Environmental Hotspot Analysis

製品ライフサイクルに立脚した環境影響評価基盤の構築と社会実装によるグリーン購入の推進

National Institute of Advanced Industrial Science and Technology (AIST)

Kiyotaka TAHARA

National Institute of
Advanced Industrial Science
and Technology
AIST

RISS Research Institute of Science for Safety and Sustainability

Law on Promoting Green Purchasing (Japan)

- Article 2
  - The "Eco-Friendly Goods and Services" as used in this Act, applicable to any of the following ...
    - Products using material or parts with lower environmental burdens
    - Products reducing the emission of greenhouse gases in use phase
    - Products using recyclable materials or reusable materials for the reduction of waste

Life Cycle thinking is insufficient !!

Background 1

International trends in Green Purchasing

- EC：Recommended the use of LCA for green procurement

EUROPEAN COMMISSION

COMMISSION RECOMMENDATION
of 9 April 2013
on the use of common methods to measure and communicate the life cycle environmental performance of products and organisations

- US：
- LEED, Using LCA is one of the criteria for green procurement

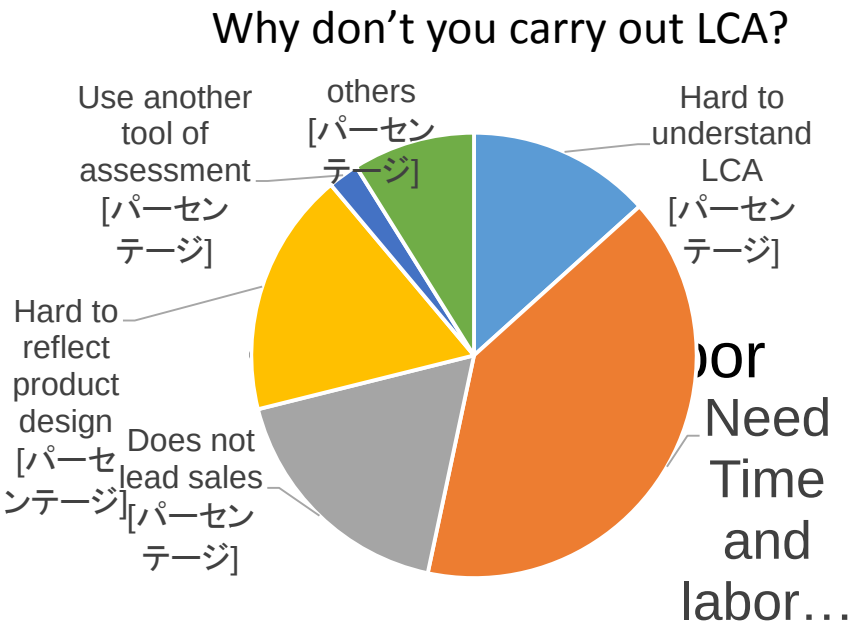
U.S. GREEN BUILDING COUNCIL LEED USGBC

- EPEAT, LCA certified by third parties is one of the criteria for green procurement

EPEAT GOLD EPEAT SILVER EPEAT BRONZE

Background2

Problems in LCA 1



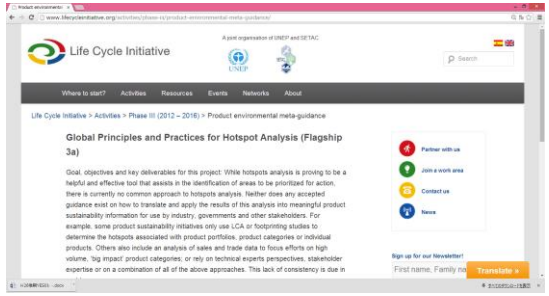
Japan Measuring Instruments Federation (2011)

The number of products with CFP:900

Awareness of CFP：26%*

*total of "know the meaning" and "have ever heard but don't know the meaning"

- UNEP：Guide of Hotspot Analysis (2012-2016)



http://www.lifecycleinitiative.org/activities/phase-iii/product-environmental-meta-guidance/

- US: Sustainability consortium
  - Hotspot analysis for a hundred of products
  - Use European LCA infrastructure, reliability

SUSTAINABILITY CONSORTIUM

Walmart, Coca-Cola, WWF, Unilever, P&G

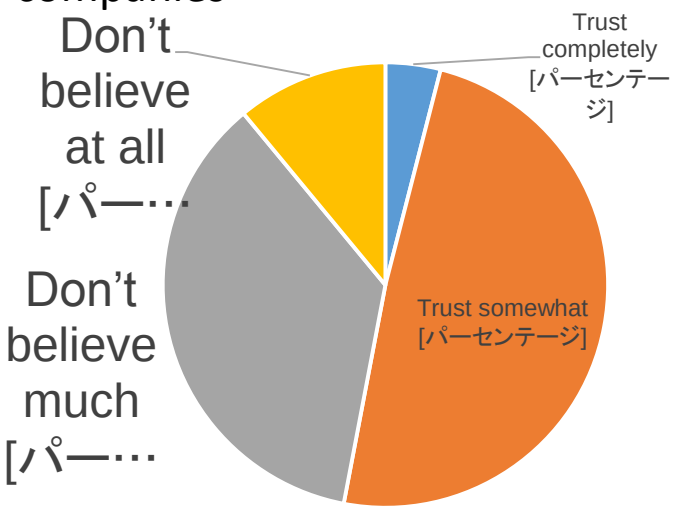
115 members

Background 3

Problems in LCA 2

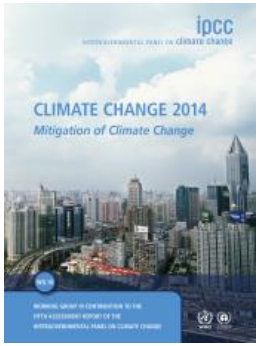
- Reliability

  Do you trust a environmental claim by companies



European Commissions: Attitudes of Europeans towards building the single market for green products, 2013 July

- IPCC
  - Scientific knowledge provided by experts
  - Publish reports regularly
  - Report for policy makers, influence on environmental policy



Scientific evaluation (product LCA) by experts

Aim of this project

EC UNEP, USA Consumer

Green purchasing→apply LCA→use env hotspot analysis→need reliability

Green purchasing←apply LCA←use env. Hotspot analysis←reliability

←scientific knowledge

- Environmental Hotspot Analysis by LCA experts
  - Apply Japanese LCA infrastructure to EHSA
  - Identify the key processes in advance
  - Producers: focus on the key process, reduction of labor
  - Government: materials for green procurement
- Research themes
  - Develop inventory database and LCIA method for EHSA covering 17 types of impact categories
  - Apply EHSA for 100 industrial products and publish the report

Structure of the Research Project

JST

Research Management Team
N. Itsubo (TCU), K. Tahara (AIST), Y. Kondo (Waseda), H. Sano (JEA), M. Kanzaki (JEMAI)

Contract

【Project 1】Develop Inventory Database and Method for EHSA

(1-1) Upstream DB Group: K. Tahara C. Fujii, A. Takada (AIST), Y, Kondo (Waseda), N. Itsubo (TCU)

(1-2) Downstream DB Group: Y. Kondo, S. Nakamura (Waseda), K. Tahara (AIST), N. Itsubo (TCU)

(1-3) Impact Assessment Group: N. Itsubo (TCU), M. Motoshita (AIST), L. Tang (NIES), Y. Ono (TCU)

DB, CF

EHSA

【Project 2】EHSA for 100 products

(2-1) Ecoleaf (Type3) Group : verify the availability of EHSA and report the results K. Tahara (AIST), Y. Kondo (Waseda), N. Itsubo (TCU), M. Kanzaki (JEMAI), METI, Users of Ecoleaf

(2-2) Ecomark (Type1) Group : verify the availability of EHSA and publish the guide N. Itsubo (TCU), K. Tahara (AIST), Y. Kondo (Waseda), H. Sano (JEA), Ministry of Env., Users of Ecomark

Report

Institutionalization

Proposal

Publication of the results of EHSA

Propose the revised Green purchasing Law

Report to Ministry of Environment, Local government, Industries, Consumers

Report to the government

Research Flow and Expected Outputs

National Institute of Advanced Industrial Science and Technology AIST

WASEDA University

東京都市大学 TOKYO CITY UNIVERSITY

Existing Method and DB

IDEA (AIST)
(3800process, 8 ICs)

WIO (Waseda univ)
(116sectors, CO_2, landfill)

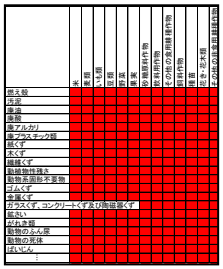
LIME (TCU, AIST et al.)
(15 Impact categories)

【Project1】Develop Inventory Database and Method for EHSA

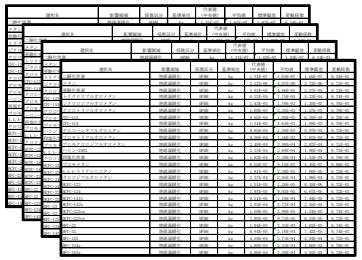
Deliverable 1

Upstream DB
(3800process, 17ICs)

Downstream DB
(400sectors, 17ICs)



Factors for EHSA
(17 ICs)



Research contents

【Project2】EHSA for a hundred of products

Research Flow and Expected Outputs

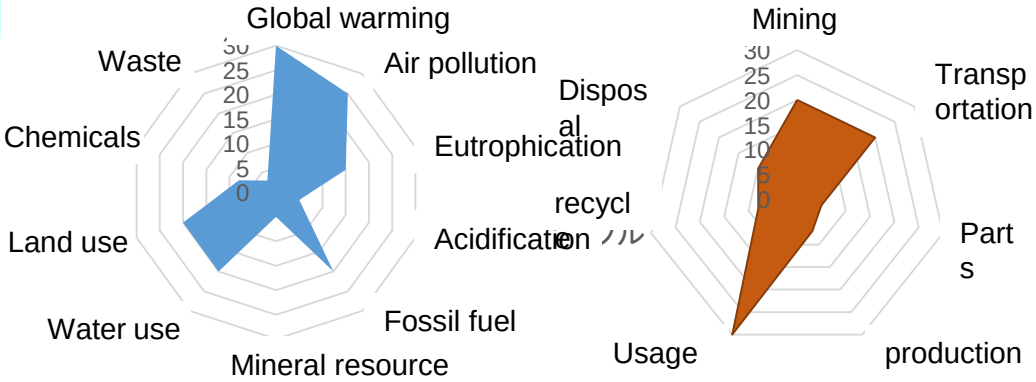
【Project2】EHSA for a hundred of products

Hearing from industrial associations
Prepare the use scenarios

Deliverable 2

Result of EHSA

Paper, stationary, furniture
OA, cellular phone, home electrical appliances, air conditioner, water heater, lightning, automobiles, fire extinguisher, uniform, interior, textile, facilities, stockpiles, construction work, service



Outcome of this project

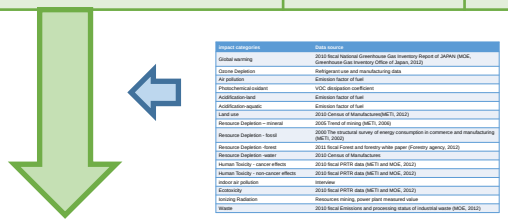
・Use for the criteria of EcoLabels (Type I and Type III)
・Propose revised green purchase law

公益財団法人 日本環境協会
エコマーク事務局

【Project 1】Develop Inventory Database and Method for EHSA：Develop of Upstream Inventory DB

Present inventory data in IDEA

	item	amount	unit	Intermediate/Elementary flow (impact category)
Input data	Butadiene	0.78	kg	Intermediate flows（material）
	Styrene	0.24	kg	Intermediate flows（material）
	Heavy oil	0.2	L	Intermediate flows（utility）
	Electricity	0.5	kWh	Intermediate flows（utility）
	Steam	7	kg	Intermediate flows（utility）
	Cooling water	0.009	m^3	Elementary flow（water resource consumption）
Output data	CO_2	0.6	kg	Elementary flow（Global warming）
	SOx	0.0002	kg	Elementary flow（Land / water acidification）
	NOx	0.0003	kg	Elementary flow（Land / water acidification）



impact categories	Data source
Global warming	2010 fiscal National Greenhouse Gas Inventory Report of JAPAN (MOE, Greenhouse Gas Inventory Office of Japan, 2012)
Ozone Depletion	Refrigerant use and manufacturing data
Air pollution	Emission factor of fuel
Photochemical oxidant	VOC dissipation coefficient
Acidification-land	Emission factor of fuel
Acidification-aquatic	Emission factor of fuel
Land use	2010 Census of Manufactures(METI, 2012)
Resource Depletion – mineral	2005 Trend of mining (METI, 2006)
Resource Depletion - fossil	2000 The structural survey of energy consumption in commerce and manufacturing (METI, 2000)
Resource Depletion -forest	2011 fiscal Forest and forestry white paper (Forestry agency, 2012)
Resource Depletion -water	2010 Census of Manufactures
Human Toxicity - cancer effects	2010 fiscal PRTR data (METI and MOE, 2012)
Human Toxicity - non-cancer effects	2010 fiscal PRTR data (METI and MOE, 2012)
Indoor air pollution	interview
Ecotoxicity	2010 fiscal PRTR data (METI and MOE, 2012)
Ionizing Radiation	Resources mining, power plant measured value
Waste	2010 fiscal Emissions and processing status of industrial waste (MOE, 2012)

	item	amount	unit	Intermediate/Elementary flow (impact category)
Input data	Butadiene	0.78	kg	Intermediate flows(material)
	Styrene	0.24	kg	Intermediate flows(material)
	Heavy oil	0.2	L	Intermediate flows(utility)
	Electricity	0.5	kWh	Intermediate flows(utility)
	Steam	7	kg	Intermediate flows(utility)
	Boiler water	X	kg	Intermediate flows(utility)
	Cooling water	0.009	m^3	Elementary flow(water resource consumption)
	Land use	X	m^2	Elementary flow(Land use)
Output data	CO_2	0.6	kg	Elementary flow(Global warming)
	CH_4	X	kg	Elementary flow(Global warming)
	SOx	0.0002	kg	Elementary flow(Land / water acidification)
	NOx	0.0003	kg	Elementary flow(Land / water acidification)
	HCFCs	X	Kg	Elementary flow(ozone layer destruction)
	PM2.5	X	Kg	Elementary flow(atmosphere pollution)
	NMVOC	X	Kg	Elementary flow(photochemical oxidant)
	Benzene	X	Kg	Elementary flow(Human toxicity / ecotoxicity)
	Styrene	X	Kg	Elementary flow(Human toxicity / ecotoxicity)

Expand the scope of inventory items from present version of IDEA. Upstream database is expected to cover 17 types of impact categories and environmental burdens of foreign countries.

Data source

impact categories	Data source
Global warming	2010 fiscal National Greenhouse Gas Inventory Report of JAPAN (MOE, Greenhouse Gas Inventory Office of Japan, 2012)
Ozone Depletion	Refrigerant use and manufacturing data
Air pollution	Emission factor of fuel
Photochemical oxidant	VOC dissipation coefficient
Acidification-land	Emission factor of fuel
Acidification-aquatic	Emission factor of fuel
Land use	2010 Census of Manufactures(METI, 2012)
Resource Depletion – mineral	2005 Trend of mining (METI, 2006)
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Human Toxicity - cancer effects	2010 fiscal PRTR data (METI and MOE, 2012)
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indoor air pollution	Interview
Ecotoxicity	2010 fiscal PRTR data (METI and MOE, 2012)
Ionizing Radiation	Resources mining, power plant measured value
Waste	2010 fiscal Emissions and processing status of industrial waste (MOE, 2012)

Example of new inventory data

	item	amount	unit	Intermediate/Elementary flow (impact category)
Input data	Butadiene	0.78	kg	Intermediate flows（material）
	Styrene	0.24	kg	Intermediate flows（material）
	Heavy oil	0.2	L	Intermediate flows（utility）
	Electricity	0.5	kWh	Intermediate flows（utility）
	Steam	7	kg	Intermediate flows（utility）
	Boiler water	X	kg	Intermediate flows(utility)
	Cooling water	0.009	m^3	Elementary flow（water resource consumption）
	Land use	X	m^2	Elementary flow(Land use)
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	CH_4	X	kg	Elementary flow(Global warming)
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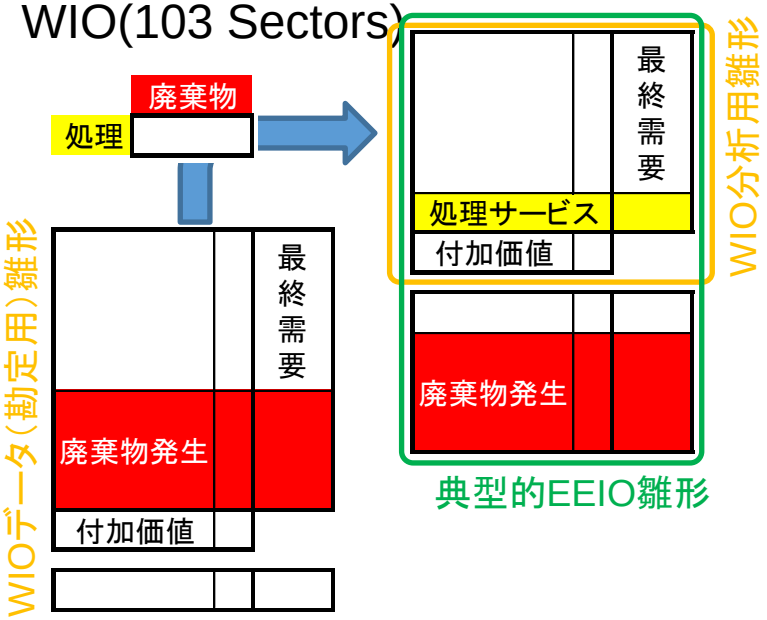
	HCFCs	X	Kg	Elementary flow(ozone layer destruction)
	PM2.5	X	Kg	Elementary flow(atmosphere pollution)
	NMVOC	X	Kg	Elementary flow(photochemical oxidant)
	Benzene	X	Kg	Elementary flow(Human toxicity / ecotoxicity)
	Styrene	X	Kg	Elementary flow(Human toxicity / ecotoxicity)

If there is actual data, we would like to use.

【Project 1】Develop Inventory Database and Method for EHSA：Develop of Downstream Inventory DB

WIO(103 Sectors)



Downstream DB(400 sectors)

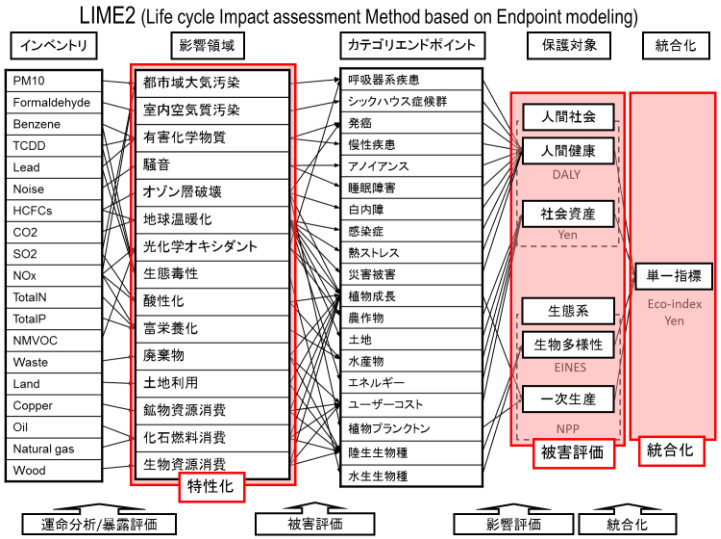
	米	麦類	いも類	豆類	野菜	果実	砂糖原料作物	飲料用作物	その他の食用耕種作物	飼料作物	種苗	花き・花木類	その他の非食用耕種作物
燃え殻													
汚泥													
廃油													
廃酸													
廃アルカリ													
廃プラスチック類													
紙くず													
木くず													
繊維くず													
動植物性残さ													
動物系固形不要物													
ゴムくず													
金属くず													
ガラスくず、コンクリートくず及び陶磁器くず													
鉱さい													
がれき類													
動物のふん尿													
動物の死体													
ばいじん													
⋮													

Data source
Waste：
fiscal Emissions and processing status of industrial waste (MOE, 2012)
Scrap, by-products:
Census of Manufactures(METI, 2012)

I-O Table, supplementary table

【Project 1】Develop Inventory Database and Method for EHSA：Develop Characterization factors (17 ICs)

LIME(15 Impact categories, Japan)



Method (ex. Air pollution)

BC, OC, SO_2 NOx NMVOC (kg)

↓ Fate analysis (Global Climate Model)

$PM_{2.5}$, $PM_{2.5}(SO_4^{2-})$, $PM_{2.5}(NO^{3-})$, O_3 (ppm)

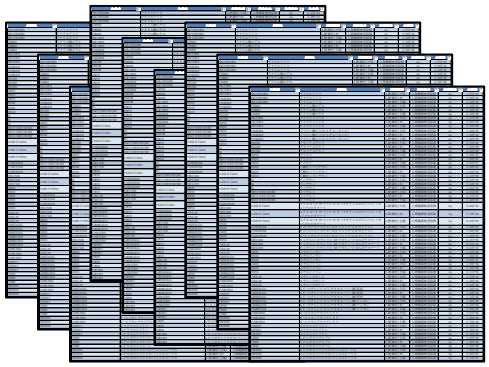
↓ Exposure analysis (Pop. density, etc)

Hazardous ratio (Intake(kg)/Threshold(kg))

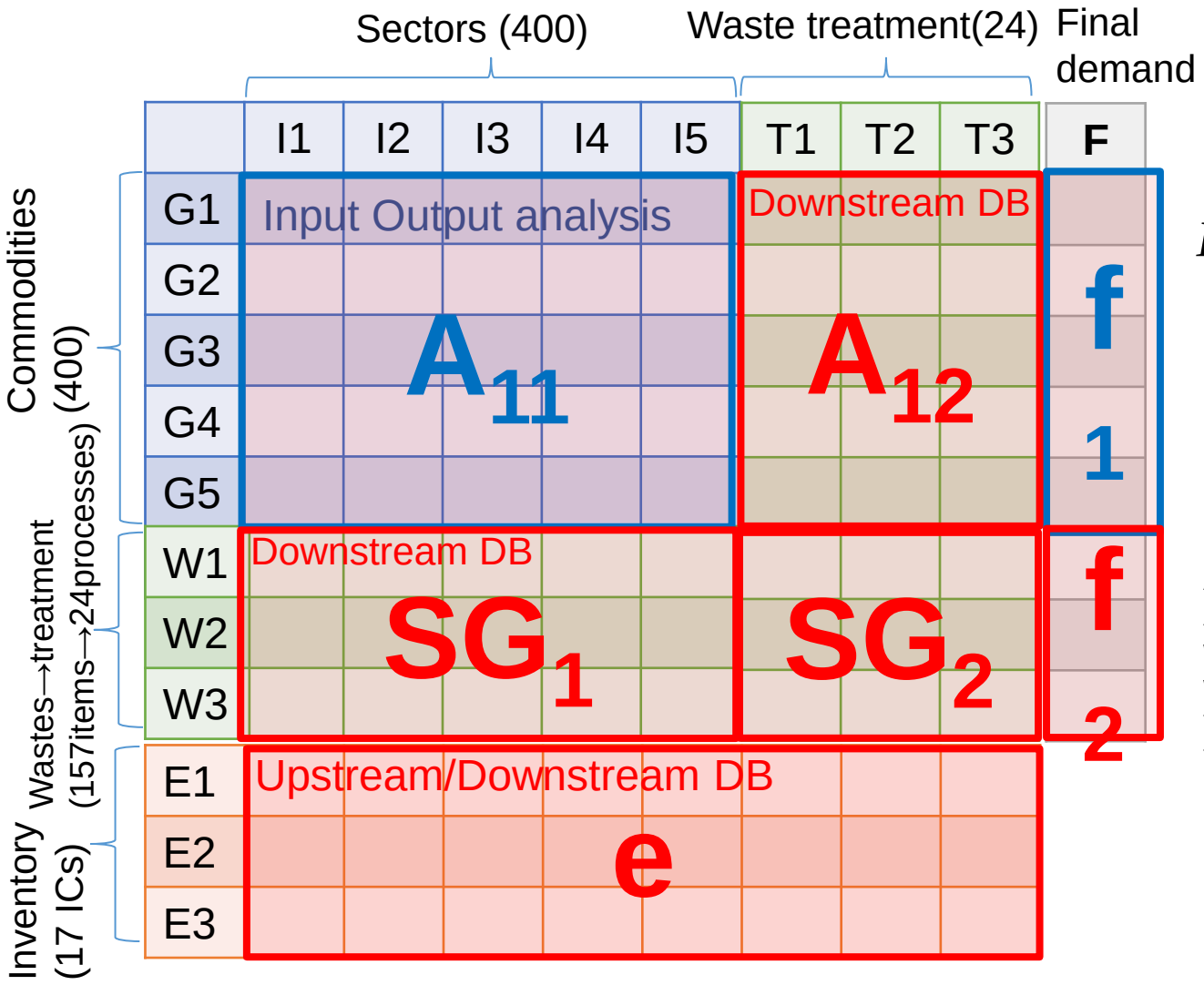
↓ Compared with the reference

Characterization factors (dimensionless)

Dataset of Characterization factors (17ICs)



【Project 2】Carry out EHSA



Environmental Hotspot Analysis

$$LCI = e(I - A)^{-1} f$$

$$A = \begin{bmatrix} A_{11} & A_{12} \\ A_{21} & A_{22} \end{bmatrix} = \begin{bmatrix} A_{11} & A_{12} \\ SG_1 & SG_2 \end{bmatrix}$$

$$f = \begin{bmatrix} f_1 \\ f_2 \end{bmatrix} = \begin{bmatrix} f_1 \\ Sw_f \end{bmatrix}$$

A_{11}:IO table (intermediate inputs)
A_{12}:waste treatment G: Input/output of waste, S: allocation matrix (type of waste→treatment)
f_1: final demand of product and service
f_2:allocation matrix from household et al.

Environmental Hotspot Impact Assessment

$$LCIA_i = \sum \left(LCI_s \times CF_{i,s} \right)$$

Data verification ・Hearing to industrial associations
・associate with UNEP to organize international workshop

EcoMark (JEA)

Life Cycle Stage

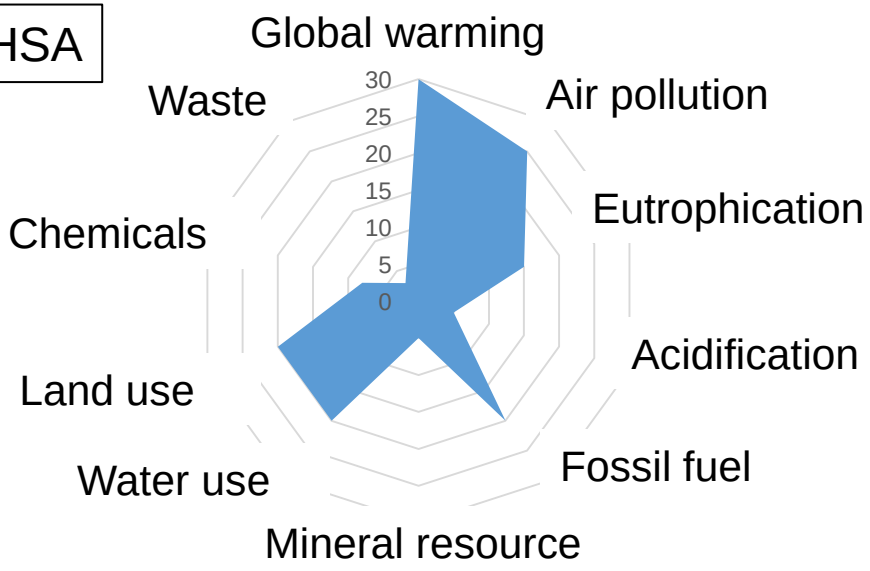
Impact categories

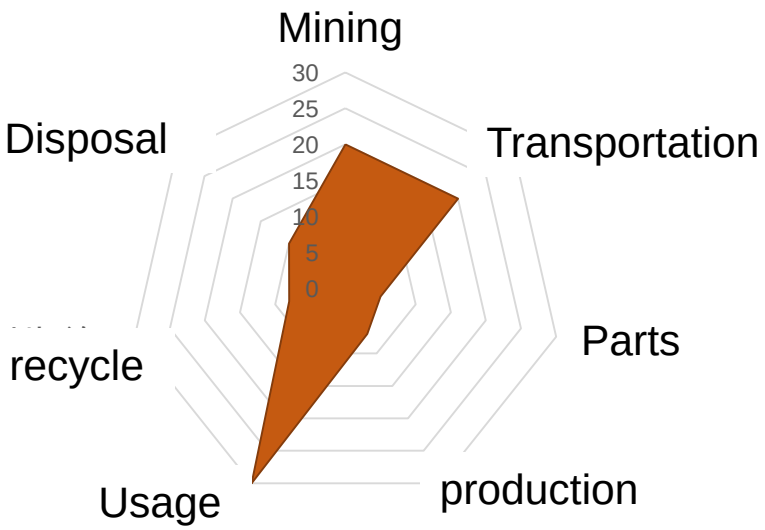
	Material	Prod.	Trans.	Use	Recycle	Dispose	Total(Pts)
Resources							10
Fossil fuels							15
Land use							20
Water use							15
Climate change							25
Air pollution							30
:							:
Total (Pts)	40	20	20	50	10	20	160

Based on the judgment of concerned parties

Based on the results of scientific analysis

EHSA





EcoLeaf (JEMAI)


製品環境情報
Product Environmental Aspects Declaration
EP及びIJプリンタ（適用PCR番号：AD-04）
No. AD-14-E416
EPSON
EXCEED YOUR VISION
WorkForce Pro WF-8090
■カラーインクジェット方式プリンター
■最大用紙サイズ（標準カセット）：A3
■自動両面印刷機能
※海外販売モデル
http://www.epson.com/
お問い合わせ先：
セイコーエプソン株式会社
http://www.epson.jp/contact/
各ステージの温暖化負荷CO_2換算値[kg]
126.9
14.4
33.4
14.5
25.4
素材製造 製品製造 物流 使用 廃棄

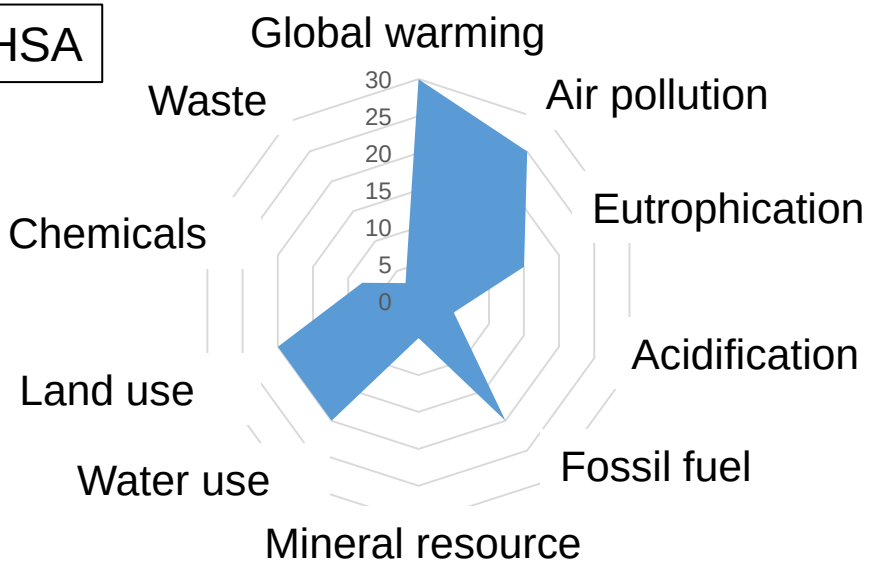
ライフサイクルでの消費・排出	全ステージ合計
温暖化負荷(CO_2)換算	214.6 kg
酸性化負荷（SO_2）換算	0.35 kg
エネルギー消費量	3,497 MJ

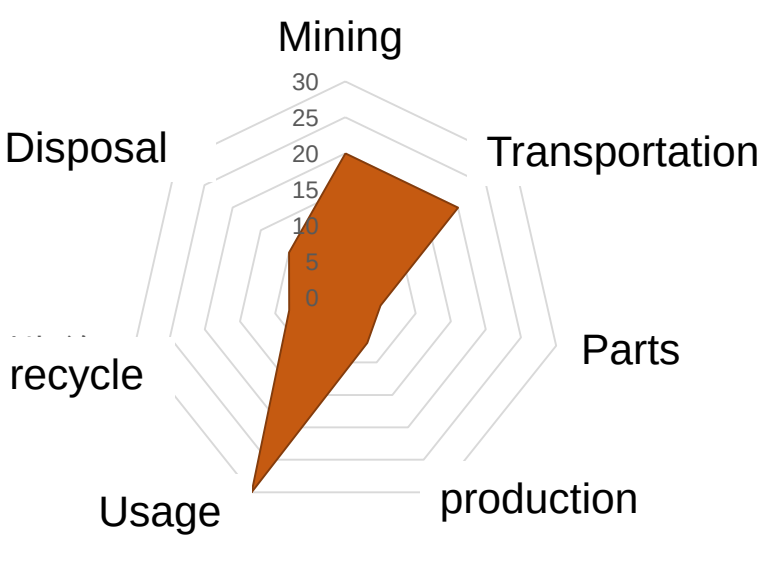
Impact categories have already chosen by program holder.
It is hard to see whether this product reduce env. Impacts.

Key impact categories can be chosen

The benefit of the assessed product can be evaluated

EHSA





Thank you very much!!