Sustainable Resource Management Workshop
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Yen Tjing Ling Industrial Research Institute, National Taiwan University , Taipei

Course A (for Governmental Agencies)

Roles and functions of government for promoting MFA application and resource management
- (A-1) An overview of recent progress -

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Contents of speech

- **Background**
- **Overview and rationale of MFA**
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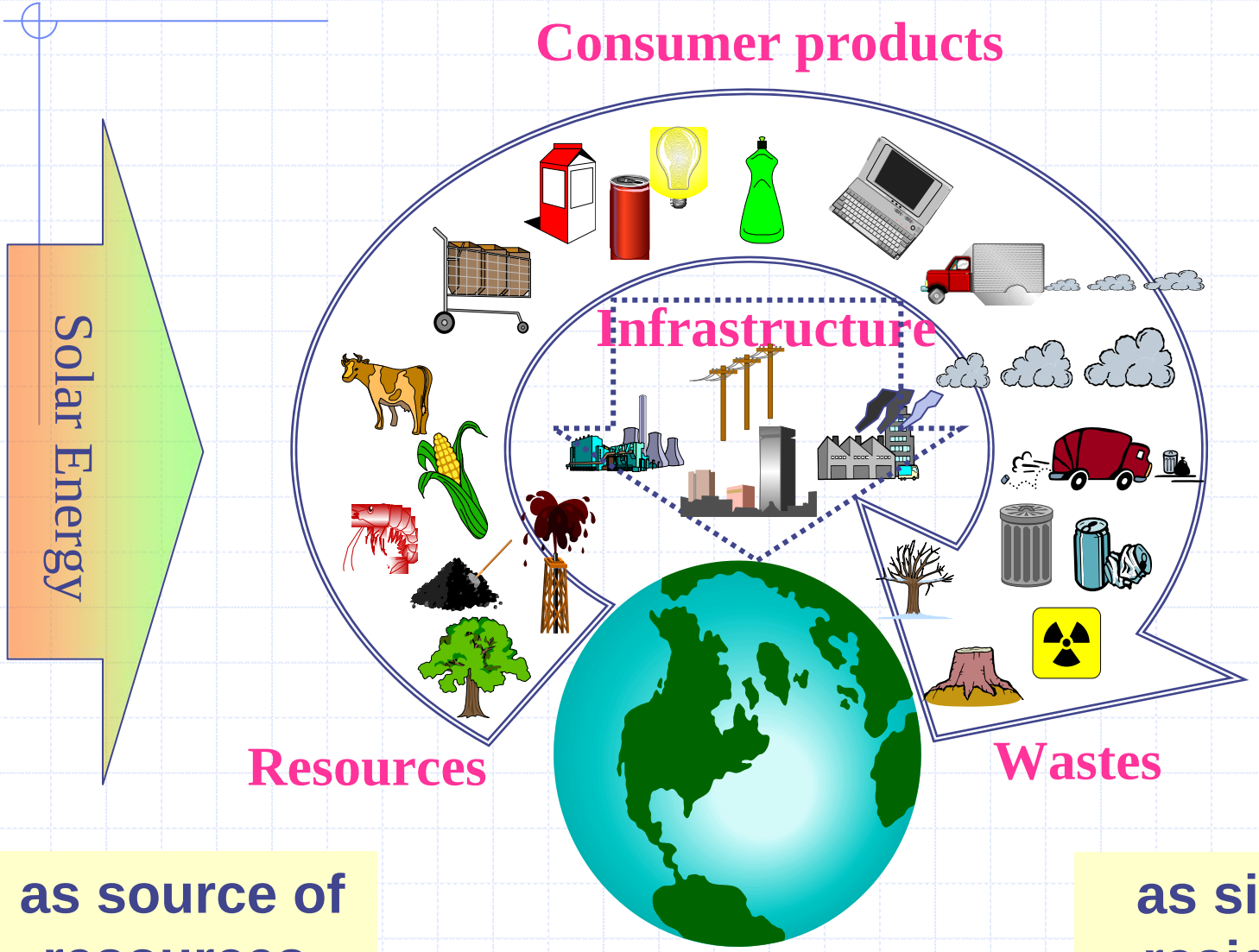
Background (personal)

- Environmental Engineering
- Life-cycle thinking for CO_2 reduction strategy
  (embodied energy analysis since 1970's)
- National emission inventories of GHGs and air pollutants
- International activities on environmental accounting and indicators
- Participation to Material Flow Studies
- Environmental implications behind international trade of natural resources
- Research on Material Cycles and Waste Management, policy for 3R and Sound Material-Cycle Society
- Sustainable consumption and production

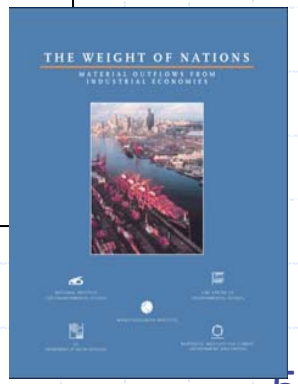
Massive flow of materials on the globe



as source of resources

as sink of residuals

The earth is finite



A framework for capturing macroscopic material flows

Source WRI(2000)

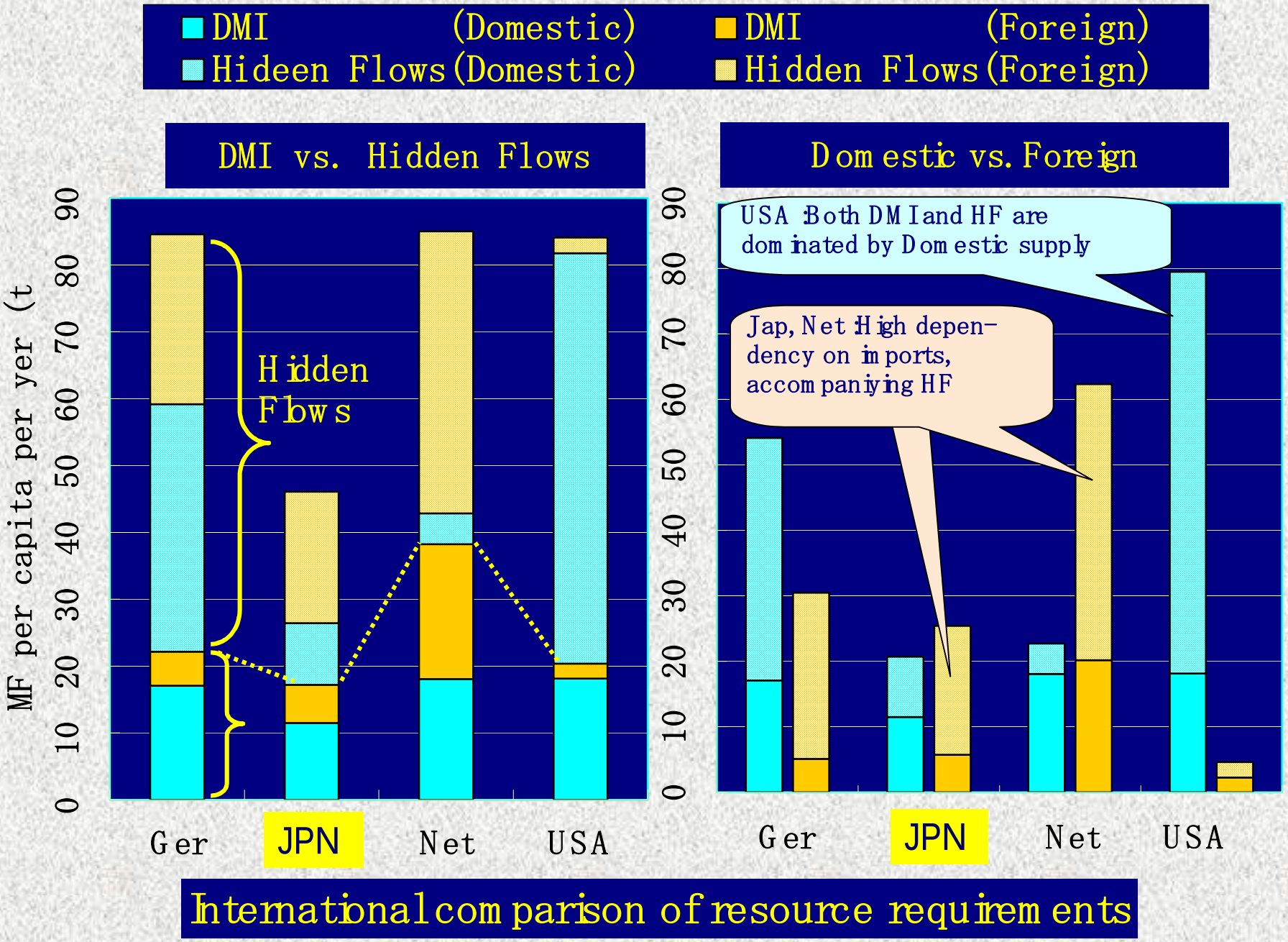
Ecological Rucksack behind Imported Ore

Metal 1 ton

Refined ore 6 ton

Crude ore 300 ton

Copper mine in Chile


DMI (Domestic)
DMI (Foreign)
Hideen Flows(Domestic)
Hidden Flows(Foreign)
DMI vs. Hidden Flows
Domestic vs. Foreign
MF per capita per yer (t
0 10 20 30 40 50 60 70 80 90
Hidden Flows
USA :Both DMI and HF are dominated by Domestic supply
Jap, Net :High dependency on imports, accompaniying HF
Ger
JPN
Net
USA
International comparison of resource requirements

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Key international activities for MFA

Research community

- International Joint Study (AUT,GER,NET,JAP,USA) since 1995
- ConAccount since 1996
- Gordon Conference on Industrial Ecology since 1998
- ISIE(International Society for Industrial Ecology) since 2001

  - Journal of Industrial Ecology, MIT Press, since 1997

International (intergovernmental) organizations

- OECD(EA, Waste prevention, De-coupling indicator, Council recommendation on MF & RP)
- EUROSTAT: Methodological guide
- EEA/ETCRWM
- UNCEEA (UN Committee of experts on Environmental and Economic Accounting)

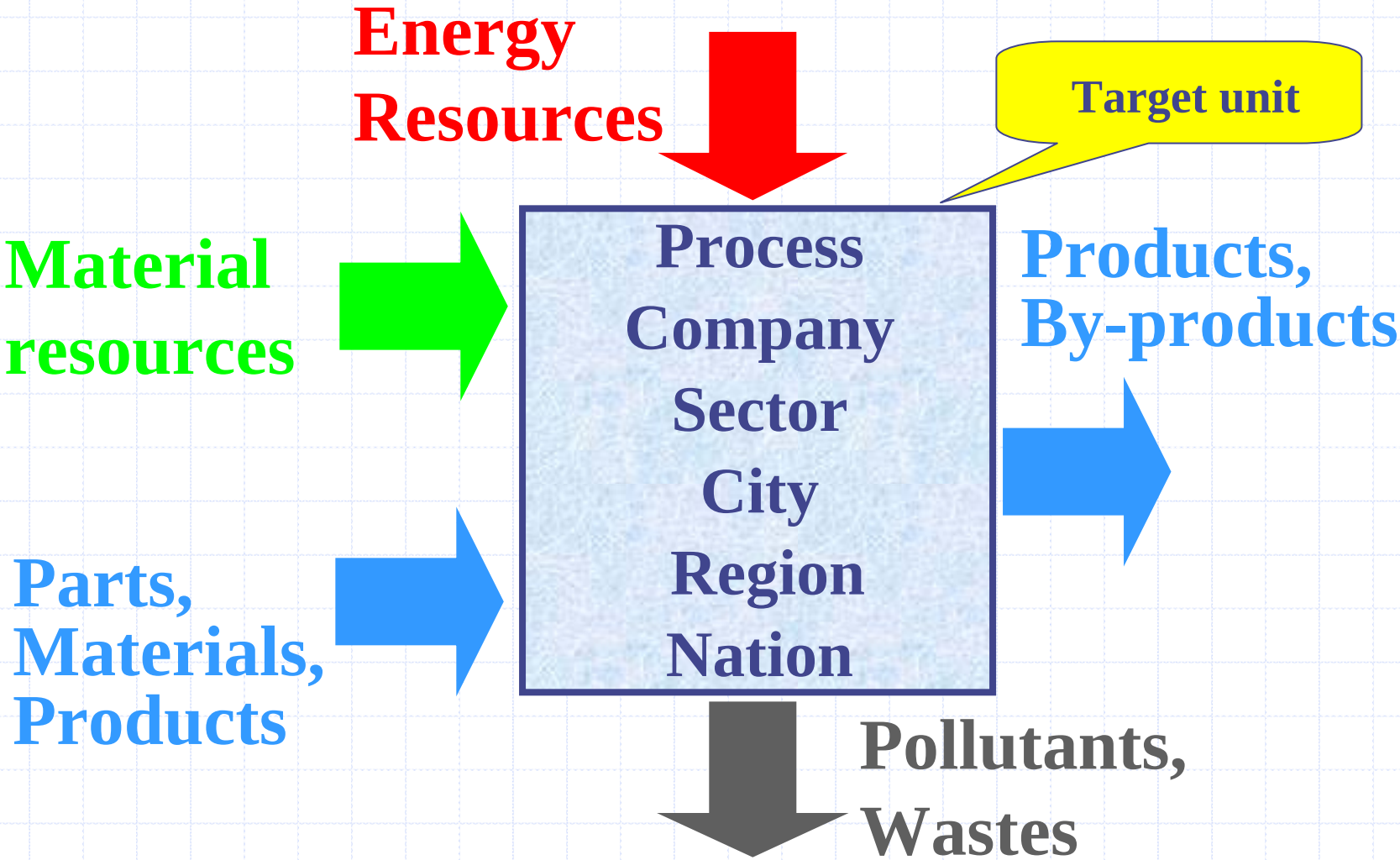
Chronology of international interactions(-2000)

- 1991 The term “Junkan-gata-shakai (Sound Material-cycle Society)” was proposed by an expert committee of Japan Environment Agency
- Since 1992 Material balance of Japan has been published on “White paper” (Quality of the Environment Report)
- Mid 1990s European experts found Japanese activity
- 1995 SCOPE Workshop on Indicators of Sustainable Development at Wuppertal Instutite

  Initiation of International joint study (GER, JPN, USA, NET, +AUT)
- Late 1990s, WRI reports (Resource Flows, The Weight of Nations)

  Methodological progress in ConAccount, ISIE, etc.
- 2000 OECD MFA Seminar
- 2000 Fundamental Law for a Sound Material Cycle Society

General framework of Material Flow Analysis



Why do material flows matter ?

- Dematerialization

  Total size of MF, scarcity of resources, scarcity of waste dumping site, etc.

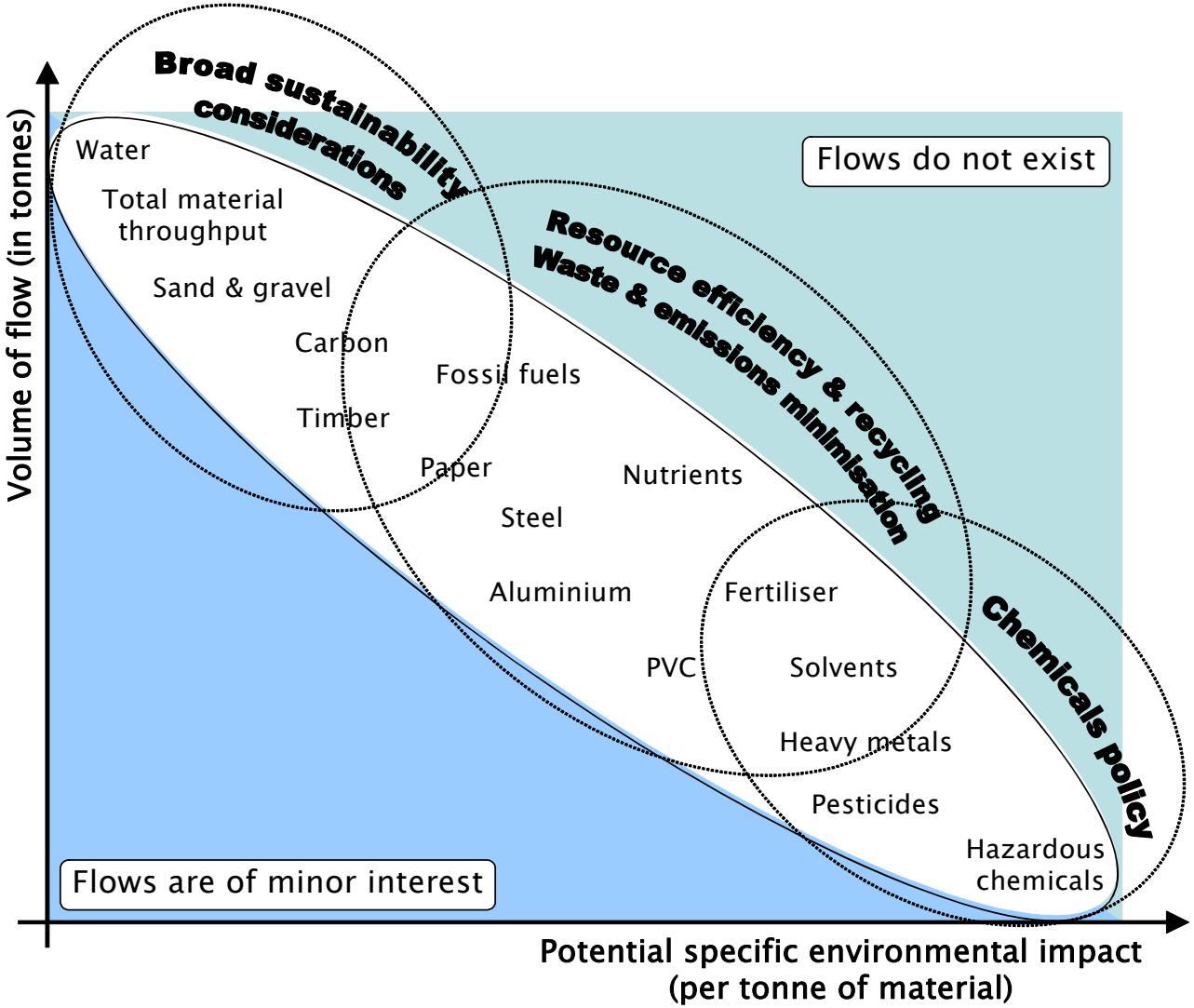
Proxy of environmental impacts ?
Common background of environmental problems?

- Detoxification

  Minimization of use and release of critical (hazardous) substances

Bringezu & Moriguchi (2001) in Handbook of Industrial Ecology

Schematic representation of material flows, environmental impacts and policy uses



Source: OECD, based on Steurer, A.(1996) as developed with Radermacher W. in 1995

Alternative views to rationalize the need to reduce the total requirement for materials

In addition to resource issues (price, scarcity, equitable use, etc.), we have rationale from perspectives of environmental impacts.

- We need to reduce the massive environmental pressures in material resources extraction
- Dematerialization directly contributes to prevention of the generation of massive solid wastes at the end-of-life of material resources
- Dematerialization contributes to a reduction of life-cycle energy consumption, greenhouse gas emissions, and other environmental impacts.

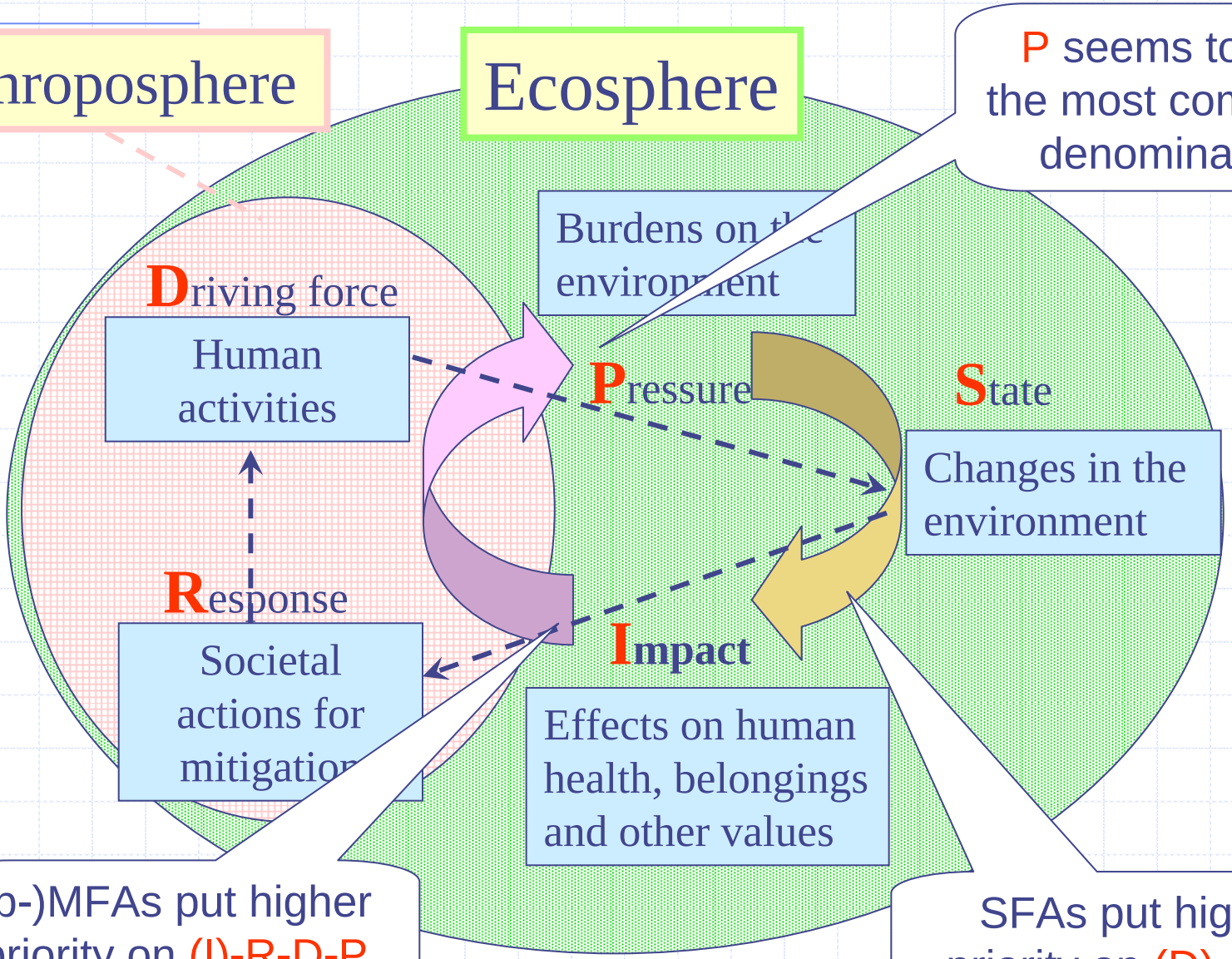
Bringezu & Moriguchi (2001) in Handbook of Industrial Ecology

Material flow related analyses and associated issues of concern

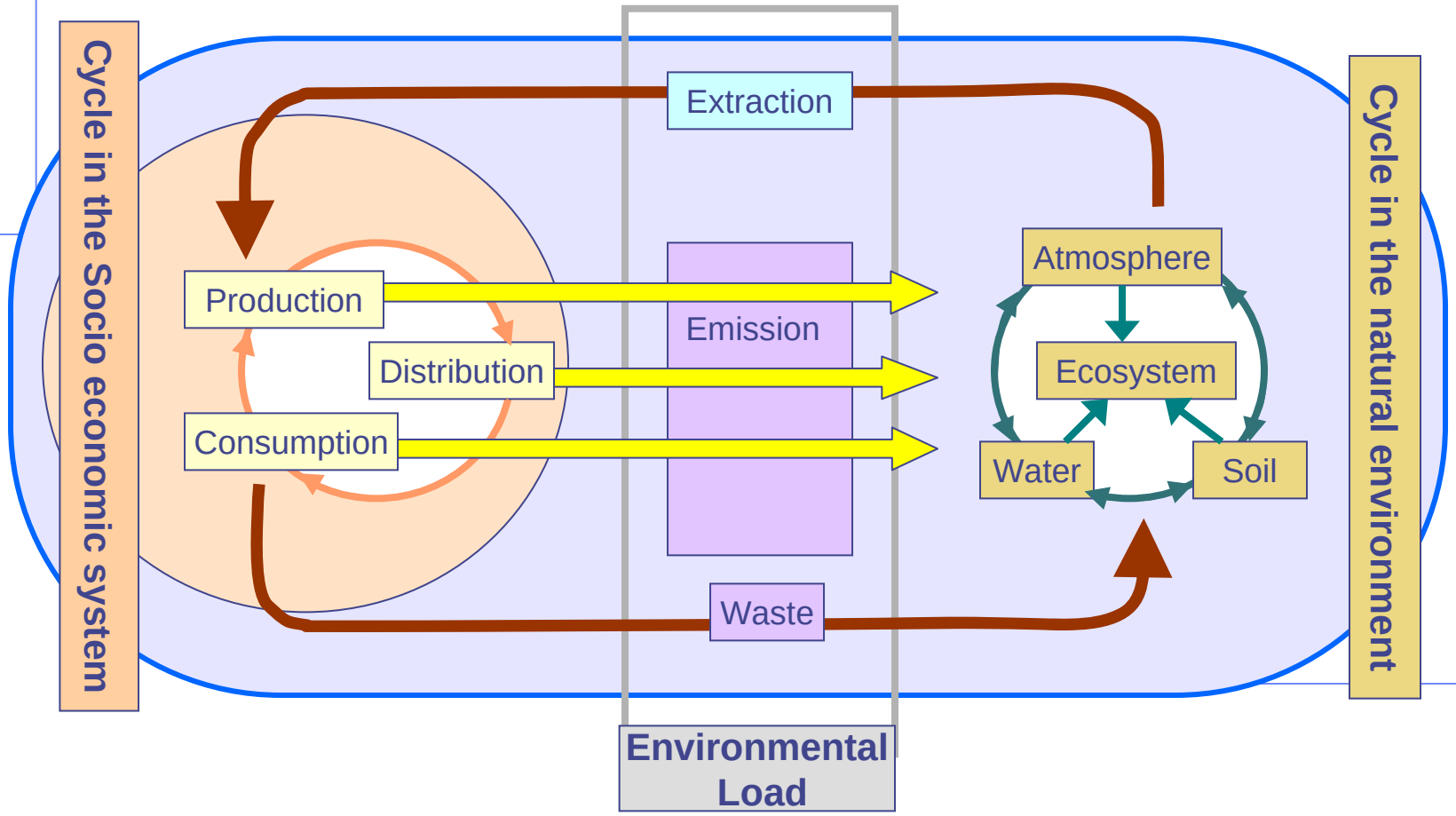
Issues of concern	Specific concerns related to environmental impacts, supply security, technology development			General environmental and economic concerns related to the throughput		
	within certain businesses, economic activities, countries, regions			of substances, materials, manufactured goods		
	associated with			*at the level of*		
Objects of primary interest	**Substances**	**Materials**	**Manufactured goods**	**Businesses**	**Economic activities**	**Countries, regions**
	chemical elements or compounds e.g. Cd, Cl, Pb, Zn, Hg, N, P, C, CO2, CFC	raw materials and semi-finished goods e.g. energy carriers, metals (ferrous, non-ferrous), sand and gravel, timber, plastics	e.g. batteries, cars, computers	e.g. firms, companies, plants, medium sized and big enterprises, MNEs	e.g. production sectors, chemical industry, iron and steel industry, construction, mining	e.g. aggregate mass of materials (& related materials mix), groups of materials, selected materials
Type of analysis	**Ia Substance Flow Analysis**	**Ib Material System Analysis**	**Ic Life Cycle Analysis**	**IIa Business level MF analysis**	**IIb Input-Output Analysis**	**IIc Economy-wide MF Analysis**
	⇳	⇳	⇳	⇳	⇳	⇳
Type of measurement tool	**Substance Flow Accounts**	**Individual Material Flow Accounts ✪**	**Life Cycle Inventories (MF Inventories)**	**Business Material flow accounts**	**Physical Input-Output Tables ✪ ⊙,** NAMEA-type approaches ⊙	**Economy-wide Material Flow Accounts ✪**

✪: MFA tools using the materials balance principle. ⊙: MFA tools using national accounting principles fully in line with the SEEA.
Source: OECD, based on Bringezu and Moriguchi 2002.

DPSIR model


Anthroposphere
Ecosphere
P seems to be the most common denominator
Driving force
Human activities
Burdens on the environment
Pressure
State
Changes in the environment
Response
Societal actions for mitigation
Impact
Effects on human health, belongings and other values
(b-)MFAs put higher priority on (I)-R-D-P
SFAs put higher priority on (D)-P-S-I

Material Cycle in the Socio-Economic System and Material Cycle in the Natural Environment



Original Source: Ministry of the Environment, Japan, amended by Moriguchi (2005)

The concept of a sound material cycle

循　環

Recycling-based society

Cycle-oriented society

Circular society / economy

Transition of socio-economic structure

Mass-production,
mass-consumption,
mass-disposal society

Sound material-cycle
society (SMCS)

大量生産･大量消費･
大量廃棄型社会

循環型社会
“Junkan”

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Chronology of international interactions(2000-)

- 2000 Fundamental Law for a Sound Material Cycle Society
- 2003 MF Indicators and targets in 1st Japanese SMCS plan

  2003 Japanese proposal at G8 meeting (MFA studies)
- 2004 OECD Council Recommendation on MF/RP

  2004-2006 OECD MFA WS in Helsinki, Berlin, Rome

  2004 Japanese proposal at G8 summit (3R initiative)
- 2005 3R Ministerial (OECD's proposal to host this Conference)
- 2007 OECD/Japan Seminar for MF/RP

  2007 Inaugural meeting of UNEP Resource Panel
- 2008 2nd Japanese SMCS plan

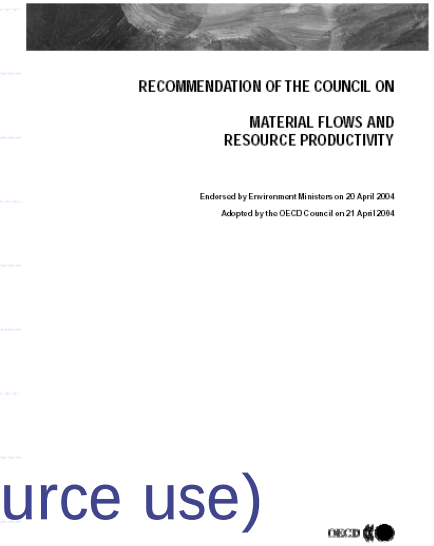
  (revised indicators, incl. monitoring of TMR)

  OECD 2nd Council Recommendation on RP

  OECD-UNEP Conf., OECD/EPOC Ministerial

  May-July: G8 Environ. Ministerial, G8 Summit

2004 Council Recommendation on MF/RP (1)


RECOMMENDATION OF THE COUNCIL ON

MATERIAL FLOWS AND RESOURCE PRODUCTIVITY

Endorsed by Environment Ministers on 20 April 2004

Adopted by the OECD Council on 21 April 2004

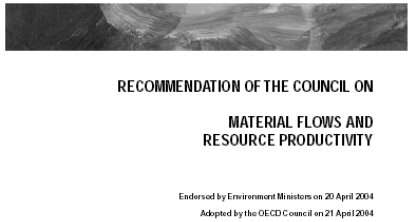
OECD

Recommends that member countries:

1. improve information on Material Flows
2. further develop and use indicators

   (with respect to the sustainability of resource use)
3. promote the development and use of MFA at macro and micro levels
4. link environmental and economic related information
5. cooperate and develop common methodologies and measurement systems

2004 Council Recommendation on MF/RP (2)


RECOMMENDATION OF THE COUNCIL ON

MATERIAL FLOWS AND RESOURCE PRODUCTIVITY

Endorsed by Environment Ministers on 20 April 2004

Adopted by the OECD Council on 21 April 2004

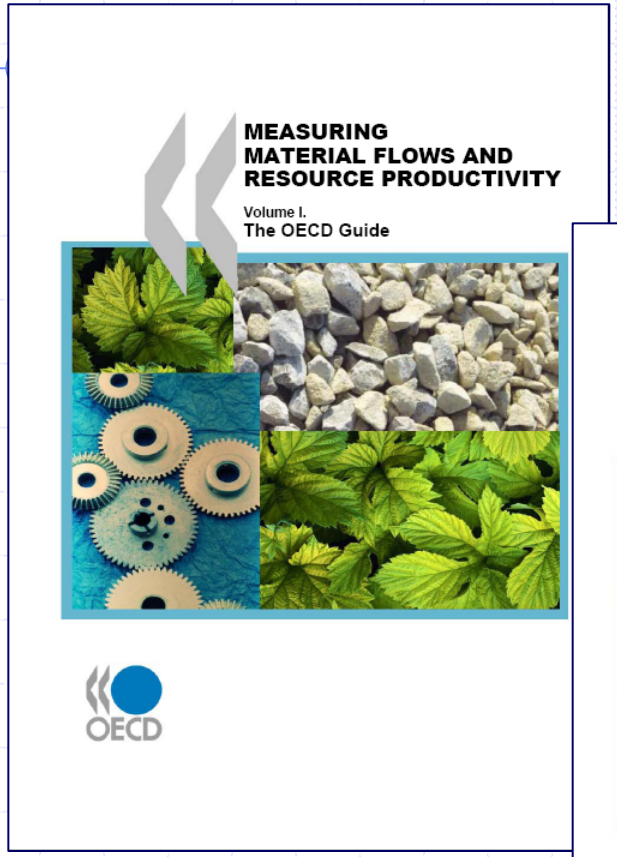
Instructs the Environmental Policy Committee:

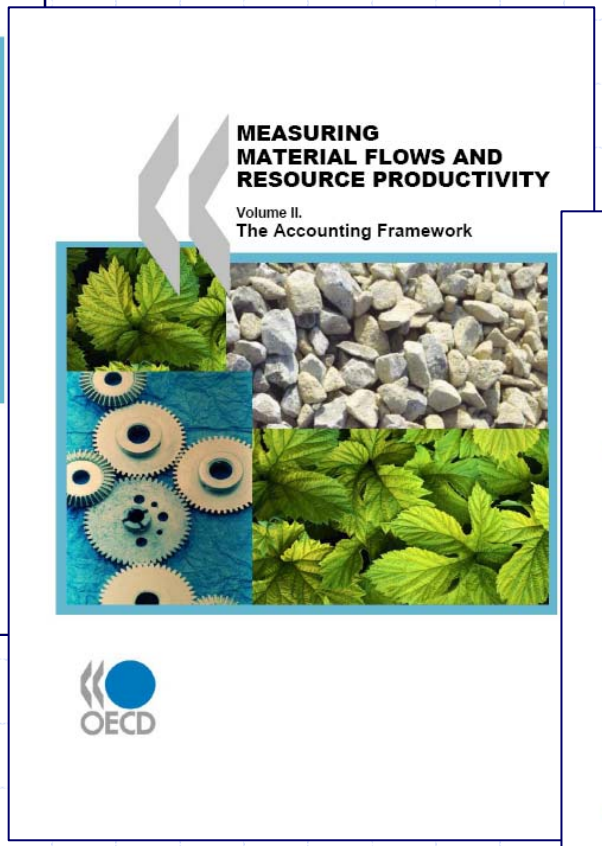
1. to support and facilitate member countries effort
2. to continue efforts to improve methods and indicators
3. to develop a guidance document to assist member countries
4. to carry out these tasks in cooperation with other OECD bodies and other international organizations
5. to report to the Council on progress achieved by Member countries within three years of its adoption

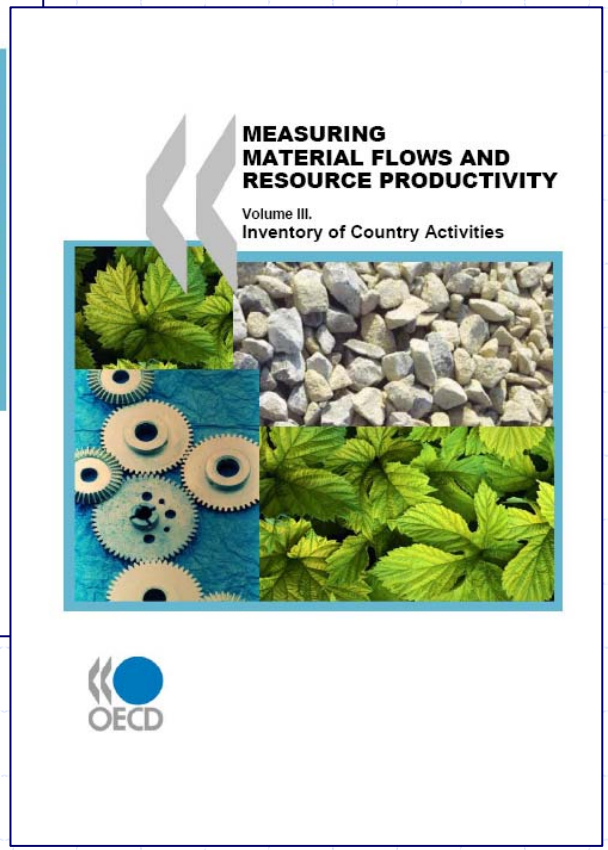
Vol. 1 The OECD Guide

Vol. 2 The Accounting Framework

Vol. 3 Inventory of Country Activities







2008 Council Recommendation on RP (1)

Recommends, with regard to the analysis of the material flows and their environmental impacts, that member countries:

1. Improve the scientific knowledge concerning the environmental impacts and costs of resource use throughout the entire life cycle of materials and the products
2. Upgrade the extent and quality of data on material flows within and among countries and the associated environmental impacts
3. Work to improve and use soundly based, relevant and internationally compatible material flow accounts
4. Further develop and promote the use of indicators for the assessment of the efficiency of material resource use
5. Co-operate with non-Member Economies to strengthen their capacity for analysis of material flows and the associated environmental impacts
6. Share OECD guidance and experience on measurement and analysis of material flows and resource productivity with all relevant ministries and departments of government, research and other non¬governmental organisations, and members of the private sector

2008 Council Recommendation on RP (2)

Recommends, with regard to the policies concerning the improvement of resource productivity, that member countries:

1. Consider the use of information about material flows and their environmental impacts for planning purposes----
2. Promote integrated life-cycle-oriented approaches, such as 3R policies (Reduce, Reuse, and Recycle), sustainable materials management and sustainable manufacturing
3. Further develop and promote the use of new technologies and innovations aimed at improving resource productivity
4. Encourage co-operation and sharing of best practices among enterprises
5. Contribute to the establishment of framework conditions that improve resource productivity through economic instruments
6. Co-operate to ensure that policy measures taken to improve resource productivity are efficient in economic terms, effective in environmental terms and equitable in social terms
7. Co-operate with non-Member Economies to strengthen their capacity for developing and implementing policies concerning the improvement of resource productivity.

2008 Council Recommendation on RP (3)

Instructs the Environment Policy Committee:

1. To review existing policies and practices and contribute to elaborating common principles and policy guidelines on resource productivity and sustainable materials management.
2. To strengthen its capacity for material flow analysis at the international level, with particular focus on key materials, on direct and indirect flows and their environmental impacts
3. To further develop and where appropriate promote the use of material flow analysis, resource productivity indicators, and methods for assessing the environmental impacts of resource use.
4. To support Member countries' efforts in developing and implementing integrated policies for managing natural resource and materials throughout their life cycles,
5. To assist non-Member Economies in developing and implementing policy frameworks and measurement systems
6. To carry out these tasks in co-operation with other appropriate OECD bodies, other international organisations such as UNEP (including the Resource panel) and G8 (including the 3R initiative) and the private sector.
7. To report to the Council on progress achieved in implementing this Recommendation, within five years of its adoption

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Kobe 3R Action Plan (May 2008)

I. Prioritize 3Rs Policies and Improve Resource Productivity

1. Prioritize Implementation of 3Rs Policy
2. Improve Resource Productivity and Set Targets
3. Pursue Co-benefits between the 3Rs and GHG Emission Reductions
4. Promote Science and Technology and Create a Market for 3R-related Products

II. Establishment of an International Sound Material-Cycle Society

1. Collaborate to Promote Sound International Resource Circulation
2. Promote International Trade of 3R-related Materials, Goods and Products

III. Collaborate for 3Rs Capacity Development in Developing Countries

1. Promote Collaboration with Developing Countries
2. Promote Technology Transfer, Information Sharing and Environmental Education
3. Promote Partnership between Stakeholders

IV. Follow-up on G8 Activities Based on the Action Plan

Effectiveness of 3Rs and ESM

Increasing quantity of solid waste

Rising price of material resources

Diversified quality of solid waste

Key trends in Asia

Trans-boundary movement of 3Rs-related goods, materials and products

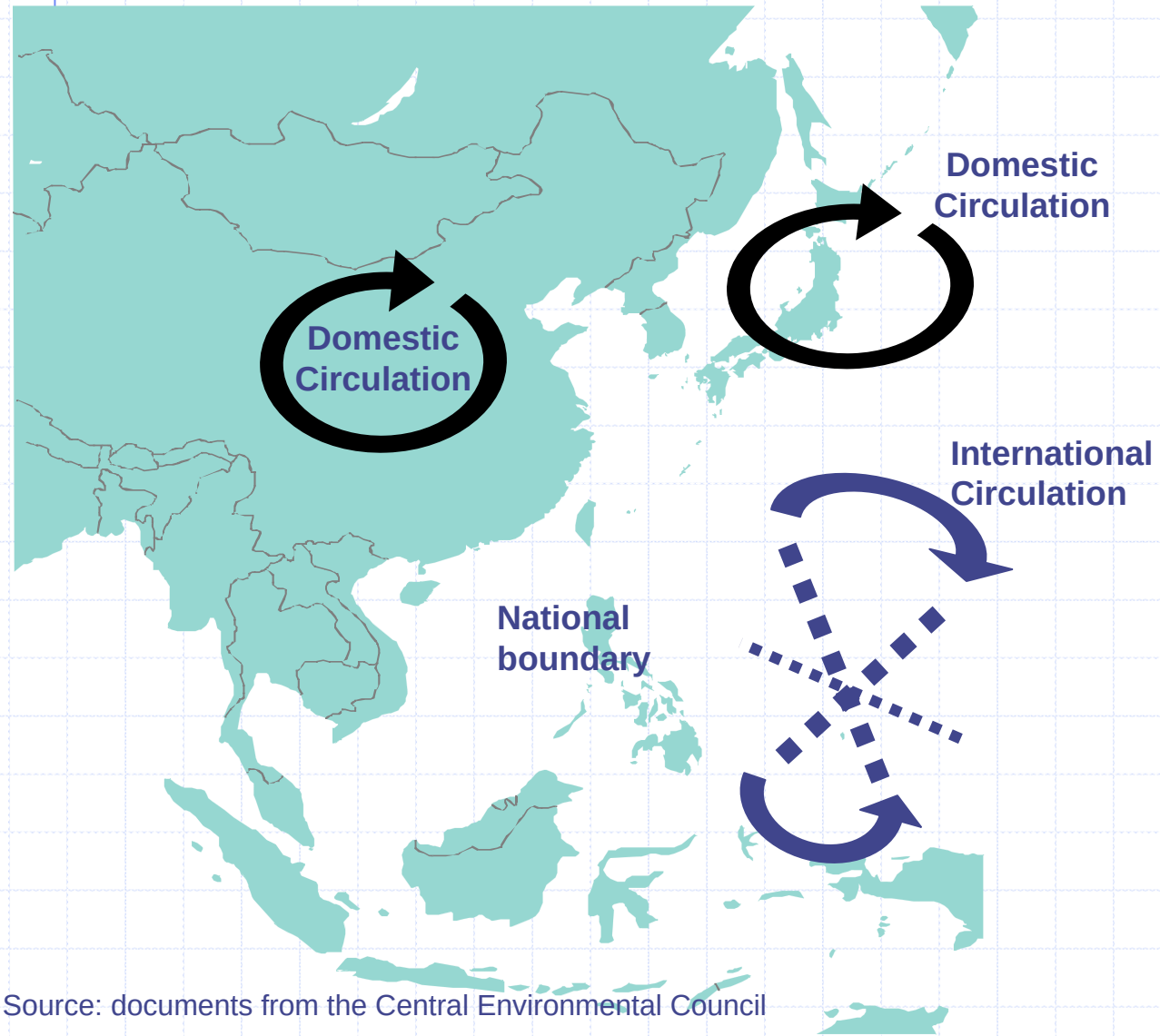
Promotion of the 3Rs (Reduce, Reuse and Recycle)

and

Promotion of the ESM: Environmentally Sound Management of Waste

More efficient use of products and resources and Reduction of environmental burdens

Basic Approach toward an International Sound Material-Cycle Society



(1) Placing **priority on improvement of the domestic 3R capacity**

(2) Simultaneously enhancing and reinforcing activities to prevent illegal import/export of waste

When (1) and (2) are successfully implemented,

(3)Facilitating import/export of CR as complementary to domestic circulation in each country

Source: documents from the Central Environmental Council

Convergence of concepts and approaches

The different concepts and approaches are converging:

- 3R, Sound material-cycle society
- Circular economy
- Integrated or sustainable waste management
- Sustainable consumption & production
- Life-cycle management
- Sustainable materials or resource management

all aim at similar objectives and require similar action by the various stakeholders.

Source: OECD/UNEP conference on resource efficiency

Key messages

- Concepts of 3R and sound material-cycle society are widely shared and being converged with similar concepts and approaches, through international activities by G8, OECD, UNEP, as well as within Asia-Pacific region.

- These approaches to integrate waste management issues at downstream of lifecycle and resource management issues at its upstream are very timely, under the increasing resource price associated with increasing demand for material resources from rapid economic development.

- Possible negative environmental problems associated with increasing international trade of both primary and secondary resources should be prevented.

- Scientific knowledge on environmental impacts of material use over whole life-cycle should be strengthened, accumulated and shared.