

Accounting for physical flows

Module 2

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Content

- Key principles of physical flow accounting
- Small quiz
- Some examples from the Netherlands

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What is physical flow accounting ?

Physical flow accounts describe the physical flows of water, energy, and materials between the economy and the environment and within the economy

- Air emissions, water emissions, solid waste
- Natural resource inputs (energy, water etc.)
- Material flows within the economy

Physical supply and use tables (PSUT) : structure based on monetary supply and use tables from SNA

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What can you do with physical flow accounting ?

Monitoring for environmental-economic policies

- Organising framework for physical data
- Important indicators
- Decoupling environmental pressure - GDP

Input for analysis

- Decomposition analysis
- Footprint calculations
- Comparison with economic data
- Input for scenario analysis

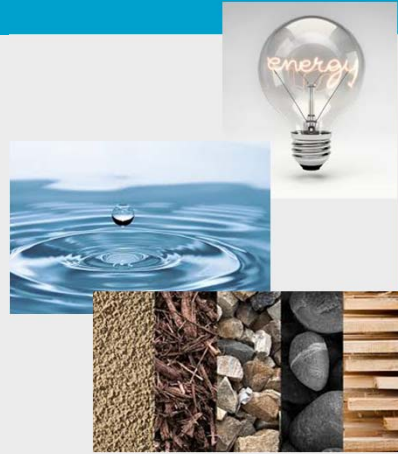
→ **INPUT FOR POLICY MAKING**

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Three subsystems

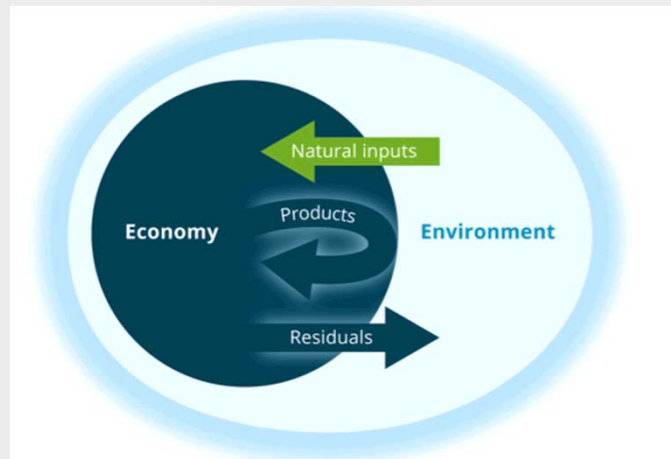
1. Energy (joules)
2. Water (cubic metres)
3. Materials (tonnes)
 - emissions to air
 - emissions to water
 - waste



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Physical flows of natural inputs, products and residuals



Basic structure of a physical supply and use table

	Industries	Households	Accumulation	Rest of the world	Environment	Total
Supply table						
Natural inputs					Flows from the environment	Total supply of natural inputs
Products	Output			Imports		Total supply of products
Residuals	Residuals generated by industry	Residuals generated by final household consumption	Residuals from scrapping and demolition of produced assets			Total supply of residuals
Use table						
Natural inputs	Extraction of natural inputs					Total use of natural inputs
Products	Intermediate consumption	Household final consumption	Gross capital formation	Exports		Total use of products
Residuals	Collection and treatment of waste and other residuals		Accumulation of waste in controlled landfill sites		Residual flows direct to environment	Total use of residuals



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Accounting identities

Supply-Use table is based on **two accounting identities**:

1. Supply and use identity

Within the economy, the amount of a product supplied must also be used with the economy, most likely by a range of different economic units, or exported

$$\text{Total supply of natural inputs} = \text{Total use of natural inputs}$$

$$\text{Total supply of products} = \text{Total use of products}$$

$$\text{Total supply of residuals} = \text{Total use of residuals}$$

2. Input-output identity

Over an accounting period, flows of materials into an economy must equal the flows of materials out of an economy plus any net additions to stock in the economy

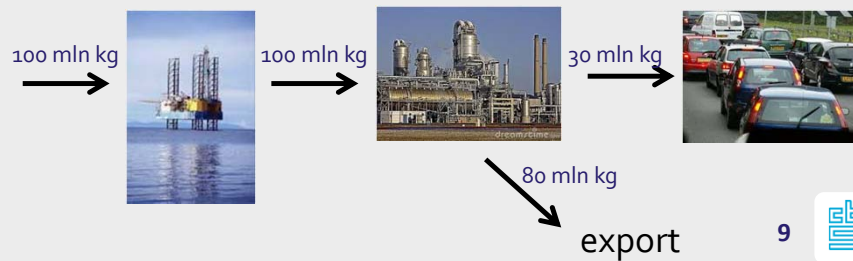
$$\text{Total inputs} = \text{Total outputs}$$

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Example

- Mining of oil resources by mining industry (100 mln kg)
- Supply of crude oil to refinery (100 mln kg)
- Refining of crude oil → production of petrol (80 mln kg)
- Export of petrol (50 mln kg)
- Use of petrol by Households (30 mln kg)



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Mining of oil resources

100 mln kg →

Supply	Mining (ISIC 6)	Refinery (ISIC 19)	Households	Import	Environment	TOTAL
Natural inputs						
Oil resources					100	100
O2						0
Products						
Crude oil						0
Petrol						0
Residuals						
CO2						0
TOTAL	0	0	0	0	100	100

Use	Mining (ISIC 6)	Refinery (ISIC 19)	Households	Export	Environment	TOTAL
Natural inputs						
Oil resources	100					100
O2						0
Products						
Crude oil						0
Petrol						0
Residuals						
CO2						0
TOTAL	100	0	0	0	0	100

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Supply to refineries

100 mln kg



Supply	Mining (ISIC 6)	Refinery (ISIC 19)	Households	Import	Environment	TOTAL
Natural inputs						
Oil resources					100	100
O2						0
Products						
Crude oil	100					100
Petrol						0
Residuals						
CO2						0
TOTAL	100	0	0	0	100	200

Use	Mining (ISIC 6)	Refinery (ISIC 19)	Households	Export	Environment	TOTAL
Natural inputs						
Oil resources	100					100
O2						0
Products						
Crude oil		100				100
Petrol						0
Residuals						
CO2						0
TOTAL	100	100	0	0	0	200

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Production of petrol

30 mln kg

80 mln kg



export

Supply	Mining (ISIC 6)	Refinery (ISIC 19)	Households	Import	Environment	TOTAL
Natural inputs						
Oil resources					100	100
O2						0
Products						
Crude oil	100					100
Petrol		80				80
Residuals						
CO2						0
TOTAL	100	80	0	0	100	280

Use	Mining (ISIC 6)	Refinery (ISIC 19)	Households	Export	Environment	TOTAL
Natural inputs						
Oil resources	100					100
O2						0
Products						
Crude oil		100				100
Petrol			30	50		80
Residuals						
CO2						0
TOTAL	100	100	30	50	0	280

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CO2 emissions by refineries



Supply	Mining (ISIC 6)	Refinery (ISIC 19)	Households	Import	Environment	TOTAL
Natural inputs						
Oil resources					100	100
CO2					60	60
Products						
Crude oil	100					100
Petrol		80				80
Residuals						
CO2		80				80
TOTAL	100	160	0	0	160	420

Use	Mining (ISIC 6)	Refinery (ISIC 19)	Households	Export	Environment	TOTAL
Natural inputs						
Oil resources	100					100
CO2		60				60
Products						
Crude oil		100				100
Petrol			30	50		80
Residuals						
CO2					80	80
TOTAL	100	160	30	50	80	420

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CO2 emissions by households



Supply	Mining (ISIC 6)	Refinery (ISIC 19)	Households	Import	Environment	TOTAL
Natural inputs						
Oil resources					100	100
CO2					150	150
Products						
Crude oil	100					100
Petrol		80				80
Residuals						
CO2		80	120			200
TOTAL	100	160	120	0	250	630

Use	Mining (ISIC 6)	Refinery (ISIC 19)	Households	Export	Environment	TOTAL
Natural inputs						
Oil resources	100					100
CO2		60	90			150
Products						
Crude oil		100				100
Petrol			30	50		80
Residuals						
CO2					200	200
TOTAL	100	160	120	50	200	630

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Check the accounting identities!

Supply	Mining (ISIC 6)	Refinery (ISIC 19)	Households	Import	Environment	TOTAL
Natural inputs						
Oil resources					100	100
O2					150	150
Products						
Crude oil	100					100
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Residuals						
CO2					200	200
TOTAL	100	160	120	50	200	630

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Exercise

There are many ways in which the environment is influenced by human activities. Sometimes, its connection to the economy is not always straightforward.

→ To which activities would you relate the following physical flows ?



1. Pollution from electricity generation for rail transport

1. Rail transport
2. Electricity producers
3. Households
4. Other....



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2. Sewage sludge from a public sewage plant leading into a river

1. Chemical industry
2. Environmental services
3. Households
4. Government
5. Other....



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3. NOx emissions from traffic

1. Households
2. Road transport sector
3. Government
4. Not part of the accounts
5. Other



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4. CFC emissions from isolation material in houses

1. Households
2. Construction industry
3. Producers of isolation material
4. Not part of the accounts
5. Other



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5. Methane emissions from swamps

1. Government
2. Agriculture
3. Environment
4. Not part of the accounts



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Compiling environmental accounts

Data sources:

- Survey data
- Administrative data
- Existing statistics



There are several issues for compiling accounts:

- Putting data in an accounting structure
- Correcting for residence principle
- Disaggregating information to ISIC
- Consistency with National Account concepts
- Compiling time series

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Examples from the Netherlands

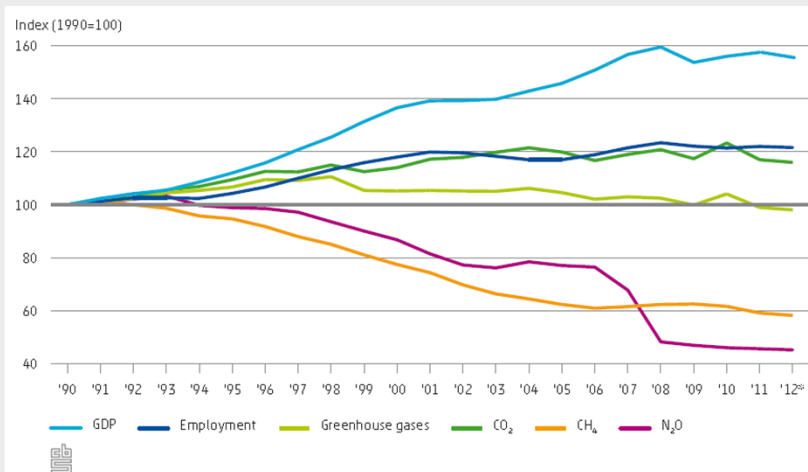
- Energy flow accounts
- Water flow accounts
- Air emission accounts
- Water emission accounts
- Waste accounts
- Full set of material flow accounts (experimental)



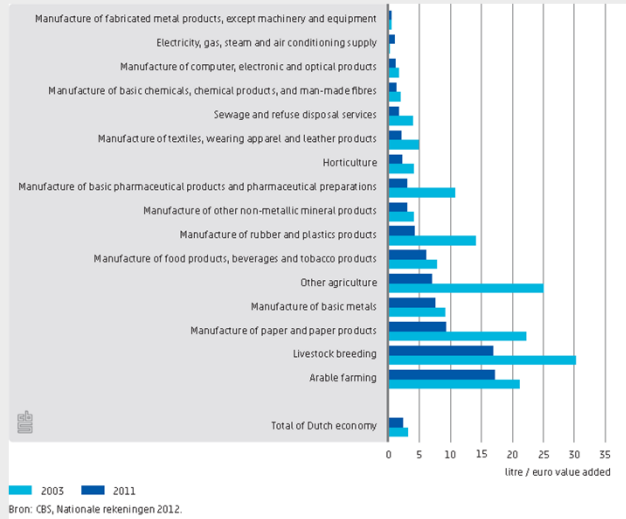
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Example: decoupling between GDP and greenhouse gas emissions



Industries with the highest use intensities for groundwater



Questions ???

