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Physical Flow Accounts: Overview

SEEA Training Seminar for ESCAP

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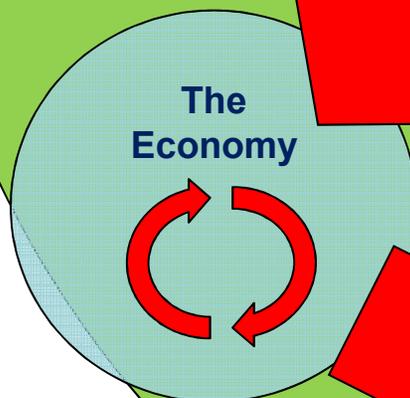
The Economy and The Environment

-Natural Resources
-Ecosystem Services

Stocks

Flows

Expenditures



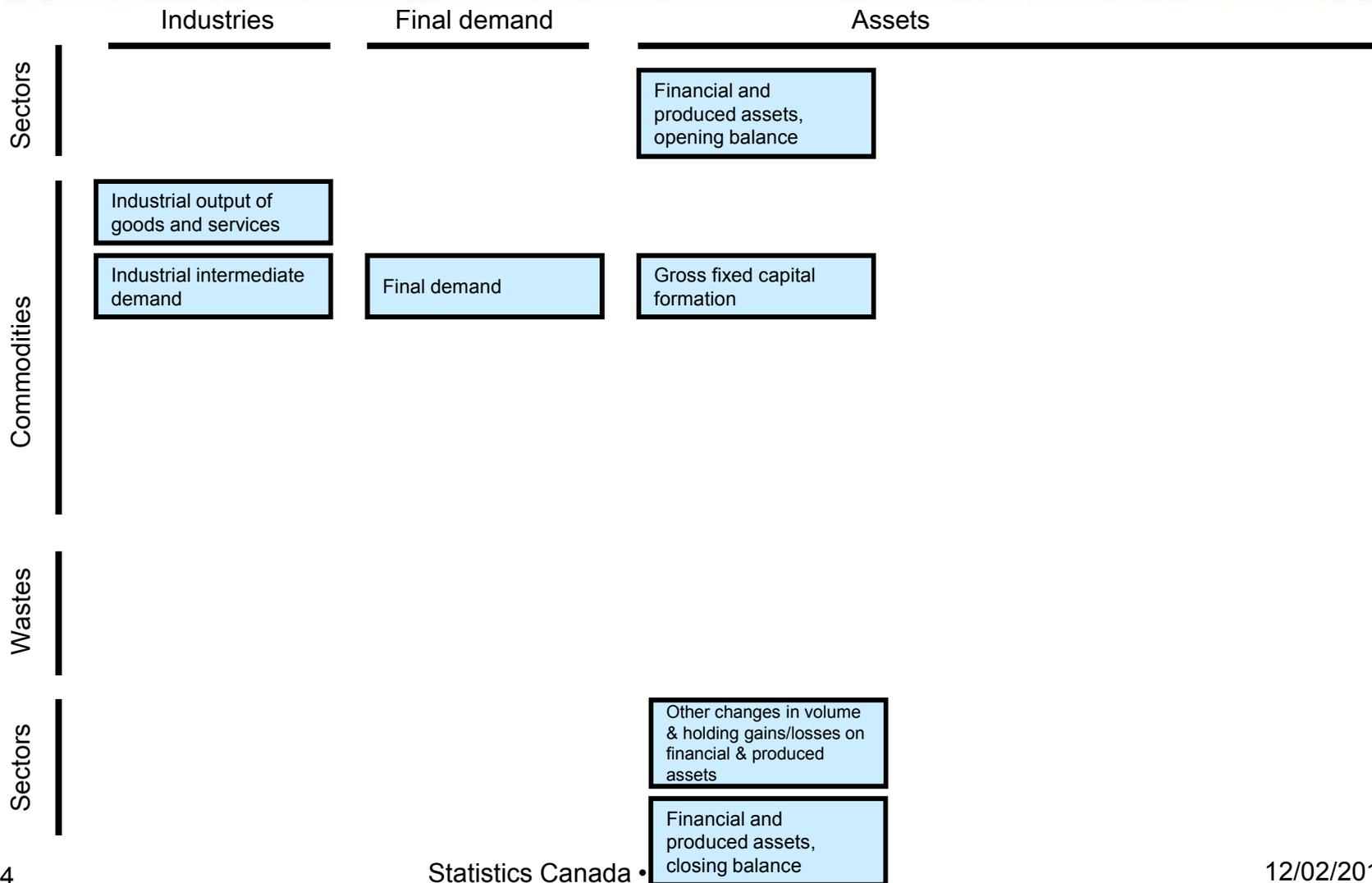
-Residuals

Uses of physical flow accounts

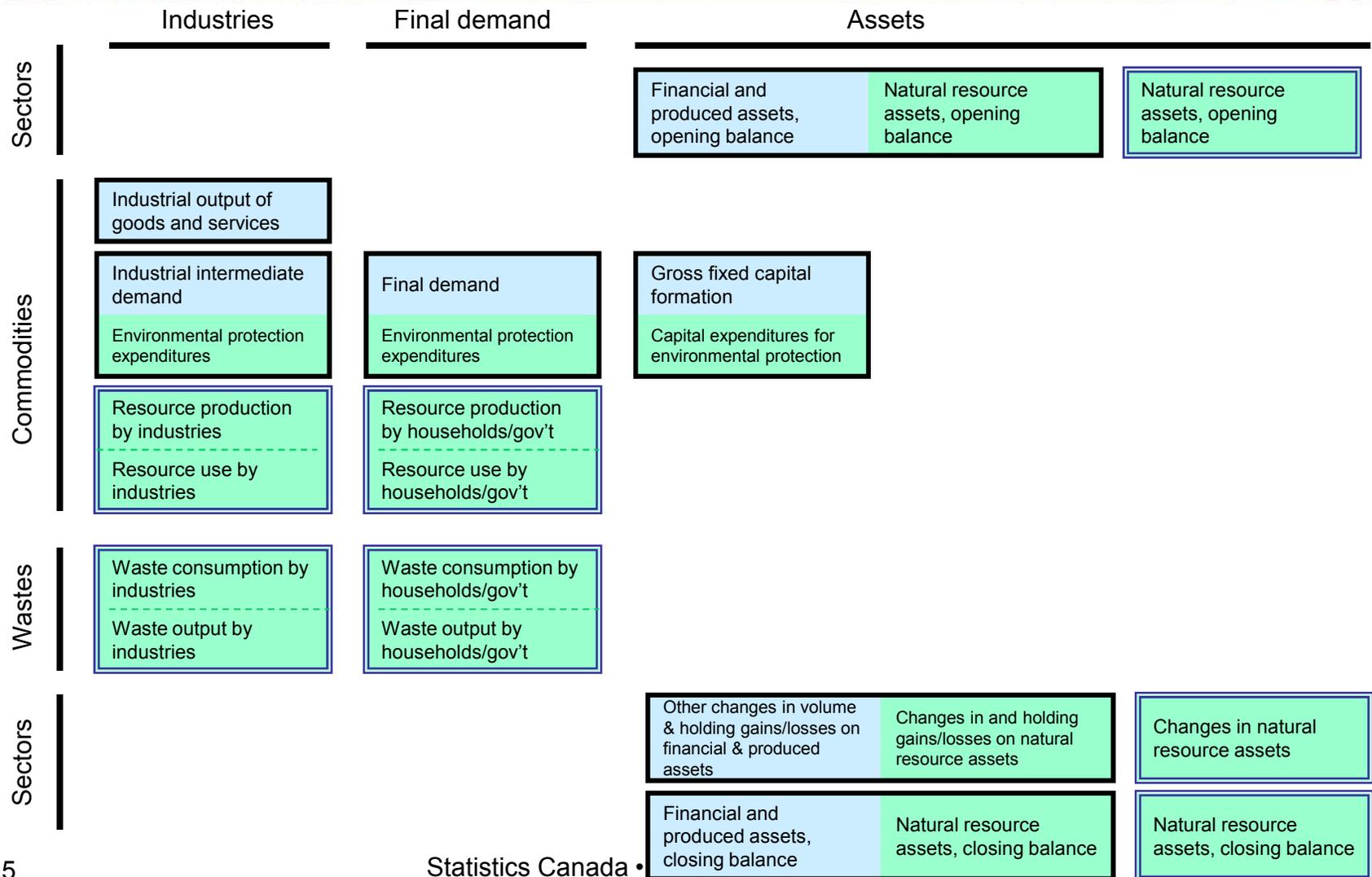


- Material consumption
- Material productivity
- Energy use analysis
- Energy policy
- Emissions analysis
- Environmental assessment
- Natural resource management
- Multi-factor productivity
- Footprint calculations

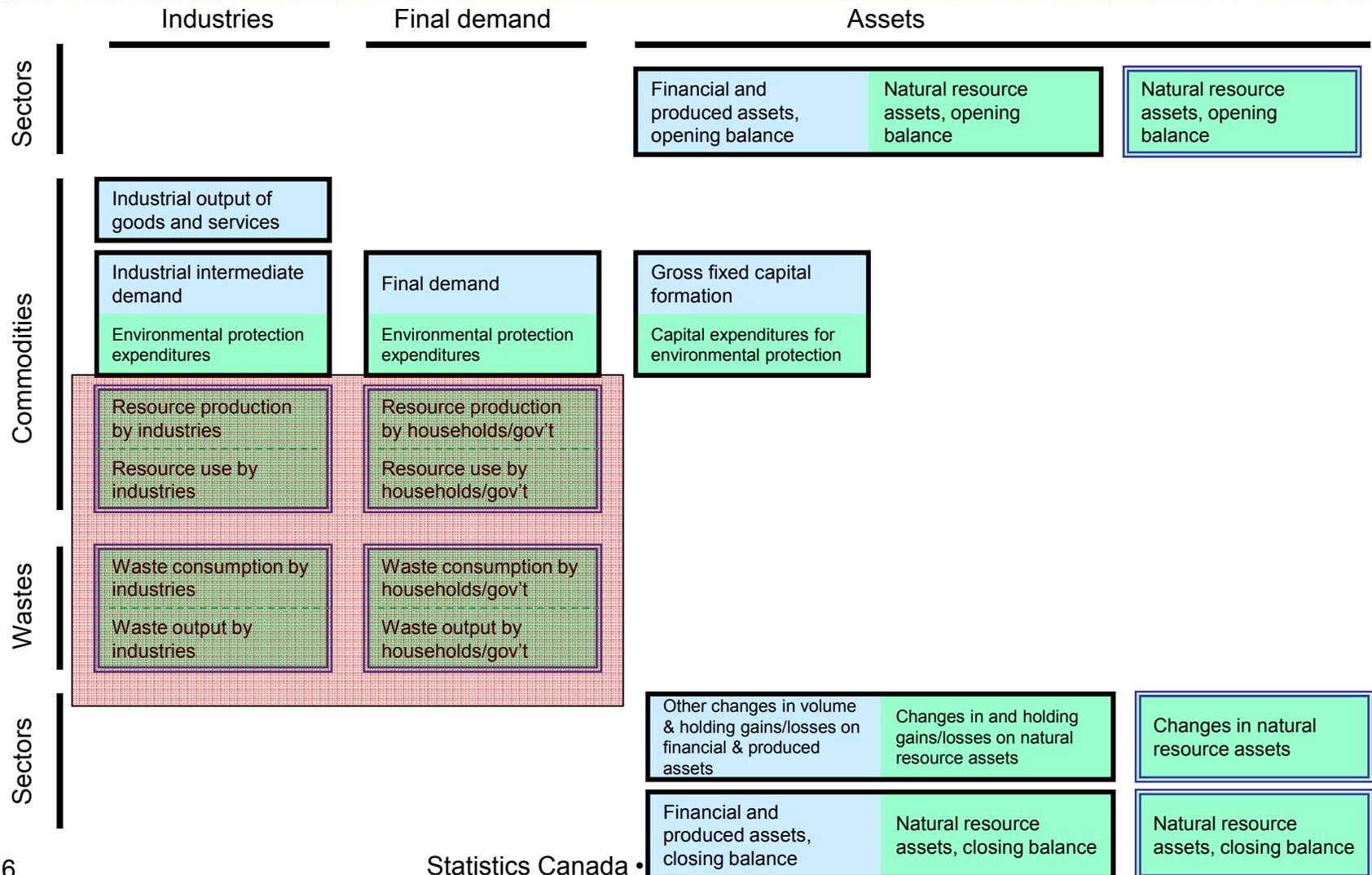
System of National Accounts framework



System of Environmental-Economic Accounts (SEEA) framework



Physical Flow Accounting



Physical Flow Accounts: Basic Tables

Table 3.1
General physical supply and use table

		Production; generation of residuals		Accumulation			
		Production; generation of residuals by industries (including household production on own account), classified by ISIC	Generation of residuals by households	Industries—classified by ISIC	Flows from the rest of the world	Flows from the environment	Total
Natural inputs						A. Flows from the environment (including natural resource residuals)	Total supply of natural inputs (TSNI)
Products	C. Output (including sale of recycled and reused products)				D. Imports of products		Total supply of products (TSP)
Residuals	I1. Residuals generated by industry (including natural resource residuals)	J. Residuals generated by household final consumption		K1. Residuals from scrapping and demolition of produced assets	L. Residuals received from rest of the world	M. Residuals recovered from the environment	Total supply of residuals (TSR)
	I2. Residuals generated following treatment			K2. Emissions from controlled landfill sites			
Total supply							
		Intermediate consumption of products; use of natural inputs; collection of residuals	Final consumption ^a	Accumulation			
		Industries—classified by ISIC	Households	Industries—classified by ISIC	Flows to the rest of the world	Flows to the environment	Total
Natural inputs	B. Extraction of natural inputs B1. Extraction used in production B2. Natural resource residuals						Total use of natural inputs (TUNI)
Products	E. Intermediate consumption (including purchase of recycled and reused products)	F. Household final consumption (including purchase of recycled and reused products)		G. Gross capital formation (including fixed assets and inventories)	H. Exports of products		Total use of products (TUP)
Residuals	N. Collection and treatment of residuals (excluding accumulation in controlled landfill sites)			O. Accumulation of waste in controlled landfill sites	P. Residuals sent to the rest of the world	Q. Residual flows to the environment	Total use of residuals (TUR)
						Q1. Direct from industry and households (including natural resource residuals and landfill emissions)	
						Q2. Following treatment	
Total use							

^a No entries for government final consumption are recorded in physical terms. All government intermediate consumption, production and generation of residuals is recorded against the relevant industry in the first column of the PSUT.

Physical Flow Accounts: Natural Inputs

3.45 *Natural inputs are all physical inputs that are moved from their location in the environment as a part of economic production processes or are directly used in production.*

Table 3.2
Classes of natural inputs

1	Natural resource inputs
1.1	Extraction used in production
1.1.1	Mineral and energy resources
1.1.1.1	Oil resources
1.1.1.2	Natural gas resources
1.1.1.3	Coal and peat resources
1.1.1.4	Non-metallic mineral resources (excluding coal and peat resources)
1.1.1.5	Metallic mineral resources
1.1.2	Soil resources (excavated)
1.1.3	Natural timber resources
1.1.4	Natural aquatic resources
1.1.5	Other natural biological resources (excluding timber and aquatic resources)
1.1.6	Water resources
1.1.6.1	Surface water
1.1.6.2	Groundwater
1.1.6.3	Soil water
1.2	Natural resource residuals

2	Inputs of energy from renewable sources
2.1	Solar
2.2	Hydro
2.3	Wind
2.4	Wave and tidal
2.5	Geothermal
2.6	Other electricity and heat
3	Other natural inputs
3.1	Inputs from soil
3.1.1	Soil nutrients
3.1.2	Soil carbon
3.1.3	Other inputs from soil
3.2	Inputs from air
3.2.1	Nitrogen
3.2.2	Oxygen
3.2.3	Carbon dioxide
3.2.4	Other inputs from air
3.3	Other natural inputs n.e.c.

[United Nations, 2012, System of Environmental-Economic Accounting: Central Framework, New York.](#)

Physical Flow Accounts: Products

3.64 Following the SNA, *products are goods and services that result from a process of production in the economy.*

North American Product Classification System (NAPCS) Canada 2012 Version 1.1

Classification structure

111 Live animals
112 Wheat
113 Canola (including rapeseed)
114 Fresh fruit, nuts and vegetables
115 Other crop products
116 Other animal products
121 Fish, shellfish and other fishery products
131 Logs, pulpwood and other forestry products
141 Crude oil and crude bitumen
142 Natural gas
143 Natural gas liquids and related products
144 Other energy products
145 Electricity
146 Natural gas distribution
151 Iron ores and concentrates
etc...

Physical Flow Accounts: Residuals

3.73 Residuals are flows of solid, liquid and gaseous materials, and energy that are discarded, discharged or emitted by establishments and households through processes of production, consumption or accumulation.

Table 3.4

Typical components for groups of residuals

Group	Typical components
Solid waste (includes recovered materials) ^a	Chemical and health-care waste, radioactive waste, metallic waste, other recyclables, discarded equipment and vehicles, animal and vegetal wastes, mixed residential and commercial waste, mineral wastes and soil, combustion wastes, other wastes
Wastewater ^a	Water for treatment and disposal, return flows, reused water
Emissions to air	Carbon dioxide, methane, dinitrogen oxide, nitrous oxides, hydrofluorocarbons, perfluorocarbons, sulphur hexafluoride, carbon monoxide, non-methane volatile organic compounds, sulphur dioxide, ammonia, heavy metals, persistent organic pollutants, particulates (e.g., PM10 dust)
Emissions to water	Nitrogen compounds, phosphorus compounds, heavy metals, other substances and (organic) compounds
Emissions to soil	Leaks from pipelines, chemical spills
Residuals from dissipative use of products	Unabsorbed nutrients from fertilizers, salt spread on roads
Dissipative losses	Abrasion (tyres/brakes), erosion/corrosion of infrastructure (roads, etc.)
Natural resource residuals	Mining overburden, felling residues, discarded catch

^a This list of typical components for groups of residuals can also be applied to certain flows defined as products.

Compilation



Data sources:

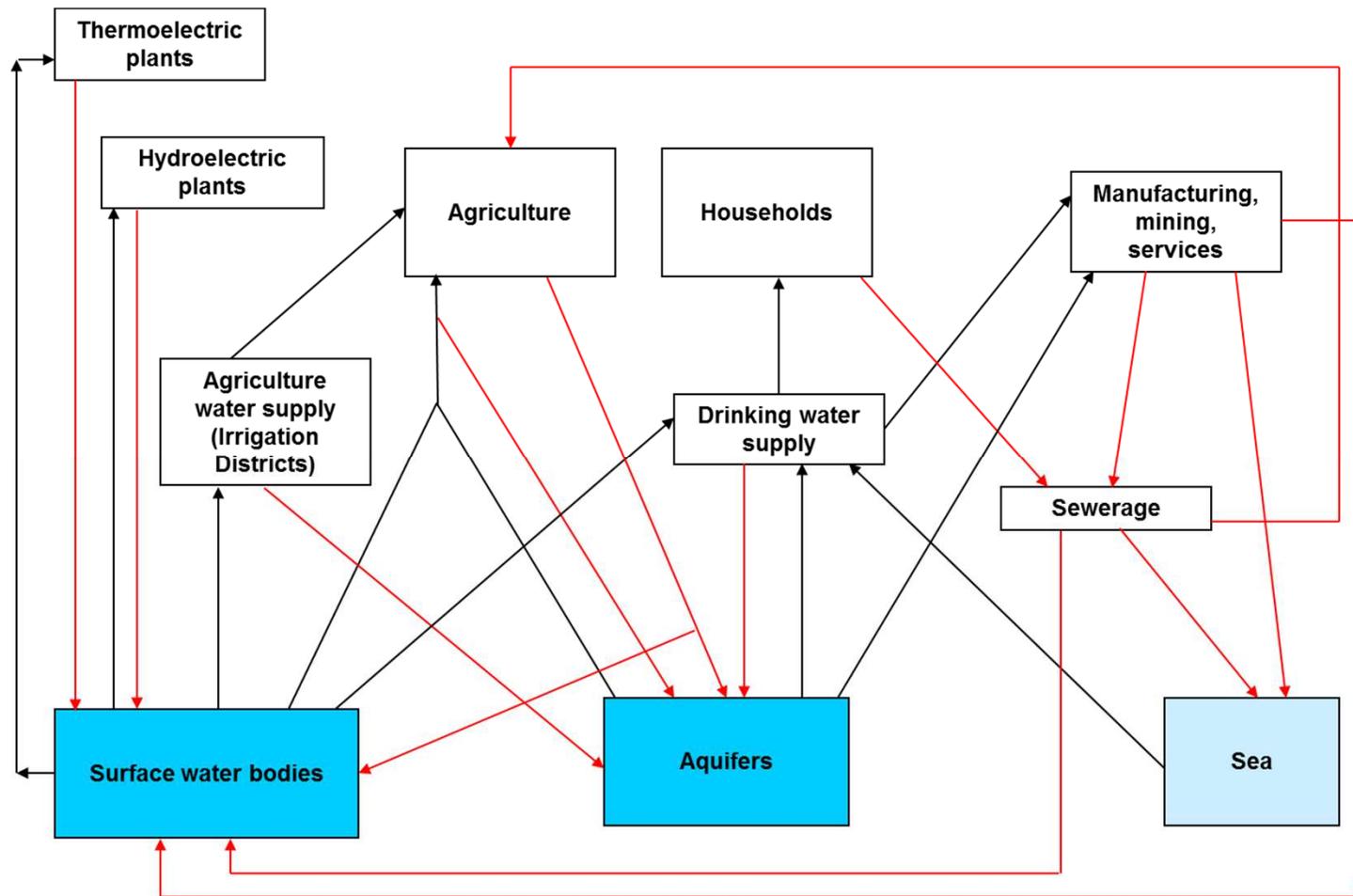
- Survey data
- Administrative data
- Existing statistics

Issues:

- Correcting for residence principle
- Disaggregating information to ISIC
- Consistency with National Account concepts
- Compiling time series

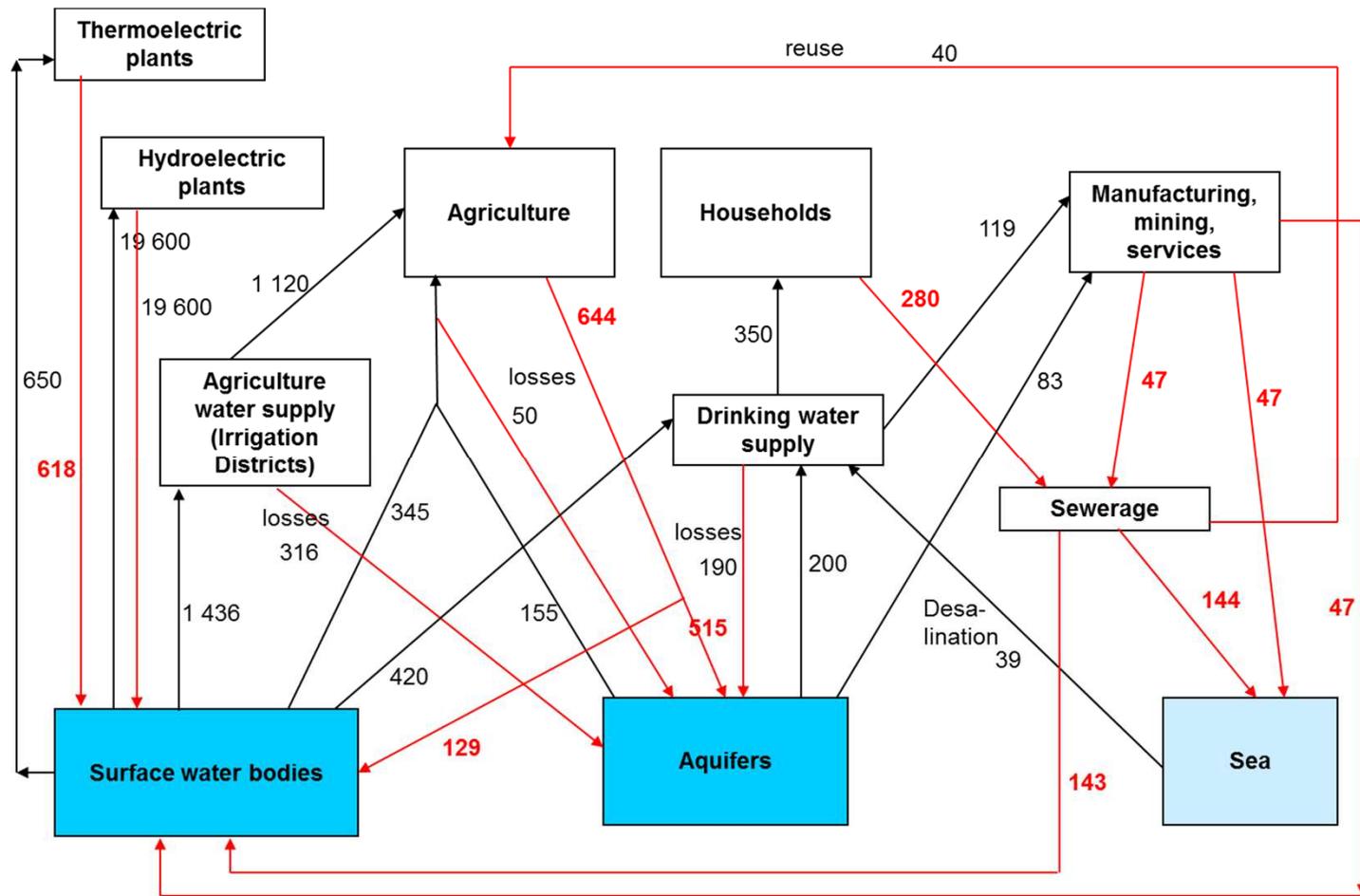
Compilation Exercise

Complete a water flow diagram based on the data provided.



Compilation Exercise

Complete a water flow diagram based on the data provided.



Compilation of supply and use tables

- 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)

- With thanks to Statistics Netherlands!

Mining of oil resources by mining industry (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

Supply of crude oil to refinery (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

Refining of crude oil → petrol (80 mln kg) & Export of petrol (50 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		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

CO2 emissions by refineries

Supply		Mining (ISIC 6)	Refinery (ISIC 19)	Households	Import	Environment	TOTAL
Natural inputs	Oil resources					100	100
	O2						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
	O2		60				60
Products	Crude oil		100				100
	Petrol			30	50		80
Residuals	CO2					80	80
TOTAL		100	160	30	50	80	420

CO2 emissions by households

Supply	Mining (ISIC 6)	Refinery (ISIC 19)	Households	Import	Environment	TOTAL
Natural inputs	Oil resources				100	100
	O2					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
	O2		60	90		150
Products	Crude oil		100			100
	Petrol			30	50	
Residuals	CO2				200	200
TOTAL	100	160	120	50	200	630

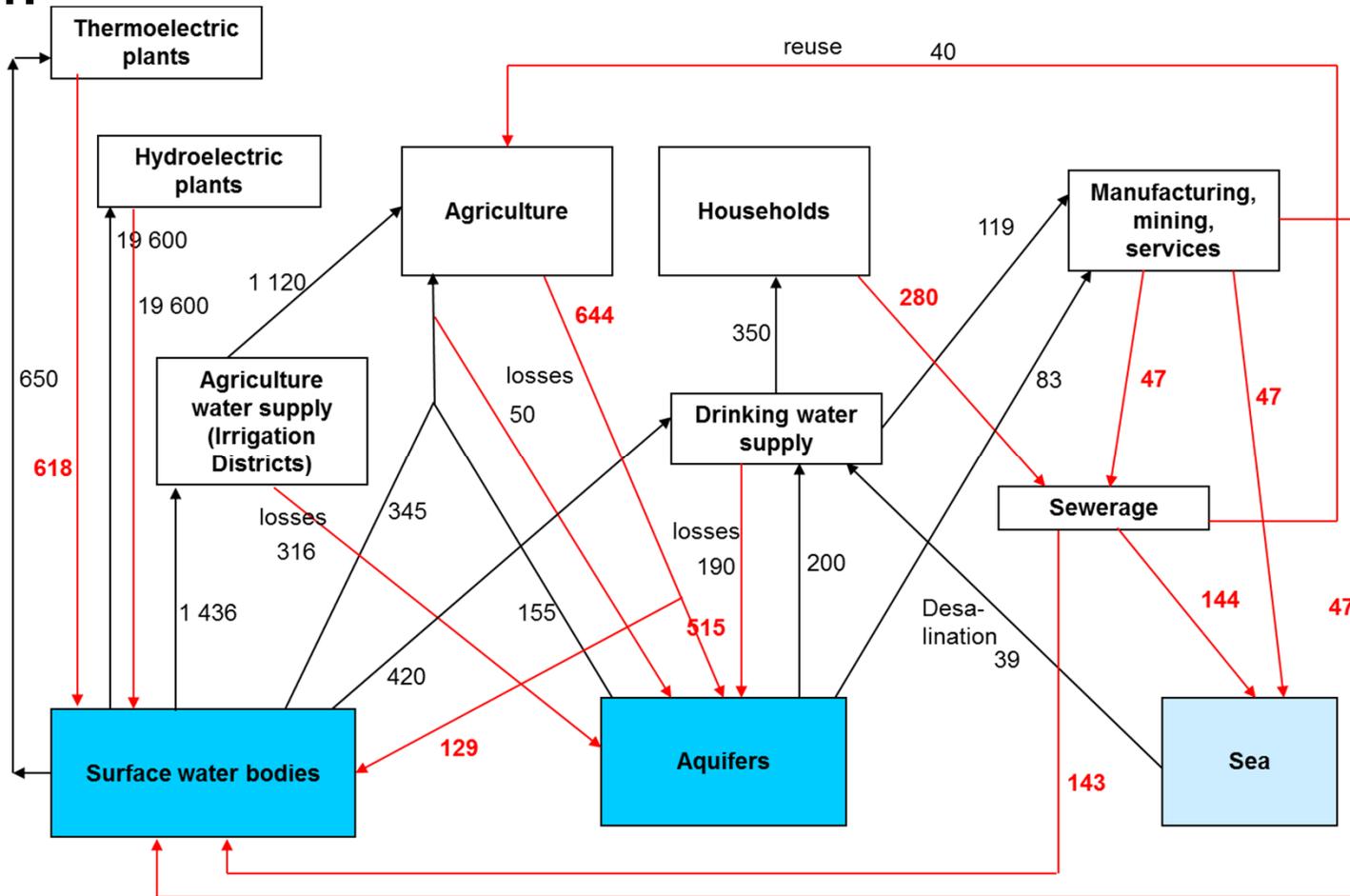
Check the accounting identities!

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	
	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
	O2		60	90			150
Products	Crude oil		100				100
	Petrol			30	50		80
Residuals	CO2					200	200
TOTAL		100	160	120	50	200	630

Compilation Exercise continued...

Use the water flow diagram to compile a supply and use table for water.



Compilation Exercise solution...

SUPPLY	Agriculture (ISIC 01-03)	Industry (ISIC 05-99 less 3510, 36, and 37)	Hydro-electricity (ISIC 3510)	Thermal Electricity (ISIC 3510)	Water Supply: drinking water (ISIC 36-A)	Water Supply: irrigation (ISIC 36-B)	Sewerage (ISIC 37)	Households	Environment	Total
Surface water									22,451	22,451
Ground water									438	438
Sea water									39	39
Water, drinking (CPC 18-A)					469					469
Water, irrigation (CPC 18-B)						1,120				1,120
Reuse water							40			40
Losses	50				190	316				556
Wastewater	644	141	19,600	618			287	280		21,570
Evaporation, transpiration, included in products	966	61		32				70		1,129
Total	1,660	202	19,600	650	659	1,436	327	350	22,928	47,812

Compilation Exercise solution...

USE	Agriculture (ISIC 01-03)	Industry (ISIC 05-99 less 3510, 36, and 37)	Hydro-electricity (ISIC 3510)	Thermal Electricity (ISIC 3510)	Water Supply: drinking water (ISIC 36-A)	Water Supply: irrigation (ISIC 36-B)	Sewerage (ISIC 37)	Households	Environment	Total
Surface water	345		19,600	650	420	1,436				22,451
Ground water	155	83			200					438
Sea water					39					39
Water, drinking (CPC 18-A)		119						350		469
Water, irrigation (CPC 18-B)	1,120									1,120
Reuse water	40									40
Losses									556	556
Wastewater							327		21,243	21,570
Evaporation, transpiration, included in products									1,129	1,129
Total	1,660	202	19,600	650	659	1,436	327	350	22,928	47,812



Questions?

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