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Physical Flow Accounts for Water

Regional Training Workshop on the System of Environmental-Economic Accounting

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Physical flow accounts for water



Objective: Acquire technical knowledge and discuss compilation issues

- 1. Review accounting structure and principles**
- 2. Review supply and use tables for water**
- 3. Data sources and compilation issues**

Introduction



Introduction

“Conventional economic aggregates generated through national accounting, such as GDP, do not reflect the extent to which production and consumption activities may be using up environmental assets and limiting the capacity for these assets to generate ecosystem services in the future.”

*-The Economics of Ecosystems and Biodiversity:
Guidance Manual for Countries (2013)*

Introduction

“Lack of integrated water data is a systematic impediment to informed decision making related to the sustainable use of water resources. Data are needed to provide information not just about water quantity, both on the surface and underground, but also about its quality, social and economic relations as well as environmental dimensions.”

*Conclusion from Session 6.4 “Data for All”
5th World Water Forum*

Introduction

Why account for water?

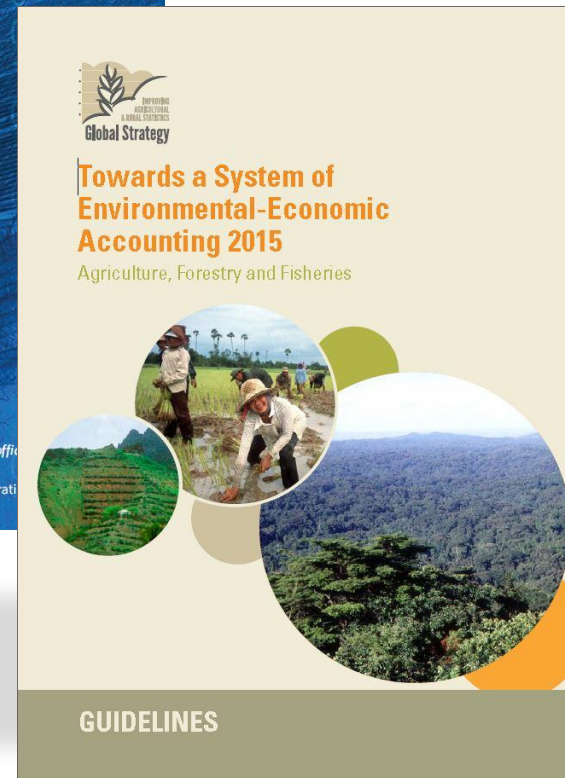
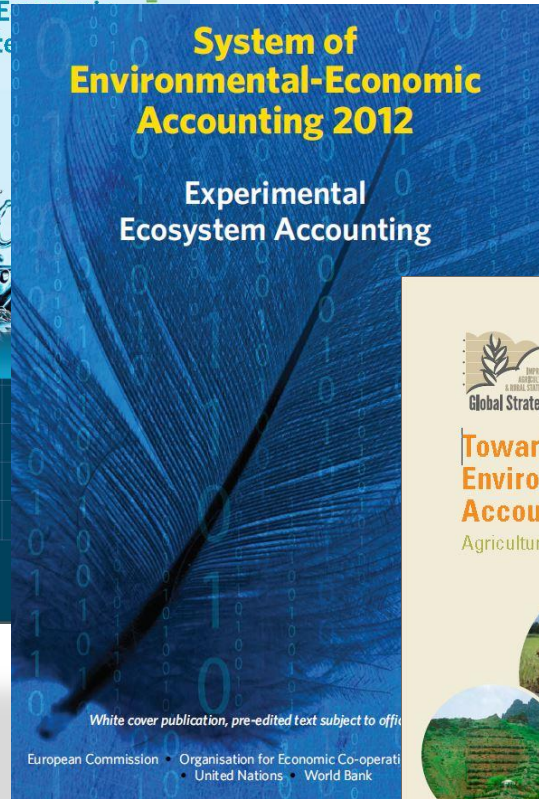
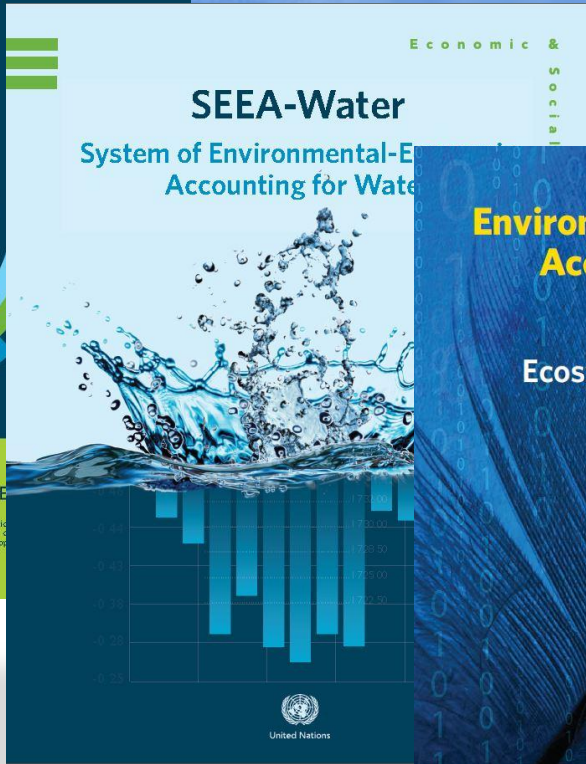
1. Increasing human pressure on water and ecosystems from:
 - Extraction of water
 - Pollution of water
 - Degradation and depletion of ecosystems (e.g. conversion of forests to palm oil plantations) changes the local water balance
2. Water accounts will support assessing the impact of:
 - Changes in vegetation cover and land use on water stocks and water provisioning and filtration services
 - Policies for managing water and ecosystems on the economy:
 - e.g., restricting human activity in catchments used for water supply
 - e.g., limiting the amount of water available for extraction by industry (e.g. agriculture).

Integrating the Environment and the Economy Internationally

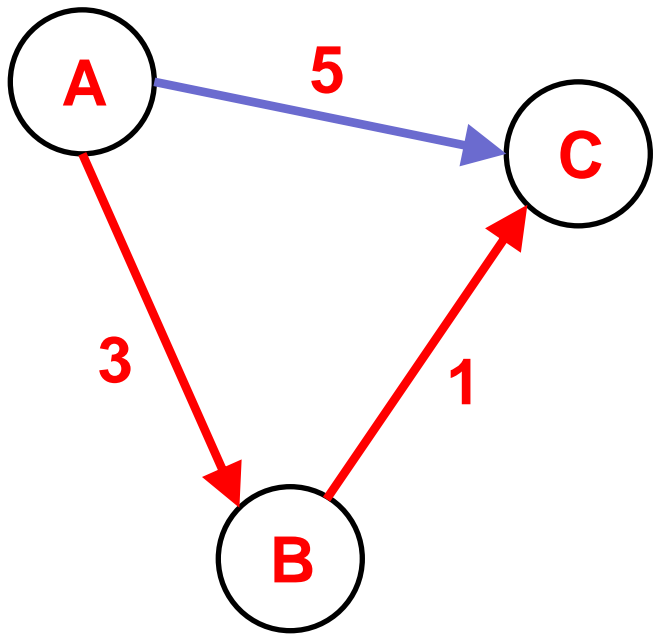
- 1993 SNA 93 discusses satellite accounts for the environment
- 2003 United Nations drafts the Integrated System of Environmental-Economic Accounting (SEEA)
- 2004 OECD council recommendation on Material Flows and Resource Productivity (renewed in 2008)
- 2007 G8+5 The Economics of Ecosystems and Biodiversity (TEEB)
- 2009 Stiglitz Commission “Beyond GDP”
- 2011 OECD: Green Growth Strategy
World Bank: Wealth Accounting and the Valuation of Ecosystem Services (WAVES)
European Union: Regulation on European Environmental Economic Accounts
- 2012 SEEA adopted as an international statistical standard.
- 2013 SEEA Experimental Ecosystem Accounting manual

System of Environmental-Economic Accounting 2012

Central Framework

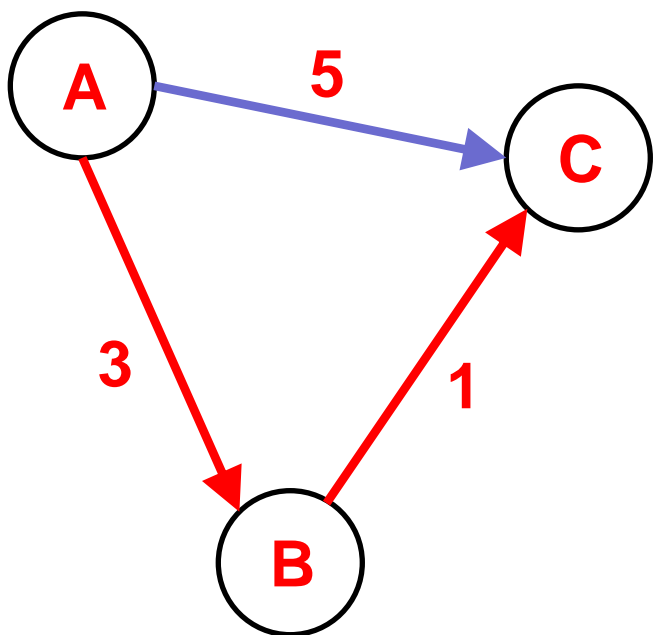


Ice Breaker



	A	B	C
A		3	5
B			1
C			

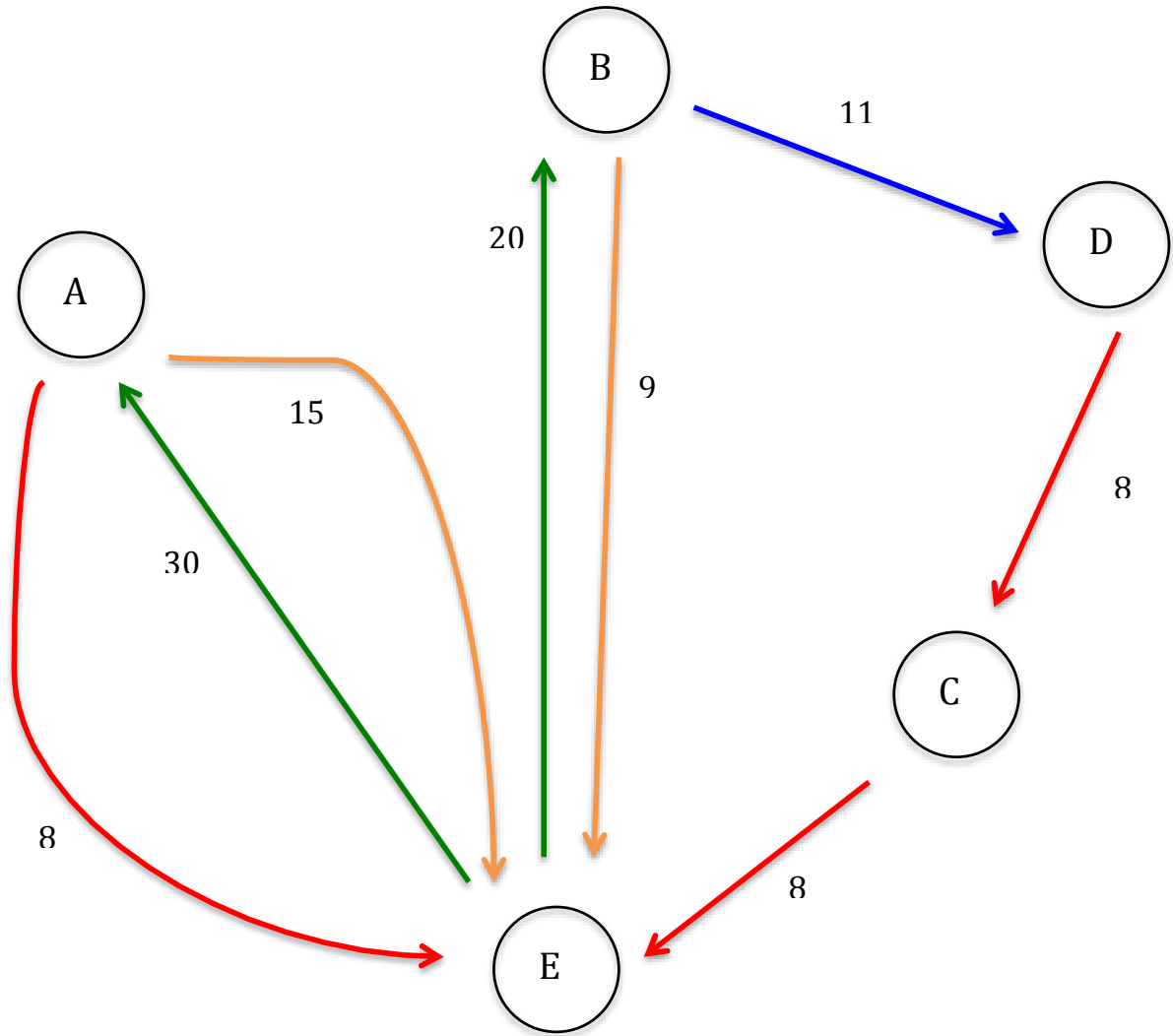
Ice Breaker



↓ Outputs	A	B	C
Blue flows	5		
Red flows	3	1	

↑ Inputs	A	B	C
Blue flows			5
Red flows		3	1

Ice Breaker



Ice Breaker



↓ OUT	A	B	C	D	E
Green					
Orange					
Red					
Blue					

↑ IN	A	B	C	D	E
Green					
Orange					
Red					
Blue					

Ice Breaker

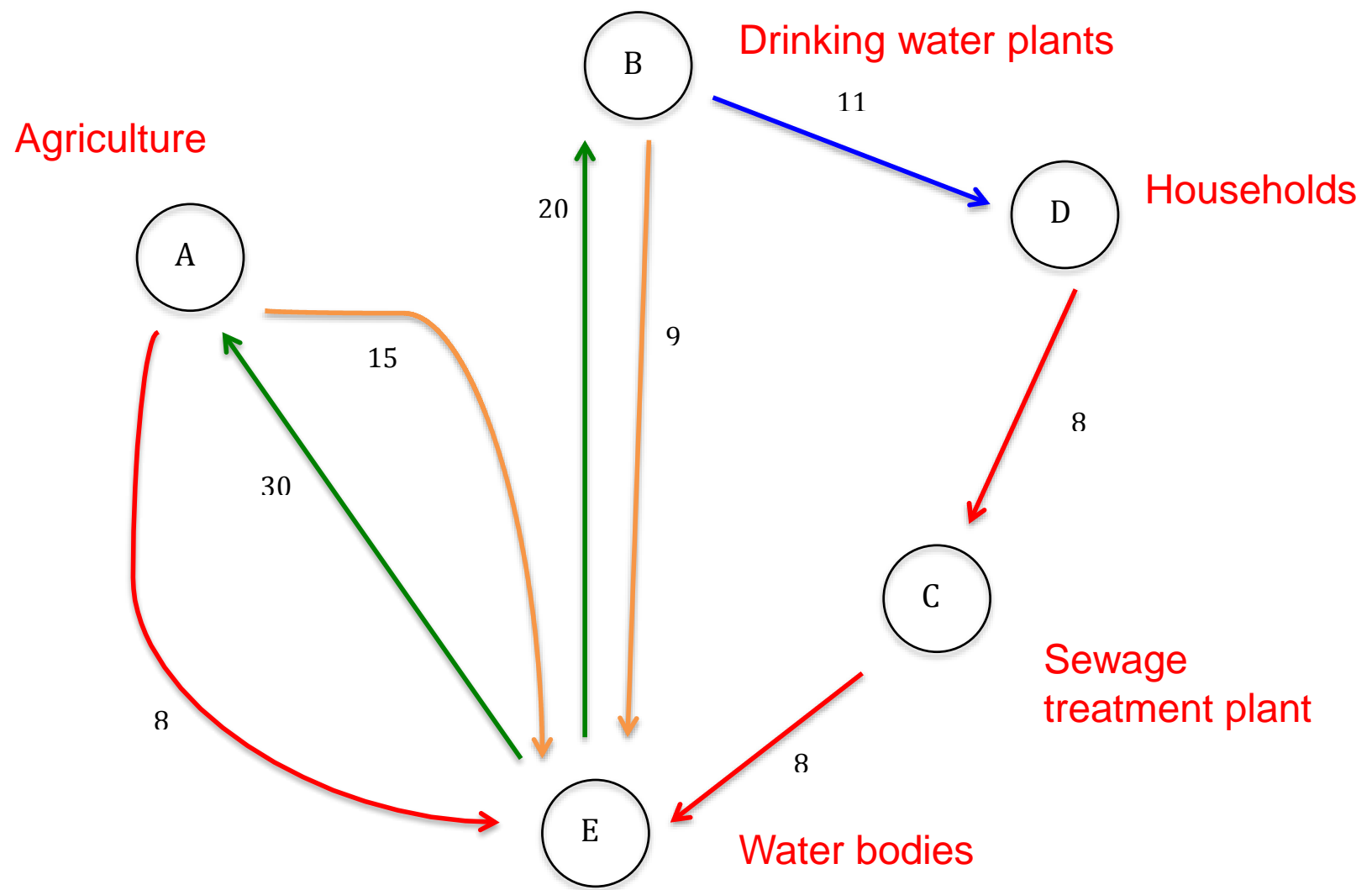
↓ OUT	A	B	C	D	E
Green					50
Orange	15	9			
Red	8		8		
Blue		11			
	23	20	8	8	50

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↑ IN	A	B	C	D	E
Green	30	20			
Orange					24
Red			8		16
Blue				11	
	30	20	8	11	40

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Ice Breaker

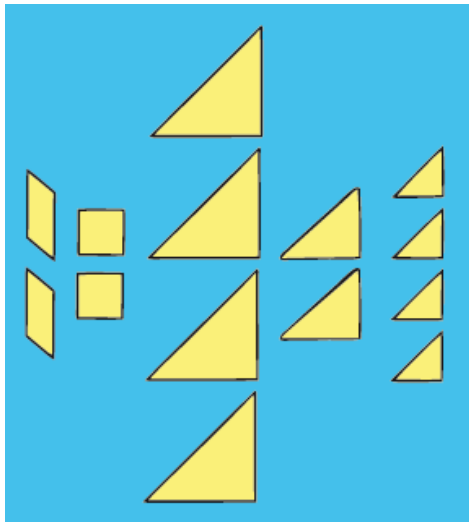


What is environmental-economic accounting?

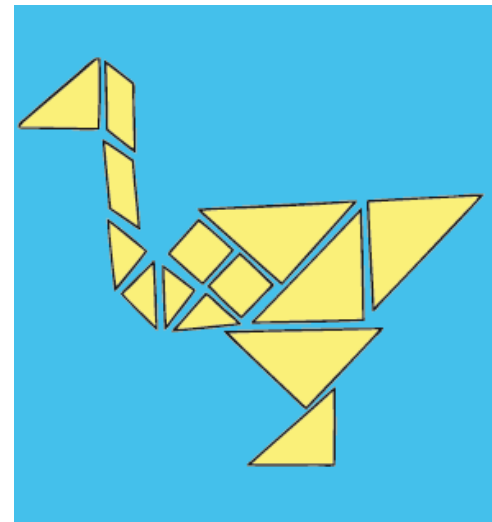
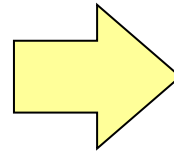
- **Environmental-economic accounting** is:
 - a) The application of concepts and methods used in the national accounts, *where appropriate*, to produce a statistical description of the relationship and linkages between the environment the economy
 - b) Where national accounts approaches are not appropriate, *specialized concepts and methods are applied*
 - c) The goal is an accounting system describing the environment that is parallel to and coherent with the national accounts.

Why Produce Environmental Accounts?

From Sectoral data to integrated information



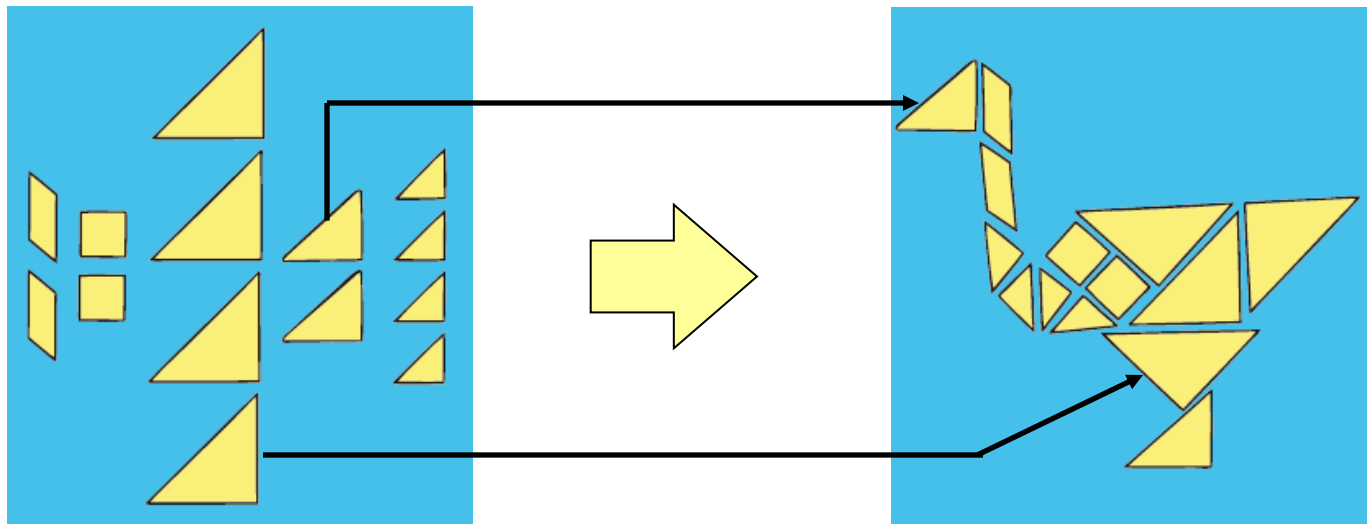
Sectoral Data



Integrated information

- **Producing relevant information for policy analysis requires transforming sectoral data into integrated policy-relevant information.**

From Sectoral data to integrated information

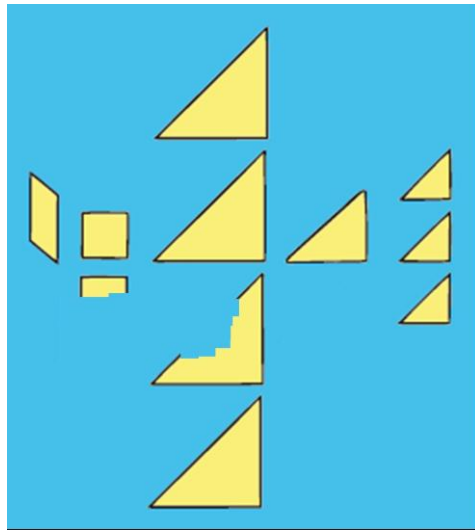


Sectoral Data

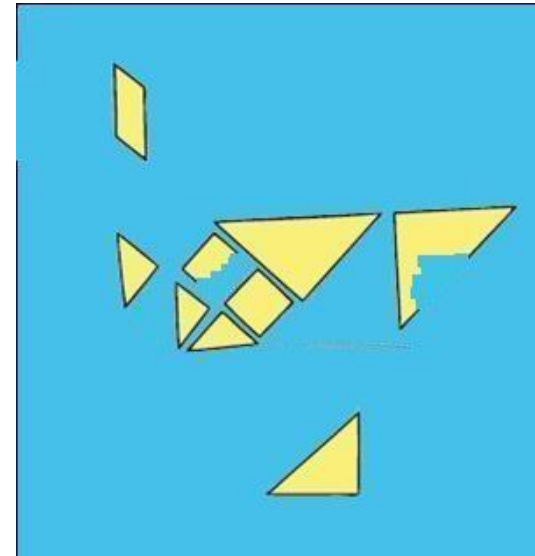
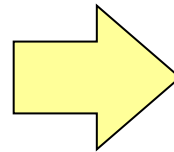
Integrated information

- It may not be possible, nor desirable, to change the detailed technical terminology or language used for describing each of the elements of the system. We just need to understand the relationships.

From Sectoral data to integrated information



Sectoral Data



Integrated information

- The data required is usually incomplete, but may provide enough elements for understanding how the “parts” fit in the “whole.”

Why Produce Environmental Accounts?

1. Integrate environmental-economic data in a coherent framework

- Increase significantly our capacity to assess the economic activity and its dependence upon the natural environment
- Favours using norms, consistency between economic and environment data, which in turn help with inter-regional and international comparisons

2. Guide/direct environmental data collection

- Data within an integrated information system are coherent to an extent not possible in a set of independent databases
- Clear guidance on what to measure but also on what not to measure

Why Produce Environmental Accounts?

1. Record the flows of materials and energy between the economy and the environment
 - resource and energy use
 - waste produced
2. Directly link environment data to the rich body of economic statistics of the national accounts
 - use same concepts, methods, and framework
 - provide numerous opportunities to study the economy and the demands it places on the environment

Why Produce Environmental Accounts?

Analytical uses...

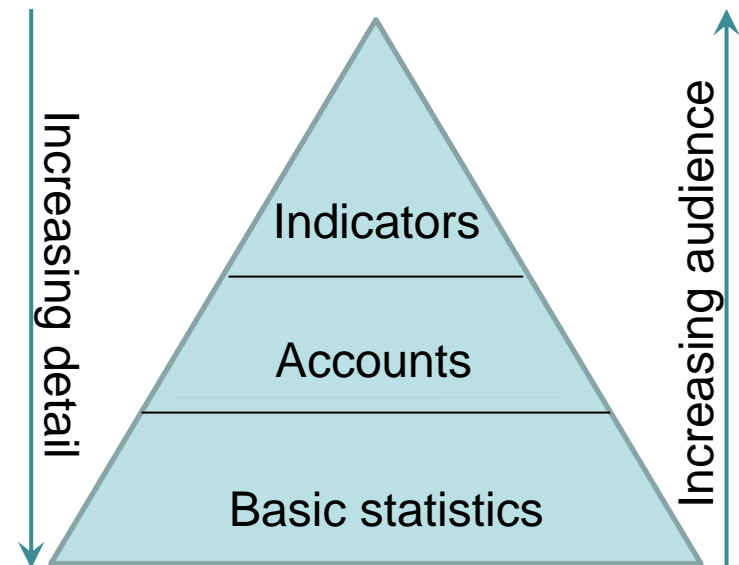
1. Linkage to the economic accounts
 - a) Measures of intensity over time
 - b) Demand perspectives on material flows

2. Linkage to ecosystem assets
 - a) Reliance on natural inputs
 - b) Impacts on the environment

Why Produce Environmental Accounts?

And indicators

- Accounts and indicators are, ideally, elements of the same statistical system
 - The foundation of the system is basic statistics
 - These are compiled into coherent and comprehensive accounts
 - The accounts are used as the data source for indicators



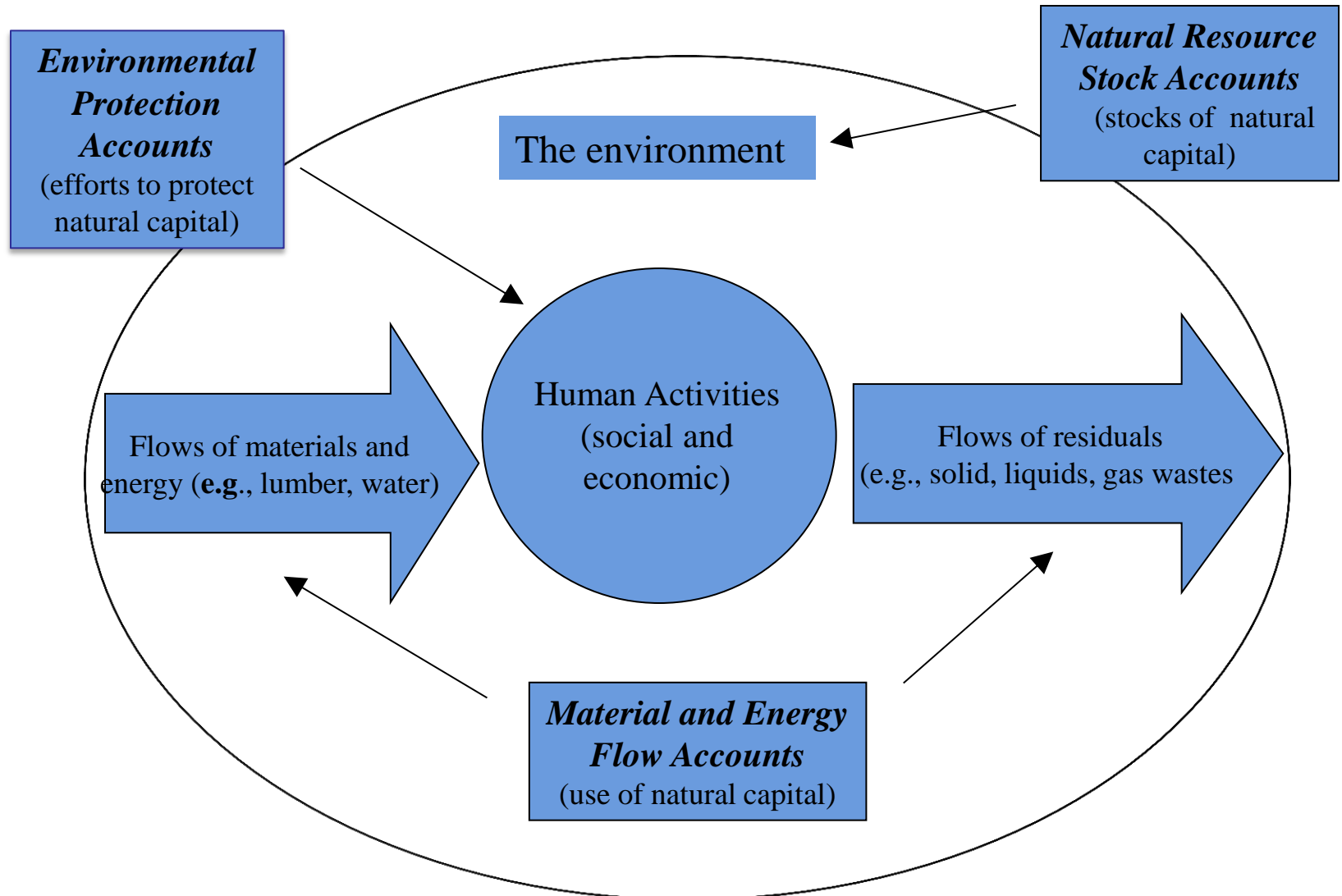
What are environmental accounts?



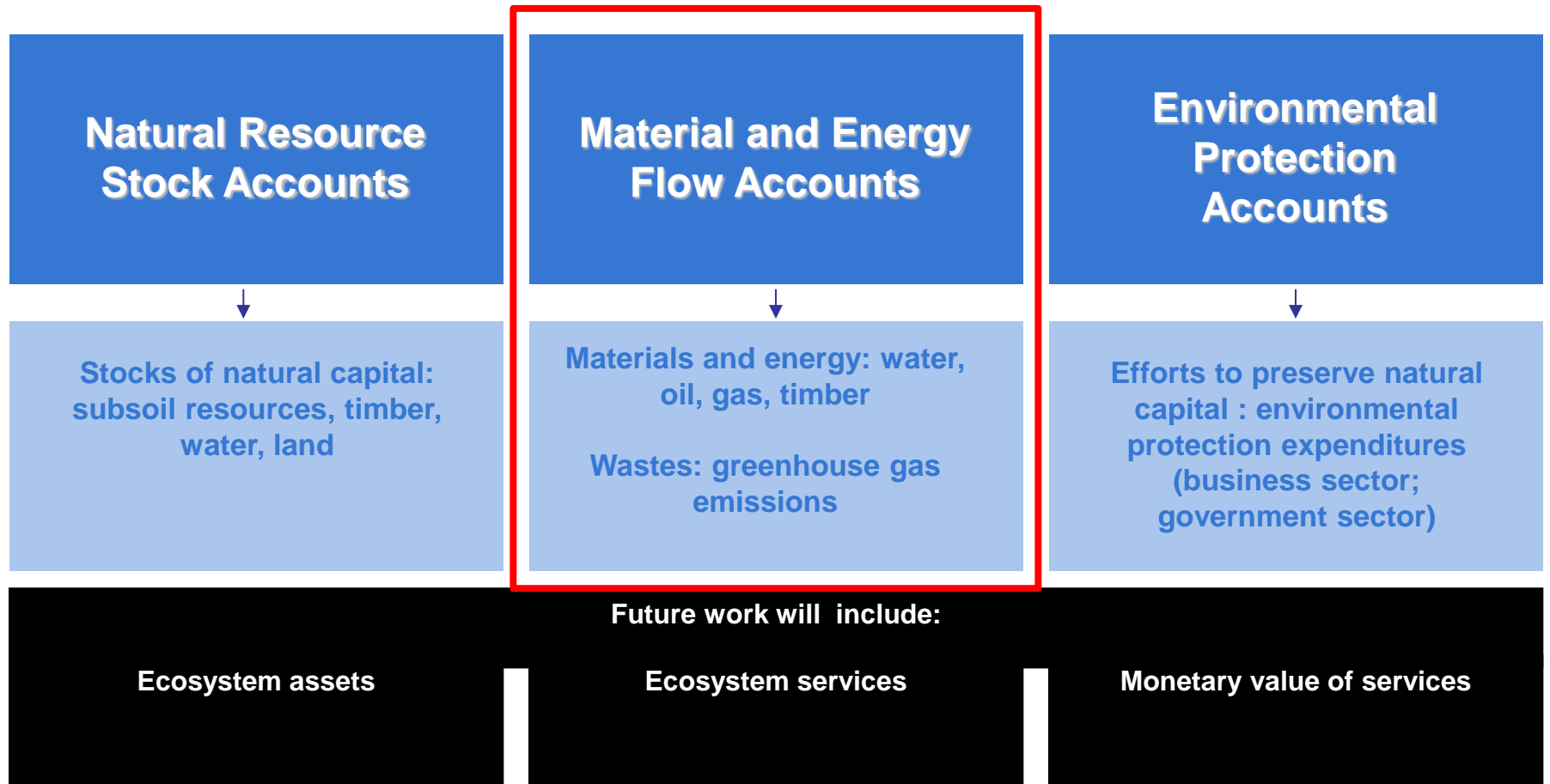
What are environmental accounts?

1. Environmental accounts are records of:
 1. The stock and value of environmental assets
 2. The flows of material and energy resources between the economy and the environment, and within the economy
 3. The expenditures on environmental protection, and the cost of environmental damage.
2. That meet specific criteria:
 1. Consistent over time
 - always uses the same methods and data sources
 2. Comprehensive in their coverage
 3. compatible with economic accounts
 4. national in scope (with sub-national detail as appropriate)

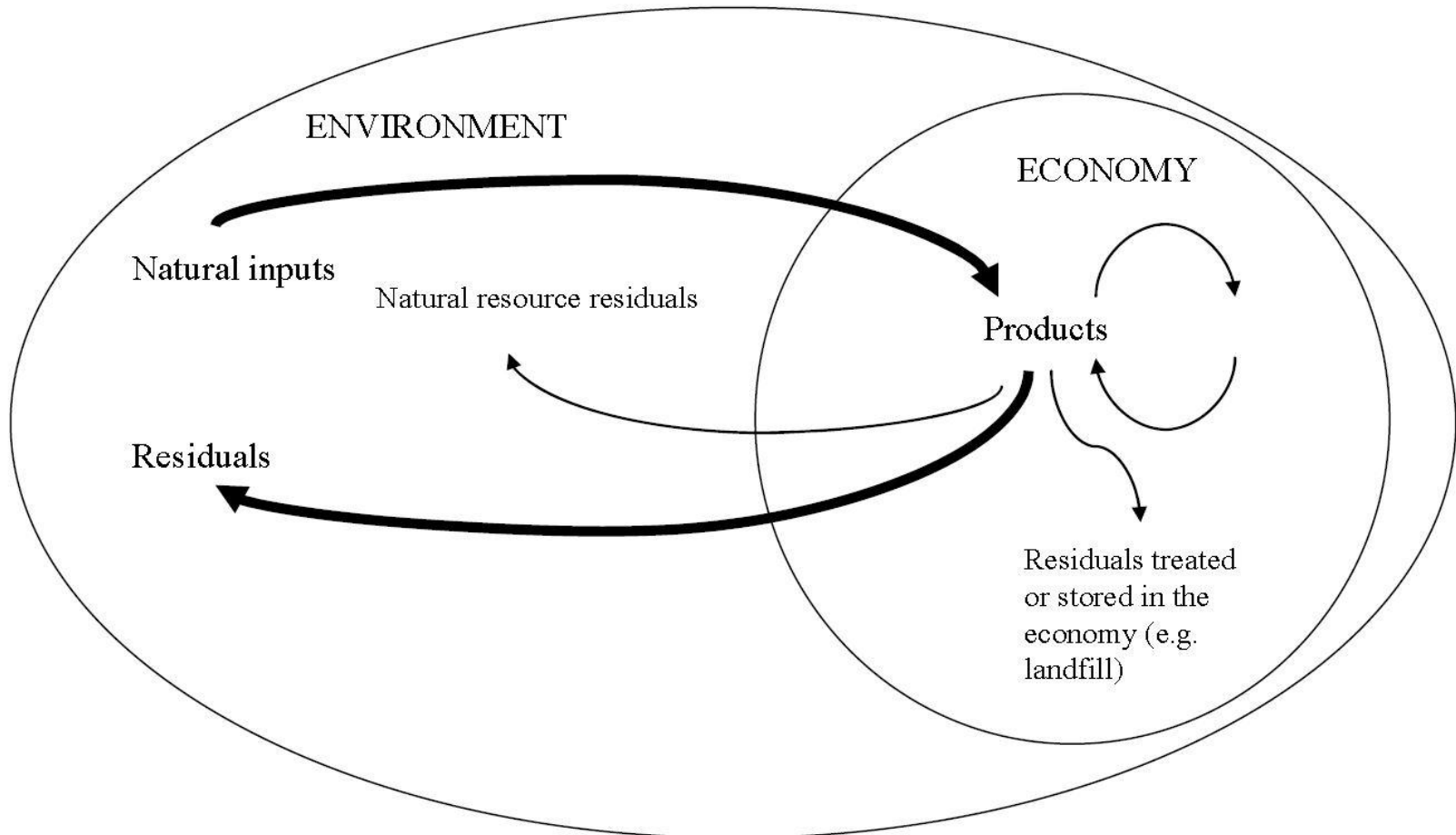
Accounting framework: Principal components



Accounting framework: Principal components



Accounting framework: Physical flows



Material and Energy Flow Accounts

1. Track the consumption of materials and energy and the pollution caused by each industry and the final demand sector
2. Flows are linked to the Input-Output (I-O) Accounts because of the common classification systems for industries and products
3. Linking physical measures to the I-O Accounts allows the detailed estimation of resource intensity and waste production characteristics of economic activities

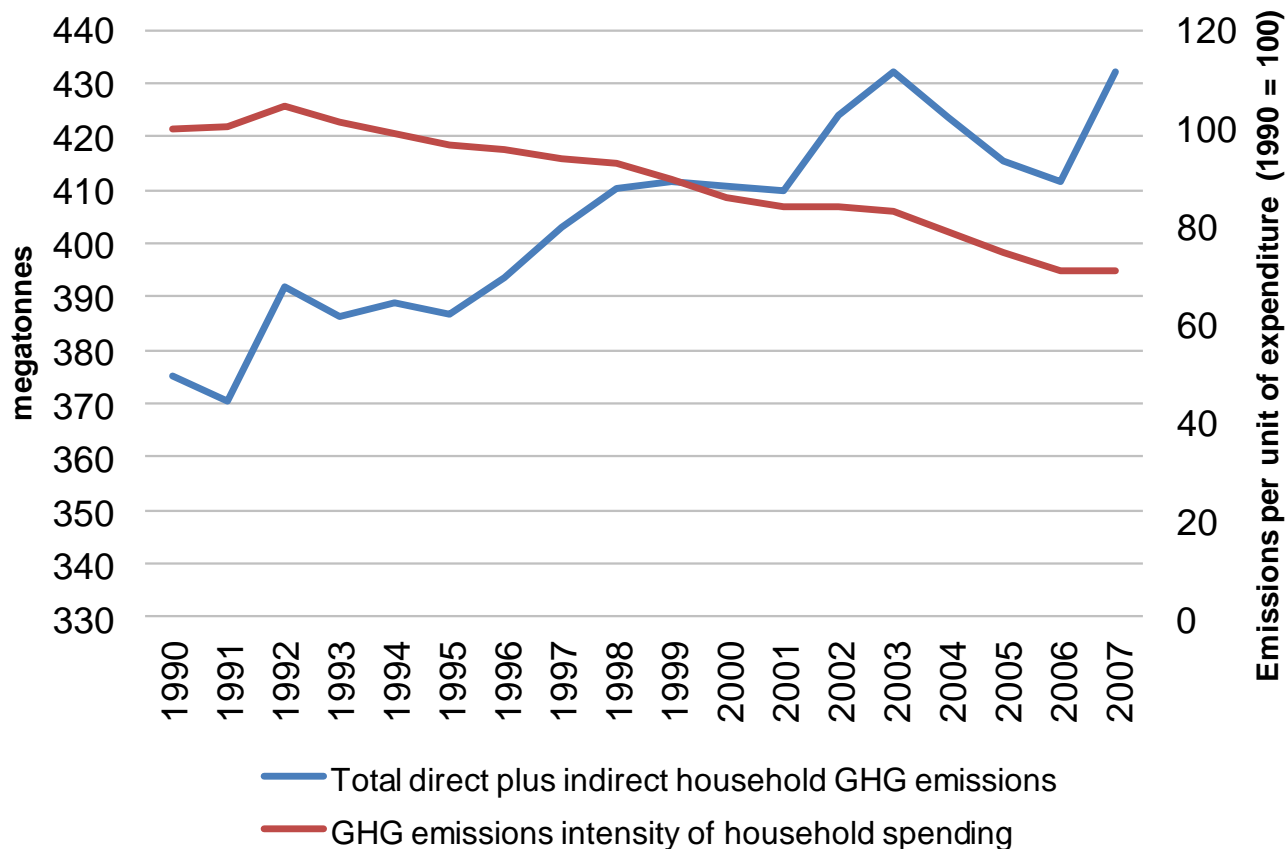
Material and Energy Flow Accounts



1. Material consumption
2. Material productivity
3. Energy use analysis
4. Energy policy
5. Emissions analysis
6. Environmental assessment
7. Natural resource management
8. Multi-factor productivity
9. Footprint calculations

Material and Energy Flow Accounts

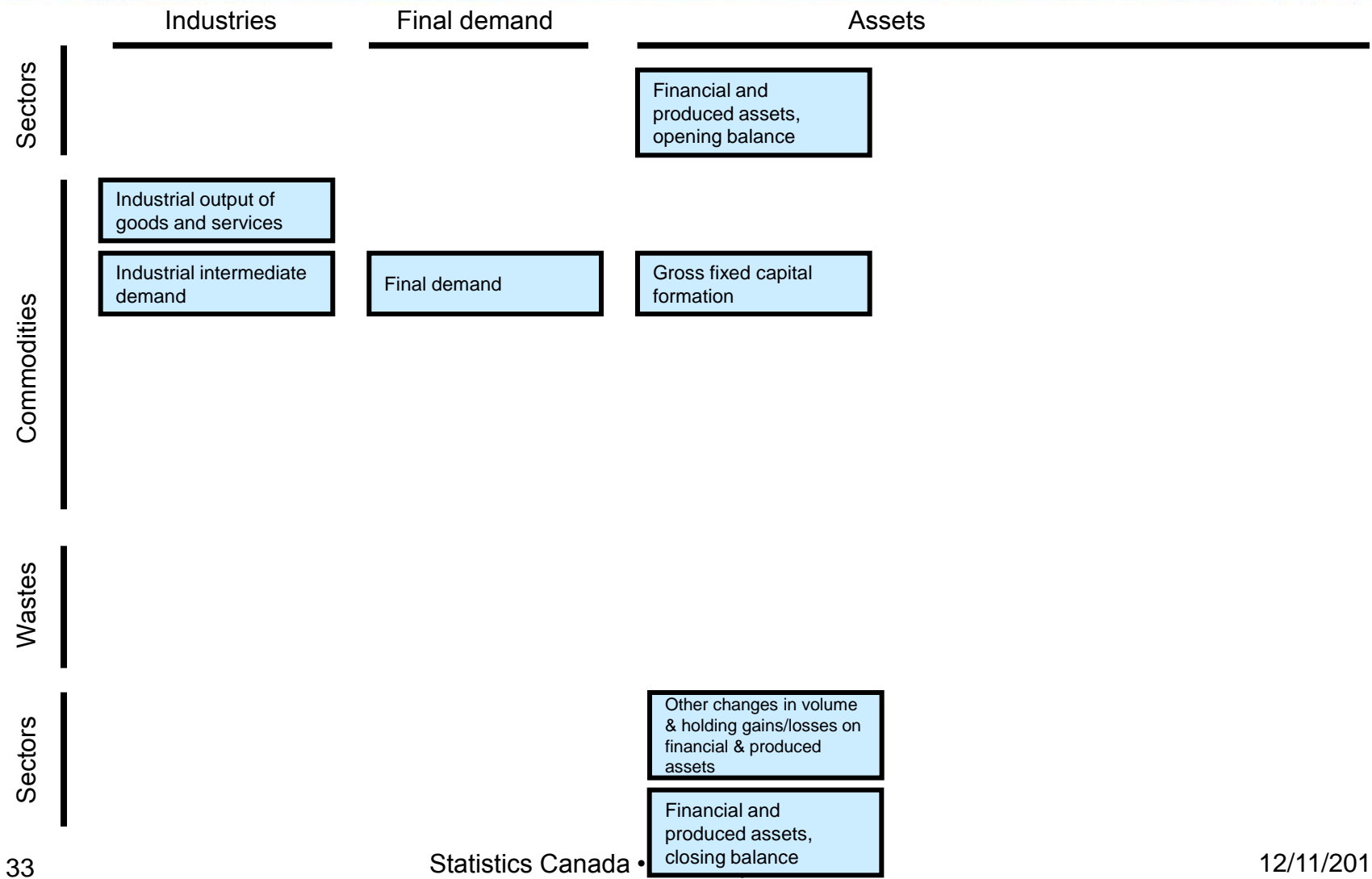
Direct and indirect GHG emissions from household activities



SEEA and the SNA



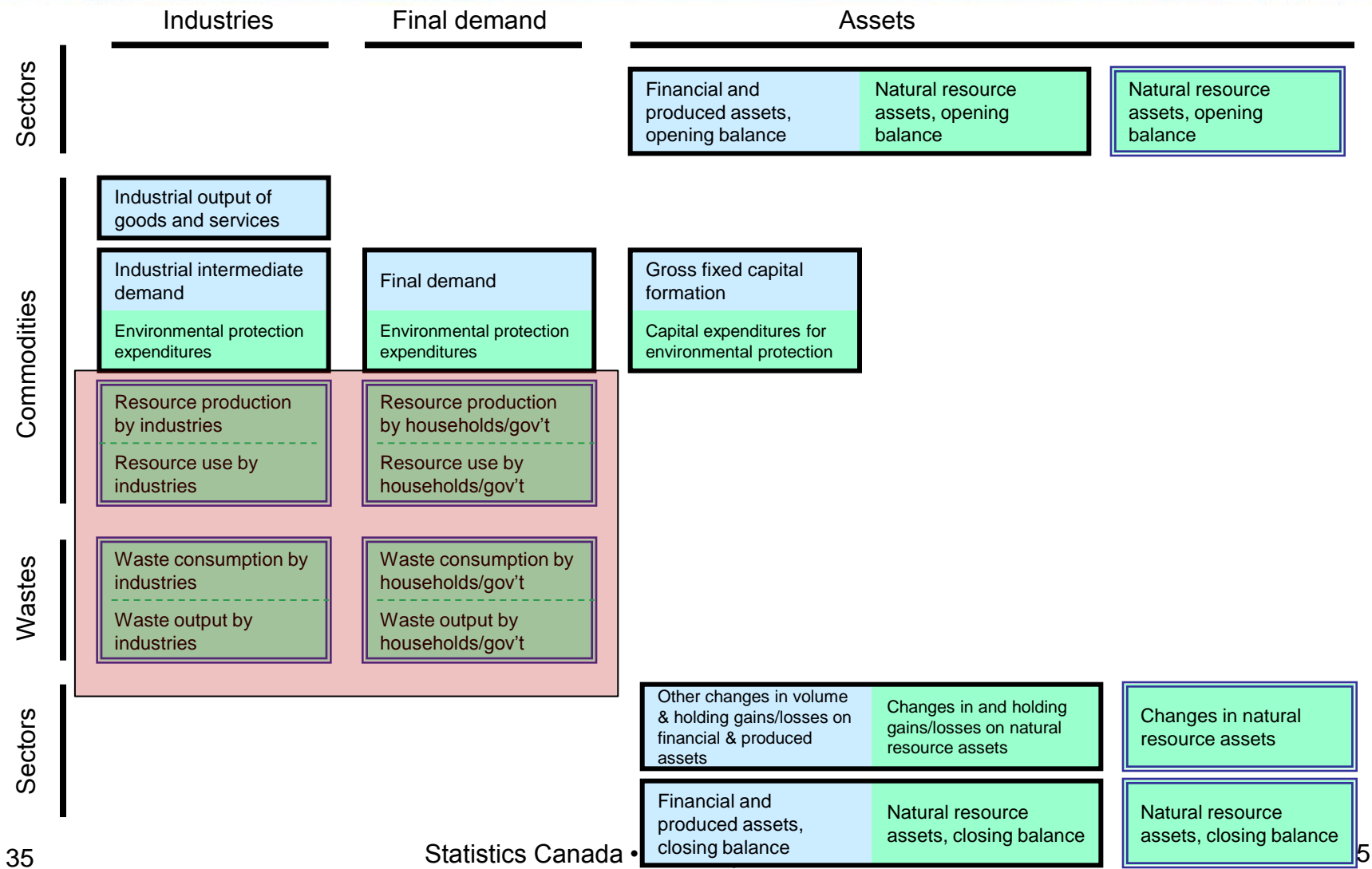
System of National Accounts framework



System of Environmental-Economic Accounts (SEEA) framework

	Industries	Final demand	Assets		
Sectors			Financial and produced assets, opening balance	Natural resource assets, opening balance	Natural resource assets, opening balance
Commodities	Industrial output of goods and services				
	Industrial intermediate demand Environmental protection expenditures	Final demand Environmental protection expenditures	Gross fixed capital formation Capital expenditures for environmental protection		
	Resource production by industries Resource use by industries	Resource production by households/gov't Resource use by households/gov't			
Wastes	Waste consumption by industries Waste output by industries	Waste consumption by households/gov't Waste output by households/gov't			
Sectors			Other changes in volume & holding gains/losses on financial & produced assets	Changes in and holding gains/losses on natural resource assets	Changes in natural resource assets
			Financial and produced assets, closing balance	Natural resource assets, closing balance	Natural resource assets, closing balance

Physical Flow Accounting



Supply and Use Tables in Physical and Monetary Terms

1. Monetary supply and use tables:

- Flows of products between different economic units
- Component of the SNA

2. Physical supply and use tables (PSUT):

- Similar structure to the monetary supply and use tables
- Record information of flows of materials and energy

Types of physical flows accounts

Physical flow accounts	Topics covered (<i>detailed definition</i>)
Full set of supply and use tables for materials	All resources and materials (energy, water, air emissions, water emissions, solid waste) (CF 3.45)
Economy-wide material flow accounts (MFA)	Supply and consumption of energy; air emissions, water emissions, and solid waste (CF 3.279)
Physical supply and use tables for water (PSUT water)	Supply and consumption of water (CF 3.186)
Physical supply and use tables for energy (PSUT energy)	Supply and consumption of energy (CF 3.140)
Air emissions accounts	Air emissions (CO ₂ , pollutants) (CF 3.233)
Water emissions accounts	Water emissions (CF 3.257)
Waste accounts	Solid wastes (CF 3.268)

- CF = Central Framework, white cover edition, refers to paragraph number

Supply Table: Shows the flows relating to the production, generation and supply of natural inputs, products and residuals by different economic units or the environment

Table 3.2.1 General physical supply and use table

Supply table

	Production; Generation of residuals		Accumulation	Flows from the rest of the world	Flows from the environment	Total
	Production; Generation of residuals by industries (incl. household production on own account) - classified by ISIC	Generation of residuals by households	Industries - classified by ISIC			
Natural inputs					A. Flows from the environment (incl. natural resource residuals)	Total Supply of Natural Inputs (TSNI)
Products	C. Output (incl. sale of recycled and reused products)			D. Imports of products		Total Supply of Products (TSP)
Residuals	I1. Residuals generated by industry (incl. natural resource residuals) I2. Residuals generated following treatment	J. Residuals generated by household final consumption	K1. Residuals from scrapping and demolition of produced K2. Emissions from controlled landfill sites	L. Residuals received from rest of the world	M. Residuals recovered from the environment	Total Supply of Residuals (TSR)

Total supply Use table

	Intermediate consumption of products; Use of natural inputs; Collection of residuals	Final consumption*	Accumulation	Flows to the rest of the world	Flows to the environment	Total
	Industries - classified by ISIC	Households	Industries - classified by ISIC			
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 (incl. purchase of recycled and reused products)	F. Household final consumption (incl. purchase of recycled and reused products)	G. Gross Capital Formation (incl. fixed assets and inventories)	H. Exports of products		Total Use of Products (TUP)
Residuals	N. Collection and treatment of residuals (excl 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 Q1. Direct from industry and households (incl. natural resource residuals)	Total Use of Residuals (TUR)

Total use

Use Table: Shows the flows relating to the consumption and use of natural inputs, products and residual by different economic units and the environment

*No entries for against the rel

Physical Flow Accounts: Basic Tables

Records flows to and from the environment

Table 3.2.1 General physical supply and use table

Supply table		Production; Generation of residuals		Accumulation	Flows from the rest of the world	Flows from the environment	Total
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	I2. Residuals generated following treatment		K2. Emissions from controlled landfill sites				
Total supply							
Use table		Intermediate consumption of products; Use of natural inputs; Collection of residuals	Final consumption*	Accumulation	Flows to the rest of the world	Flows to the environment	Total
	Industries - classified by ISIC	Households	Industries - classified by ISIC				
Natural inputs	B. Extraction of natural inputs						Total Use of Natural Inputs (TUNI)
	B1. Extraction used in production						
	B2. Natural resource residuals						
Products	E. Intermediate consumption (incl. purchase of recycled and reused products)	F. Household final consumption (incl. purchase of recycled and reused products)	G. Gross Capital Formation (incl. fixed assets and inventories)		H. Exports of products		Total Use of Products (TUP)
Residuals	N. Collection and treatment of residuals (excl 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 (incl. natural resource residuals & landfill emissions)	
						Q2. Following treatment	
Total use							

*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: Basic Tables

Table 3.2.1 General physical supply and use table

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Total supply							
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	Industries - classified by ISIC	Households	Industries - classified by ISIC				
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Products	E. Intermediate consumption (incl. purchase of recycled and reused products)	F. Household final consumption (incl. purchase of recycled and reused products)	G. Gross Capital Formation (incl. fixed assets and inventories)	H. Exports of products			Total Use of Products (TUP)
Residuals	N. Collection and treatment of residuals (excl 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 Q1. Direct from industry and households (incl. natural resource residuals & landfill emissions) Q2. Following treatment		Total Use of Residuals (TUR)
Total use							

4(*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.

3. PSUT – Water:

- A. Flows expressed in units of volume per unit of time (e.g. million cubic meters per year)
- B. Flows from the environment to the economy are recorded as natural inputs (e.g. abstractions of water)
- C. Flows within the economy are recorded as product flows
- D. Flows from the economy to the environment are recorded as residuals

Physical Flow Accounts: Natural Inputs

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

Table 3.2.2 Classes of natural inputs

1	Natural resource inputs	2	Inputs of energy from renewable sources
1.1	Extraction used in production	2.1	Solar
1.1.1	Mineral and energy resources	2.2	Hydro
1.1.1.1	Oil resources	2.3	Wind
1.1.1.2	Natural gas resources	2.4	Wave and tidal
1.1.1.3	Coal and peat resources	2.5	Geothermal
1.1.1.4	Non-metallic mineral resources (excl. coal & peat resources)	2.6	Other electricity and heat
1.1.1.5	Metallic mineral resources	3	Other natural inputs
1.1.2	Soil resources (excavated)	3.1	Inputs from soil
1.1.3	Natural timber resources	3.1.1	Soil nutrients
1.1.4	Natural aquatic resources	3.1.2	Soil carbon
1.1.5	Other natural biological resources (excluding timber and aquatic resources)	3.1.3	Other inputs from soil
1.1.6	Water resources	3.2	Inputs from air
1.1.6.1	Surface water	3.2.1	Nitrogen
1.1.6.2	Groundwater	3.2.2	Oxygen
1.1.6.3	Soil water	3.2.3	Carbon dioxide
1.2	Natural resource residuals	3.2.4	Other inputs from air
		3.3	Other natural inputs n.e.c.

Physical Flow Accounts: Residuals



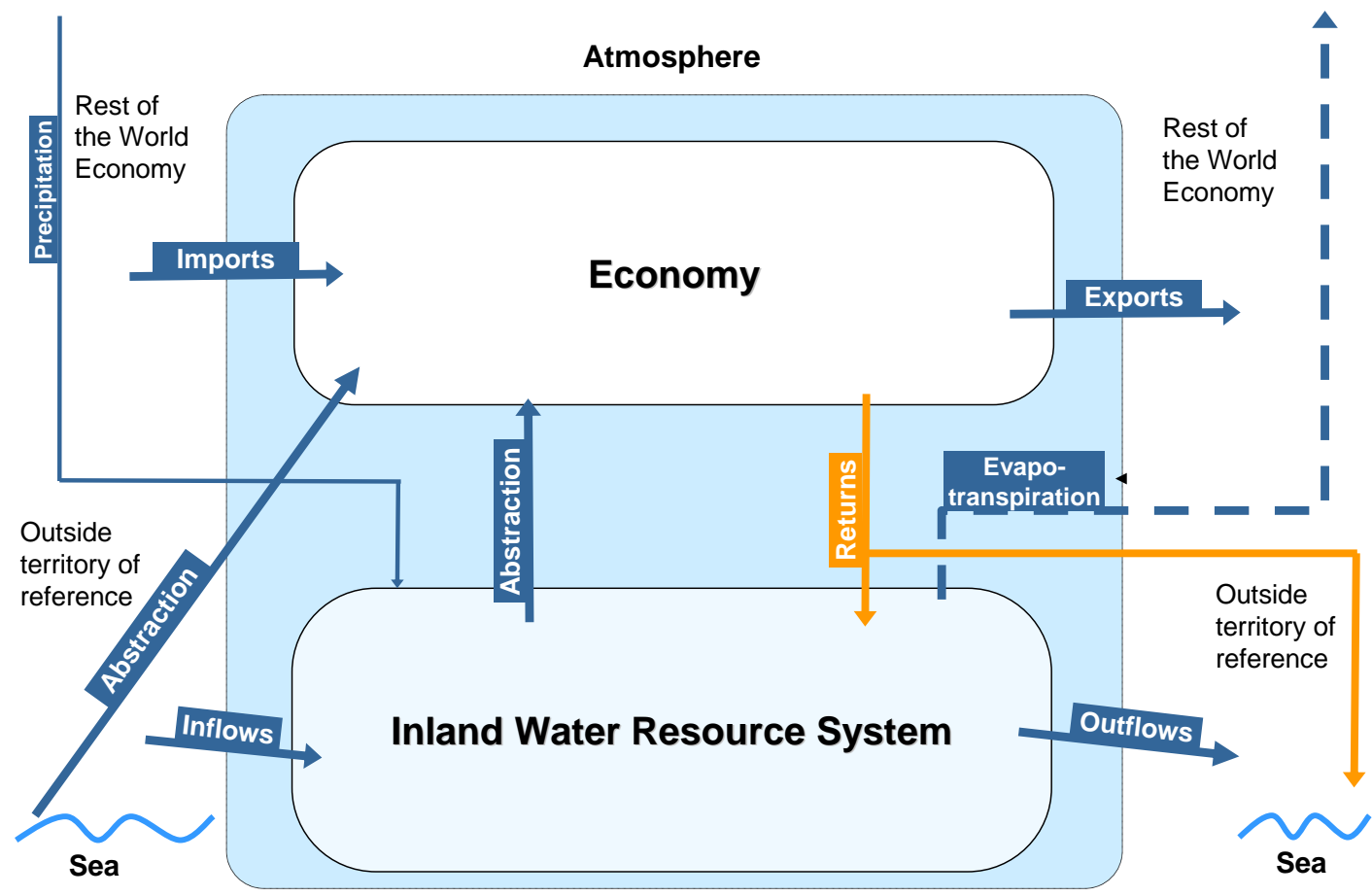
3.73 Residuals are flows of solid, liquid and gaseous materials, and energy that are discarded, discharged or emitted by establishments and households through processes of production, consumption or accumulation.

Table 3.2.4 Typical components for groups of residuals

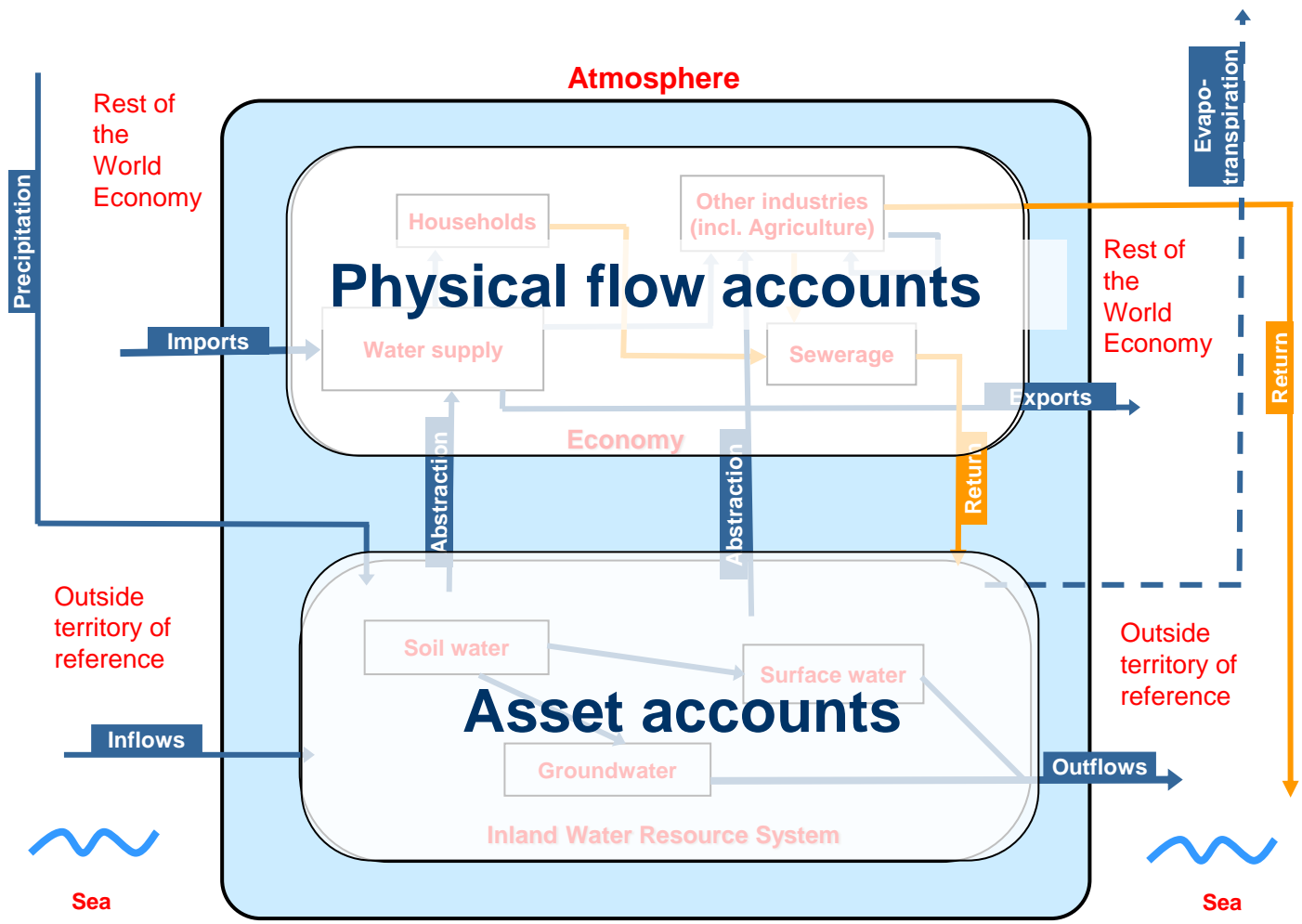
Group	Typical components
Solid waste (includes recovered materials)*	Chemical and healthcare waste, Radioactive waste, Metallic waste, Other recyclables, Discarded equipment and vehicles, Animal and vegetal wastes, Mixed residential and commercial waste, Mineral wastes and soil, Combustion wastes, Other wastes
Wastewater*	Water for treatment and disposal, Return flows, Reused water
Emissions to air	Carbon Dioxide, Methane, Dinotrogen oxide, Nitrous oxides, Hydrofluorocarbons, Perfluorocarbons, Sulphur Hexaflouride, 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, Phosphorous 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 fertilisers, salt spread on roads
Dissipative losses	Abrasion (tyres/brakes), Erosion/corrosion of infrastructure (roads, etc)
Natural resource residuals	Mining overburden, felling residues, discarded catch

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

Physical Flow Accounts: Schematics



Physical Flow Accounts: Schematics



Physical flow accounts



Components of supply and use tables

1. Abstraction of water
2. Distribution and use of abstracted water
3. Flows of wastewater and reused water
4. Return flows of water to the environment
5. Evaporation of abstracted water, evapotranspiration and water incorporated into products

Physical supply table for water

Physical supply table for water

Abstraction of water; Production of water; Generation of return flows

Flows from the rest
of the world

Flows from the
environment

Total supply

Agriculture, forestry and fishing
Mining & quarrying, Manufacturing and Construction
Electricity, gas, steam and air conditioning
Water collection, treatment and supply
Sewerage
Other industries
Households

Imports

(I) Sources of abstracted water

Inland water resources											
Surface water										440.6	440.6
Groundwater										476.3	476.3
Soil water										50.0	50.0
Total										966.9	966.9
Other water sources											
Precipitation										101.0	101.0
Sea water										101.1	101.1
Total										202.1	202.1
Total supply abstracted water										1 169.0	1 169.0

(II) Abstracted water

For distribution				378.2							378.2
For own-use	108.4	114.6	404.2	61.2	100.1	2.3					790.8

(III) Wastewater and reused water

Wastewater											
Wastewater to treatment	17.9	117.6	5.6	1.4	49.1	235.5					427.1
Own treatment											
Reused water produced											
For distribution					42.7						42.7
For own use		10.0									10.0

(IV) Return flows of water

To inland water resources											
Surface water			300.0		52.5	0.2	0.5				353.2
Ground water	65.0	23.5		47.3	175.0	0.5	4.1				315.4
Soil water											
Total	65.0	23.5	300.0	47.3	227.5	0.7	4.6				668.6
To other sources		5.9	100.0		256.3		0.2				362.4
Total Return flows	65.0	29.4	400.0	47.3	483.8	0.7	4.8				1 031.0

(V) Evaporation of abstracted water, transpiration and water incorporated into products

Evaporation of abstracted water	76.2	43.2	2.5	1.8	0.7	3.6	10.0				138.0
Transpiration											
Water incorporated into products											
Total supply	267.5	314.8	812.3	489.9	627.3	55.7	250.3			1 169.0	3 986.8

Water Supply Table

1. Water supply

- water leaving/flowing-out from an economic unit (Industries, Households and rest of the world). Water supply is the sum of *water supply to other economic units* and *water supply to the environment*.

2. Water supply to the environment (a.k.a. returns)

- water returned into the environment during a given period of time after use. Returns can be classified according to the receiving media (i.e. water resources and sea water) and to the type of water (e.g. treated water, cooling water, etc.).

3. Water supply within the economy

- water distributed to households and industries (including agriculture) and to the rest of the world (exports). Water supply within the economy is net of losses in distribution.

Physical use table for water

Physical use table for water

	Abstraction of water; Intermediate consumption; Return flows						Final consumption Households	Accumulation	Flows to the rest of the world Exports	Flows to the environment	Total use
	Agriculture, forestry and fishing	Mining & quarrying, Manufacturing and Construction	Electricity, gas, steam and air conditioning	Water collection, treatment and supply	Sewerage	Other industries					
(I) Sources of abstracted water											
Inland water resources											
Surface water	55.3	79.7	301.0	4.5	0.1						440.6
Groundwater	3.1	34.8	3.2	432.9		2.3					476.3
Soil water	50.0										50.0
Total	108.4	114.5	304.2	437.4	0.1	2.3					966.9
Other water sources											
Precipitation				1.0	100.0						101.0
Sea water			100.0	1.1							101.1
Total	0.0	0.0	100.0	2.1	100.0	0.0					202.1
Total use abstracted water	108.4	114.5	404.2	439.5	100.1	2.3					1 169.0
(II) Abstracted water											
Distributed water	38.7	45.0	3.9			51.1	239.5				378.2
Own use	108.4	114.6	404.2	50.4	100.1	2.3	10.8				790.8
(III) Wastewater and reused water											
Wastewater											
Wastewater received from other units					427.1						427.1
Own treatment	12.0	40.7									52.7
Reused water											
Distributed reuse											
Own use											
Total	12.0	40.7			427.1						479.8
(IV) Return flows of water											
Returns of water to the environment											
To inland water resources										668.6	668.6
To other sources										362.4	362.4
Total return flows										1 031.0	1 031.0
(V) Evaporation of abstracted water, transpiration and water incorporated into products											
Evaporation of abstracted water										138.0	138.0
Transpiration											
Water incorporated into products											
Total use	267.5	314.8	812.3	489.9	627.3	55.7	250.3			1 169.0	3 986.8

Water Use Table

1. Water use

- water intake of industries and households for production and consumption activities. Water Use is the sum of water use within the economy and water use from the environment.

2. Water use within the economy

- water intake for production and consumption activities, which is distributed by industries or households and by the Rest of the World (Imports).

3. Water use from the environment

- water abstracted from water resources, seas and oceans, and precipitation collected by industries and households for production and consumption activities, including rain-fed agriculture.

PSUT: Abstraction of water

Physical supply table for water		Abstraction of water; Production of water; Generation of return flows							Flows from the rest of the world	Flows from the environment	Total supply
		Agriculture, forestry and fishing	Mining & quarrying, Manufacturing and Construction	Electricity, gas, steam and air conditioning supply	Water collection, treatment and supply	Sewerage	Other industries	Households	Imports		
(l) Sources of abstracted water											
	Inland water resources										
	Surface water									440.6	440.6
	Groundwater									476.3	476.3
	Soil water									50.0	50.0
	Total									966.9	966.9
	Other water sources										
	Precipitation									101.0	101.0
	Sea water									101.1	101.1
	Total									202.1	202.1
	Total supply abstracted water									1 169.0	1 169.0

Physical use table for water		Abstraction of water; Intermediate consumption; Return flows						Final consumption	Accumulation	Flows to the rest of the world	Flows to the environment	Total use
		Agriculture, forestry and fishing	Mining & quarrying, Manufacturing and Construction	Electricity, gas, steam and air conditioning supply	Water collection, treatment and supply	Sewerage	Other industries	Households	Exports			
(l) Sources of abstracted water												
	Inland water resources											
	Surface water	55.3	79.7	301.0	4.5	0.1					440.6	
	Groundwater	3.1	34.8	3.2	432.9		2.3				476.3	
	Soil water	50.0									50.0	
	Total	108.4	114.5	304.2	437.4	0.1	2.3				966.9	
	Other water sources											
	Precipitation				1.0	100.0					101.0	
	Sea water			100.0	1.1						101.1	
	Total	0.0	0.0	100.0	2.1	100.0	0.0				202.1	
	Total use abstracted water	108.4	114.5	404.2	439.5	100.1	2.3				1 169.0	

PSUT: Distribution and use of abstracted water

Physical supply table for water	Abstraction of water; Production of water; Generation of return flows							Flows from the rest of the world	Flows from the environment	Total supply
	Agriculture, forestry and fishing	Mining & quarrying, Manufacturing and Construction	Electricity, gas, steam and air conditioning supply	Water collection, treatment and supply	Sewerage	Other industries	Households			
(II) Abstracted water								Imports		
For distribution										378.2
For own-use	108.4	114.6	404.2	61.2	100.1	2.3				790.8

Physical use table for water	Abstraction of water; Intermediate consumption; Return flows							Final consumption	Accumulation	Flows to the rest of the world	Flows to the environment	Total use
	Agriculture, forestry and fishing	Mining & quarrying, Manufacturing and Construction	Electricity, gas, steam and air conditioning supply	Water collection, treatment and supply	Sewerage	Other industries	Households					
(II) Abstracted water										Exports		
Distributed water	38.7	45.0	3.9				51.1	239.5				378.2
Own use	108.4	114.6	404.2	50.4	100.1	2.3		10.8				790.8

PSUT: Flows of wastewater and reused water

		Abstraction of water; Production of water; Generation of return flows							Flows from the rest of the world	Flows from the environment	Total supply
		Agriculture, forestry and fishing	Mining & quarrying, Manufacturing and Construction	Electricity, gas, steam and air conditioning supply	Water collection, treatment and supply	Sewerage	Other industries	Households	Imports		
(III)	Wastewater and reused water										
	Wastewater										
	Wastewater to treatment	17.9	117.6	5.6	1.4		49.1	235.5			427.1
	Own treatment										
	Reused water produced										
	For distribution						42.7				42.7
	For own use		10.0								10.0

Physical use table for water		Abstraction of water; Intermediate consumption; Return flows							Final consumption	Accumulation	Flows to the rest of the world	Flows to the environment	Total use
		Agriculture, forestry and fishing	Mining & quarrying, Manufacturing and Construction	Electricity, gas, steam and air conditioning supply	Water collection, treatment and supply	Sewerage	Other industries	Households		Exports			
(III)	Wastewater and reused water												
	Wastewater												
	Wastewater received from other units					427.1						427.1	
	Own treatment	12.0	40.7									52.7	
	Reused water												
	Distributed reuse												
	Own use												
	Total	12.0	40.7			427.1						479.8	

PSUT: Return flows of water to the environment

Physical supply table for water		Abstraction of water; Production of water; Generation of return flows							Flows from the rest of the world	Flows from the environment	Total supply
		Agriculture, forestry and fishing	Mining & quarrying, Manufacturing and Construction	Electricity, gas, steam and air conditioning supply	Water collection, treatment and supply	Sewerage	Other industries	Households	Imports		
(IV) Return flows of water											
To inland water resources											
Surface water				300.0		52.5	0.2	0.5			353.2
Ground water	65.0		23.5		47.3	175.0	0.5	4.1			315.4
Soil water											
Total	65.0		23.5	300.0	47.3	227.5	0.7	4.6			668.6
To other sources			5.9	100.0		256.3		0.2			362.4
Total Return flows	65.0		29.4	400.0	47.3	483.8	0.7	4.8			1 031.0

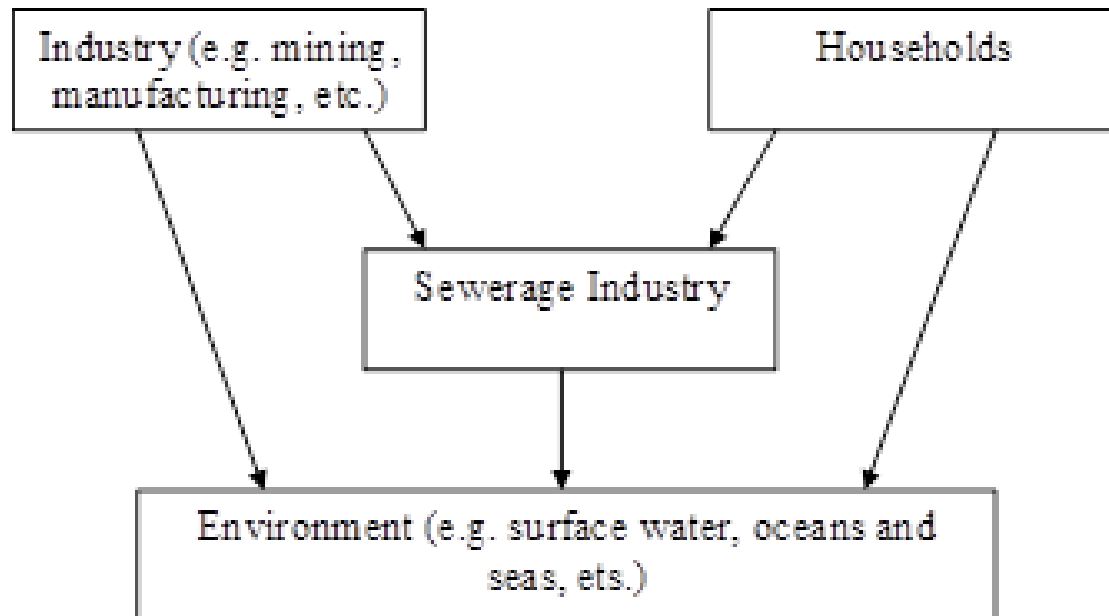
		Abstraction of water; Intermediate consumption; Return flows							Final consumption	Accumulation	Flows to the rest of the world	Flows to the environment	Total use
		Agriculture, forestry and fishing	Mining & quarrying, Manufacturing and Construction	Electricity, gas, steam and air conditioning supply	Water collection, treatment and supply	Sewerage	Other industries	Households		Exports			
(IV) Return flows of water													
Returns of water to the environment													
To inland water resources											668.6	668.6	
To other sources											362.4	362.4	
Total return flows											1 031.0	1 031.0	



Accounting for emissions to water

Accounting for emissions to water

- Substances released to water resources by establishments and households as a result of production, consumption and accumulation process
- Flows:



Accounting for emissions to water

- Cover
 - Substances added to wastewater and collected in the sewage system
 - Substances added to wastewater and discharged directly to water bodies
- Point sources
 - Geographical location of the discharge of the wastewater is identified (e.g. sewage facilities)
- Non-point sources
 - Without a single point of origin or a specific outlet into a receiving water resources (e.g. urban runoff)

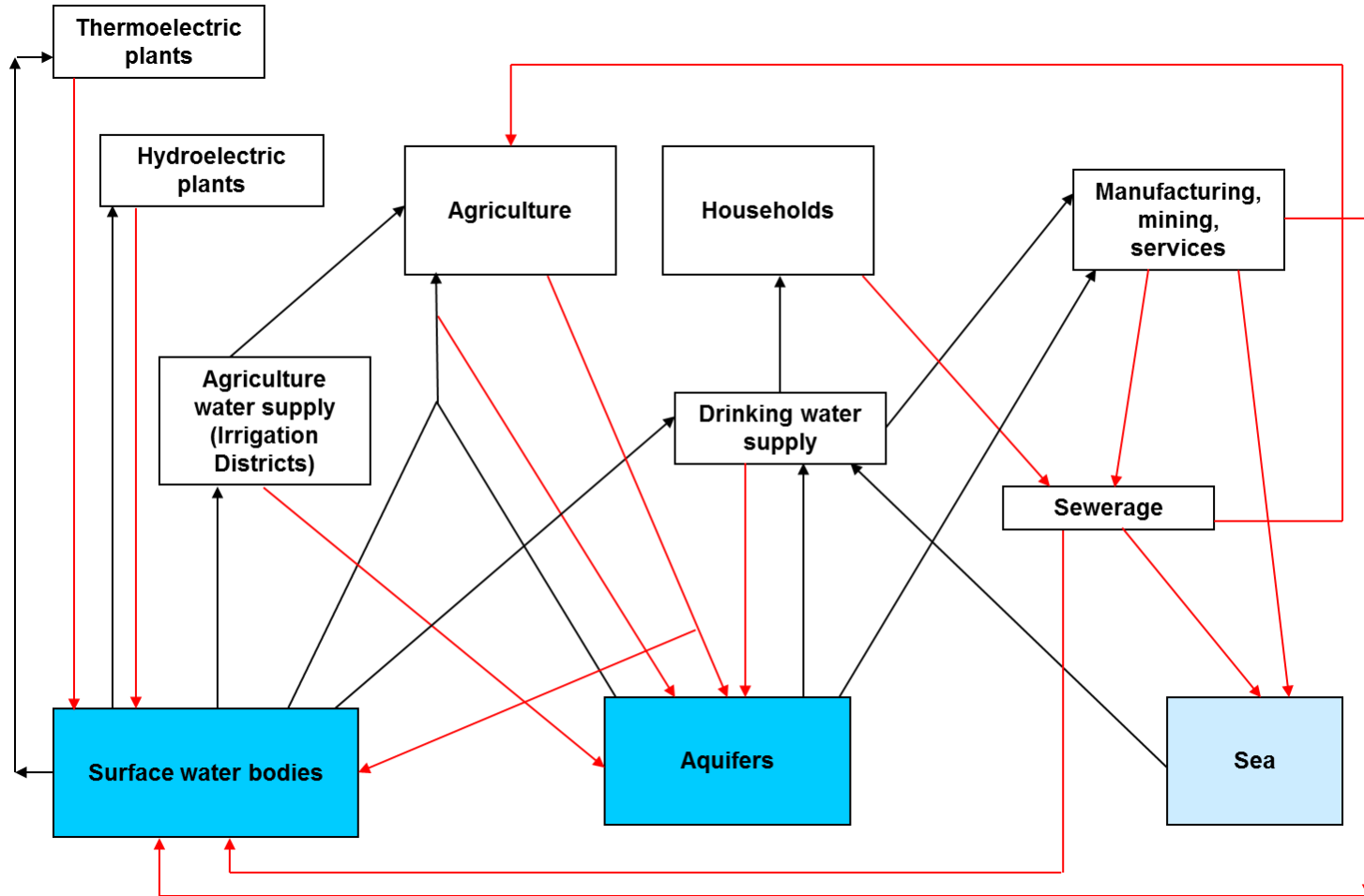
PSUT: Key components

- Emission by types of substances (supply) and received by the environment (use)
 - Direct flow to the environment
- Release to (supply) and collection by (use) economic units
 - Flow to sewage industry

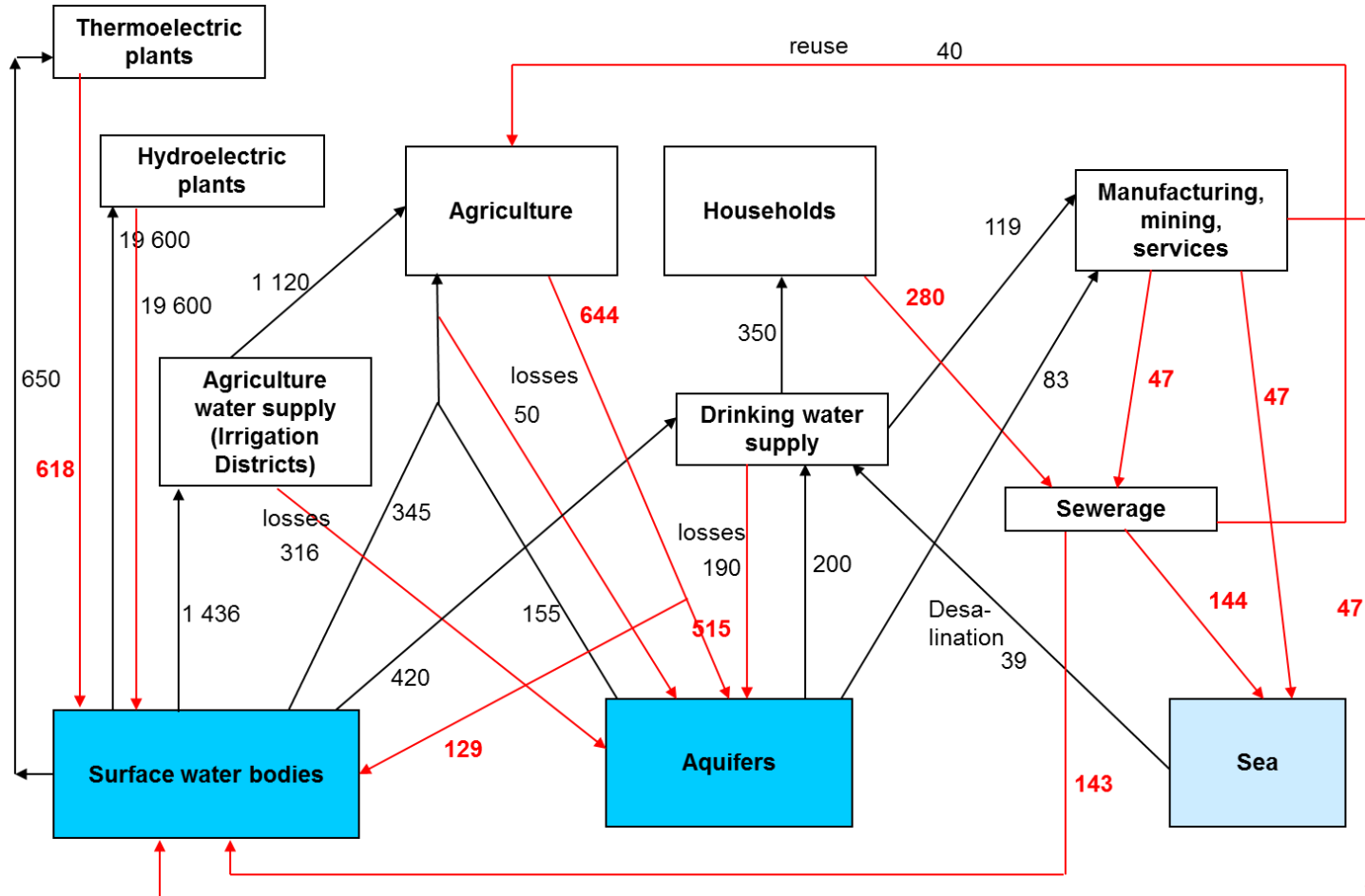
PSUT for water emission

Physical supply table for gross releases of substances to water							
	Generation of gross releases to water			Accumulation	Flows with the rest of the world	Flows from the environment	Total supply
	Sewerage industry	Other industries	Households	Emissions from fixed assets			
Emissions by type of substance							
BOD / COD *	5 594	11 998	2 712				20 304
Suspended solids							
Heavy metals							
Phosphorous	836	1 587	533				2 956
Nitrogen	10 033	47 258	1 908				59 199
Releases to other economic units							
BOD / COD *		7 927	8 950				16 877
Suspended solids							
Heavy metals							
Phosphorous		814	6 786				7 600
Nitrogen		15 139	30 463				45 602
Physical use table for gross releases of substances to water							
	Collection of gross releases to water				Flows with the rest of the world	Flows to the environment	Total use
	Sewerage industry	Other industries	Households				
Emissions received by the environment							
BOD / COD *						20 304	20 304
Suspended solids							
Heavy metals							
Phosphorous						2 956	2 956
Nitrogen						59 199	59 199
Collection by other economic units							
BOD / COD *	16 877						16 877
Suspended solids							
Heavy metals							
Phosphorous	7 600						7 600
Nitrogen	45 602						45 602

Compilation Exercise :



Compilation Exercise



Create your own PSUT-supply



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										
Ground water										
Sea water										
Water, drinking (CPC 18-A)										
Water, irrigation (CPC 18-B)										
Reuse water										
Losses										
Wastewater										
Evaporation, transpiration, included in products										
Total										

Create your own PSUT-use



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										
Ground water										
Sea water										
Water, drinking (CPC 18-A)										
Water, irrigation (CPC 18-B)										
Reuse water										
Losses										
Wastewater										
Evaporation, transpiration, included in products										
Total										

Data sources and compilation

Data sources:

- Survey data
- Administrative data
- Modelled data Existing statistics
- ...

Issues:

- Estimating for sectors not covered by surveys
- Understanding the impact of the C.V. on the analysis
- Consistency with National Account concepts
- Compiling time series
- ...

Real world example - Canada

- Data sources
- Selected accounts results

Current Water Surveys

- Industrial Water Survey
- Survey of Drinking Water Plants
- Agricultural Water Survey

- Households and the Environment Survey

Industrial Water Survey



- First conducted in 1972 by Statistics Canada for Environment Canada, the survey was conducted every 5 years until 1996 when cancelled due to budget cuts.
- Funding revived in 2004 through the Canadian Environmental Sustainability Indicators (CESI) project to provide data for a national water quality indicator.
- Survey run every 2 years since 2005. 2013 data now being processed and will be released by October this year. 2015 data collection will be in field by April 2016.

Industrial Water Survey



- The Industrial Water Survey is composed of three distinct questionnaires:
 - Manufacturing
 - Mining
 - Thermal electric

Industrial Water Survey

- The Industrial Water Survey collects information on:
 - water intake and intake treatment/purpose
 - water recirculation (reuse)
 - water discharge and its treatment
 - water acquisition/treatment costs
 - water–related operating and maintenance expenses
- There are 36 data tables available through CANSIM:
153-0047 to 153-0051; and 153-0067 to 153-0097.

Survey of Drinking Water Plants

- This survey is a census of drinking water plants serving 300 or more people.
- Funding was secured in 2004 as part of the Canadian Environmental Sustainability Indicators (CESI) project to provide data for national water quality indicators.
- Survey run every 2 years since 2007. 2013 data being released on June 19, 2015. 2015 data collection will be in field by early 2016.

Survey of Drinking Water Plants

- The survey collects information on:
 - Volumes of water production (monthly & annual)
 - Source water type and source water quality (i.e. surface water turbidity)
 - Population served & sector uses (residential/ICI/losses)
 - Type of treatment
 - Financial costs including capital expenditures and operation and maintenance
- There are 9 data tables available through CANSIM: 153-0105 to 153-0108; and 153-0124 through 153-0128.

Agricultural Water Survey (AWS)

- This survey is conducted to gather information on irrigation water use, irrigation methods and practices, and sources and quality of water used for agricultural purposes on Canadian farms.
- Survey pilot was conducted in 2007 and has run every 2 years since 2010. 2014 data now being processed and will be released September 9th this year. 2016 data collection will be in field by October 2016.

Agricultural Water Survey

- The main topics covered include:
 - Volume of water used for irrigation
 - Area irrigated by crop type, yield and irrigation system
 - Sources of water: Groundwater/surface water, on-farm/off-farm
 - Irrigation methods and water management techniques
 - Water quality: intake treatment
- Currently there are 2 tables of data available through CANSIM (153-0099 and 153-0100). Will expand to 10 tables with the release of the 2014 data in September.

Households and the Environment Survey

- The Households and the Environment Survey measures the environmental practices and behaviours of Canadian households.
- The survey was first conducted in 1991 and repeated in 1994, 2006 and 2007. Since 2007 it has been run every 2 years.
- Partial 2013 data were released on March 10, 2015. All variables to be available in fall 2015. 2015 data collection will be in field in October 2015.

HES – select water-related content

- **Related to consumption or conservation of water:**
 - Source of water supply, water metering
 - Primary type of drinking water at home
 - Low flow showerheads, low volume toilets
 - Frequency of lawn, garden watering, sprinkler systems
 - Devices used to water lawns and gardens, timers, rain barrels, cisterns
- **Related to water quality**
 - Use of fertilizers, pesticides
 - Disposal of old medicines, old batteries
 - Septic system maintenance
 - Use of motor boats
- **Related to impacts of water quality (and concerns)**
 - Use of bottled water, home treatment of water - reasons
 - Boil water advisories
 - Water testing by labs – results
 - Beach use

Surveys: Current developments

1. Exploring use of administrative data for Industrial Water Survey (Oil & Gas) and the Agricultural Water Survey
2. Survey of Drinking Water Plants currently has an agreement with Quebec municipal affairs ministry to collect Quebec information in order to reduce burden
3. Conducted a feasibility study on sewage treatment statistics. We looked at gaps and user's data demands. Then determined what could be fulfilled using existing data and a new survey.

Selected accounts results



Table 153-0116 [1](#), [2](#), [3](#), [4](#), [6](#), [7](#), [8](#), [9](#)**Physical flow account for water use**
every 2 years (cubic metres x 1,000)

[Data table](#) [Add/Remove data](#) [Manipulate](#) [Download](#) [Related information](#) [Help](#)

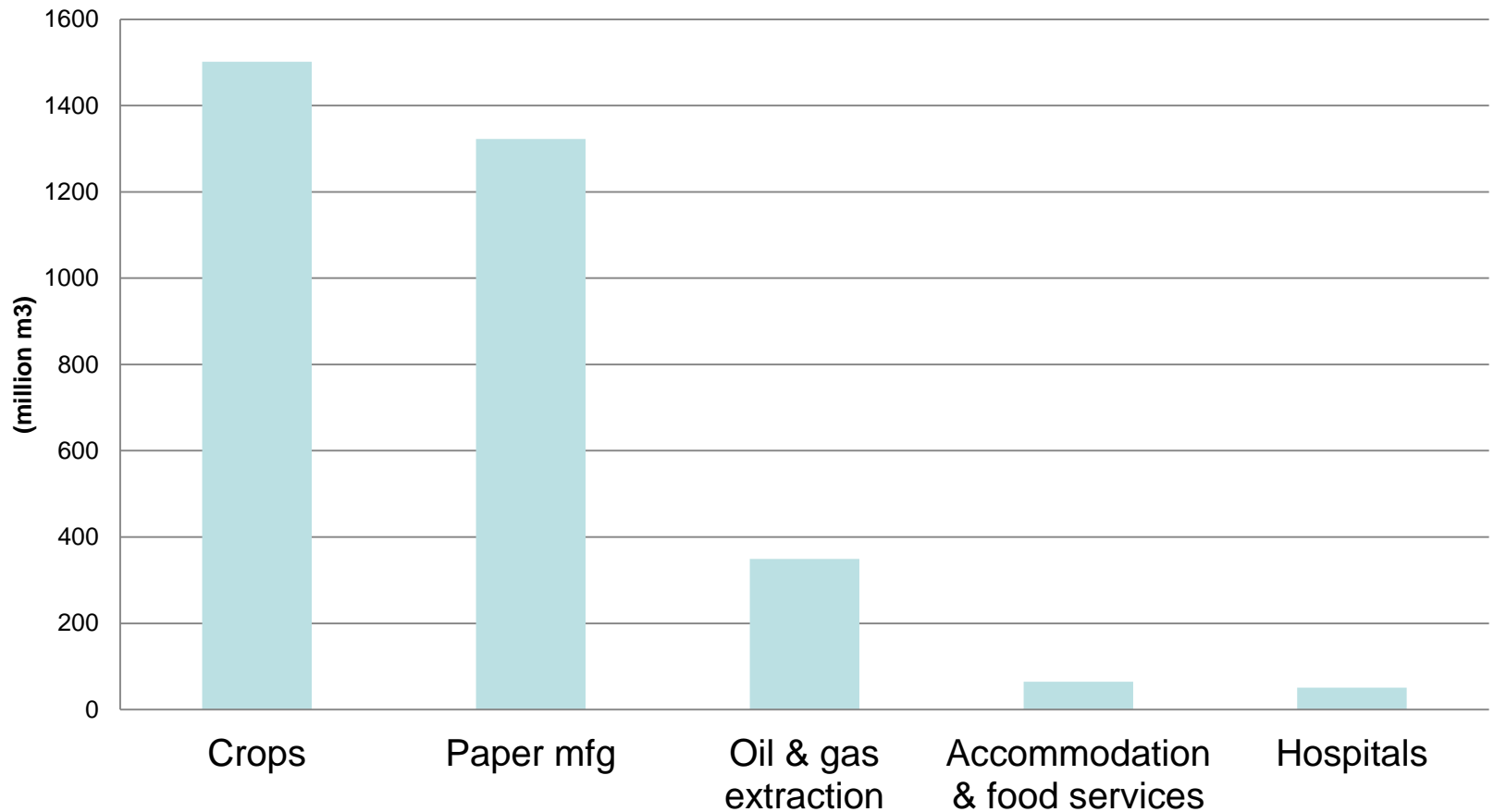
The data below is a part of CANSIM table 153-0116. Use the [Add/Remove data](#) tab to customize your table.

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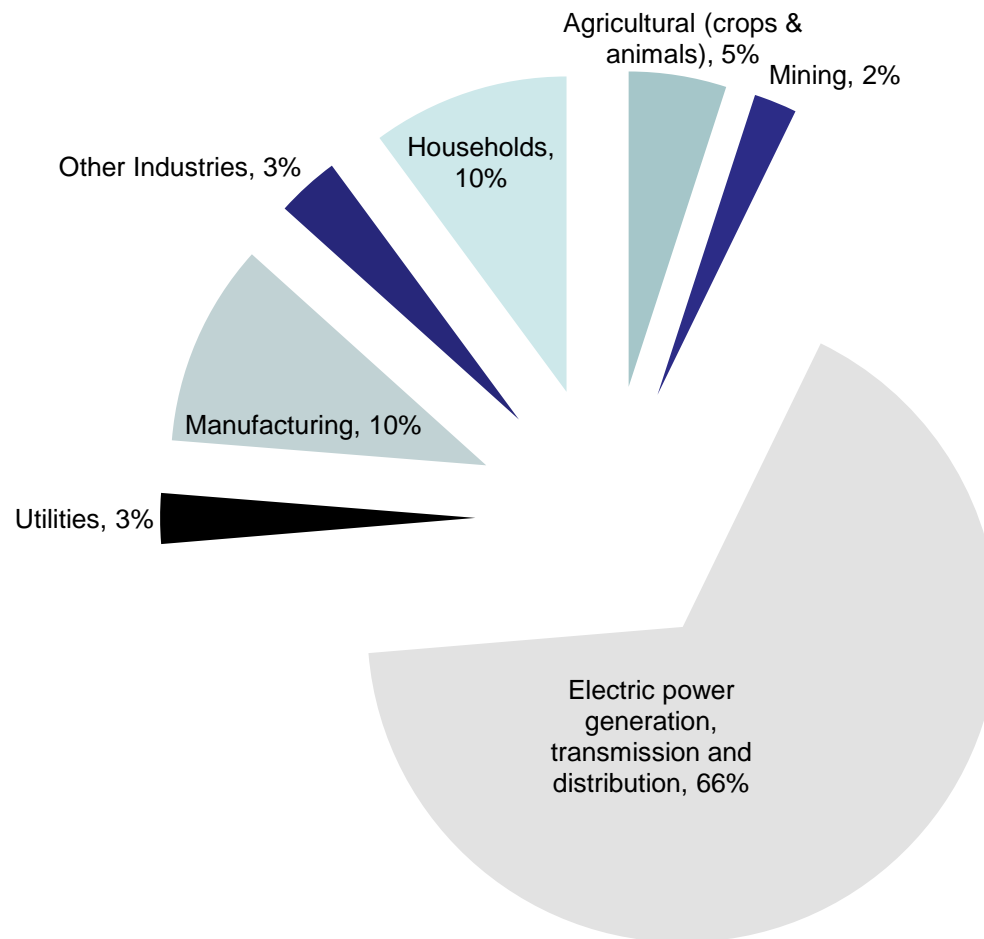
Geography = Canada

Sector	2009	2011
Total, industries and households	38,836,120	35,350,913
Total, industries	35,159,287	31,777,873
Crop production [BS111]	2,045,300	1,501,614
Animal production [BS112]	279,586	267,789
Forestry and logging [BS11300]	346	525
Fishing, hunting and trapping [BS11400]
Support activities for agriculture and forestry [BS11500]
Oil and gas extraction [BS21100]	293,060	349,362
Coal mining [BS21210]	20,966	33,632
Metal ore mining [BS21220]	319,054	260,066
Non-metallic mineral mining and quarrying [BS21230]	103,073	135,477
Support activities for mining and oil and gas extraction [BS21300]	9	39
Electric power generation, transmission and distribution [BS22110]	26,213,561	23,497,215
Natural gas distribution, water, sewage and other systems [BS221A0]	968,870	914,206
Residential building construction [BS23A00]	4,929	5,984
Non-residential building construction [BS23B00]	2,092	2,635
Transportation engineering construction [BS23C10]	87	147

PFA account, water use in Canada, selected industries, Canada, 2011



PFA account, water use in Canada, 2011



PFA account, water by final demand category

Physical flows by final demand category annual (data in thousands)

[Data table](#)
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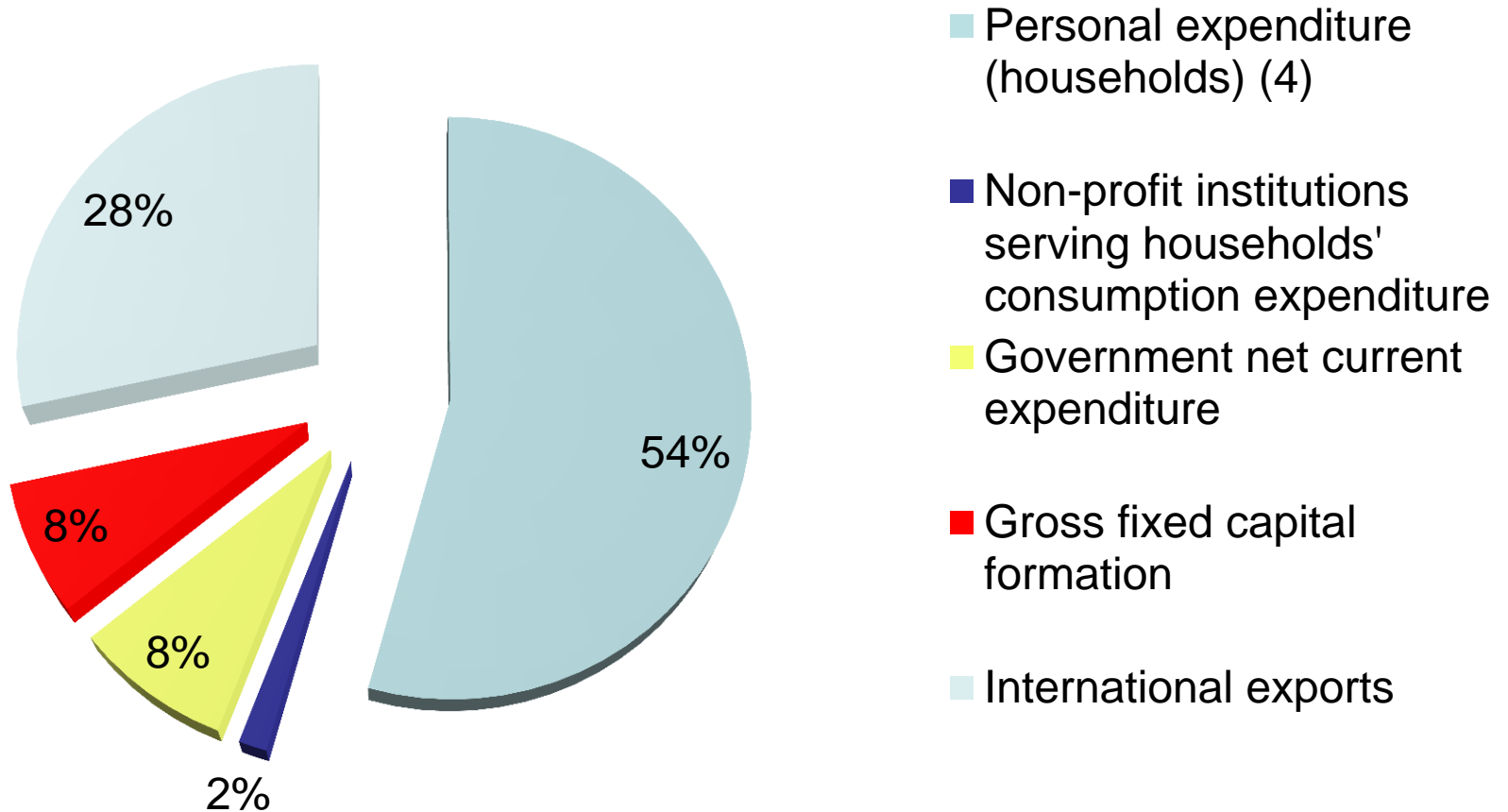
Selected items [\[Add/Remove data\]](#)

Geography = Canada

Flow = Water use by final demand category (cubic metres)

Sector	2009	2010	2011
Total, industries and households	38,836,120	..	35,350,913
Personal expenditure (households) ^a	21,251,873	..	19,220,080
Non-profit institutions serving households' consumption expenditure	576,527	..	524,918
Government net current expenditure	3,190,015	..	2,937,261
Gross fixed capital formation	2,805,129	..	2,626,545
International exports	11,012,576	..	10,042,109

PFA account, water by final demand category, 2011



Water Use by final demand categories, 2005

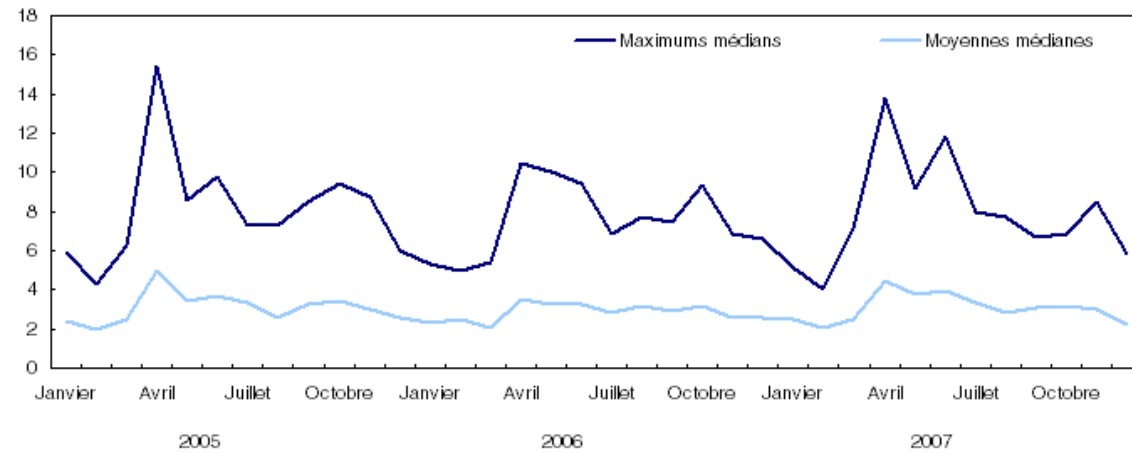
Including precipitation and hydro-electric power generation		
	Mm ³	percent
Internal demand	2,043,138	58.0
Personal expenditure	1,516,777	43.1
Machinery and equipment	57,978	1.6
Inventories	181,986	5.2
Construction	42,693	1.2
Government	243,703	6.9
External demand		
Exports	1,476,898	42.0
Total demand for water	3,520,036	100.0

...Excluding Hydro

	Including precipitation		Excluding precipitation	
	Mm ³	percent	Mm ³	percent
Internal demand	211,068	33.7	24,118	63.0
Personal expenditure	98,727	15.8	18,003	47.0
Machinery and equipment	6,890	1.1	731	1.9
Inventories	71,107	11.4	1,732	4.5
Construction	19,417	3.1	483	1.3
Government	14,927	2.4	3,169	8.3
External demand				
Exports	414,857	66.3	14,169	37.0
Total demand for water	625,925	100.0	38,287	100.0

Water Quality Account

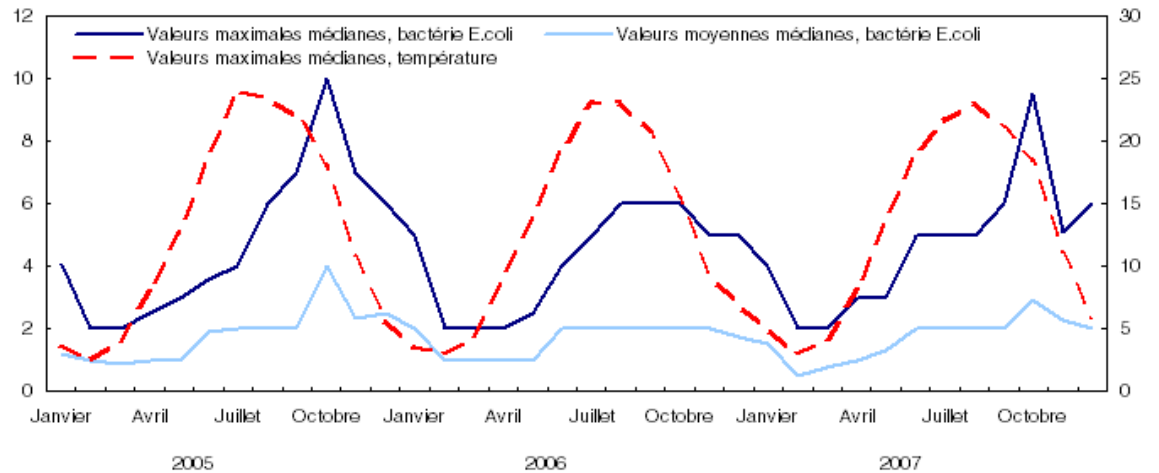
unités de turbidité néphélométrique (UTN)



Turbidity in raw water

Escherichia coli (E. coli) and water temperature

unités formatrices de colonies (UFC) par 100 ml



Physical Flow Accounts for Water

Thanks to the following individuals for sharing their ideas and material ...

- Murray Cameron
- Julian Chow
- Ricardo Martinez-Lagunes
- Joe St.-Lawrence
- Michael Vardon

And thanks to the NBS and UNSD for their kind invitation.

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Result PSUT-supply

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

Result PSUT-use



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