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UN recommendation on environmental accounting

Environmental accounting in the EU

Activity A.12: Methodology on environmental accounting with emphasis on air and waste accounts
9-12 December 2013

Jukka Muukkonen

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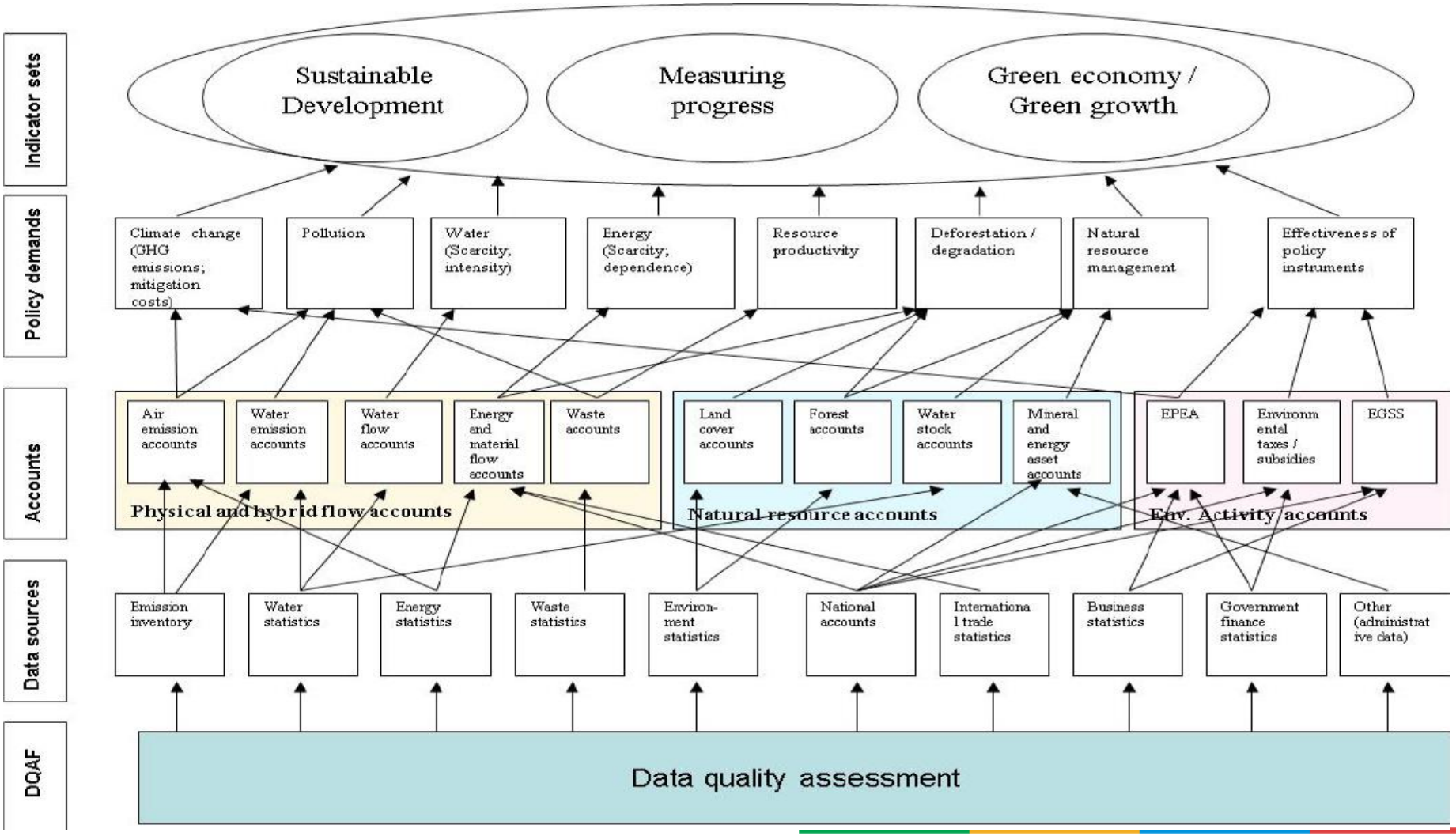
’ UN mission on environmental accounting’



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UN mission on environmental accounting

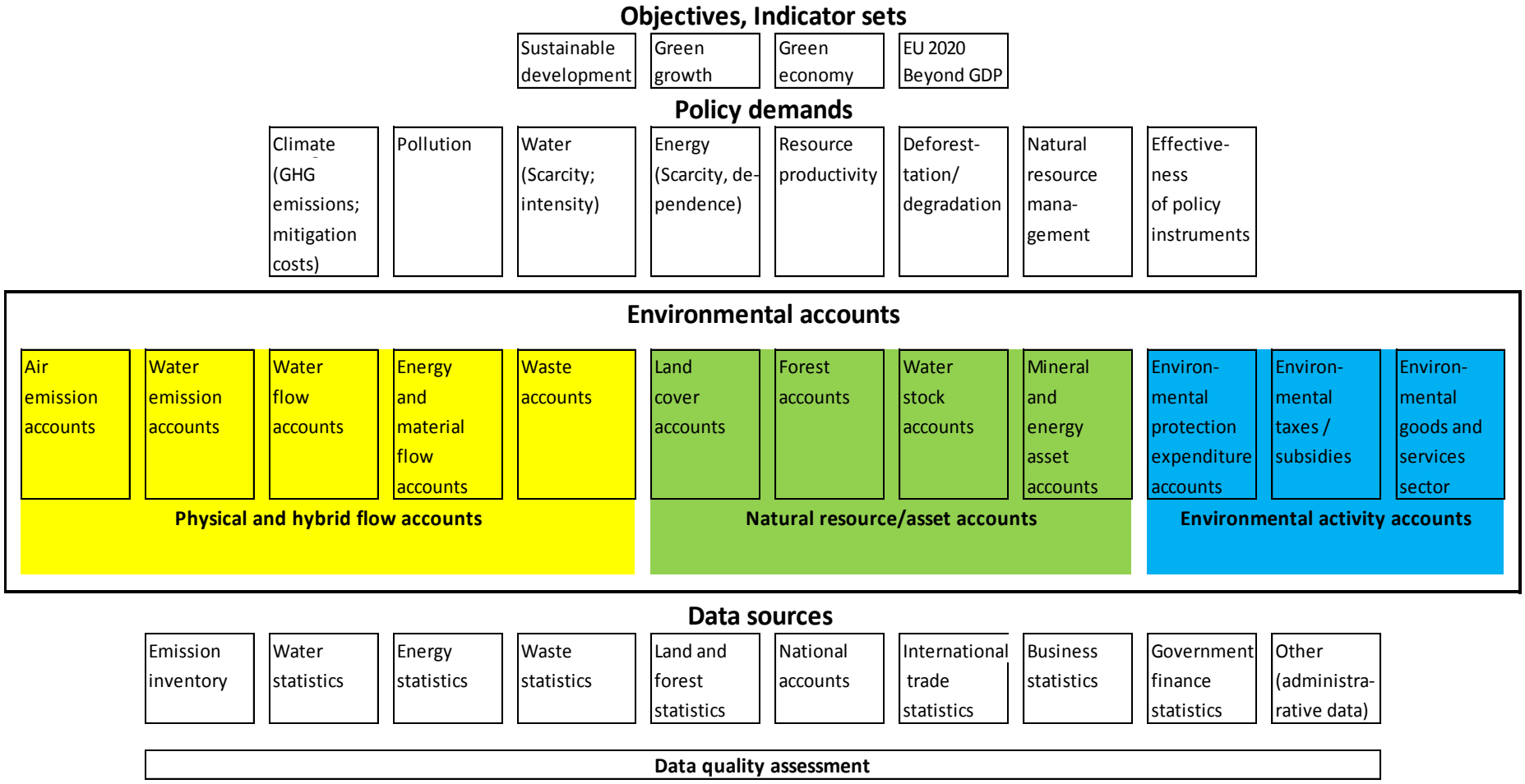

Figure A.1, Flow chart
Implementation Strategy for the System of Environmental-Economic Accounting SEEA
Prepared by the Committee of Experts on Environmental-Economic Accounting

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System of Environmental-Economic Accounting (SEEA)

- A satellite system of the System of National Accounts
- Brings together economic and environmental information in a common framework to measure the contribution of the environment to the economy and the impact of the economy on the environment
- It provides policy-makers with indicators and descriptive statistics to monitor these interactions as well as a database for strategic planning and policy analysis to identify more sustainable paths of development
- Developed under the joint responsibility of the United Nations, Eurostat, IMF, OECD and the World Bank

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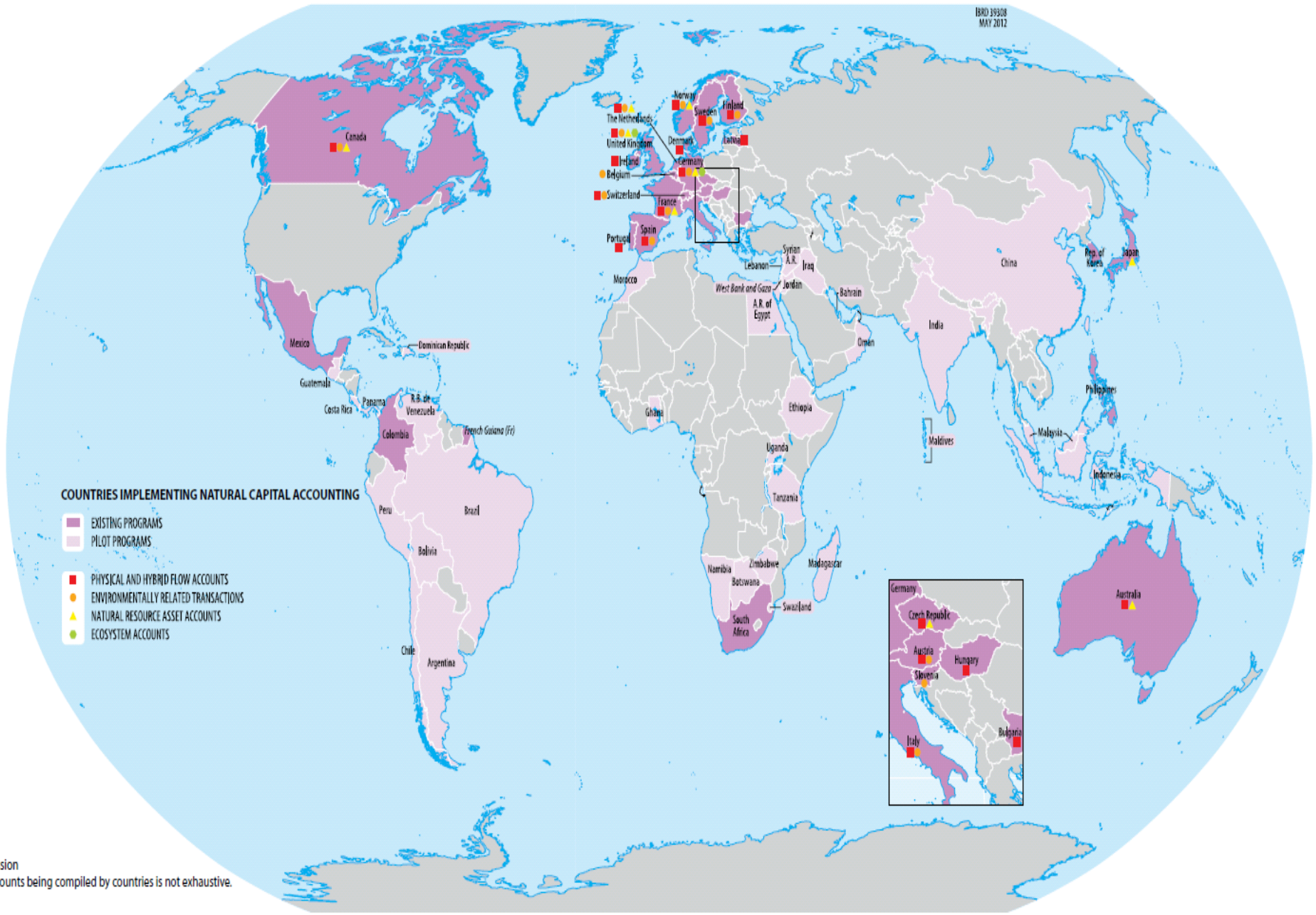
Some characteristics of SEEA

- Full – coherent system – consistent with the System of National Accounts, SNA (satellite system, i.e. same definitions/classifications)
- Combines environmental and economic data
- Macro-level accounts (e.g. industry level)
- Multipurpose system (several uses and users)
- Statistical system with interconnected accounts and tables – accounting rules
- Flexibility in implementation
  (Start with the most important and/or easy to get)
- UN programme to encourage and support countries to implement SEEA at applicable level



s Commission
on on accounts being compiled by countries is not exhaustive.

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Minimum required, recommended and desired SEEA datasets (draft)

	1 (minimum	2 (recomm	3 (desired)	Key aggregates
Physical flow accounts				
Full set of supply and use tables for materials			x	
E-W material flow accounts (materials use)		x		Domestic material consumption
PSUTs for water (water use)	x			Total water consumption
PSUTs for energy (energy use)	x			Total net energy consumption
Air emissions accounts	x			Net emissions to air
Water emissions accounts		x		Net emissions to water
Waste accounts		x		Net emissions
Monetary flow acocunts				
Environmental Protection expenditure Accounts	x			Total environmental protection expenditure
Resorce Use and Management Expenditure Accounts		x		Total resource management expenditure
Environmental goods and Services Sector		x		EGSS: total value added and employment
Environmentally related payments to government	x			Total environmental taxes
Environmentally related payments by government		x		Total environmentally motivated subsidies
Emission permits	x			
Permits and licences to use environmental assets			x	
Costs related to termination of fixed assets			x	
Asset accounts				Depletion (in physical and monetary terms)
Mineral and energy resources	x			
Land (forest)	x			
Soil resources			x	
Timber resources		x		
Fish resources		x		
Other biological resources			x	
Water resources			x	

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UN handbooks on environmental accounting

Environmeltal Accounting	Economic Statistics, Energy Statistics, Water Statistics
Handbook of National Accounting: Integrated Environment and Economic Accounting 1993 (SEEA 1993)	System of National Accounts 1993 (SNA 1993)
Handbook of National Accounting: Integrated Environmental and Economic Accounting 2003 (SEEA 2003)	
Handbook of National Accounting: Integrated Environmental and Economic Accounting for Fisheries 2004 (SEEA-F)	System of National Accounts 2008 (SNA 2008)
System of Environmental-Economic Accounting for Water 2007 (SEEA-Water)	International Recommendations for Water Statistics 2010 (IRWS)
System of Environmental-Economic Accounting Central Framework 2012 (SEEA CF)	
Experimental Ecosystem Accounts 2013 (SEEA part 2) Extensions and Applications 2013 (SEEA part 3)	International Recommendation for Energy Statistics 2011 (IRES)
System of Environmental-Economic Accounting for Energy 2013 (SEEA-Energy)	Energy Statistics Compilation Manual 2013 (ESCM)

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System of Environmental-Economic Accounting SEEA

- Part 1: SEEA Central Framework: The international statistical standard
  - Physical flow accounts (input-output, residuals, effective use of resources).
  - Monetary flow accounts (supply and demand).
  - Asset accounts (strong and week sustainability).
- Part 2: Experimental Ecosystem Accounting
  - Ecosystem services (from natural resources to ecosystem services).
- Part 3: SEEA Applications and Extensions
  - Highlights the potential of data from environmental accounts to be applied to a range of policy and research questions

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Environmental issues and accounts discussed in SEEA

Accounting principle	Issue: Degradation/ Pollution (Flows)	Environmental protection	Natural Resources (Stocks)
Physical accounting	Material flow accounting MFA Input-output tables Supply-use tables		Physical asset accounts for environmental resources (Extended definition of natural resources)
Hybrid accounting	Physical/monetary input-output and supply-use tables		
Monetary accounting SNA environmental disaggregations		Environmental protection expenditures, Environmental goods and services, Environmental taxes, subsidies	Valuation of resource stocks
Variations of the SNA and indicators	Valuation of degradation Adjustment of macro-aggregates, e.g. green GDP and NDP Footprint indicators, e.g. ecological, water, CO_2		

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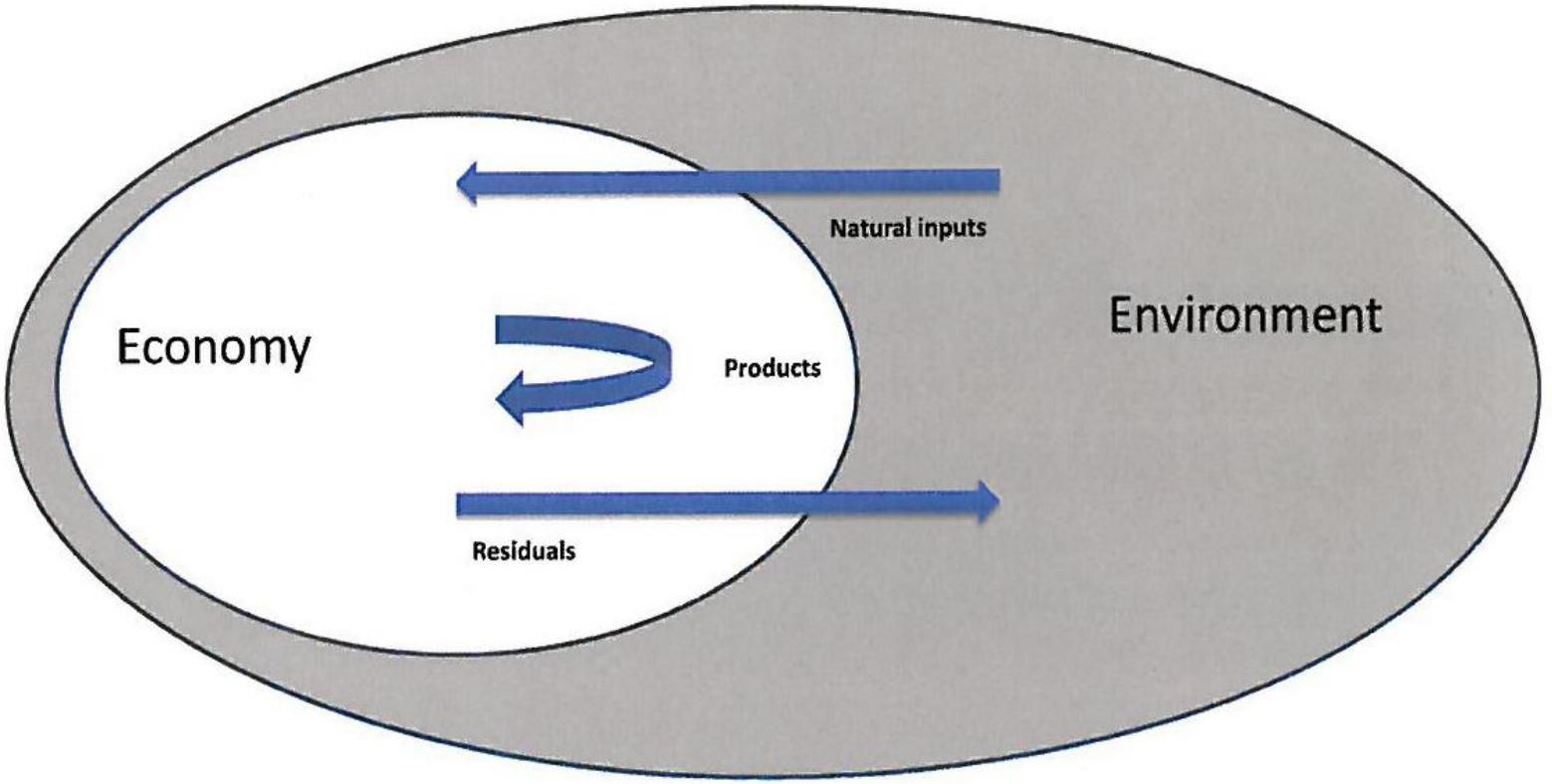
Contents of the SEEA Central Framework (SEEA CF)

- 1. Introduction to the SEEA Central Framework
- 2. Accounting Structure
- **3. Physical Flow Accounts**
  - **Natural inputs, products, residuals**
  - **energy, water, materials**
- **4. Environmental Activity Accounts and Related Flows**
  - **Environmental expenditures, environmental goods and services sector, environmental taxes and transfers**
- **5. Asset Accounts**
  - **Mineral and energy resources, land, soil, timber, aquatic and other resources, water resources**
- 6. Integrating and presenting the accounts

Flows between the economy and the environment

Figure 2.2.1 Physical flows of natural inputs, products and residuals



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Flows between the economy and the environment

- Natural inputs:
  material, air, water, space, light, heat, wind, other flows
- Products in the economy:
  raw materials, intermediate products, final products (e.g. by CPC)
- Residuals:
  waste, emissions into air, emissions into water,
  residuals from dissipative use of products, dissipative losses,
  natural resource residuals

SEEA CF: Natural inputs

Table 3.2.2 Classes of natural inputs

Natural resource inputs

- Extraction used in production
  - Mineral and energy resources
    - Oil resources
    - Natural gas resources
    - Coal and peat resources
    - Non-metallic mineral resources
    - Metallic mineral resources
  - Soil resources (excavated)
  - Natural timber resources
  - Natural aquatic resources
  - Other natural biological resources
  - Water resources
    - Surface water
    - Groundwater
    - Soil water
- Natural resource residuals

Inputs of energy from renewable sources

- Solar
- Hydro
- Wind
- Wave and tidal
- Geothermal
- Other electricity and heat

Other natural inputs

- Inputs from soil
  - Soil nutrients
  - Soil carbon
  - Other inputs from soil
- Inputs from air
  - Nitrogen
  - Oxygen
  - Carbon dioxide
  - Other inputs from air
- Other natural inputs n.e.c.

Stocks and flows in environmental accounting

Stocks 1.1. and 31.12.
Changes in stocks

- Mineral and energy resources:
  metals, other minerals, oil, gas, coal, peat
- Land (space)
- Soil
- Timber: cultivated, natural
- Aquatic resources: cultivated, natural
- Other biological resources
- Water: surface, ground, soil water

- Growth, discoveries
- Extraction, natural losses, catasrophes
- Reappraisals, revaluations

Flows, supply and use 1.1.– 31.12.
By industry and by material

- Natural inputs: material, air, water, space, light, heat, wind, other flows
- Products in the economy:
  raw materials, intermediate products, final products
- Residuals: waste, emissions into air, emissions into water, dissipative residuals and losses, natural resource residuals

- Environmental expenditures,
- Environmental goods and services
- Environmental taxes and transfers
- Env. licences, emission trade

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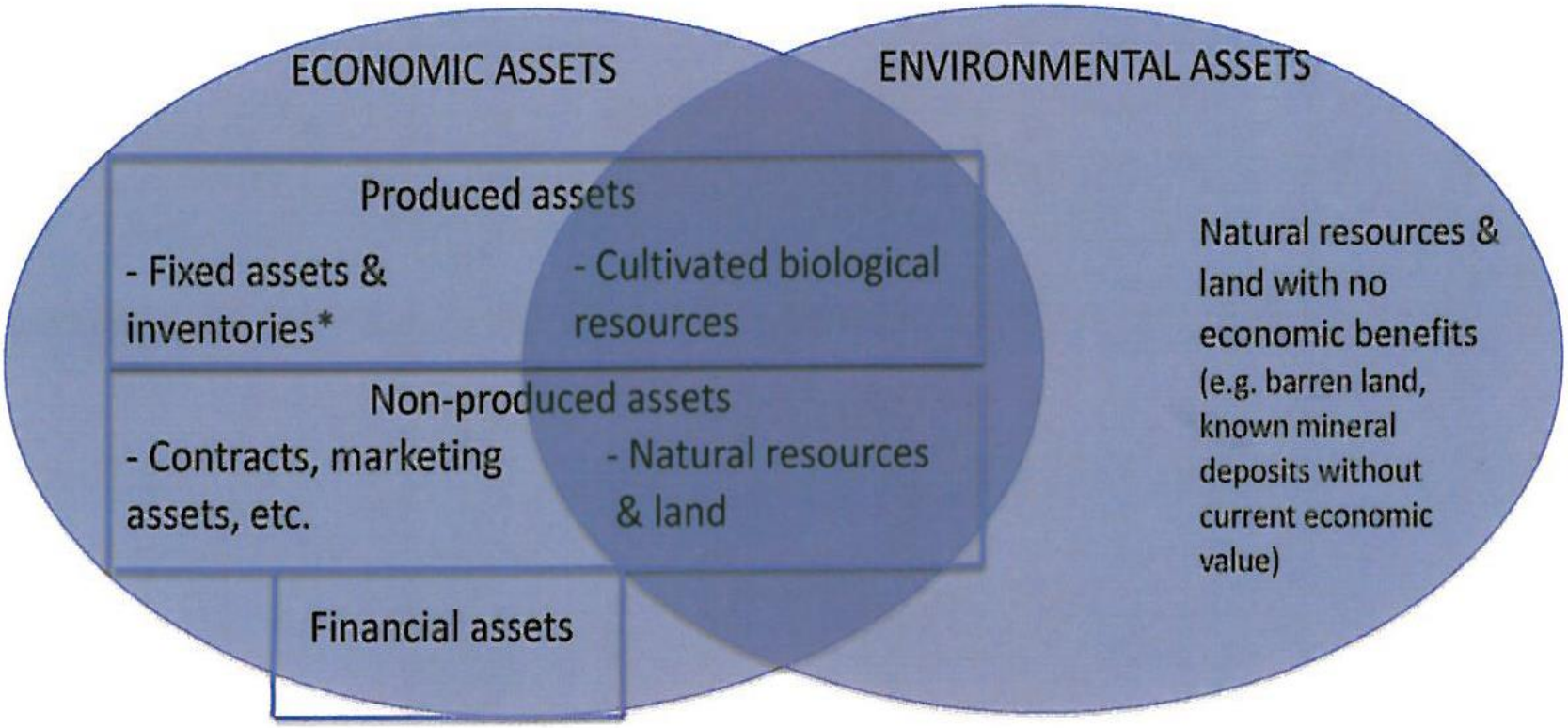
CEEA CF: Economic assets and environmental assets

Figure 5.2.1 Relationship between environmental and economic assets



* other than cultivated biological resources

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SEEA CF: Basic model for stock balance

Table 5.3.1 General structure of the physical asset account for environmental assets (physical units)

	Mineral & energy resources	Land (incl. forest land)	Soil resources	Timber resources		Aquatic resources		Water resources
				Cultivated	Natural	Cultivated	Natural	
Opening stock of resources	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Growth in stock	na	Yes*	Soil formation Soil deposition	Growth	Natural growth	Growth	Natural growth	Precipitation Return flows
Discoveries of new stock	Yes	na	na	na	na	Yes*	Yes*	Yes*
Upwards reappraisals	Yes	Yes	Yes*	Yes*	Yes*	Yes*	Yes	Yes*
Reclassifications	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Total additions to stock								
Extractions	Extractions	na	Soil extraction	Removal	Removal	Harvest	Gross catch	Abstraction
Normal reductions in stock	na	na	Erosion	Natural losses	Natural losses	Normal losses	Normal losses	Evaporation Evapotranspirat.
Catastrophic losses	Yes*	Yes*	Yes*	Yes	Yes	Yes	Yes	Yes*
Downwards reappraisals	Yes	Yes	Yes*	Yes*	Yes*	Yes	Yes	Yes*
Reclassifications	Yes	Yes	Yes	Yes	Yes	Yes	Yes	na
Total reductions in stock								
Closing stock of resources	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

na – not applicable

* - not usually significant for the resource or it is typically not separately identified in the source data

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SEEA CF: An example on asset accounts

Table 5.5.4 Monetary asset account for mineral and energy resources (currency units)

	Type of mineral and energy resource (Class A: Commercially recoverable resources)				
	Oil resources	**Natural gas resources**	**Coal & peat resources**	**Non-metallic minerals**	**Metallic minerals**
Opening value of stock of resources	24 463	19 059	41 366	1 668	6 893
Additions to value of stock					
Discoveries					1 667
Upwards reappraisals		3 100		391	
Reclassifications					
Total additions to stock		3 100		391	1 667
Reductions in value of stock					
Extractions	1 234	775	4 467	98	333
Catastrophic losses					
Downwards reappraisals			4 467		
Reclassifications					
Total reductions in stock	1 234	775	8 934	98	333
Revaluations	412	-972	5 945	-442	-4 287
Closing value of stock of resources	23 641	20 412	38 377	1 519	3 940

(Class B: Potentially commercially recoverable resources)

(Class C: Non-commercial and other known deposits)

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SEEA CF: Supply and Use Table

Table 2.3.2 Basic form of a Physical Supply and Use Table*

SUPPLY TABLE						
	Industries	**Households**	**Accumulation**	**Rest of the World**	**Environment**	**Totals**
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 household final consumption	Residuals from scrapping and demolition of produced assets			Total supply of residuals
USE TABLE						
	Industries	**Households**	**Accumulation**	**Rest of the World**	**Environment**	**Totals**
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 & treatment of waste and other residuals		Accumulation of waste in controlled landfill sites		Residual flows direct to environment	Total use of residuals

* Note: Grey cells are null by definition. Blank cells may contain relevant flows. These flows are explained in detail in Chapter 3.

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Classifications in the SEEA Central Framework

- The SEEA CF contains a range of classifications and lists to support understanding of the relevant concepts and compilation of relevant statistics.
- None of the classifications and lists should be considered as mandatory for reporting purposes.

- A. Classification of Environmental Activities
  - I. Environmental Protection
  - II. Resource Management (interim)
- B. Classification of Land Use (interim)
- C. Land Cover Classification (interim)
- D. List of Solid Waste

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The scope and definition of environmental activities

- The scope of environmental activities is those economic activities whose **primary purpose** is to reduce or eliminate pressures on the environment or to make more efficient use of natural resources.
- **Environmental protection activities are those activities whose primary purpose is the prevention, reduction and elimination of pollution and other forms of degradation of the environment.**
- **Resource management activities are those activities whose primary purpose is preserving and maintaining the stock of natural resources and hence safeguarding against depletion.**
- Activities are environmental activities only if the primary purpose of the activity is consistent with the definitions of the environmental protection or resource management.

A. Classification of Environmental Activities

I: Environmental Protection

1 Protection of ambient air and climate
2 Wastewater management
3 Waste management
4 Protection and remediation of soil and water
5 Noise and vibration abatement
6 Protection of biodiversity and landscapes
7 Protection against radiation
8 Research and development for environmental protection
9 Other environmental protection activities

II: Resource Management

10 Management of mineral and energy resources
11 Management of timber resources
12 Management of aquatic resources
13 Management of other biological resources
14 Management of water resources
15 Research and development for resource management
16 Other resource management activities

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D. List of Solid Waste

01 Chemical and healthcare waste	**06 Animal and vegetal wastes**
- Spent solvents	- Animal and mixed food waste
- Acid, alkaline or saline wastes (hazardous)	- Vegetal wastes
- Used oils (hazardous)	- Animal faeces, urine and manure
- Chemical wastes (hazardous)	**07 Mixed residential and commercial wastes**
- Industrial effluent sludges (hazardous)	- Mixed municipal waste,
- Sludges and liquid wastes from waste treatment (hazardous)	- Waste from markets
- Health care and biological wastes (hazardous)	- Bulky waste and
02 Radioactive waste	- Street cleaning residues
03 Metallic waste	**08 Mineral wastes and soils**
- Metallic wastes, ferrous	- Mineral waste from construction and demolition (hazardous)
- Metallic wastes, non-ferrous	- Other mineral wastes (hazardous)
- Metallic wastes, mixed ferrous and non-ferrous	- Soils (hazardous)
04 Non-metallic recyclables	- Dredging spoils (hazardous)
- Glass wastes (hazardous)	- Mineral wastes from waste treatment and stabilised wastes (hazardous)
- Paper and cardboard wastes	**09 Combustion wastes**
- Plastic wastes	- Combustion wastes (hazardous)
- Wood wastes (hazardous)	**10 Other wastes**
- Textile wastes	- Mixed and undifferentiated materials (hazardous)
- Rubber wastes	- Sorting residues (hazardous)
05 Discarded equipment and vehicles	- Common sludges
- Waste containing PCB (hazardous)	
- Discarded equipment (hazardous)	
- Discarded vehicles (hazardous)	
- Batteries and accumulators wastes (hazardous)	

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UN SEEA CF and environmental accounting in EU

- Many European countries and Eurostat have been strongly involved in development of the SEEA CF.
- Environmental accounting in EU countries is an application of the SEEA CF.
- According to the EU strategy on environmental accounting, in the near future EU is focusing on physical and monetary flows.
- Accounting of environmental stocks is developed as a part of national accounting system of the EU (ESA). Data on physical stocks and changes in them is needed in calculating and estimating monetary values for the ESA purposes.

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Environmental accounting in the EU and in Finland

EU strategy on environmental accounting

- Objectives of sustainable development, environmental policy, the Lisbon treaty
- The sixth environmental program of the EU:
  air protection, waste prevention and recycling, sustainable use of natural resources
- Beyond GDP 2007; environmental accounting to support wellbeing
- EU2020 strategy: resource efficiency, green economy
- ESS Sponsorship Group; sustainable environment

EU regulation on environmental accounting

- In 2013 mandatory reporting, data 2008-2011and
  - Air emissions by industry
  - Economy-wide material flow accounts
  - Environmental taxes by industry
- In 2017 mandatory reporting, data 2013-2015
  - Energy accounts
  - Environmental protection expenditures
  - Environmental goods and services sector
- Annual reporting continues
- New modules planned
  water accounts, waste accounts, forest accounts, mineral stocks,...

Modules for Environmental Accounts (1)

Physical flow accounts

Modules	Publication at Stat.Fi	EU regulation	UN SEEA
Economy-wide material flow accounts	1970-2011	Regulation 7/2011	Flows
Waste Statistics	1994-2012	Waste statistics regulation 2004-	Flows
Land use	National Land Survey 2000,2005,2010	-	Stocks

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Modules for Environmental Accounts (2)

Monetary flow accounts

Modules	Publication at Stat.Fi	EU regulation	UN SEEA
EPE - Industry	1992-2011	Regulation 2014?	Environmental protection
EPE –Public sector	1994-2011	Regulation 2014?	Environmental protection
Environmental taxes, fees and charges	1980-2012	Reported yearly	Environmental protection
Environmental taxes by economic activity	2008-2011 (1995-2007)	Regulation 7/2011	Environmental protection
EGSS	2009- 2011	Regulation 2014?	Environmental protection

Modules for Environmental Accounts (3)

SEEA hybrid accounts

Modules	Publication at Stat.Fi	EU regulation	UN SEEA
Forest accounts	1980-2011	-	Flows
Air emissions accounts by industry (NAMEA-air)	2008-2011 1995-2007	Regulation 7/2011	Flows
Energy Accounts	Grants-project 2012-2013	Regulation 2014?	Flows

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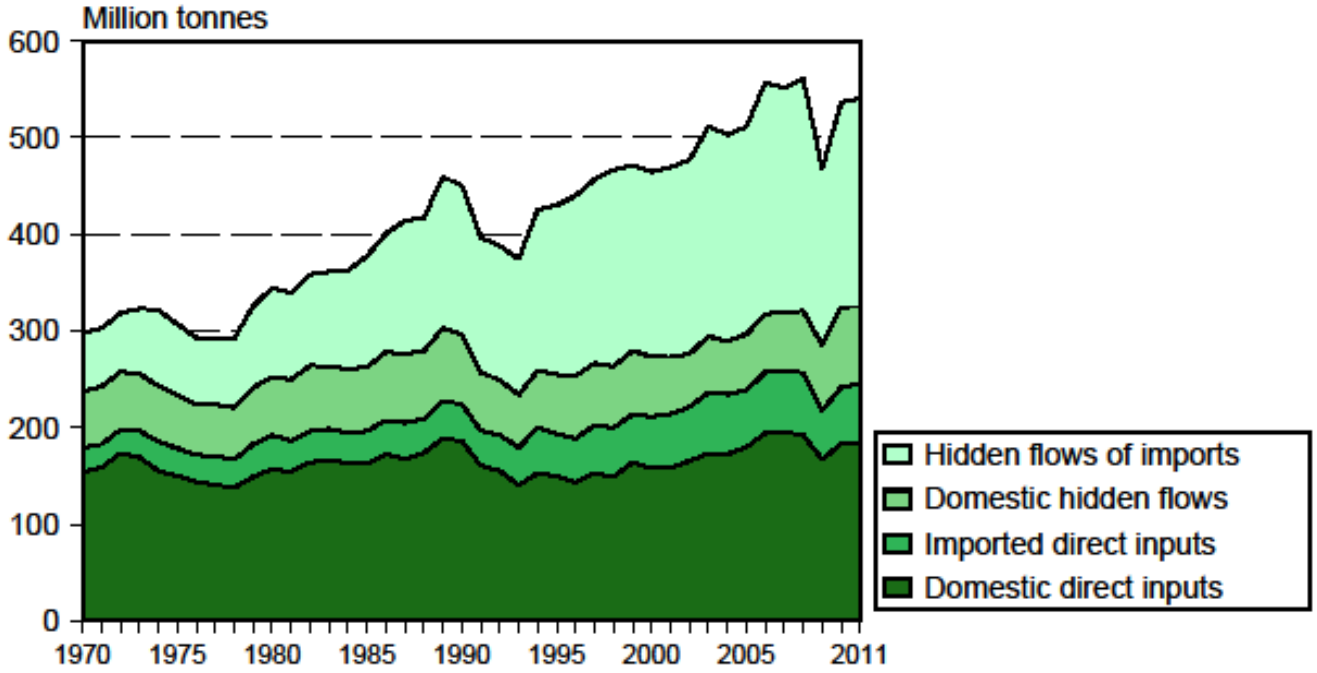
Some examples on Finnish environmental accounting

- Economy-wide material flow accounts
- Forest (timber) accounts
- Waste statistics
- Air emission accounts
- Environmental taxes
- Environmental expenditures
- Environmental goods and services

Statistics Finland

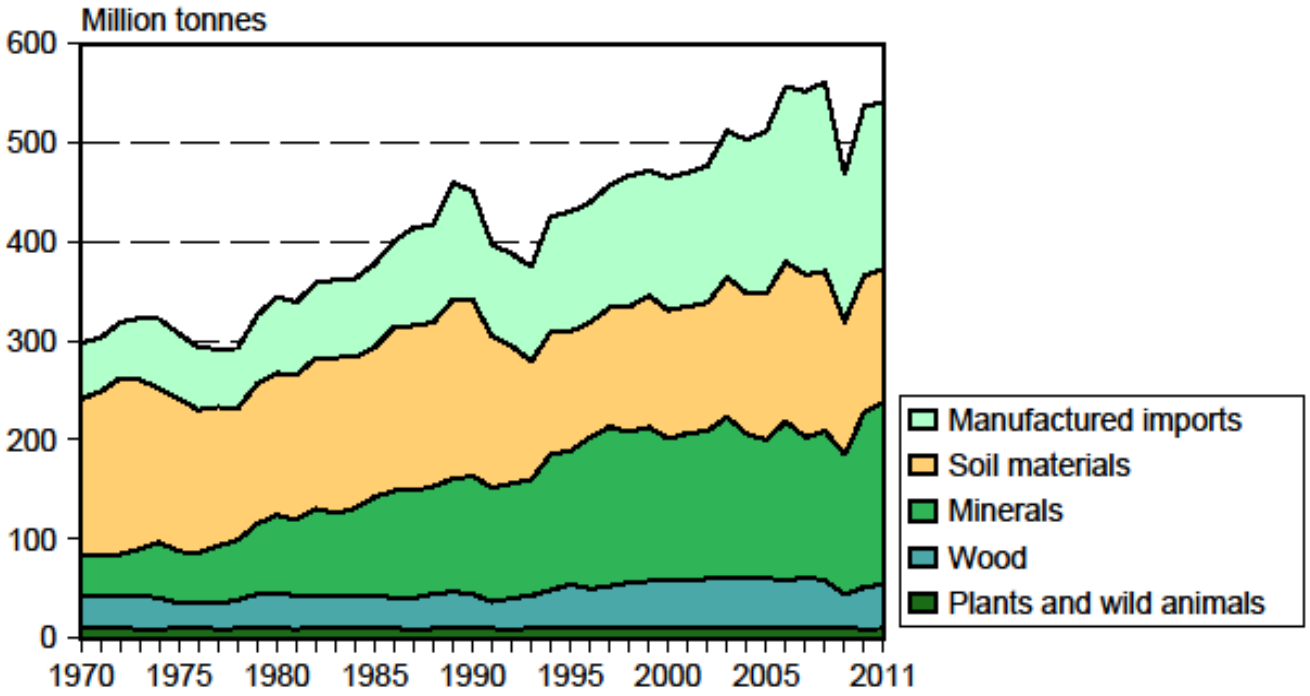
Total material requirement of Finland 1970–2011



Sources: Statistics Finland. http://thule.oulu.fi

Statistics Finland

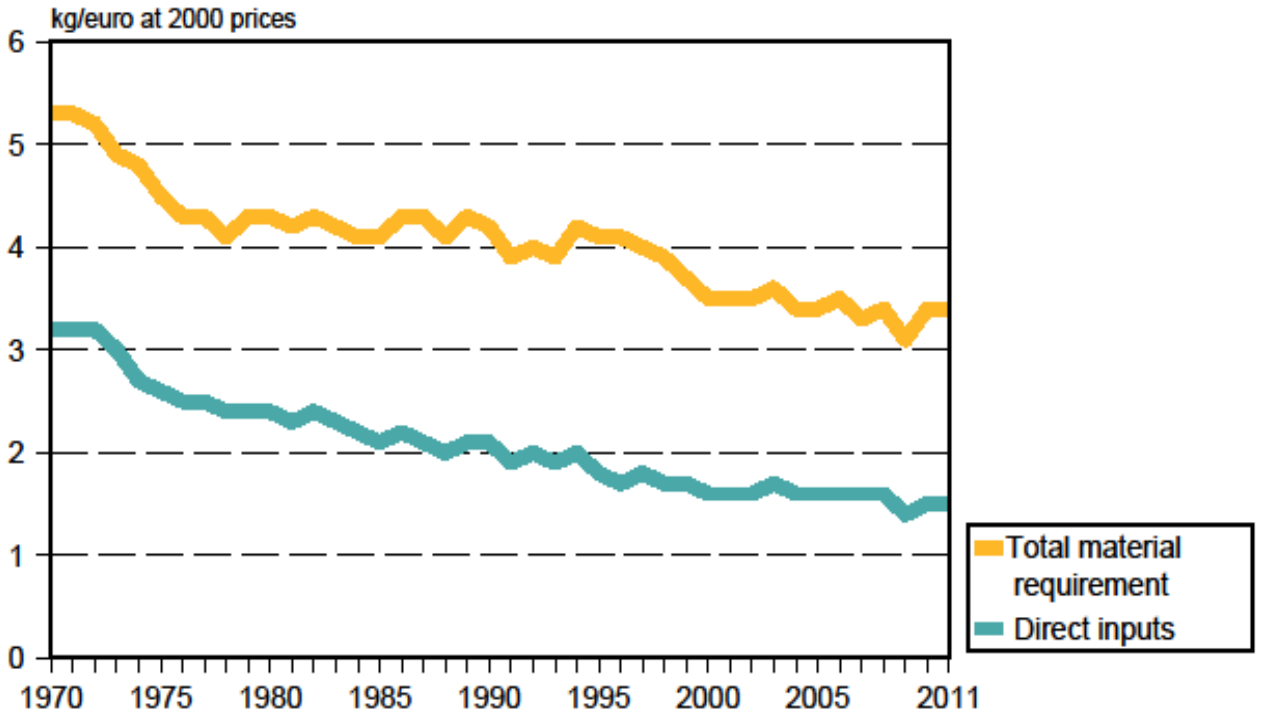
Total material requirement by material groups 1970–2011



Sources: Statistics Finland. http://thule.oulu.fi

Statistics Finland

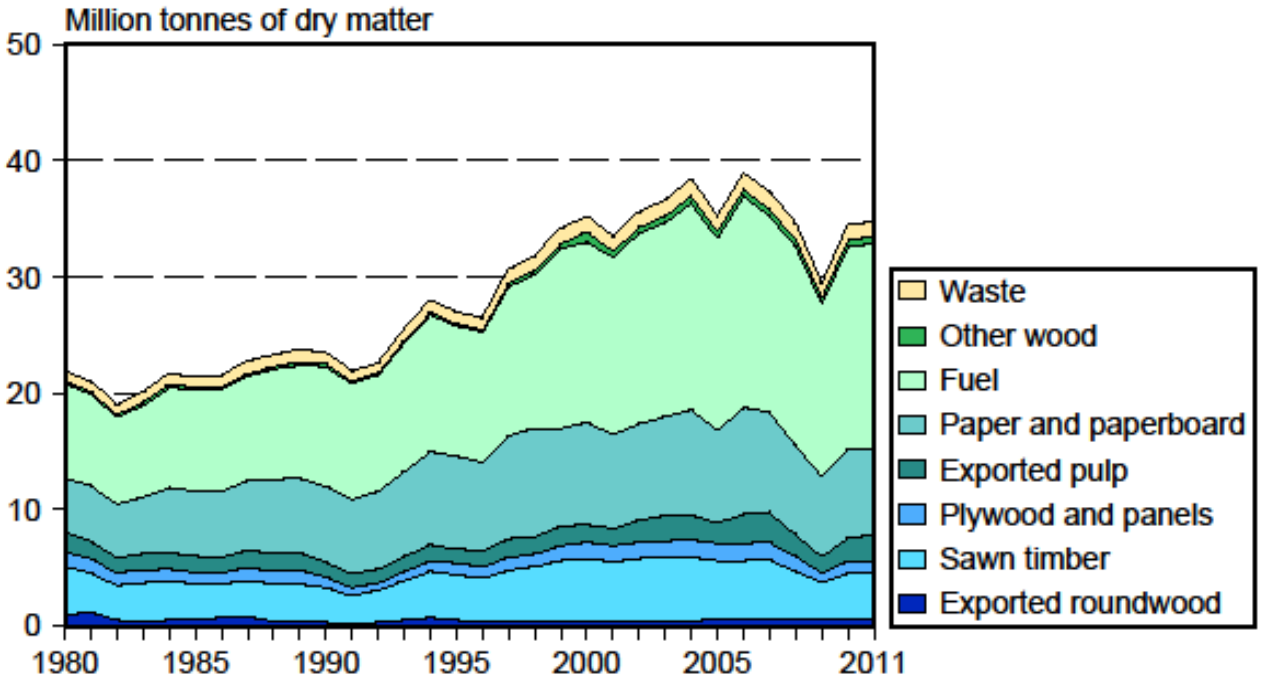
Material intensity of Finnish economy 1970–2011



Sources: Statistics Finland. http://thule.oulu.fi

Statistics Finland

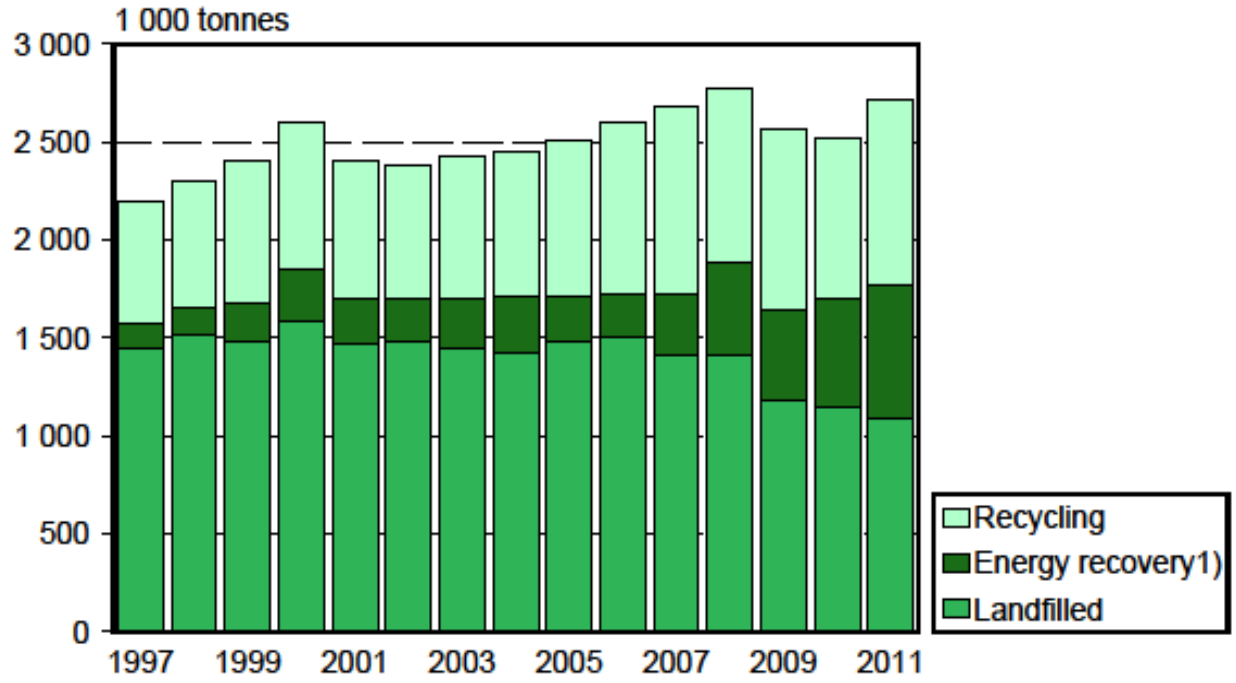
Wood in products 1980–2011



Source: Statistics Finland

Statistics Finland

Municipal solid waste in 1997–2011

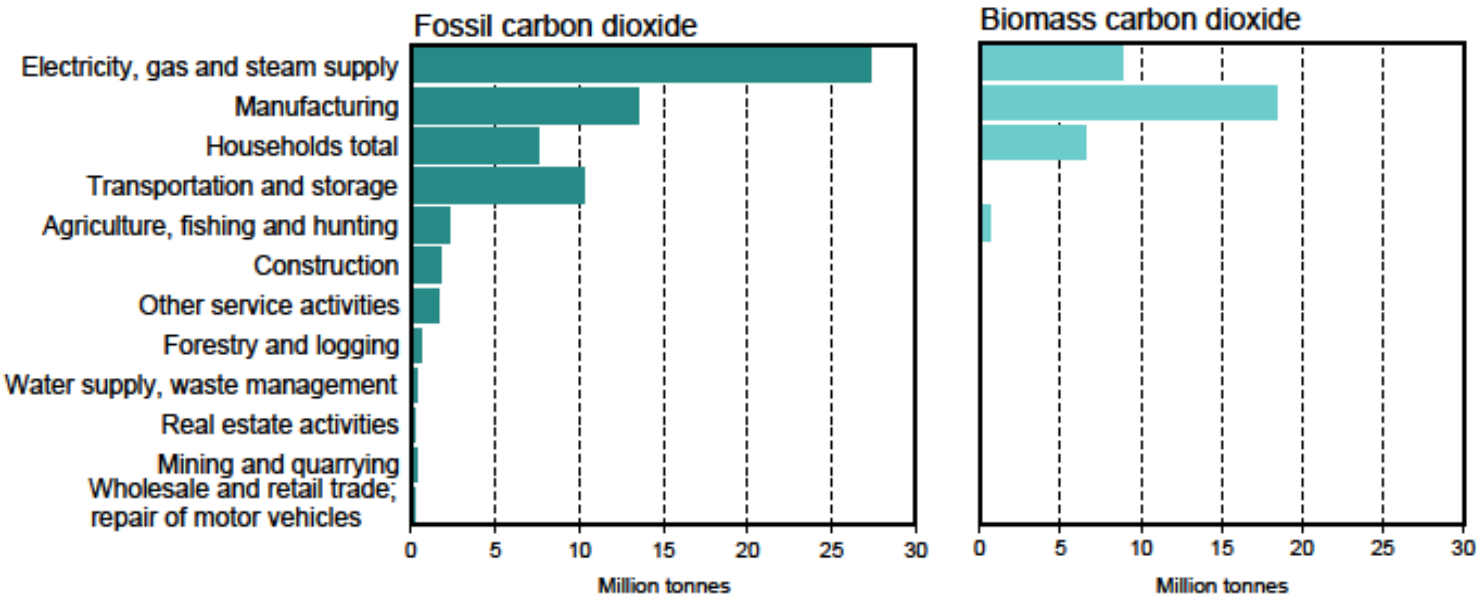


1) Including waste incineration without energy recovery

Sources: Finnish Environment Institute. Statistics Finland

Statistics Finland

Carbon dioxide emissions into air by industy group 2010[1]

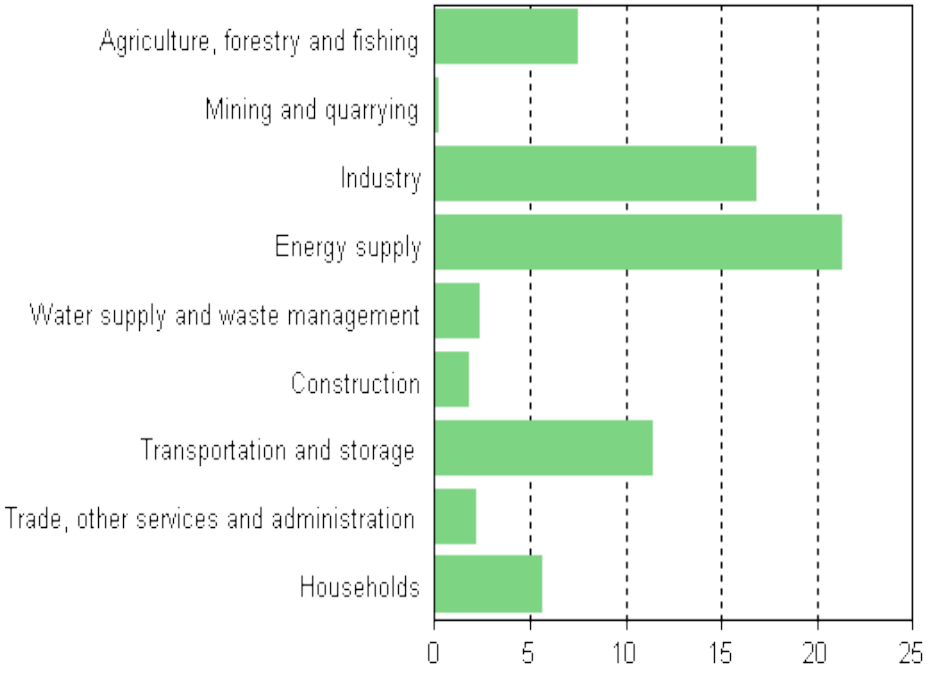


[1] Does not include sinks

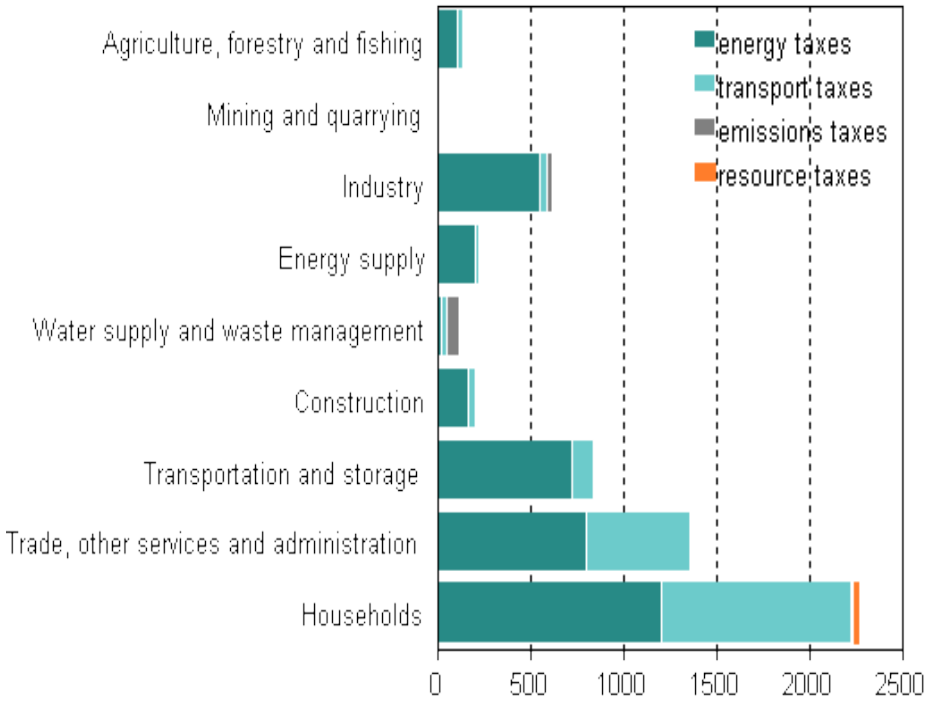
Source: Statistics Finland

Emission into air and environmental taxes by industry

Greenhouse gas emissions by industry in 2011, Million tons CO2 equivalent

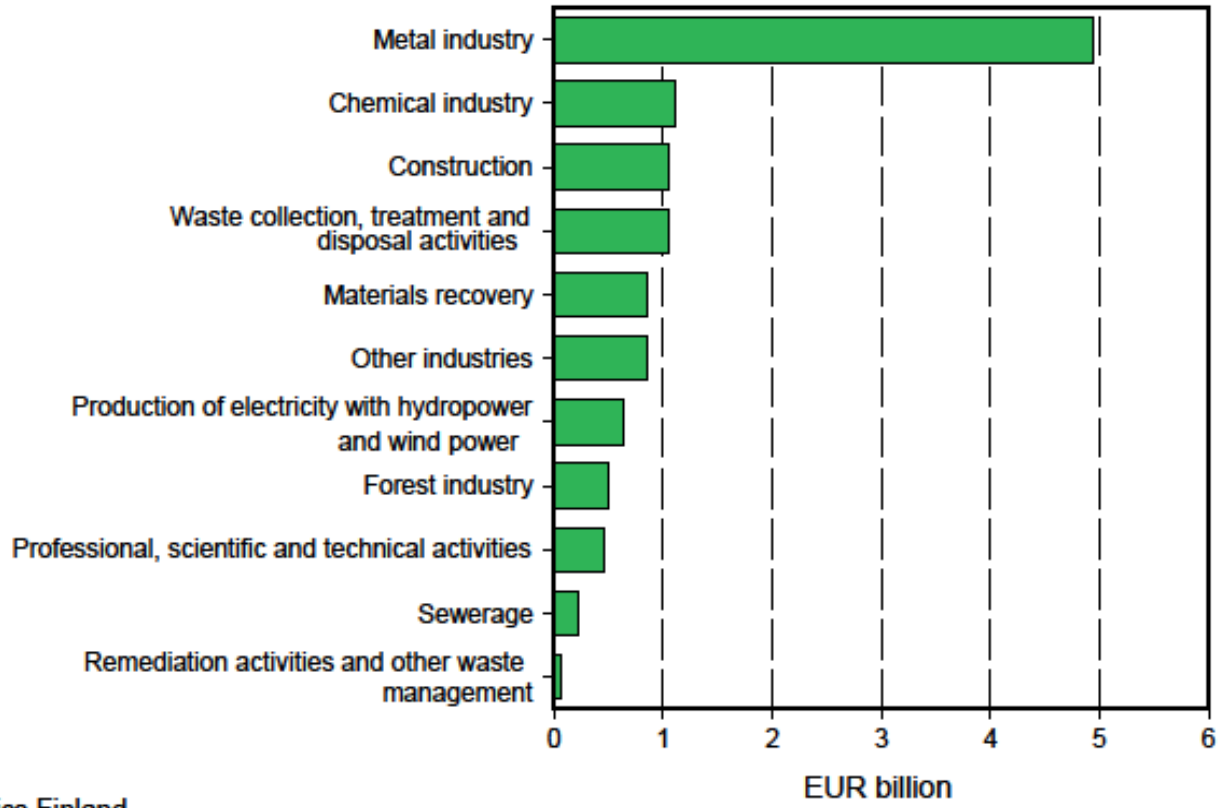


Environmental taxes by industry and tax type in 2011, EUR million



Statistics Finland

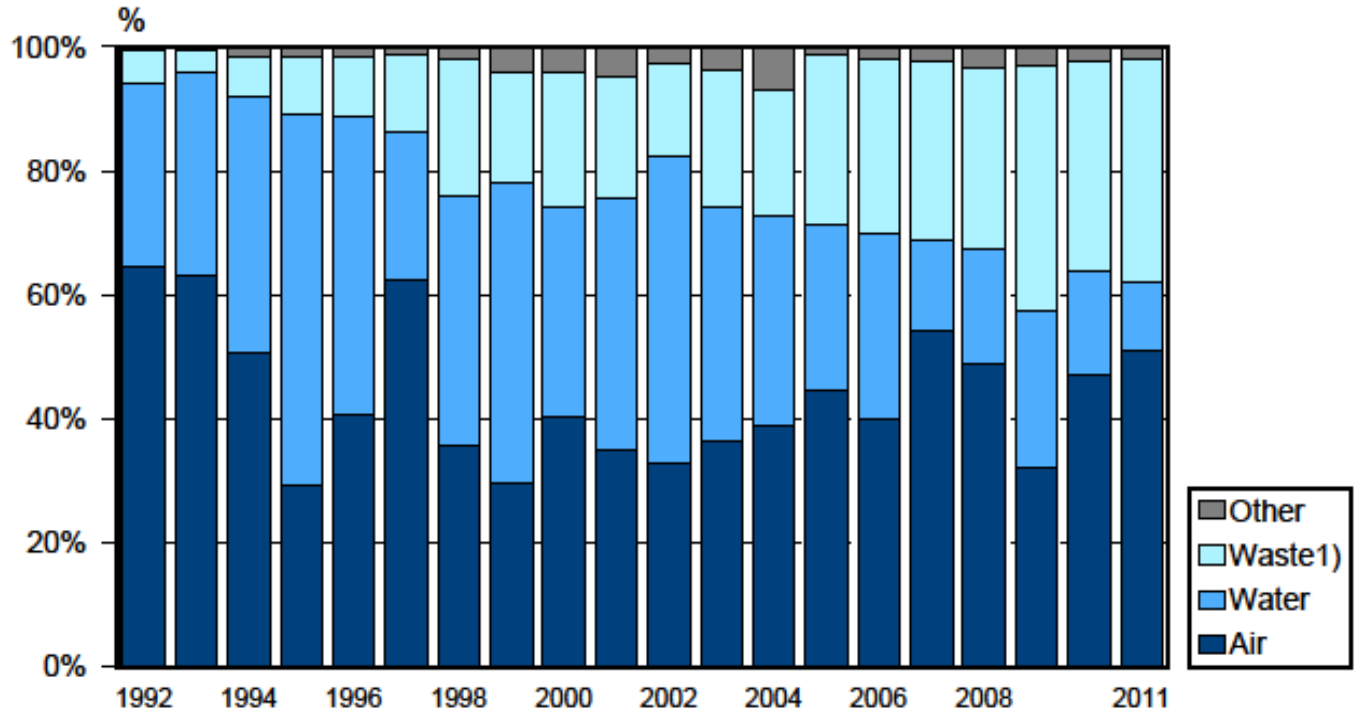
Turnover from environmental goods and services sector 2011



Source: Statistics Finland

Statistics Finland

Environmental protection investment by environmental domain in industry, 1992–2011



1) Includes waste management and soil and groundwater protection

Source: Statistics Finland

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Some features of practical work in environmental accounting

- Co-operation of accountants, producers of basic data, and users of the accounts
- Combination of statistics and expertise on environmental and economic issues
- In some cases basic data are insufficient, and estimation and new calculation methods are needed
- Challenging and interesting work
- Increases accountants' knowledge and use of existing statistics on natural resources, environment and economy

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Environmental accounting in short:

- Brings together economic and environmental information in a common framework to measure the contribution of the environment to the economy and the impact of the economy on the environment
- Content of the statistical standard SEEA CF:
  - Physical Flow Accounts
  - Environmental Activity Accounts and Related Flows
  - Asset Accounts
- Environmental accounting in EU countries is an application of the SEEA CF. In the near future EU is focusing on physical and monetary flows.
- in 2017 EU countries provide mandatory statistics on material flow accounts, air emission by industry, energy accounts by industry, environmental taxes, environmental expenditures and environmental goods and services