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GHG inventory calculations and reporting in Finland

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History

The first GHG inventory calculations were done by the Ministry of Trade and Industry (1988) and later by a private consulting company (1990, 1992)

The development of the air emission calculation system ILMARI started in 1993 at Statistics Finland as a part of the Energy Statistics

Results from ILMARI have been used for GHG inventories since 1995 (after the First National Communication)

Third version of ILMARI was developed as part of combined energy and environmental data system YEIS in the beginning of 2000's

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Organisation

- From 1994 to 2000 1 person; first in Economic Structures
- From 2000 to 2003 2 persons in Business Structures / Environment and Energy unit
- 2004 Stat Fi was nominated as the national entity with overall responsibility for the national greenhouse gas inventories => new GHG unit was established under Business Structures; 7 persons
- From 2012 GHG unit became part of Economy and Environment (so we came full circle)

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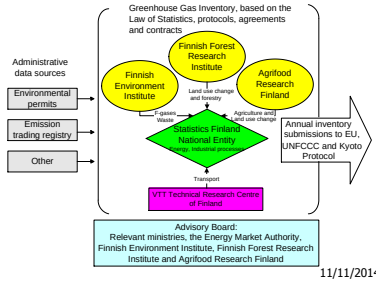
Finland's national GHG inventory system



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Some features of Finnish energy and industry sectors

A lot of energy intensive industry: pulp and paper, iron and steel, other metals, refineries, petrochemical industry, other chemicals, non-metallic minerals et.
A small number of companies
Many autoproducer CHP power plants using industrial residues

Cold climate => demand for heating 8-9 months per year
District heating covers >50 %
DH is produced mainly in CHP power plants; there are also a lot of heat-only boilers mainly for reserve and peak load (usually very low operating hours)

Coal, oil and natural gas are imported, LNG becoming soon.
Domestic fuels: wood in different types, peat, waste derived fuels (SRF/REF), liquid biofuels (partly domestic), biogas, other biofuels (e.g. residues from agriculture)

We have many multi-fuel-fired power plants: domestic fuels are very often co-fired, supported with oil or hard coal
There are some power plants using more than 10 specified fuel types

Also most power plants produce several secondary energy products: electricity, steam for industry, district heat

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YEIS / ILMARI calculation system

The basic idea of ILMARI is to combine plant level fuel and emission data (point sources) from different data sets to sectoral model calculations and total fuel fuel sales data to cover all fuel combustion activities

Fuel consumption data for GHG inventory are prepared in close co-operation with energy statistics team

Point source data cover most of fuels used in energy production and industry

Fuel and emission data for transport sector and mobile machinery are mainly calculated by LIPASTO submodels run by VTT Research Centre

Space heating fuel consumption data are estimated by Raklamm model (in StatFi)

All these data are combined together and adjusted to total fuel data

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Use of bottom-up data in GHG inventory

Primary source for plant-level fuel data is VAHTI emission register

Fuel data from ETS plants (EU emission trading scheme) are used to complete bottom-up fuel data (when VAHTI data is missing or plants are not included in VAHTI)

Plant-level fuel data are cross-checked semi-automatically

There are also other fuel data sets:

- StatFi fuel survey for manufacturing industries
- Energy Industry/StatFi joint survey for electricity and heat producers

All these four data sets are linked to the same YEIS database system, and semi-automatic cross-checking is possible (requires that point sources are correctly linked between each data set); corrections in fuel data have to made manually

There are also other data sets, which are not (yet) directly linked to YEIS, but are partly used in cross-checking and completing fuel data:

- Biogas register
- Woodfuel consumption survey (by Finnish forest research institute)
- District heating statistics

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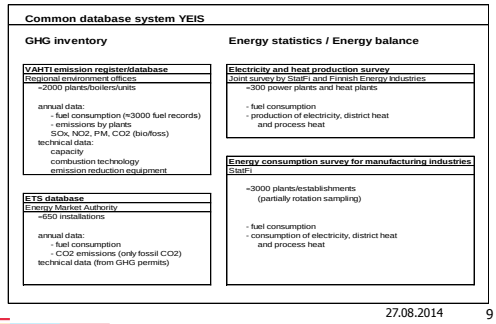
Point source data in Energy Statistics and GHG inventory (CRF1A1 and 1A2)



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Calculation methods

CO2 emissions

- all emissions (point sources and other sources) are calculated using average EFs for each fuel (in some cases EFs are plant specific)

SOx emissions

- point source emissions (from VAHTI) are split to each fuel and process
- emissions from other sources are calculated using average sulphur contents of fuels

NOx and PM emissions

- point source emissions (from VAHTI) are split to each fuel
- emissions from other sources are calculated using average emission factors for different source categories

CO, CH4, N2O, NMVOC emissions

- all emissions (point sources and other sources) are calculated using average emission factors for different source categories

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Fuel properties & default CO2 emission factors

StatFi maintains a list of fuels (fuel classification) including code, name and description for each fuel type

This list includes also national default NCV and CO2 emission factors

The same list is used in

- StatFi surveys
- ETS (EU emission trading scheme) reports
- most other fuel surveys

Most NCVs and EFs are constant, but some are updated annually (based on measured data from ETS)

www.tilastokeskus.fi/polttoaineluokitus (in Finnish, Swedish and English)

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Things that make life easier...

Stat Fi has access to ETS data (database including detailed annual activity data, tiers, emissions etc.)

Close co-operation between StatFi and EMV (Energy Market Authority, responsible for ETS)

Close co-operation with other organisations producing fuel data

Common list of fuels, including national default NVCs and CO2EFs

Stat Fi has access to other fuel data sets

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Challenges / Future development

New reporting guidelines (IPCC2006GL): changes in categories

Different default oxidation factors in IPCC96, MRG1, MRG2, IPCC2006: inventory, AAU reporting, NAP2

Minor problems in getting ETS data and inventory data consistent and comparable:

- transferred CO2
- different CRF codes and allocation (e.g. iron and steel and coking plant)

What is the acceptable difference between GHG and ETS data in plant level / fuel level / national level?

New production system for energy statistics is being developed

Update in GHG production system in under development

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Fuel comparison ETS/GHG

	PJ			CO2 1000 t				NCV	EF
Fuel	ETS	GHG	diff. %	ETS	GHG	diff.	diff. %	diff. %	diff. %
Hard coal	103,4	103,4	-0,1 %	9 553	9 550	-3	0,0 %	-0,2 %	0,0 %
Peat	77,7	78,0	0,3 %	8 227	8 172	-55	-0,7 %	0,1 %	-1,0 %
Natural gas	117,5	117,4	-0,1 %	6 443	6 431	-13	-0,2 %	0,0 %	-0,1 %
Heavy fuel oil	16,6	16,7	0,6 %	1 308	1 310	2	0,2 %	0,2 %	-0,4 %
Liquid fuels	52,2	52,4	0,4 %	3 335	3 371	36	1,1 %	0,1 %	0,7 %
Solid fuels	103,9	103,9	0,0 %	9 605	9 603	-2	0,0 %	-0,2 %	0,0 %
Mixed fuels and waste	8,9	8,9	-0,3 %	278	247	-31	-11,2 %	-19,1 %	-10,9 %
Wood fuels	239,9	243,9	1,7 %					-1,7 %	
Fossil fuel + peat	360,3	360,5	0,1 %	27 889	27 823	-66	-0,2 %	-0,8 %	-0,3 %

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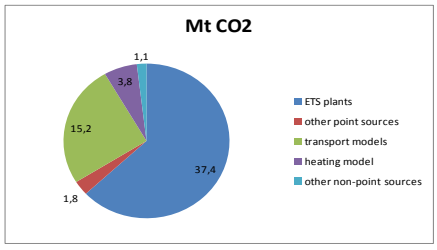
CO2 emissions from fuel combustion by data sources (2010)



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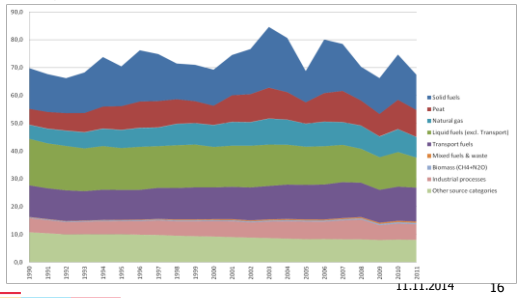
GHG emissions 1990-2011 [Mt CO2eq]: combustion by fuels, industrial processes and other source categories



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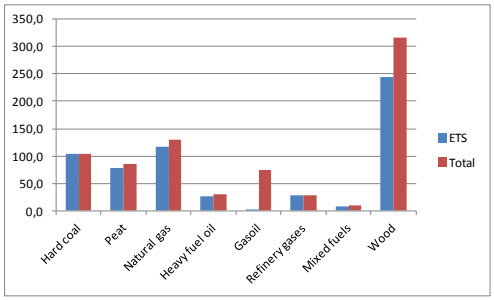
Coverage of ETS data by main fuel [PJ]



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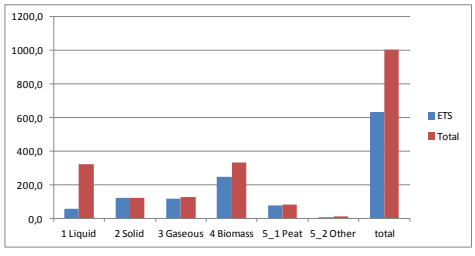
Coverage of ETS data by CRF fuel categories [PJ]



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Summary

Combining bottom-up fuel and emission data from several sources

Cross-checking of plant level data

Cross-checking of aggregated fuel data: quantities, TJ

CO2 emission data from ETS are used mainly for verification

NCV and CO2-emission factor for each fuel are compared (national default vs. ETS data), in some cases national default values are corrected

CO2 emissions from plants using mass-balance approach are taken directly from ETS data, however emissions are split to energy based emissions and industrial process emissions

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Thank you for your attention!