National work with the GAINS model: experiences from Sweden and other countries

Работы в рамках модели GAINS на национальном уровне: опыт Швеции и других стран

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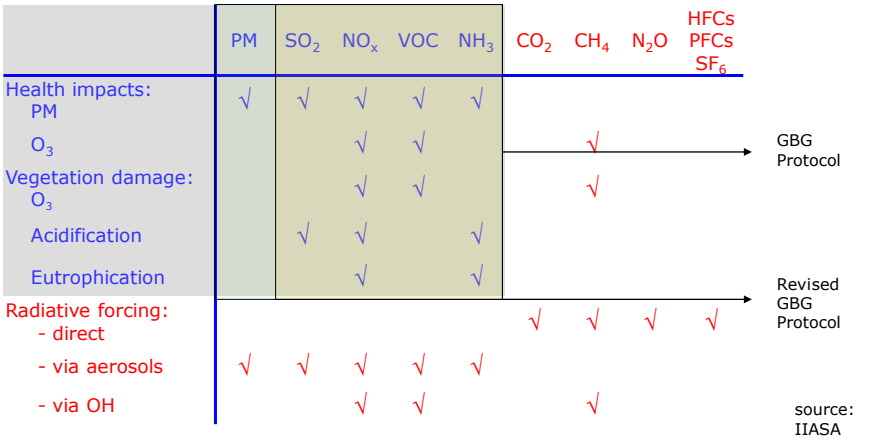
IVL Swedish Environmental Research Institute

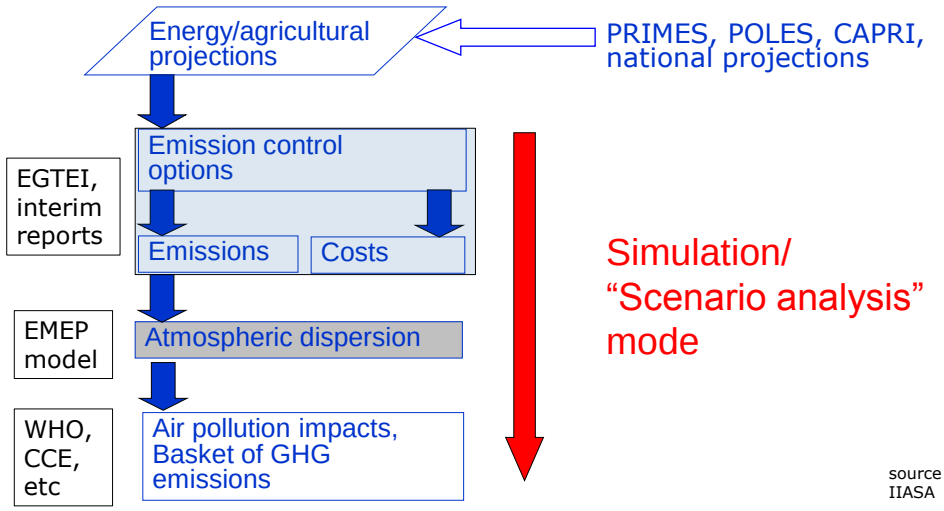
Outline

- A brief presentation of the GAINS model
- Examples of research activities in national GAINS modelling groups:
  - Sweden
  - Netherlands
  - Ireland
  - Italy
  - Finland
  - Russia

The GAINS model – framework

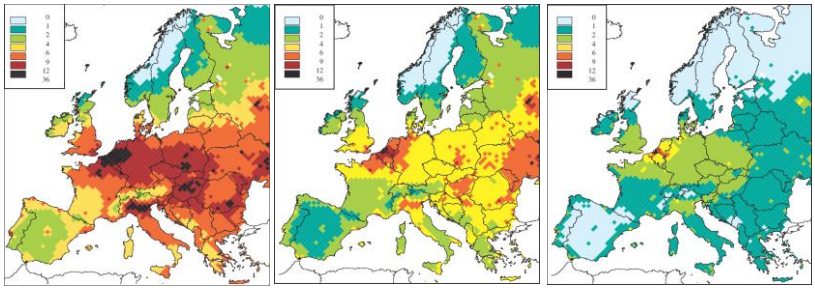


The GAINS model - structure



The GAINS model – example results

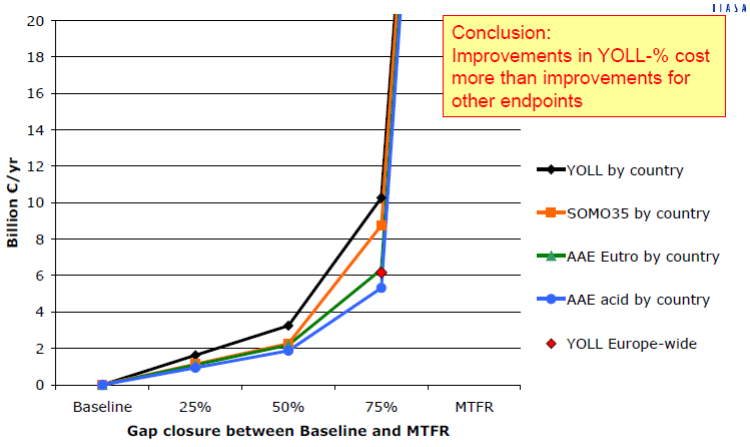
Loss in life expectancy attributable to fine particulate matter [months]



2000 | 2020 CAFE baseline Current legislation | 2020 Maximum technical emission reductions

source: IIASA

The GAINS model – example results



Provisional results!

Amann, 2010

IIASA recognition from Atmosfera 2009
EECCA country data needs for further improvement

- Macroeconomic projections
- Projections of emission generating activities:
  - Energy
  - Transport
  - Agricultural projections (livestock numbers)
  - Activities of heavy industries
  - Growth of NMVOC generating sectors
- Fuel quality, country-specific emission and cost factors
- 'Current legislation' penetration of control technologies

Also (if possible)

- Potentials for switching to energy efficient and low CO2 technologies

Cofala, 2009

IIASA conclusions from Atmosfera 2009

- GAINS has been used in many policy-relevant studies at the CLRTAP and EU level
- Depending on the purpose, different model features are applied
- Preliminary databases and assessment available also for EECCA countries
- Data and results can be viewed via the internet
- Tutorial is available also in Russian
- Important updates of database for EECCA countries needed
- Can be done only in close collaboration national experts

PLEASE HELP!!!

Cofala, 2009

GAINS activities in national groups

~15 countries are now working actively with Integrated Assessment Models, out of which 6 with GAINS

This presentation shows examples from 5 countries, but all 5 countries are working in several other research areas as well

Sweden:
Nordic low CO_2 emission scenarios in GAINS

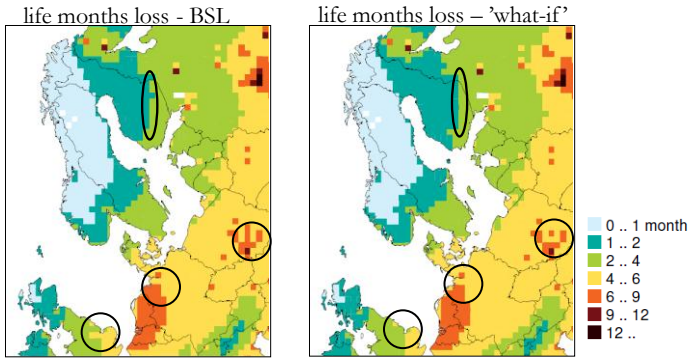
Emission reductions baseline vs low emission scenarios

Country / emission	Finland	Norway	Sweden	Denmark	Other*	Total Nordic	Unit
CO_2	28	21	29	20	3	25	%
Non-CO_2 GHG	12	1	4	3	1	4	%
SO_2	35	8	14	-5	3	18	%
NOx	25	25	37	-3	2	19	%
PM2,5	15	-18	13	-42	0	-8	%

*'Other' emissions is applicable in the 'What-if' scenario.
*Germany and Poland are in the emission calculations included in the group Other.

Sweden:
Nordic low CO_2 emission scenarios in GAINS

Health improvements would occur far from the Nordic countries if Nordic countries were to export surplus electricity to Germany and Poland o



Sweden:
Nordic low CO_2 emission scenarios in GAINS

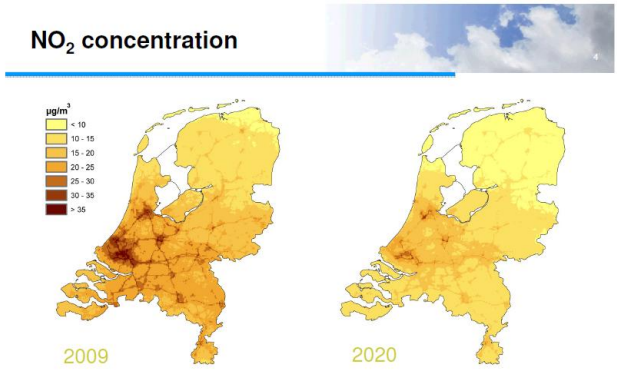
The Nordic net abatement costs following the low emission scenarios

Incremental cost on top of the baseline scenarios						
Country	**Denmark**	**Finland**	**Norway**	**Sweden**	**Total**	
Domestic	-367	-334	-75	-1231 (-574)*	-2007 (-1350)*	million €/year
PP and IND	488	427	284	-911 - 0	288 - 1199	million €/year
Transport	-394	-167	-705	794	-472	million €/year
Total costs on top of the national baselines	-273	-74	-496	-1348 - 220	-2191 - -623	million €/year

Different climate strategies, lead to varying costs burdens for the Nordic countries

Netherlands – GAINS NL

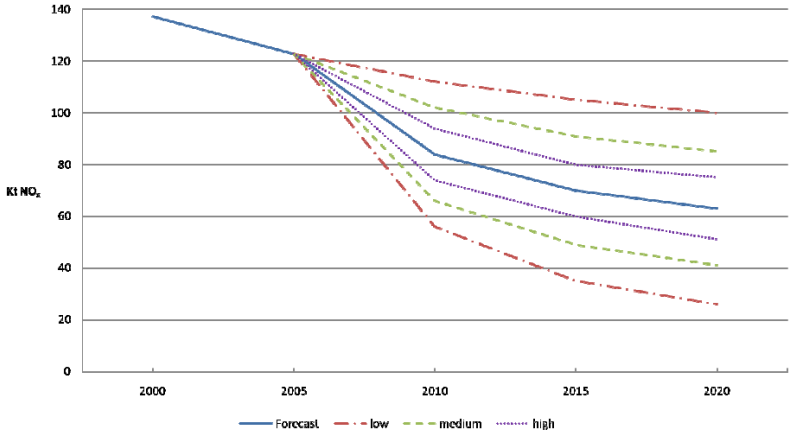
Modelling framework to assess exceedances of NO2 and PM10 along city streets and motorways



Aben, 2010

Ireland – GAINS Ireland

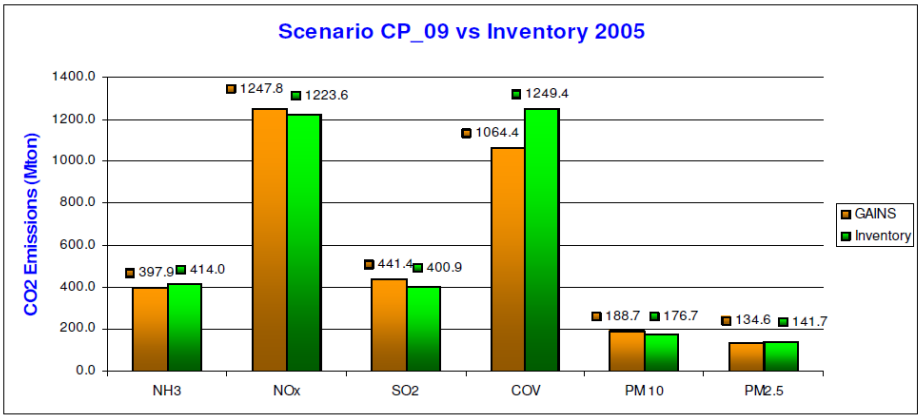
Presenting uncertainty in GAINS modelling



King, 2010

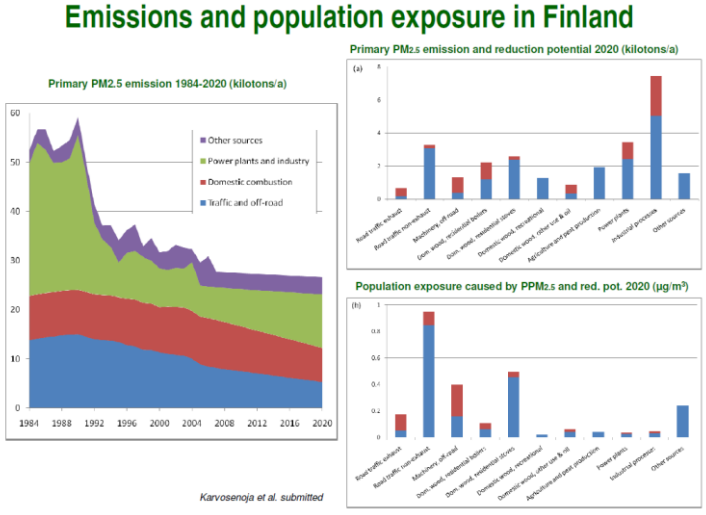
Italy – GAINS Italy

Comparison GAINS – Inventory 2005 (preliminary results)



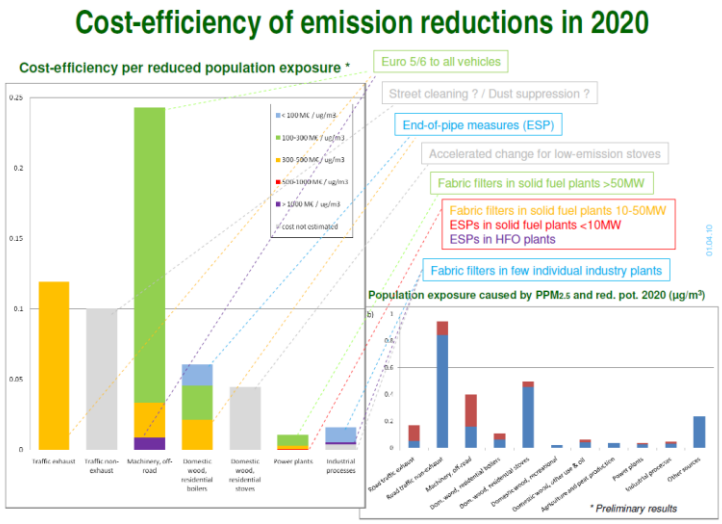
Pignatelli, 2009

Finland – FRES model



Karvosenoja, 2010

Finland – FRES model



Karvosenoja, 2010

Swedish / Russian co-operation

Exploring transboundary impact of $PM_{2.5}$ emissions
(as an addition to previous presentation)

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What would have happened if Western Europe did not control $PM_{2.5}$ emissions?

- If 29 European countries (not including Russia) would have a VERY low ambition level:
- The European emissions of PM2.5 would be ~13500 kton of $PM_{2.5}$ in 2010
- These higher emissions would cause a reduction in average life expectancy of 7.8 months per person in Russia

(reduction in life expectancy due to ambient air concentration of PM2.5)

(very low ambition level includes a use of **cyclone** emission removal technology in for 50 % of the fuel used in the Power plants, Industry and conversion sectors)

What if some countries were to use all technologies available to reduce primary $PM_{2.5}$ emissions from stationary sources?

- Polish max PM2.5 reduction efforts in 2010:
  - European emissions would have been ~12500 kton $PM_{2.5}$
  - reduced ave. life expectancy in Russia would be 7.7 months / person
- Polish + Belarus max PM2.5 reduction in 2010:
  - European emissions would have been ~12250 kton $PM_{2.5}$
  - reduced ave. life expectancy in Russia would be 7.5 months / person

(Max PM reduction efforts include use of **high efficiency deduster** emission removal technology in 100 % of the fuel used in the Power plants, Industry and conversion sectors, as well as a 100 % use of most efficient technology in other sectors)

The current situation - emissions of fine particulate matter ($PM_{2.5}$)

- In the National 2010 Baseline, the European (incl Russia) emissions of $PM_{2.5}$ is estimated to be ~3500 kton in 2010
- These emissions cause a reduction in average life expectancy of 6.8 months per person in Russia, due to exposure to high background concentrations of $PM_{2.5}$

(reduction in life expectancy due to ambient air concentration of $PM_{2.5}$)

And what if 29 countries would have used all technologies available to reduce primary $PM_{2.5}$ emissions from stationary sources?

- Euro29 max PM reduction efforts in 2010:
  - European emissions would have been ~2900 kton $PM_{2.5}$
  - reduced ave. life expectancy in Russia would be 6.7 months / person

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And what if the European part of Russia also would have implemented all technologies?

- Four scenarios for the European part of Russia in 2010:
  - 100 % High efficiency deduster in power plants and industry
    - Europe emissions ~2850 kton $PM_{2.5}$,
      Russian loss in ave. life expectancy 6.5 months / person
  - Maximum efforts in households and waste management etc
    - Europe emissions ~2750 kton $PM_{2.5}$,
      Russian loss in ave. life expectancy 6.1 months / person
  - Maximum efforts in process industry
    - Europe emissions ~2570 kton $PM_{2.5}$,
      Russian loss in ave. life expectancy 5.5 months / person)
  - **Cumulative effect of the above**
    - Europe emissions ~2380 kton $PM_{2.5}$,
      Russian loss in ave. life expectancy 4.7 months / person)

And what if the European part of Russia also would have implemented all technologies?

- $PM_{2.5}$ Emission reductions in European Russia will have an impact on the rest of Europe
- The anticipated years of life lost in Europe outside Russia would be reduced by 10 million life years.

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Further information

www.rusaco.se

Conclusions

- GAINS modelling helps the international work on reducing emissions of air pollutants
- National modellers can also use the model for analysis
- National developments of GAINS model work require resources and expertise
- Development of Russian work with the GAINS model shold be encouraged. Both for domestic and international purposes

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Thank you

More information:
http://www.iiasa.ac.at/rains

Access to the on-line model:
http://gains.iiasa.ac.at/gains/

Information about the Swedish/Russian co-operation project:
www.rusaco.se (in russian)