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Atmospheric Pollution and Economic Development Program

Integrated Assessment Model GAINS

Implementation for EECCA countries

Air pollution problems

- Ground-level ozone
  - Concentrations 3 - 4 times above pre-industrial levels
  - Impaired lung function and other respiratory problems for children and asthmatics
  - Damage to sensitive plants (agricultural crops, trees)
- Acidification
  - Leaching of nutrients, release of toxic metals
  - Damage to plant and animal life in lakes
- Eutrophication
  - Excess nitrogen deposition in terrestrial and aquatic ecosystems, threat to bio-diversity
- PM exposure
  - Health impacts

Air pollution and greenhouse gases
Critical linkages

- Emission originate from the same sources

- Aerosols/small particles cause health impacts <u>and</u> influence radiative forcing

- Tropospheric ozone damages health and vegetation <u>and</u> causes radiative forcing

A multi-pollutant/multi-effect problem extended towards radiative forcing
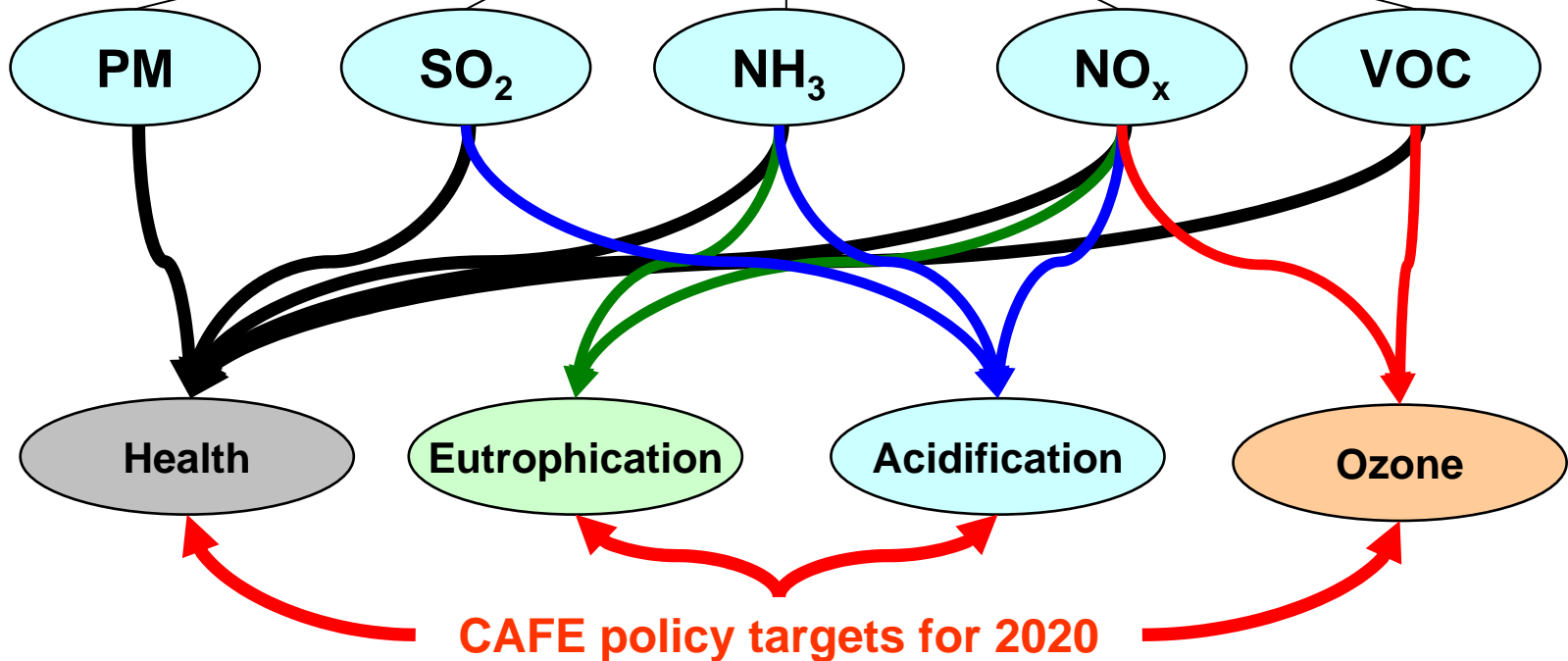

	SO$_2$	NO$_x$	NH$_3$	VOC	Primary PM+BC	CH$_4$	CO$_2$+ GHGs
Acidification	√	√	√				
Eutrophication		√	√				
Ground-level ozone		√		√		√	
Health impacts					√		
via sec. aerosols	√	√	√	√			
Radiative forcing						√	√
via aerosols	√	√	√	√	√		
via OH		√		√		√	

Multi-pollutant/multi-effect analysis
for identifying cost-effective policy scenarios

IIASA's RAINS computer model

PM   SO$_2$ NH$_3$ NO$_x$ VOC

Health   Eutrophication   Acidification   Ozone

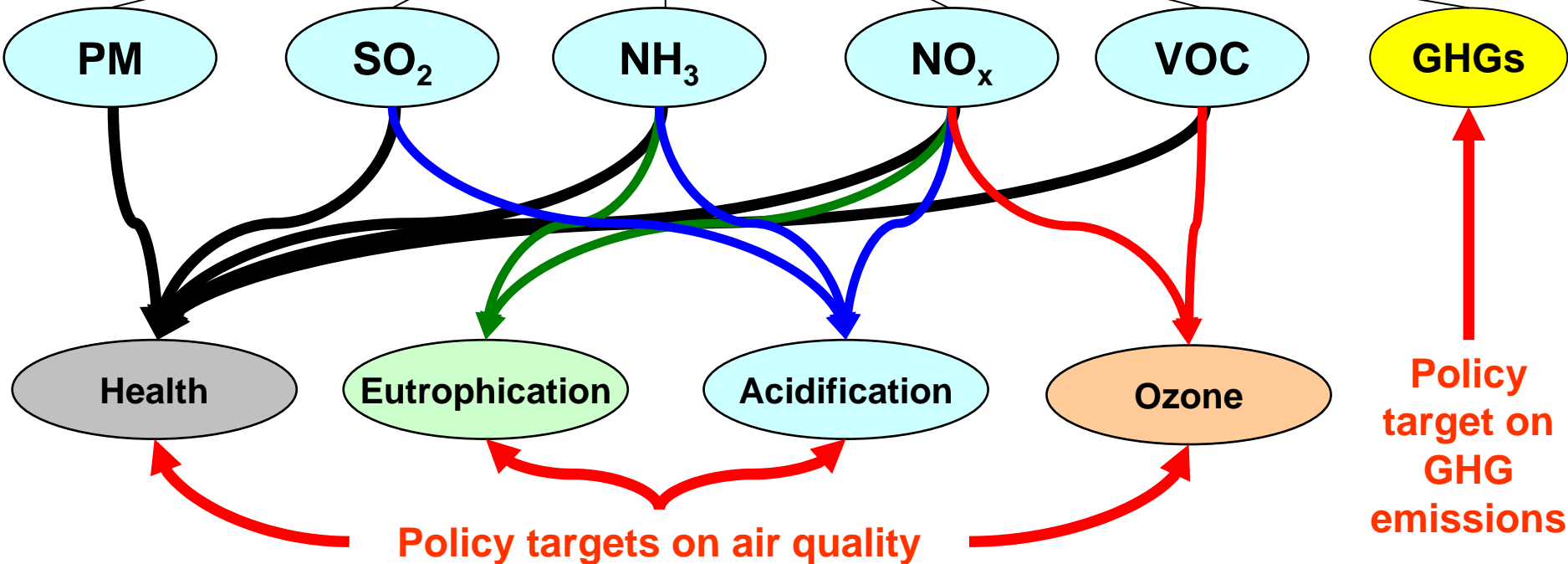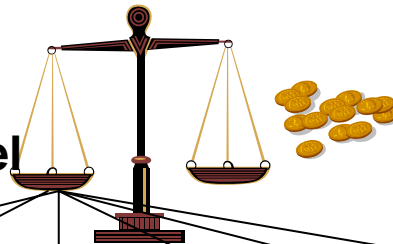CAFE policy targets for 2020

The GAINS approach

for identifying cost-effective emission control strategies

(**GHG**-**A**ir pollution **IN**teractions and **S**ynergies)

IIASA

IIASA's **GAINS** optimization model

PM SO$_2$ NH$_3$ NO$_x$ VOC GHGs

Health Eutrophication Acidification Ozone

Policy target on GHG emissions

Policy targets on air quality

GAINS: **G**HG-**A**ir pollution **IN**teractions and **S**ynergies

- Focus on:
  - Cost-effective mitigation measures and co-benefits
  - Policy-relevant scales of analysis
    - up to 2030
    - country-by- country
- Extension of RAINS model for air pollution to GHGs:
  - Model the chain of (air) pollution from sources to effects
  - GHG emissions consistent with UNFCCC
  - GHG cost data from reviewed literature
  - Air pollution and cost data reviewed by CAFE stakeholders
  - Assessment of emission reduction potentials and costs:
    - RAINS: SO_2, NO_x, VOC, NH_3, PM (~400 control options)
    - GAINS: CO_2, CH_4, N_2O, HFC, PFC, SF_6 (260 control options)
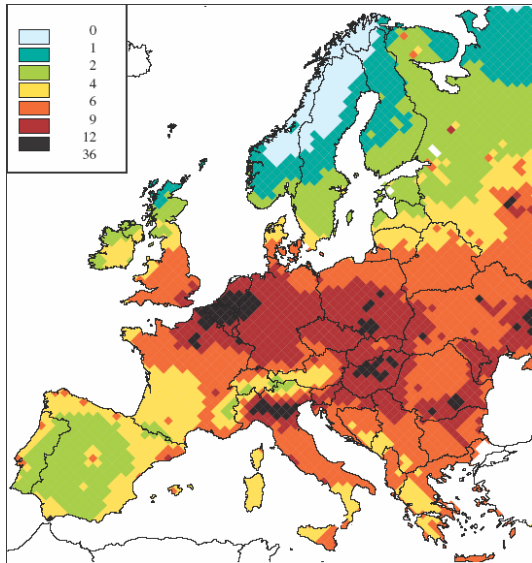
Policy applications of RAINS/GAINS

Protocols to the UN/ECE Convention on CLRTAP:

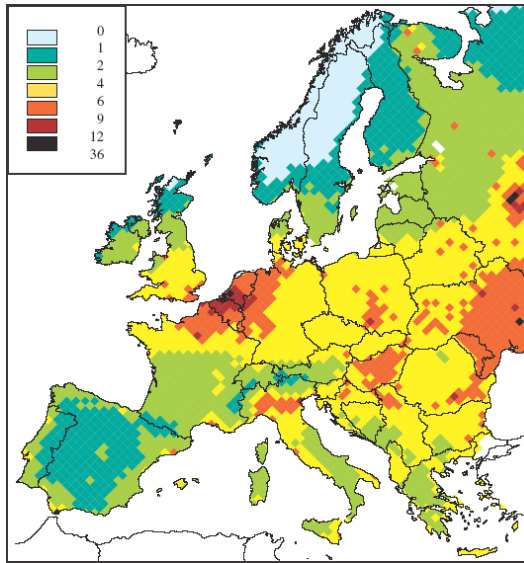- 1994: 2nd S Protocol,

- 1999 – Gothenburg Protocol)

Support to EU policies:

- 1999 - NEC Directive,

- 2003 – 2005 CAFE Programme and TSAP,
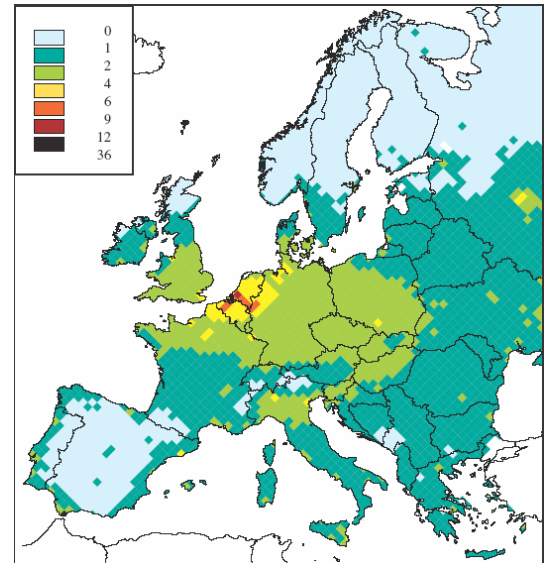
- 2007 – Revision of NEC Directive

Loss in life expectancy
attributable to anthropogenic PM2.5 [months]

2000

2020
CAFE baseline
Current legislation

2020
Maximum technical
emission reductions

Loss in average statistical life expectancy due to identified anthropogenic PM2.5
Calculations for 1997 meteorology

- All European countries plus Turkey available
- Implementation for China, India and Pakistan underway
- Other countries:
    - assessment within a study on global projections of air pollutants
    - countries/ world regions treated in a simplified way
    - updates and extensions planned

Inclusion of EECCA countries

- Russia, Belarus, Ukraine – preliminary assessment (partly) in collaboration with national scientists

- Parties to CLRTAP (Moldova, Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyz Republic): national scenarios based on scaling down the IPPC SRES B2 scenario, no national partners

- Other countries (Tajikistan, Turkmenistan, Uzbekistan): only aggregated assessment, no national partners

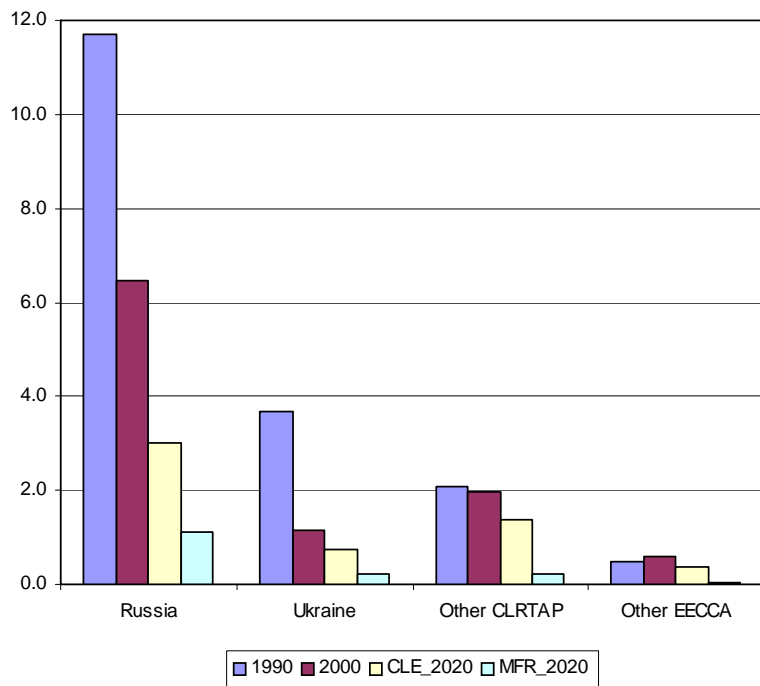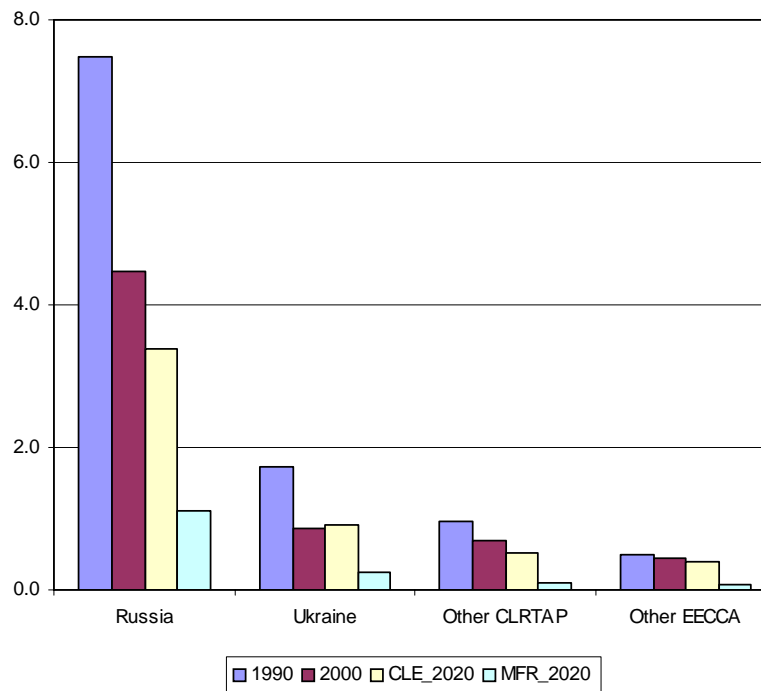# EECCA: Emissions of SO2 and NOx by sector, million tons

NOx

SO2
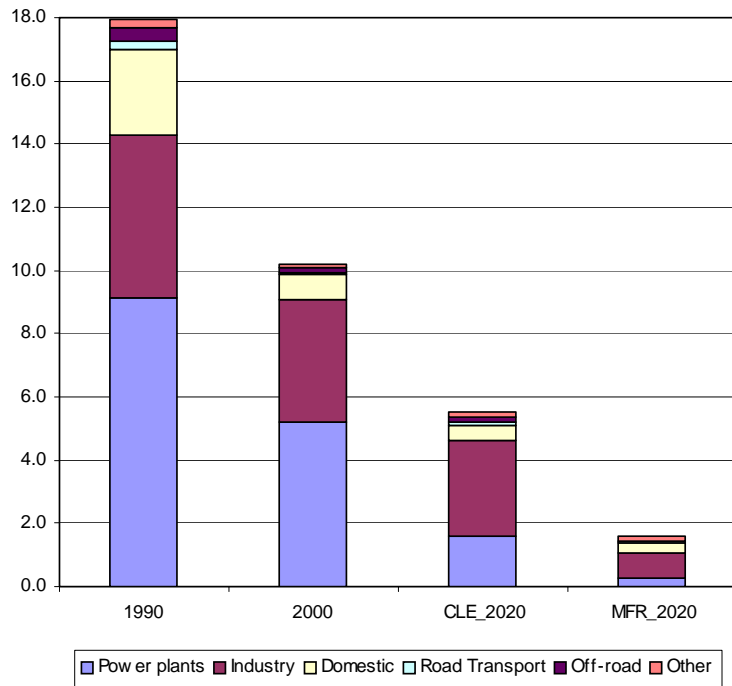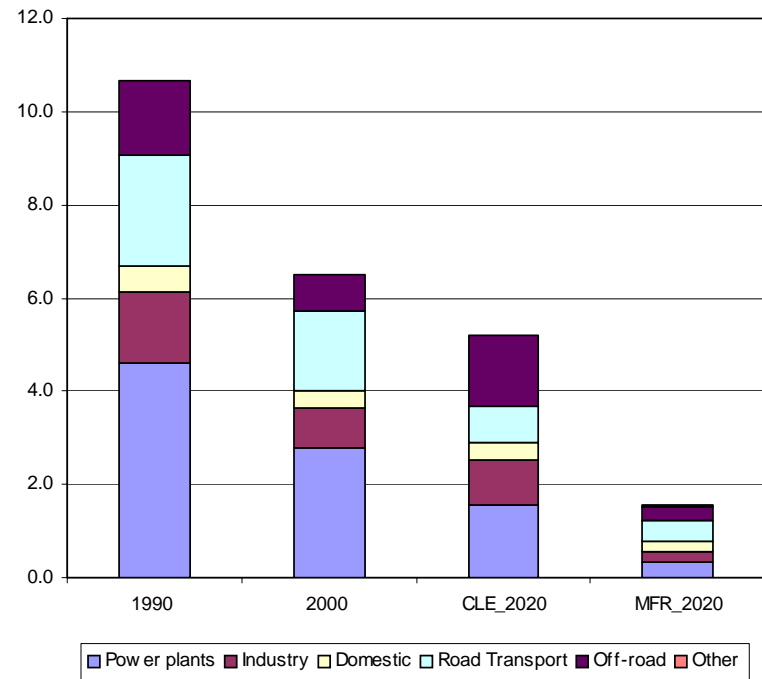
Emissions of SO2 and NOx by country group, million tons

NOx

SO2

EECCA compared with EU and world emissions

	SO2		NOx	
	2000	2020	2000	2020
World	15%	7%	13%	7%
EU	62%	100%	59%	70%

Data needs

- Macroeconomic projections
- Scenarios of emission generating activities:
  - Energy scenarios
  - Development of 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
- Potentials for switching to energy efficient and low CO_2 technologies

Data collection

- Close collaboration with national experts necessary
- Templates with input data available
- Names of model categories in English but (very rough and simplified) translation to Russian available
- Data and results can be viewed via the internet
- Bilateral consultations important, they improve understanding
- Timing needs to be synchronized with the work on review of the Gothenburg Protocol

PLEASE HELP!!!

More information:

www.iiasa.ac.at/rains

On-line model, (air pollutants, CO2 emissions)

http://www.iiasa.ac.at/web-apps/apd/RainsWeb

Documentation:

CO2:   http://www.iiasa.ac.at/Admin/PUB/Documents/IR-05-053.pdf

CH4:   http://www.iiasa.ac.at/Admin/PUB/Documents/IR-05-054.pdf

N2O: http://www.iiasa.ac.at/Admin/PUB/Documents/IR-05-055.pdf

F-gases: http://www.iiasa.ac.at/Publications/Documents/IR-05-056.pdf

Air pollutants: http://www.iiasa.ac.at/rains/databases.html?sb=9