

Simultaneously reducing air pollution and greenhouse gases

IIASA launched the GAINS model in 2006 to explore the synergies and trade-offs between control of local and regional air pollution and mitigation of global greenhouse gases (GHGs). GAINS is used to analyze the future socioeconomic drivers of emissions, emission control options, the chemical transformation and dispersion of pollutants in the atmosphere, and ensuing human health and environmental impacts.

Many air pollutants and GHGs have common sources, and can interact in the atmosphere. Alone or together, they produce a variety of environmental effects at different scales. The IIASA Greenhouse gas – Air pollution Interactions and Synergies (GAINS) model aims to minimize the negative effects of atmospheric pollution and GHGs on human health, ecosystems, and climate change without cost to economic development. GAINS incorporates the IIASA RAINS model.

Scope

GAINS considers about 3,500 end-of-pipe measures for reducing emissions of eight major air pollutants, and 350 options to reduce CO₂ through structural changes. It assesses emissions on a medium-term time horizon in five year intervals through 2030. In “scenario analysis” mode GAINS provide estimates of regional costs and environmental benefits of alternative emission control strategies. In “optimization” mode it identifies cost-optimal allocations of emission reductions to achieve specific targets like GHG emissions ceilings.

Geographic reach

In 2013 the GAINS model achieved global coverage. GAINS is implemented online for 43 countries in Europe, including the European part of Russia. There is a GAINS-Asia model and dedicated online versions for China and South Asia. A special version of GAINS has been developed for online comparison of GHG mitigation efforts among the Kyoto Protocol Annex-I countries to support negotiations under the UN Framework Convention on Climate Change (UNFCCC).

Impacts

- GAINS is used as a policy support tool in the sphere of air pollution and greenhouse gas mitigation for planners and negotiators of the UN Economic Council for Europe, other UN agencies, the Intergovernmental Panel on Climate Change, national institutions, the EU, and nongovernmental organizations.
- The GAINS multi-pollutant/multi-effect perspective has shaped the European policy approach on air quality in the last decades. In 2013 the European Commission introduced a new clean air policy package to reduce pollution, based on GAINS scenarios. The new policies, based on research from the five-year, IIASA-led European Consortium for Modelling Air Pollution and Climate Strategies, would avoid 58,000 premature deaths, save 123,000 km² of land from nitrogen pollution, and protect 19,000 km² of forest from acidification by 2030.
- The European Commission in 2014 agreed a proposal for new climate and energy targets for 2030, including a reduction of EU greenhouse gas emissions by 40% below the 1990 level. Negotiations leading to the compromise were informed by an extensive impact assessment to which IIASA researchers contributed data and results from the GAINS model on the potential benefits and costs of various climate policies.
- Collaborative research between IIASA and NASA’s Goddard Institute for Space Studies was the basis of the new global climate initiative, the Climate and Clean Air Coalition (CCAC) to reduce short-lived climate pollutants, announced in 2012 by then US Secretary of State, Hillary Rodham Clinton. Work by the two institutes pinpointed 14 of 2,000 GAINS options for improving air quality that also had the greatest climate benefits. CCAC now has nearly 100 country and nonstate partners.
- Building on its assessments of health impacts and longevity with respect to atmospheric pollution in Europe since 2000, GAINS is now using data from the latest epidemiological studies to evaluate cause-specific concentration-response relationships for lung cancer and cardiovascular and respiratory diseases for European countries.



Further information:
www.iiasa.ac.at/impacts/gains