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Air pollution control for a healthier environment

IIASA played a significant role in bringing under control toxic air pollutants that damage human health and the environment. The Regional Acidification Information and Simulation (RAINS) model, developed at IIASA, was at the center of international environmental negotiations to achieve cleaner air in Europe at lowest cost.

By the 1970s acid rain caused by sulfur dioxide (SO_2) and nitrogen oxide (NO_x) pollution from energy generation, industrial sources, motor vehicles, and agriculture, was causing severe damage to the European environment. Prevailing winds transported pollution across national borders so that low-polluting countries experienced more than their fair share of pollution "fall-out."

Instruments to combat transboundary pollution were needed at an international level. When negotiating a new treaty in 1979, policymakers and scientists understood that making uniform cuts in emissions across countries would not be efficient or effective. Getting states to negotiate a consensus on cutting emissions would also require tactical diplomacy and scientific proof. The IIASA interactive RAINS model provided both. Non-technical negotiating teams were quickly trained to interrogate RAINS about the costs and impacts of suggested measures to ensure that negotiations were fair.

IIASA models supporting international legislation

Negotiations resulted in the 1979 Convention on Long-range Transboundary Air Pollution (LRTAP), which entered into force in 1983. This framework convention, proposed by the UN Economic Council for Europe (UNECE), is one of the oldest and most successful international treaties protecting the environment.

IIASA was appointed the Centre for Integrated Assessment Modelling (CIAM) of the 1999 Protocol to the LRTAP, The Gothenburg Protocol to Abate Acidification, Eutrophication and Ground-level Ozone, which entered into force in 2005. This "multi-effect, multipollutant" protocol aimed to control four substances, SO_2, NO_x, ammonia, and volatile organic compounds, by 2010 and provided international emission ceilings that achieved negotiators' goals in a cost-effective manner. The RAINS model, in "optimization" mode, was also used during negotiations for the 1994 Oslo Protocol on Further Reduction of Sulphur Emissions.

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- The success of RAINS led to the development of the GAINS model in 2006 to assess the benefits of simultaneously mitigating air pollution and greenhouse gases. Using GAINS, IIASA researched the national greenhouse gas emission reduction commitments that must be achieved in 2020 and beyond by parties to the Gothenburg Protocol. The protocol's technical annexes were also revised with updated sets of emission limit values and with emission ceilings for fine particulate matter.
- From 1990–2009 emissions of SO_2 and NO_x, respectively, decreased by about 70% and 35% in Europe. More effective air pollution control brought about improved human health, including increased life expectancy. There was clear environmental recovery from acidification.
- Asian rapid economic growth has been fueled by coal as the dominant energy source. A significant increase in emissions of various air pollutants led to the development of RAINS-Asia, a tool for optimization analysis of the acidification problem in Asia while taking into account the potential for use of renewable energy. Developments within GAINS-Asia made it possible to assess present and future SO_2 concentrations with relevance to human health and to evaluate sulfur deposition, which damages plants and aquatic ecosystems.
- Since 1995 RAINS/GAINS have provided quantitative scientific analyses for the key policy initiatives of the European Commission in the areas of air pollution and climate change. Recently, IIASA models provided quantitative input to the proposal of the European Commission on climate and energy goals for 2030, including reducing EU greenhouse gas emissions by 40% below the 1990 level.

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

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