GAINS ASIA

A TOOL TO COMBAT AIR POLLUTION AND CLIMATE CHANGE SIMULTANEOUSLY

IIASA ERI teri ies Institute for Environment and Sustainability u^b UNIVERSITÄT BERN SIXTH FRAMEWORK PROGRAMME

THE GAINS-ASIA MODEL INTEGRATES A NUMBER OF ESTABLISHED ECONOMIC AND ENVIRONMENTAL MODELS DEVELOPED BY INTERNATIONAL EXPERTS AT THE FOLLOWING INSTITUTIONS:

IIASA
INTERNATIONAL INSTITUTE FOR APPLIED SYSTEMS ANALYSIS
Laxenburg, Austria

ERI
ENERGY RESEARCH INSTITUTE
Beijing, China

TERI
THE ENERGY AND RESOURCES INSTITUTE
New Delhi, India

JRC-IES
INSTITUTE FOR ENVIRONMENT AND SUSTAINABILITY OF THE JOINT RESEARCH CENTRE OF THE EUROPEAN UNION
Ispra, Italy

UBERN
THE UNIVERSITY OF BERN
Bern, Switzerland

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FURTHER INFORMATION:

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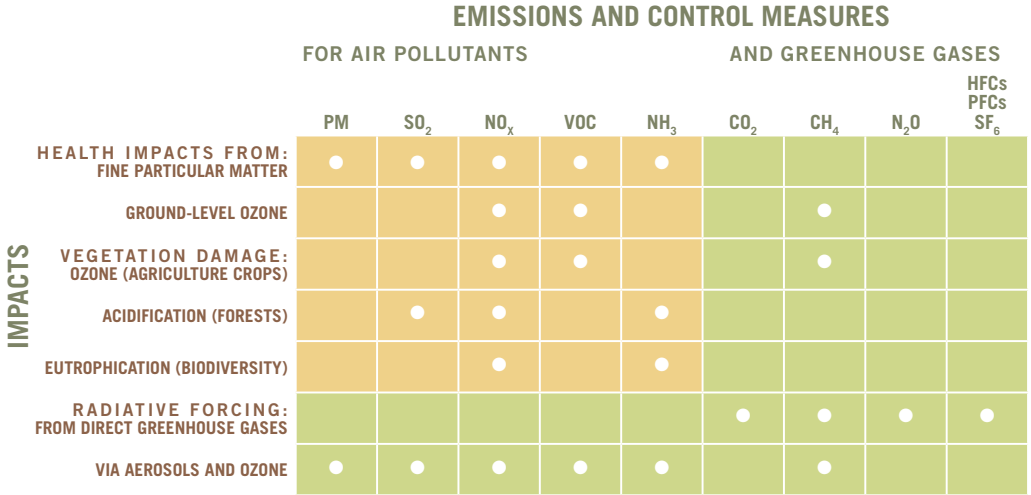
GAINS – A scientific tool that brings air pollution and climate change policies together for China and India

Current and future economic growth will cause serious air quality problems in Asia, negatively impacting human health and crop production, unless further air pollution policies are implemented. Increased economic activity will also lead to more greenhouse gas emissions and subsequent climate change. Yet, air pollutants and greenhouse gases can be reduced simultaneously at far lower costs than tackling them separately, because they often originate from the same sources.

An international team of researchers has developed a scientific tool to guide policymakers through the complex process of air pollutant control and greenhouse gas mitigation in China and India. Known as GAINS (Greenhouse Gas and Air Pollution Interactions and Synergies), this state-of-the-art interdisciplinary model builds on a scientific tool that has already helped European governments slash air pollution across the continent without compromising economic development.

This brochure conveys the key policy messages from the GAINS-Asia project for people working towards cleaner air in Asia. For policymakers, industry, NGOs and researchers wishing for more information and to conduct independent analyses, the GAINS-Asia model and documentation is freely available online at HTTP://GAINS.IIASA.AC.AT

The GAINS model harvests synergies between air pollution and climate strategies by integrating multiple pollutants and their multiple effects



TACKLING MULTIPLE POLLUTANTS:
The GAINS model quantifies the interactions between the emissions of five air pollutants and six greenhouse gases and how they impact on people's health, on vegetation and on climate change.

1

In essence, GAINS is a scenario-generating device that helps users to understand the impacts of future actions – or inaction – and to design strategies to achieve long-term environmental goals at the lowest possible cost.

Scientists, civil servants, politicians, and other non-technical users can pose any number of »what-if« questions to GAINS: How much would it cost to reduce air pollution levels to a given standard for all of India? For the worst-affected areas only? What is the cheapest way to reduce the health impacts of air pollution on China's population? What air pollution controls maximise the reduction of greenhouse gases? Fed with the relevant data GAINS gives answers to such questions within minutes.

2

The GAINS model analyses the multiple sources and multiple effects of five air pollutants and six greenhouse gases to identify their most cost-effective control.

GAINS quantifies the impacts of five air pollutants (SO_2, NO_x, PM, NH_3, VOC) and six greenhouse gases (CO_2, CH_4, N_2O, PFC, HFC, SF_6) on human health, crop losses, acid deposition, and the Kyoto basket of greenhouse gases. It combines scientific information and best available data on economic development, emission control technologies and their costs, emission factors, atmospheric dispersion and air quality impacts. Its optimization tool finds the portfolio of emission control measures that achieve environmental targets at the lowest cost.

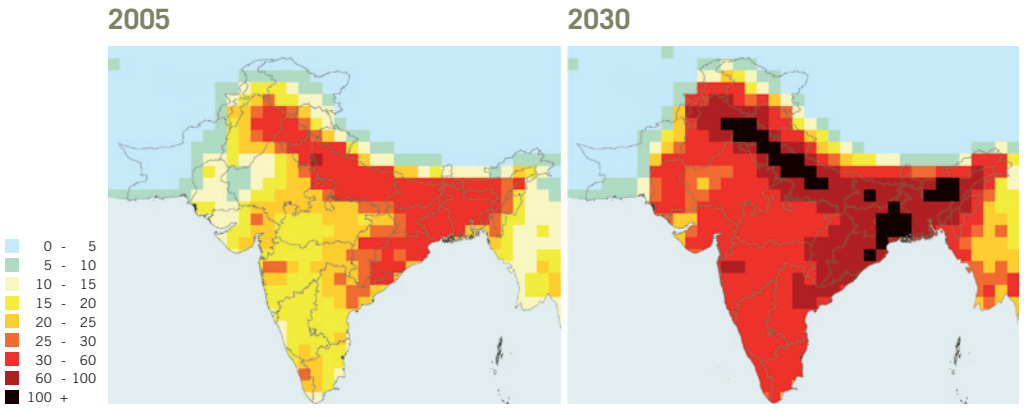
3

GAINS has been implemented for China and India. It builds on governmental projections of economic development and can be used to explore pollution control strategies for individual provinces and states.

Emissions of pollutants and greenhouse gases from energy, agriculture and other sectors are accounted for at the level of individual provinces and states, and air quality impacts both for urban and rural areas can be evaluated with spatial resolution of 1×1 degree. GAINS focuses on the time period up to 2030 in 5-year intervals.

GAINS is easy to use and freely accessible on the Internet. It can also be implemented for other countries in the future.

Current economic growth will intensify air quality problems in Asia unless current pollution control laws are significantly upgraded



HEALTH IMPACTS IN INDIA.
Air pollution damages people's health and air quality problems are expected to intensify in Asia unless current pollution controls are improved.
For example, the maps of India show the loss in statistical life expectancy (in months) attributable to fine particulate matter (PM2.5) estimated for 2005 and 2030.

1

Population growth and development will further boost the level of economic activities in Asia.

In Asia, population growth combined with the envisaged increase in economic wealth will multiply current levels of energy use, traffic, industrial production and agricultural output in the coming decades. For instance, the Indian government foresees total energy consumption to increase by a factor of 4.5 between 2005 and 2030.

2

Current air pollution control strategies will not be sufficient to balance out the negative effects.

Unless current emission control laws are tightened, this economic growth will lead to substantially higher emissions of harmful air pollutants. Increased coal consumption would multiply current emissions of sulfur dioxide in India by a factor of 5 by 2030.
Depending on the effectiveness of the implementation of current emission control regulations for vehicles, emissions of nitrogen oxides would grow by a factor of 2.5 to 3 by 2030.
And greenhouse gas emissions are expected to increase by a factor of 4 by 2030.

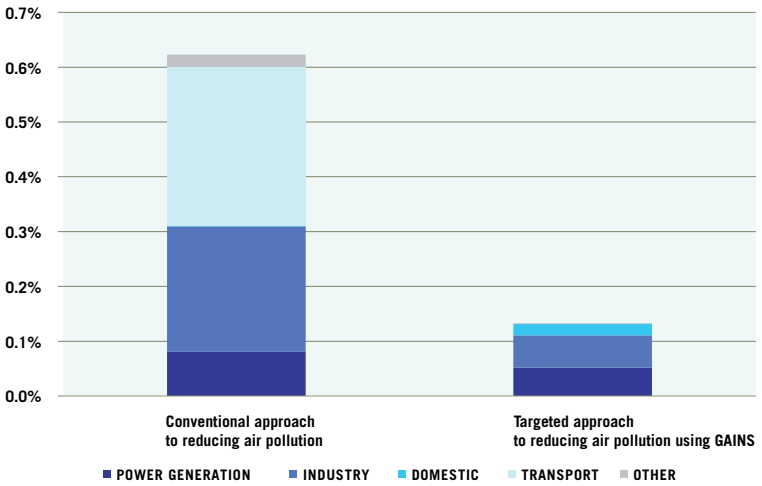
3

Deteriorating air quality will cause serious impacts on human health and vegetation, including economically important crops.

This growth in emissions will deteriorate Asian air quality further, and cause serious impacts on human health and vegetation. The GAINS model estimates that outdoor exposure to fine particulate matter will, by 2030, shorten statistical life expectancy in India by 57 (29-80) months, compared to 17 (8-23) months in 2005 (see map). Higher ground-level ozone means crop losses of wheat, corn and rice will triple or more by 2030.

Using GAINS can help countries reduce costs for improving air quality by 80%

COSTS OF FURTHER AIR POLLUTION MEASURES IN 2030 [% OF GDP (PPP)]



REDUCING THE COSTS OF AIR POLLUTION CONTROL.

The chart shows how air pollution in China can be reduced far more economically by carefully selecting the most cost-effective portfolio of measures.

The first column shows the costs of a conventional across-the-board approach to reducing air pollutants in 2030. The resulting cleaner air will reduce losses in statistical life expectancy from air pollution by 43%. It will also reduce crop losses by around 50%.

The second column shows how China could achieve these same benefits at a far lower cost by using GAINS to carefully identify the most effective and efficient portfolio of emission control measures.

1

Advanced emission control technologies are available to maintain acceptable levels of air quality despite the pressure from growing economic activities.

There are two broad methods to cut air pollution; either reducing the levels of activities that emit the pollutants; or not changing production and consumption levels but controlling the waste they produce.
The latter method is known as end-of-pipe emission control technology and by fully applying existing technical measures Asia can avoid serious deteriorations in air quality. However, such an undifferentiated across-the-board approach would impose significant burdens on the economy.

2

A cost-effective strategy can reduce costs for air pollution control by up to 80% compared to conventional approaches.

An optimized emission control strategy, which selectively allocates specific reduction measures across economic sectors, pollutants and regions, could achieve equal air quality improvements at only 20% of the costs of a conventional across-the-board approach.
The GAINS optimization tool allows a systematic search for those measures that ensure total emission control costs are minimized. For Asia, an integral element of such an air pollution control strategy will be measures to eliminate indoor pollution from the combustion of solid fuels.

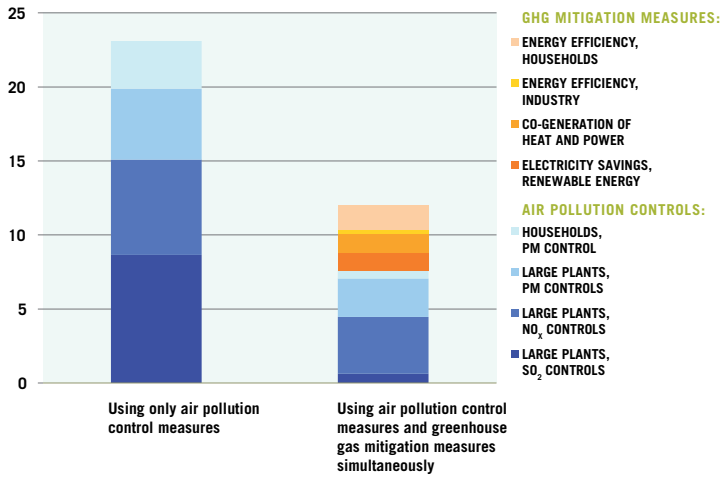
3

Enhancing air quality in Asia improves the environment, human health, and agricultural productivity.

The GAINS model allows policymakers in China and India to analyse and design their own air pollution control strategy. The benefits of such a strategy are illustrated in the following example.
Air pollution lowers statistical life expectancy in China, these health impacts could be reduced by 43% by 2030 by using available technology to improve ambient air quality.
This can be achieved at an additional expense of 0.63% of GDP with a conventional across-the-board approach to reducing air pollutants or at only an additional cost of 0.13% of GDP using the targeted approach of GAINS (see figure). The investment will also reduce crop losses by around 50% and have far ranging positive impacts on the environment.

Well-designed air pollution control strategies can also reduce emissions of greenhouse gases

COSTS FOR REDUCING HEALTH IMPACTS FROM AIR POLLUTION BY 50% (BN € IN 2030)



BENEFITS OF TACKLING AIR POLLUTION AND CLIMATE CHANGE SIMULTANEOUSLY:

To achieve a given target in ambient air quality, China can dramatically save costs by adopting a smart mix of measures to reduce air pollution and greenhouse gas emissions.

The left column shows the most cost effective way for halving negative health impacts from air pollution using only air pollution control measures.

The right column shows how much more cheaply the same target can be reached using measures to lower air pollution and greenhouse gas emissions simultaneously. This cost saving also results in a 9 % reduction in greenhouse gas emissions.

1

Measures exist that simultaneously reduce emissions of air pollutants and greenhouse gases.

In many cases emissions of air pollutants and greenhouse gases are emitted from the same sources. Thus, controls directed at air pollutants frequently affect greenhouse gas emissions, and vice versa. The GAINS model provides an integrated perspective that can maximize synergies between air pollution control and greenhouse gas mitigation strategies.

2

Strategies to reduce greenhouse gas emissions can dramatically lower air pollution control costs.

For achieving given targets on ambient air quality, the cost of air pollution controls can be further reduced by adopting certain low carbon strategies. GAINS demonstrates that the additional controls of climate-friendly measures, e.g., energy efficiency improvements, co-generation of heat and power, fuel substitution, integrated coal gasification combined cycle (IGCC) plants, etc., are more than compensated for by savings in air pollution control equipment.

3

A smart mix of measures to simultaneously cut air pollution and greenhouse gas emissions will help combat climate change and air pollution more cheaply than tackling either issue separately.

GAINS demonstrates that low carbon strategies result in lower emissions of sulfur dioxide, nitrogen oxides and fine particulate matter at no additional costs. For China, India, and Europe, GAINS estimates that each percent of CO_2 reduction will typically reduce health impacts from fine particulate (PM) air pollution by 1%. This is important information for judging the net benefits of greenhouse gas mitigation strategies. GAINS also shows by selecting a smart mix of measures to simultaneously cut air pollution and greenhouse gas emissions, China can almost halve air pollution control costs as well as lower greenhouse gas emissions by 9 % (see figure).

GAINS:
A scientific tool to combat air pollution and climate change simultaneously

Current economic growth will intensify air quality problems in Asia unless current pollution control laws are significantly upgraded.

Compared to a conventional strategy, the GAINS cost-effectiveness approach can find ways to reduce costs for improving air quality by 80%.

By selecting a smart mix of measures to simultaneously cut air pollution and greenhouse gas emissions, countries can further reduce air pollution control costs as well as cut greenhouse gas emissions.

The GAINS online model, implemented for China and India, is freely accessible on the Internet at http://gains.iiasa.ac.at and can be implemented for other countries.

GAINS was developed by an international and independent team of scientists from China, Europe and India, led by the International Institute for Applied Systems Analysis (IIASA).

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