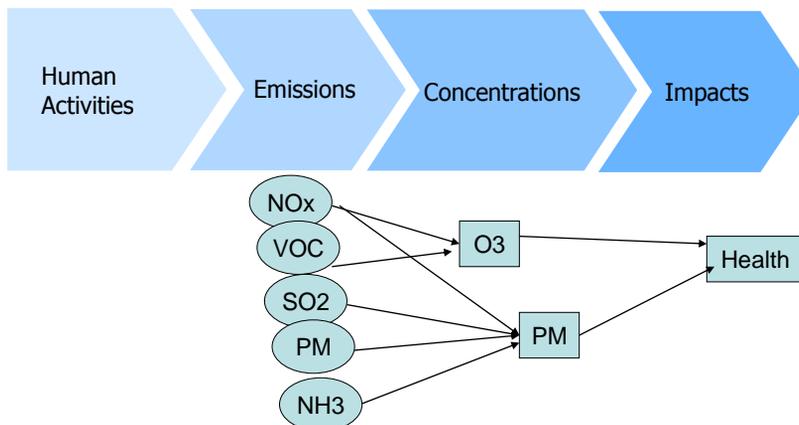




Estimating Co-Benefits with the GAINS model - Examples from India and China -

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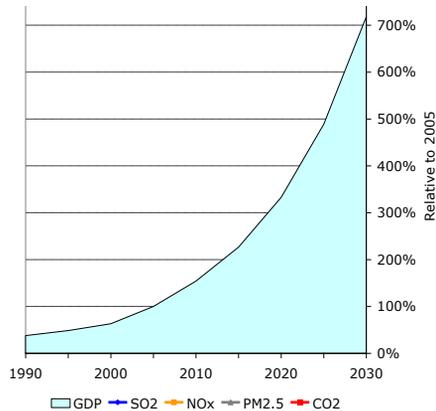
Atmospheric pollution: the causal chain



Current economic growth will increase emissions unless additional air pollution controls are implemented



Governmental economic projection for India

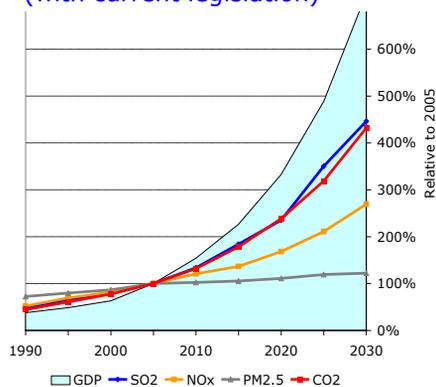


- Population growth and development will further boost the level of economic activities in Asia.

Current economic growth will increase emissions unless additional air pollution controls are implemented



Governmental economic projection for India and implied emissions (with current legislation)



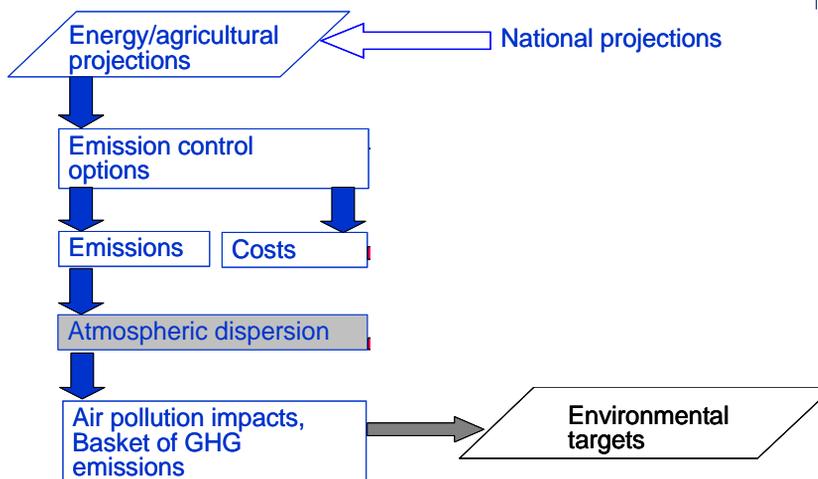
- Population growth and development will further boost the level of economic activities in Asia.
- Current air pollution control strategies will not be sufficient to balance out the negative effects on air pollution and GHG emissions.
- **There is a need for further emission control strategies that do not harm economic development.**

GAINS: A tool for a systematic assessment of the cost-effectiveness of emission control strategies



- GAINS quantifies sectoral emission control potentials and costs,
 - for exogenous (governmental) activity projections (by State and province),
 - considering physical and economic interactions between pollutants,
 - assessing urban/rural impacts from air quality effects and climate indicators.
- Search for least-cost mix of mitigation measures to meet air quality and/or GHG targets
- GAINS is implemented for China (with ERI), India (with TERI), Pakistan, Europe

The GAINS model follows pollution from the sources to their impacts



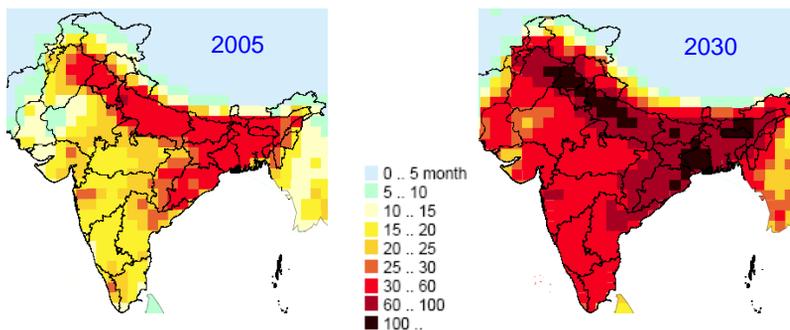
GAINS: A model to harvest synergies by integrating multiple pollutants and their multiple effects




	Emissions and control measures									
	for air pollutants					and greenhouse gases				
	PM BC OC	O ₂	NO _x	VOC	NH ₃	CO ₂	CH ₄	N ₂ O	HFCs PFCs SF ₆	
Impacts	Health impacts:									
	from fine particulate matter									
	✓	✓	✓	(✓)	✓					
	from ground-level ozone									
				✓	✓				(✓)	
	Vegetation damage:									
Ozone (agricultural crops)										
			✓	✓				(✓)		
Acidification (forests, water)										
		✓	✓		✓					
Eutrophication (biodiversity)										
			✓		✓					
Radiative forcing:										
- from direct greenhouse gases										
						✓	✓	✓	✓	
- via aerosols and ozone										
	(✓)	(✓)	(✓)	(✓)	(✓)		(✓)			

Air quality problems are expected to intensify unless additional air pollution controls are implemented

Loss in statistical life expectancy attributable to outdoor exposure of PM_{2.5} (GAINS estimates)

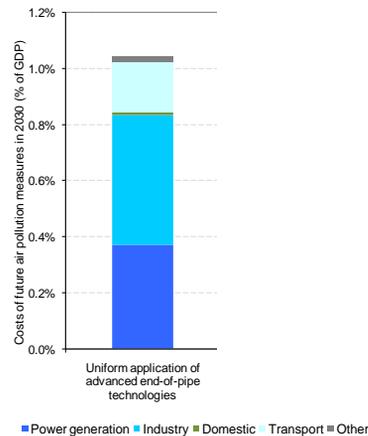


The GAINS cost-effectiveness approach can reduce costs for improving air quality by up to 55%



- Full application of advanced emission control technologies can reduce health impacts in India by 53% in 2030

Emission control costs for reducing PM health impacts in India by 53%

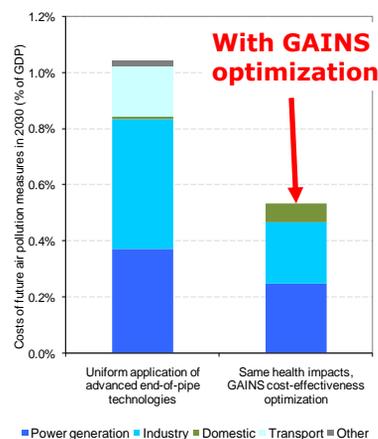


The GAINS cost-effectiveness approach can reduce costs for improving air quality by up to 55%



- Full application of advanced emission control technologies can reduce health impacts in India by 53% in 2030
- The GAINS optimization can identify the most cost-effective portfolio of measures – these achieve the same health improvements at 45% of the costs

Emission control costs for reducing PM health impacts in India by 53%



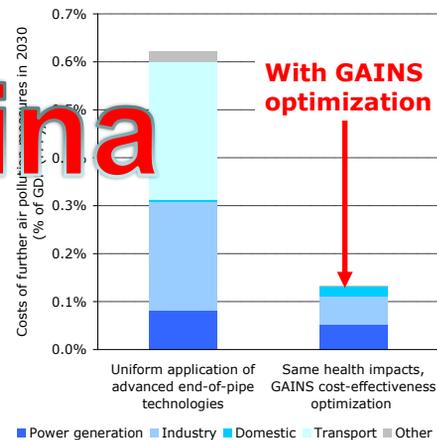
The GAINS cost-effectiveness approach can reduce costs for improving air quality by up to **80%**



- Full application of advanced emission control technologies can reduce health impacts in China by 43% in 2030
- The GAINS optimization can identify the most cost-effective portfolio of measures – these achieve the same health improvements at **20%** of the costs

China

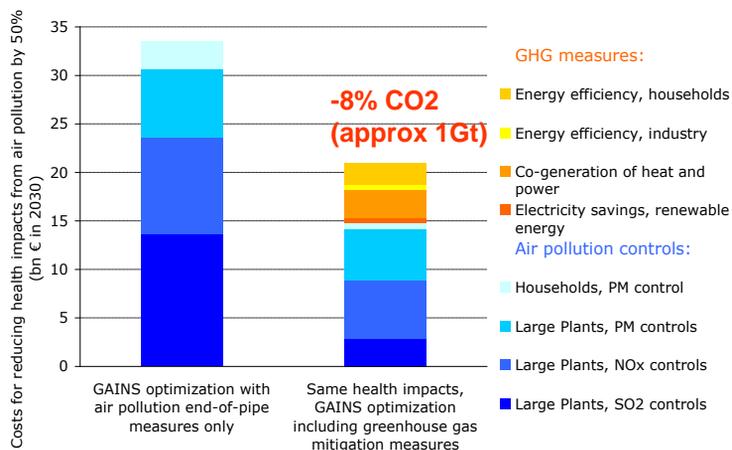
Emission control costs for reducing PM health impacts in China by 43%



Well-designed air pollution control strategies can also reduce GHG emissions – e.g. **China**



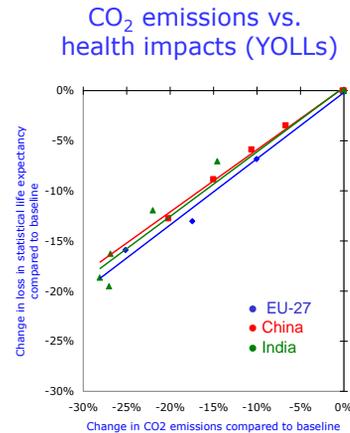
Emission control costs for reducing PM health impacts in China by 50%



Low carbon strategies have significant co-benefits - in Europe and in Asia



- Low CO₂ strategies result in
 - less SO₂, NO_x and PM emissions,
 - lower damage to health and vegetation from reduced air pollution,
 - cost savings for air pollution control equipment, compensating for up to 40% of GHG mitigation costs.



Conclusion



- Air pollutants and greenhouse gases often stem from the same sources
- GAINS looks at both problems from a systems perspective:
 - Air pollution concerns can drive GHG mitigation, and vice versa
 - Cost-effective strategies typically address both
 - Cost savings can be quantified with GAINS
- Rule of thumb:
 - For every 5% of CO₂ mitigation, the health impact from PM is reduced by 4%

The GAINS model is freely accessible on the Internet: <http://gains.iiasa.ac.at>



- Access to on-line versions
 - India
 - Pakistan
 - China
 - Europe

- Policy reports, user tutorials, model documentation, etc.

