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Analysing the Multiple Benefits of Managing Air Pollution in Asia: *Towards a Systems Perspective*

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How Can Asia Manage Air Pollution and Climate Change? From Understanding Impacts to Implementing Solutions
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Sustainable Development Goals (SDGs) provide a comprehensive agenda for development and sustainability

6 MAJOR TRANSFORMATIONS

Digital revolution
Artificial intelligence, big data, biotech, nanotech, autonomous systems

Human capacity & demography
Education, health, ageing, labor markets, gender, inequalities

Smart cities
Decent housing, mobility, sustainable infrastructure, pollution

SDGs:
Prosperity
Social Inclusion
Sustainability

TWI2050
The World in 2050
www.twi2050.org

Sustainable consumption & production
Resource use, circular economy, sufficiency, pollution

Food, biosphere, water & oceans
Sustainable intensification, biodiversity, forests, healthy diets, nutrients

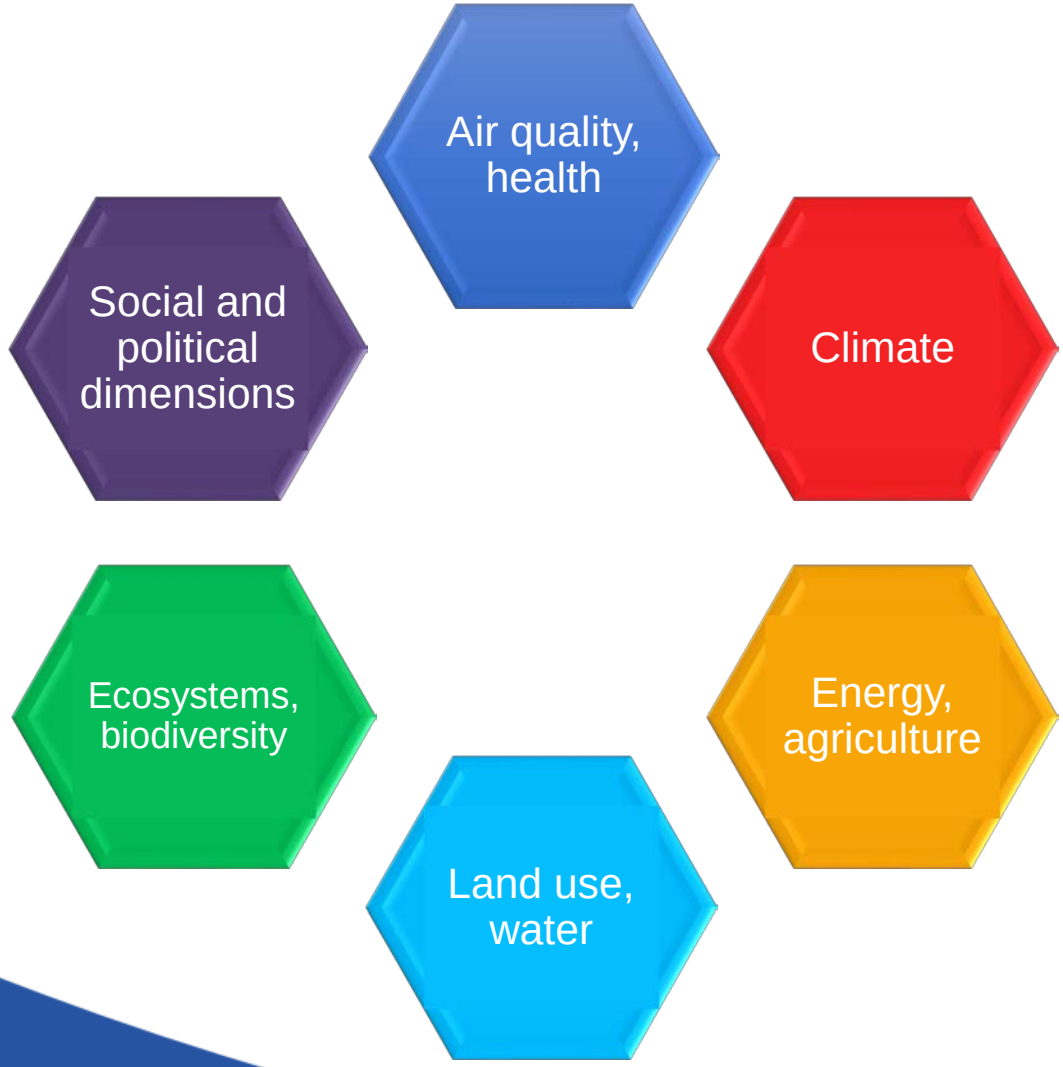
Decarbonization & energy
Energy access, efficiency, electrification, decent services

Air pollution does not occur explicitly in SDGs, but provides an important and unique entry point to these transformations, especially since:

- Societies in developing and industrialized (!) countries are concerned and willing to take action (*Global Burden of Disease 2017: a fragile world; Lancet, 2018*), and
- Well-chosen air pollution measures can deliver not only air quality and health benefits, but also contribute to solve global and long-term challenges, and to other development priorities

But only a systems perspective will reveal these opportunities

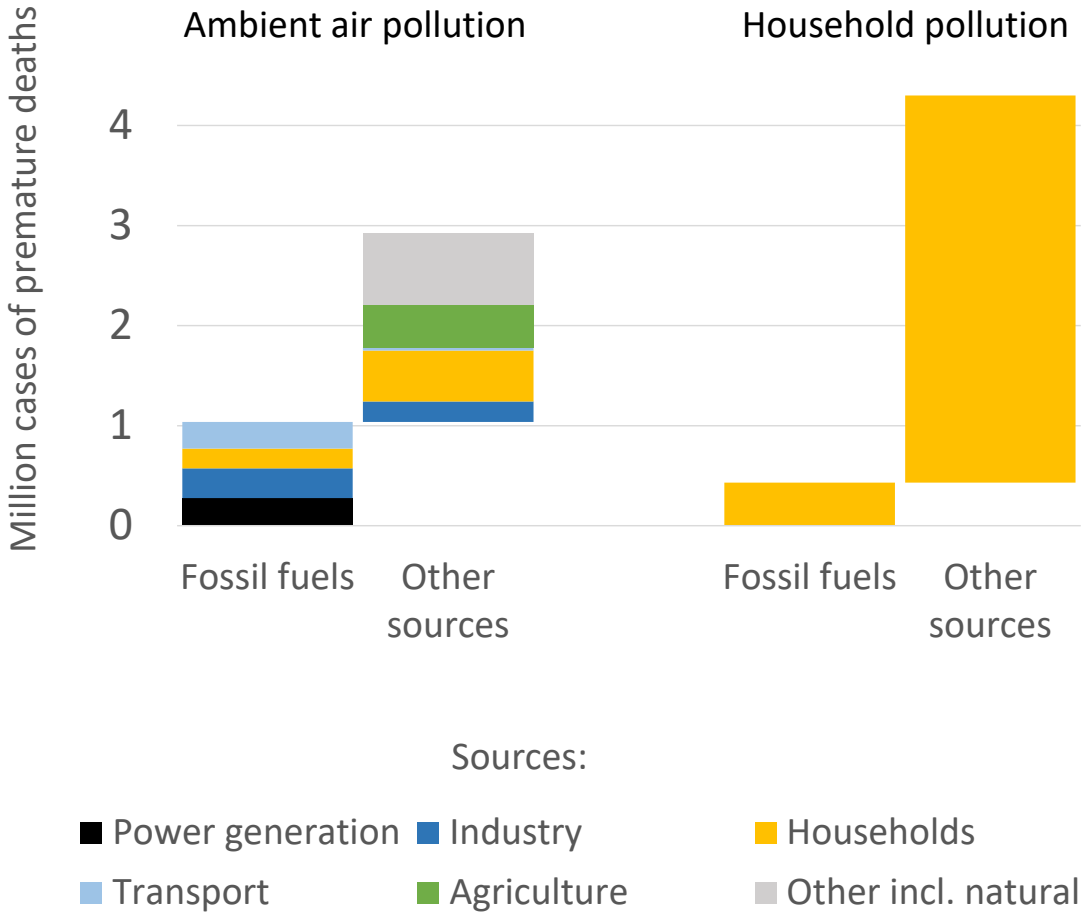
Tackling air pollution provides a unique entry point to address multiple benefits

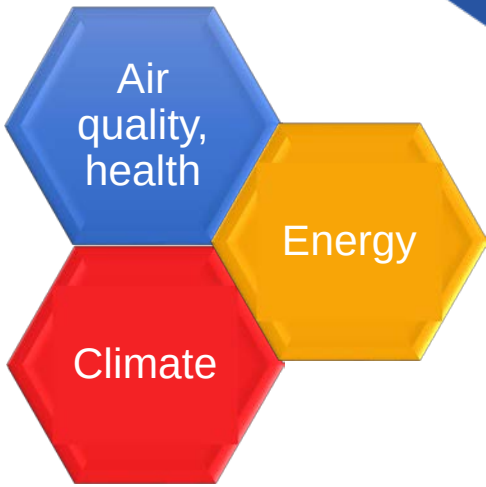


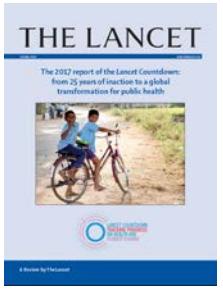
Addressing them requires knowledge on:
- atmospheric sciences,
- engineering/economic models,
- health impact assessment,
- social and political sciences

Systems perspective can integrate these areas and produce outcomes to support decision making

Sources of health impacts/exposure to fine particulate matter (PM2.5) – 2015, a global estimate



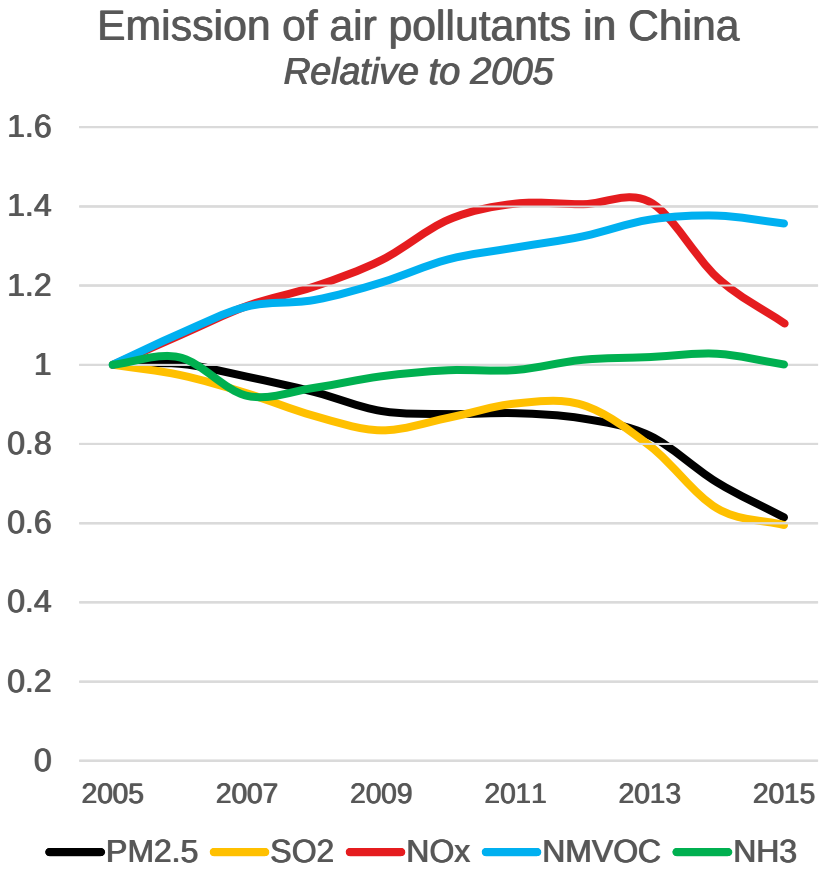




IIASA calculations for the '*The Lancet Countdown on Health and Climate change*' (N. Watts et al., Lancet, 2018)

Air pollution control in China

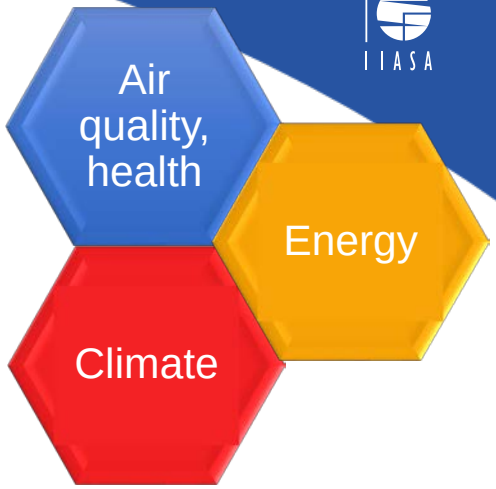
Air quality, health



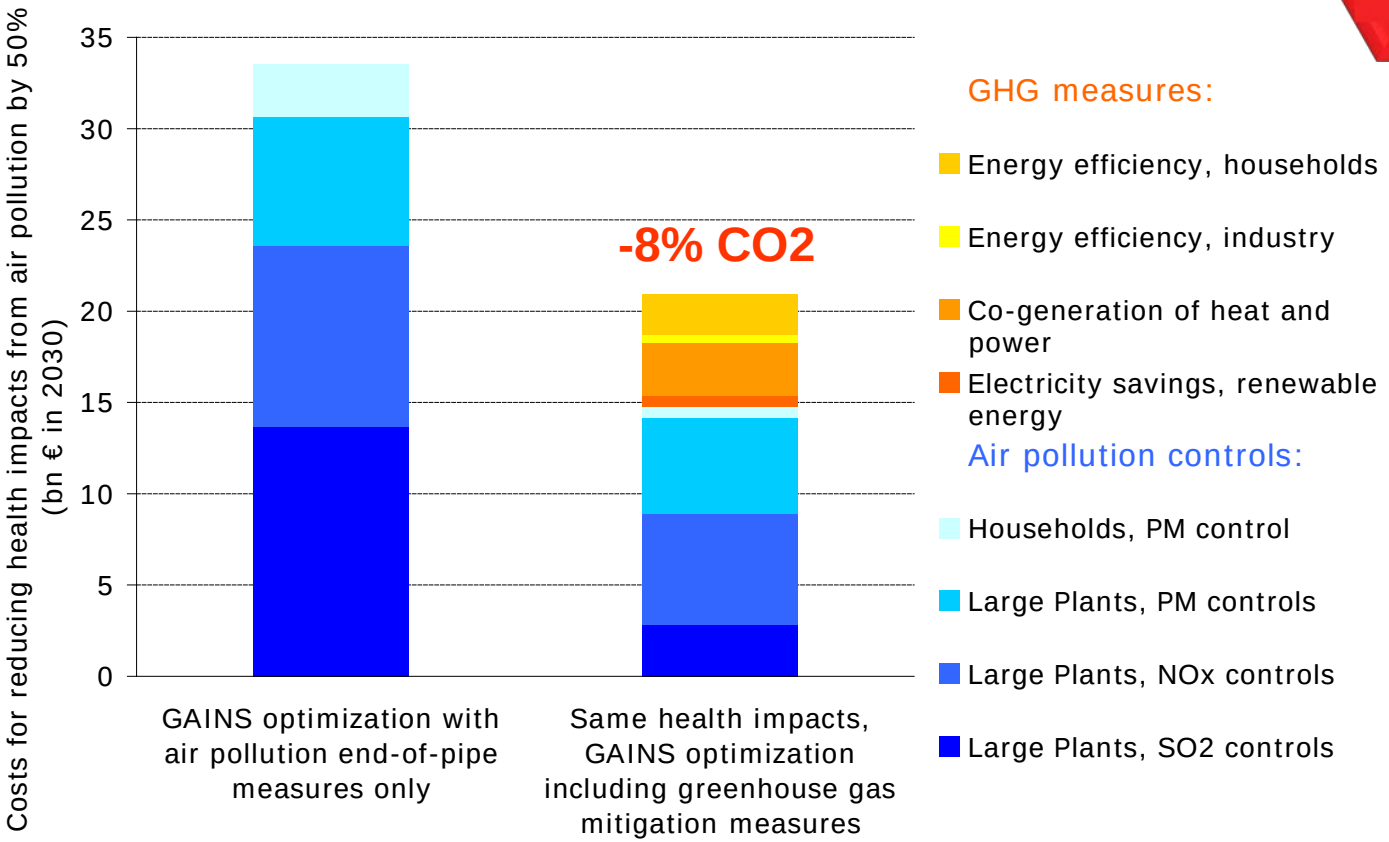
Emissions source: Zhao et al., 2018

- Strict policies has been addressing air pollution emissions since more than a decade – focus on particulate matter
- Lower priority on other air pollution impacts (e.g., ozone, eutrophication)
- Integrated strategy (systems approach) could address simultaneously several impacts, including climate change, and achieve significant cost savings

Well-designed air pollution control strategies can also reduce GHG emissions



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



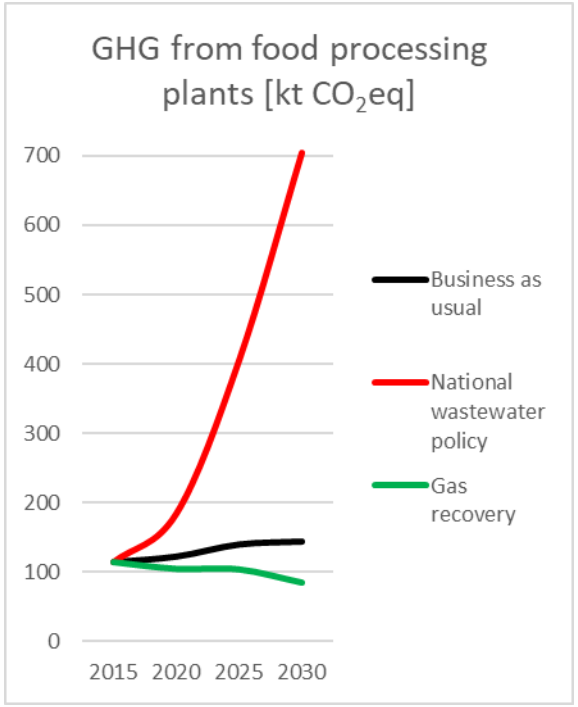
Source: GAINS- Asia. Amann et al., 2008

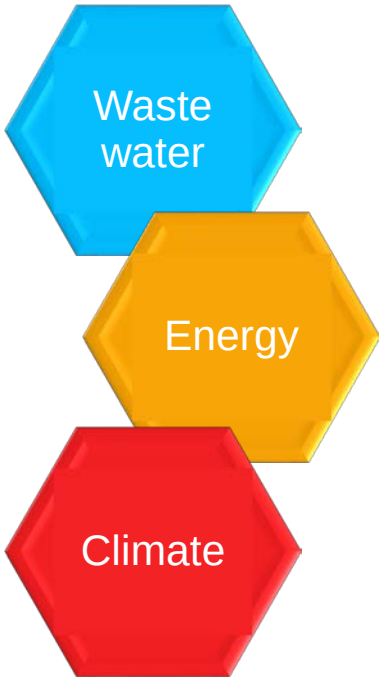
Recent projects addressing multiple benefits

Collaborative effort between IGES, Kyushu University , and IIASA

Co-benefits from scaling up modernization of coal fired Heat Only Boilers in Ulaanbaatar and Mongolia

Co-benefits from scaling up a waste water management in food (fish) processing plants in Indonesia

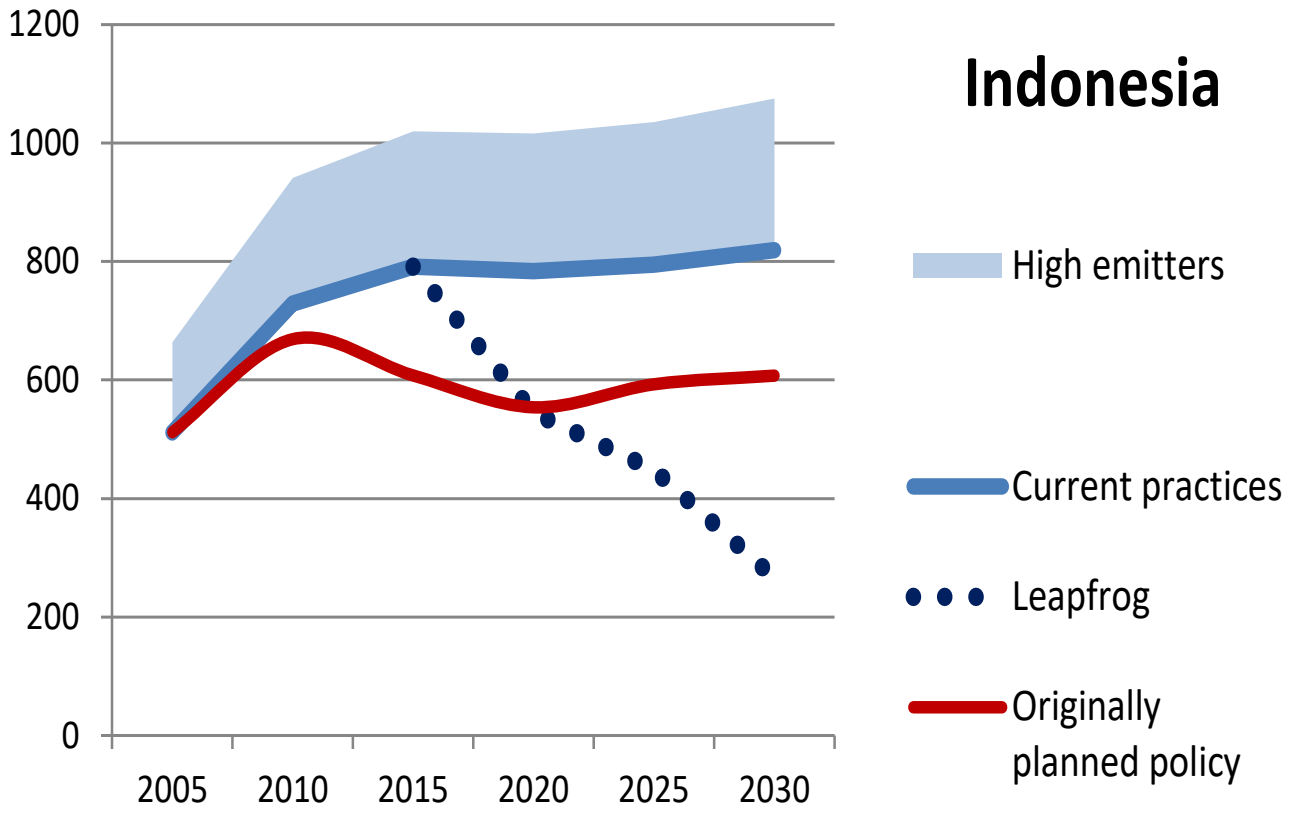




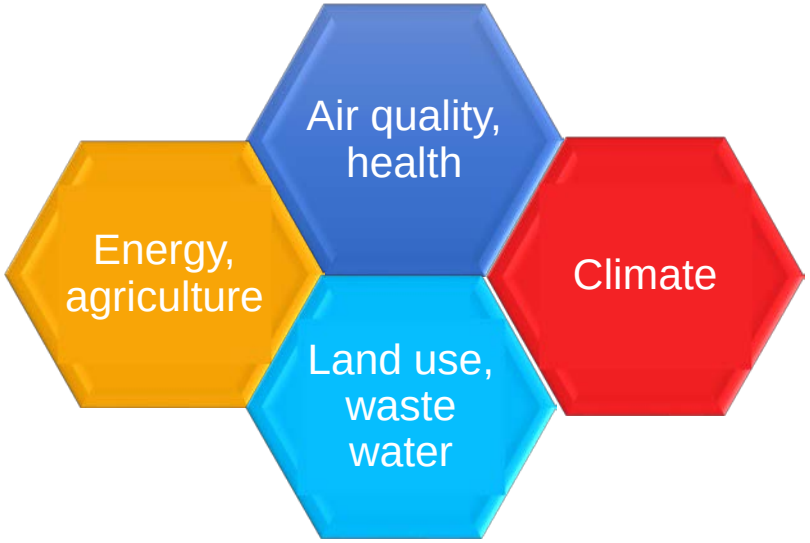
Diesel controls planned (before 2010) but not timely implemented in some countries in Asia

Air quality, health

PM2.5 emissions from road transport (kilotons)
Source: *Amann et al. (2015; IGES discussion paper)*



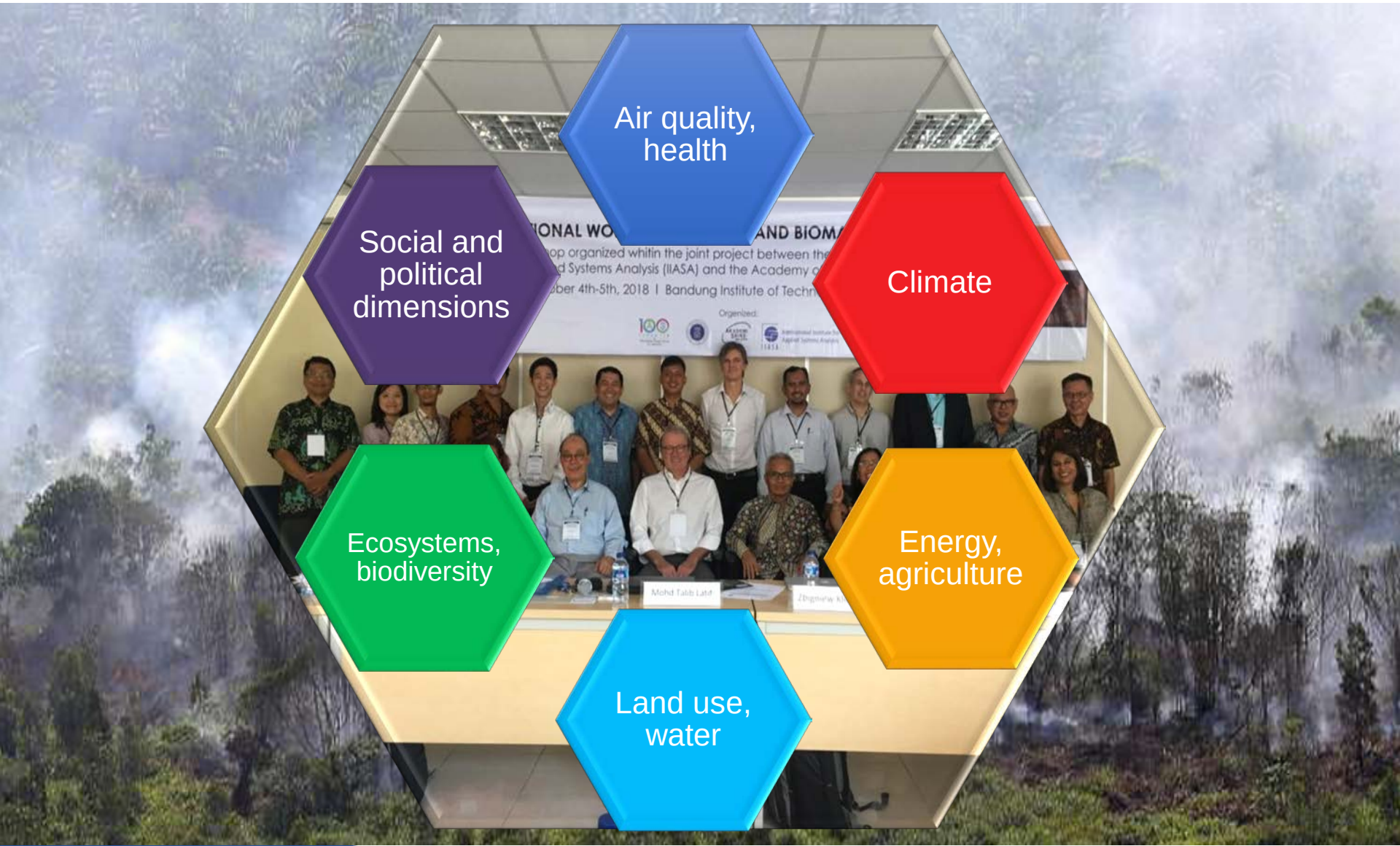
GAINS-Vietnam:
A bilateral project with the IIASA NMO (VAST)



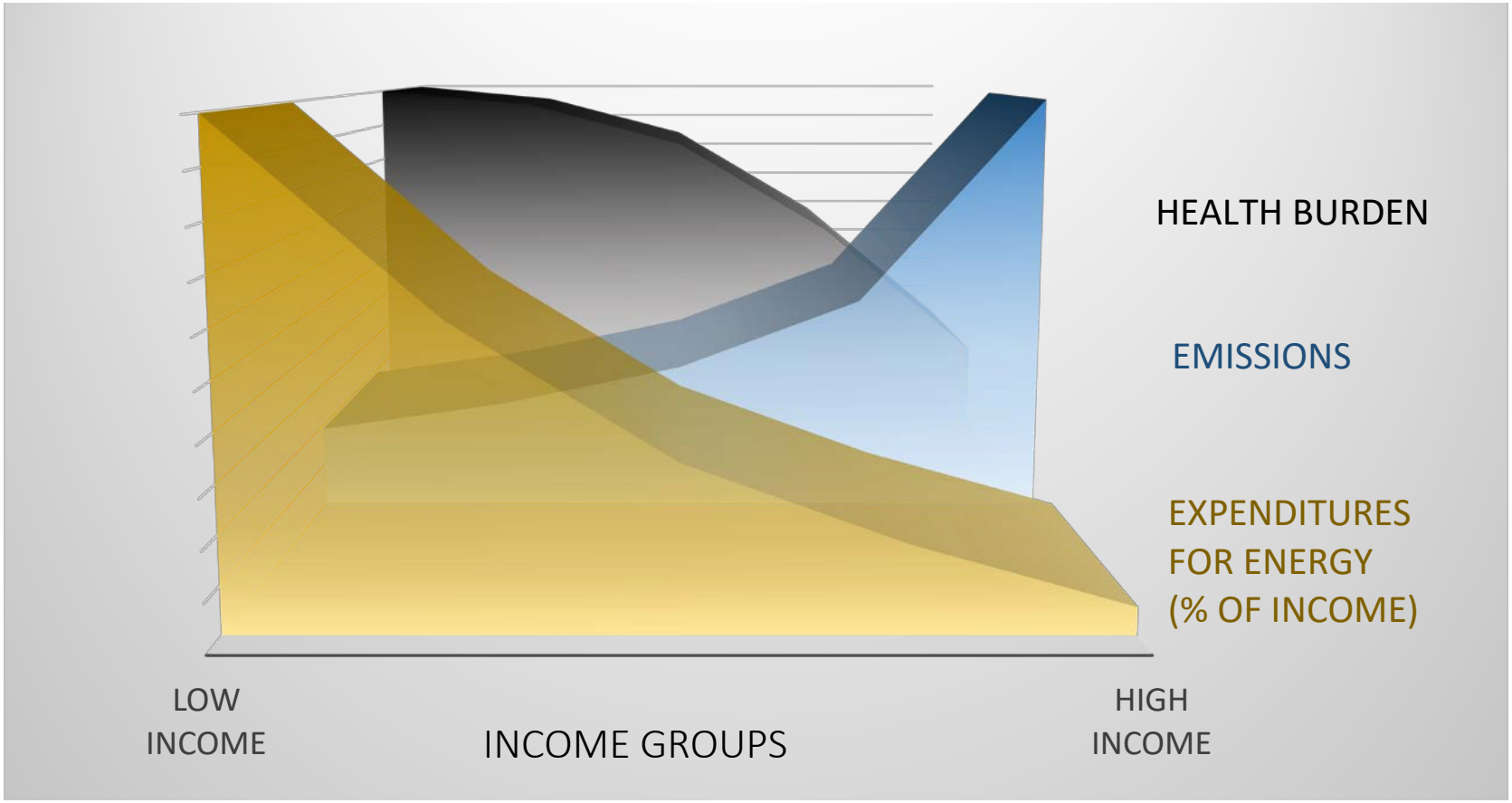
- Build a science community on environmental management in Vietnam to interact with decision makers
- Joint implementation of the GAINS model with national data on energy, waste, agriculture
- Citizen science – An *App* for craft villages
- GAINS model transferred to VAST

Haze and biomass burning in Asia

A project with the Malaysian NMO,
involving scientists from Malaysia, Indonesia, Vietnam, Japan, China, IIASA



Inequalities of pollution
India - 2010



Source: Kiesewetter et al., 2018

It is desirable to extend the modelling framework enabling additional impact analyses

- **Environmental**:
  - Air: Open burning (PM, BC/OC, dioxins, NOx), Landfills & Anaerobic treatment (CH_4)
  - Water: pathogens contamination, eutrophication (N, phosphates)
  - Heavy metals, POPs
- **Health**: gastrointestinal diseases, respiratory and heart/lung diseases
- **Costs**: investment and operation costs for infrastructure and expected revenues from recycling, recovered energy and saved landfill costs
- **Socio-economic**: inclusive transformations, making informal jobs formal without marginalizing already vulnerable groups
- **Land-use changes**

Heterogeneity perspective: impact analyses by identified groups (income, urban/rural, etc.)

UNEP/CCAC/APCAP Assessment identifies air quality management options with optimum co-benefits in Asia

1st objective:
Reduce exposure to outdoor and household air pollution

2nd objective:
Maximize co-benefits with greenhouse gas emissions

Effective portfolios of measures to improve air quality

Complementary SLCP + CO_2 measures with additional health benefits

- **Human health**
- **Econ. wealth**
- **Food**
- **Ecosystems**
- **Climate**

The model suite used for this analysis and the interactions between models