# Evaluating Health Co-benefits of Air Pollution Control and Climate Change Mitigation Policies for Pakistan


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## Introduction

**Statement of the problem:**
Despite the fact that the Pakistan's environmental protection act and climate change act recognize dual challenges of air pollution and climate change, the country lacks an integrated national strategy for addressing both issues simultaneously. Because energy-related air pollutants and $CO_2$ emissions often arise from the same sources, therefore the adoption of an integrated approach to tackle both can deliver important co-benefits. The purpose of this study is to demonstrate the potential for alternative policy approaches that maximize the qualitative co-benefits of air pollution management and greenhouse gas mitigation in Pakistan.

**Research question:**
What are the air quality, health, climate, and economic co-benefits of integrating advanced end-of-pipe air pollution control technologies and national sustainable development strategies in the baseline and alternative policy scenarios for Pakistan?

## Materials and Methods

- The methodological approach combines two scientific modeling tools: the EnerNEO Pakistan model (an energy-economic model developed by Enerdata) and the GAINS model (an integrated assessment model developed by the International Institute for Applied Systems Analysis).
- The data on energy use pathways (sector-specific fuel-use data) were generated using the EnerNEO Pakistan model and then fed into the GAINS model to determine the efficacy of policy measures on air quality, public health, climate, and emission control cost.
- The data on activities that result in non-exhaust emissions from mobile sources, as well as industrial process emissions, agriculture and waste sectors were derived from the GAINS database.

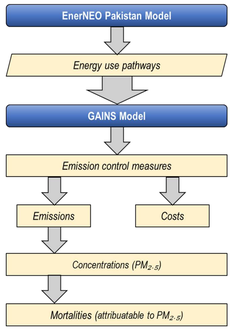


**Figure 1.** The methodological approach

## Results

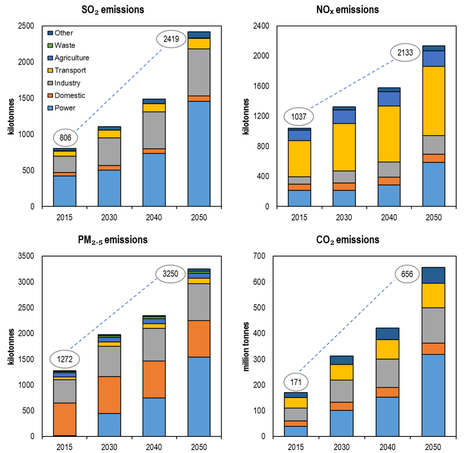


**Figure 2.** Air pollutants and $CO_2$ emissions by sector in the reference scenario

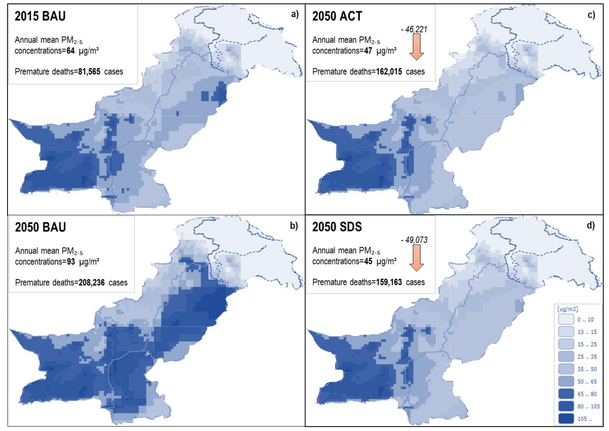


**Figure 3.** Ambient concentrations of $PM_{2.5}$ in a) 2015 and for the b) business-as-usual (BAU) scenario in 2050; c) advanced control technology (ACT) scenario in 2050; and d) sustainable development scenario (SDS) in 2050.

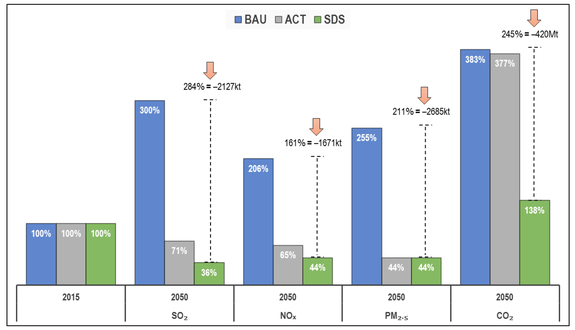


**Figure 4.** Comparison of air pollutants and $CO_2$ emissions in the alternative scenarios (relative to 2015)

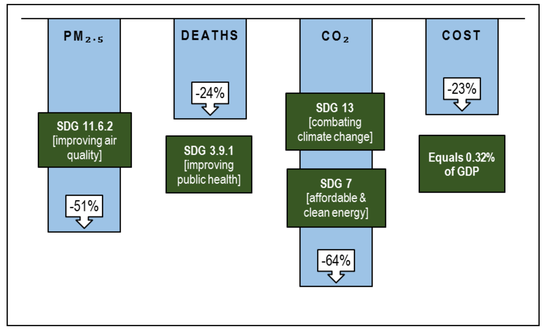


**Figure 5.** Co-benefits of SDS by 2050 in comparison to the reference scenario

By 2050:

- increase in $PM_{2.5}$ and $CO_2$ emissions by a factor of 2.6 and 3.8 in BAU scenario.
- increase in $PM_{2.5}$ concentrations and attributed premature deaths by a factor of 1.5 and 2.6 in BAU scenario.
- decrease in $PM_{2.5}$ and $CO_2$ emissions by a factor of 5.8 and 2.8 in SDS compared to BAU scenario.
- decrease in $PM_{2.5}$ concentrations and attributed premature deaths by a factor of 0.5 and 0.8 in SDS compared to BAU scenario.
- decrease in air pollution control cost by a factor of 1.3 (around 3 billion euro) in SDS compared to ACT scenario.

## Conclusions

- Pakistan's current air pollution control policies are insufficient to meet the country's national ambient air quality standards (NAAQS) in a business-as-usual scenario.
- While advanced end-of-pipe air pollution control technologies alone could improve air quality and reduce adverse health effects in Pakistan, when combined with national sustainable development strategies, they have the potential to reduce more than half of the national $CO_2$ emissions by 2050 compared to the business-as-usual scenario and save approximately a quarter on air pollution control costs compared to the pure advanced control technology scenario.
- Such co-benefits further facilitates the implementation of various SDGs in Pakistan, including SDG 11.6.2 (improving air quality), SDG 3.9.1 (improving public health), SDG 13 (climate action), and SDG 7 (affordable & clean energy).
- Acknowledging these synergies in the design and implementation of future policy frameworks will provide a more impactful response to the most pressing national health and environmental challenges and offer great potential for Pakistan's contribution in the global fight against climate change.

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