

# Air Pollution in South Asia: Issues and Solutions

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**BAQ, Kuching, 16 November 2018**

FOR MOUNTAINS AND PEOPLE

Lets start in northern South Asia.  
The Himalaya are changing...

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1973



Photo: Fritz Berger  
(ICIMOD archive)

2011



Photo: A. Panday

Some of the melting is due to greenhouse gas-induced global warming.

But a big part is also due to:

- Black carbon warming the atmosphere in contact with the snow and ice.
- Black carbon and dust depositing onto white surfaces, melting them faster.

# The largest storage of frozen water outside the polar regions



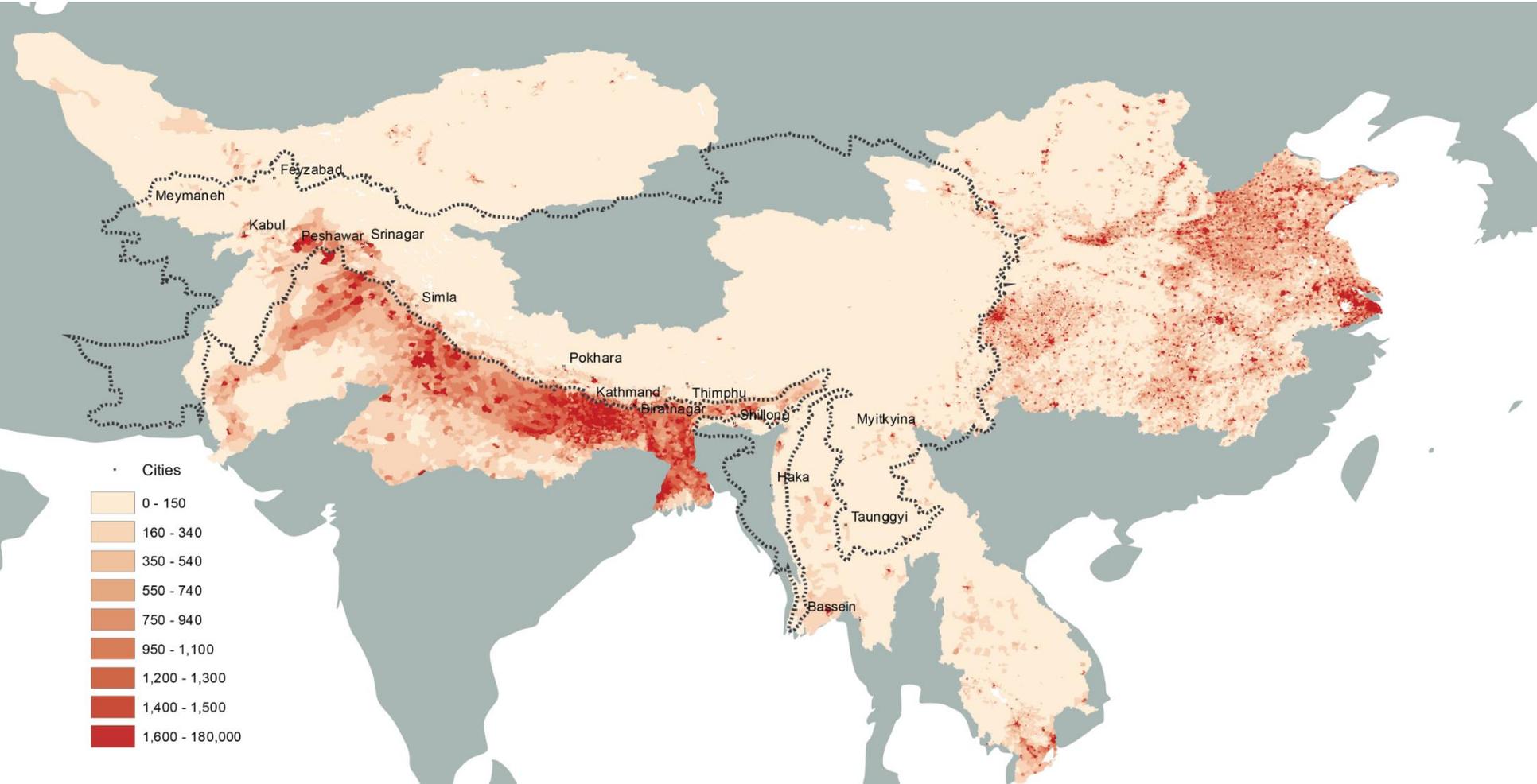
# Communities dependent on glaciers and snow melt are feeling the impacts

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Nang, Ladakh,  
India  
Photo: Karen

# HKH basins support some of the world's most populated areas



Air pollution affects monsoon rainfall patterns.



Microphysical processes  
Impacts on convection

... with impacts on food security and disasters.

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Photo © Arnico Panday, ICIMOD

There are some pollution sources near the high mountains.

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The hills below the high mountains are densely  
Populated.

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## Annapurna Himalaya

Pokhara  
City

Many of our practices defy even basic ideas of what is good for environment and health.

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But air pollution in the hills has more than just local sources.

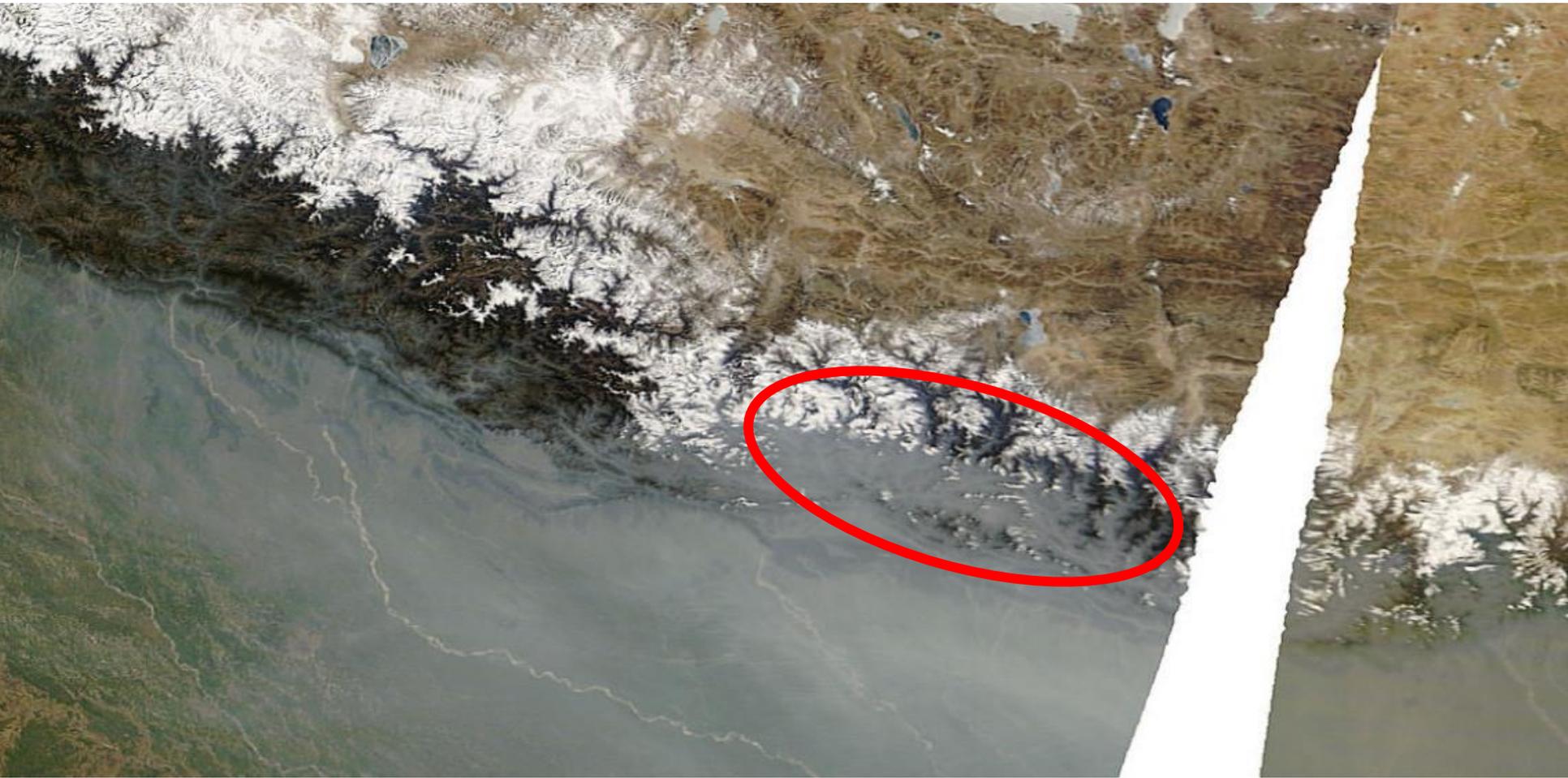


View from Hattiban Resort, on 28 February 2013 (L) and 2 March 2013 (R)

Regional haze!







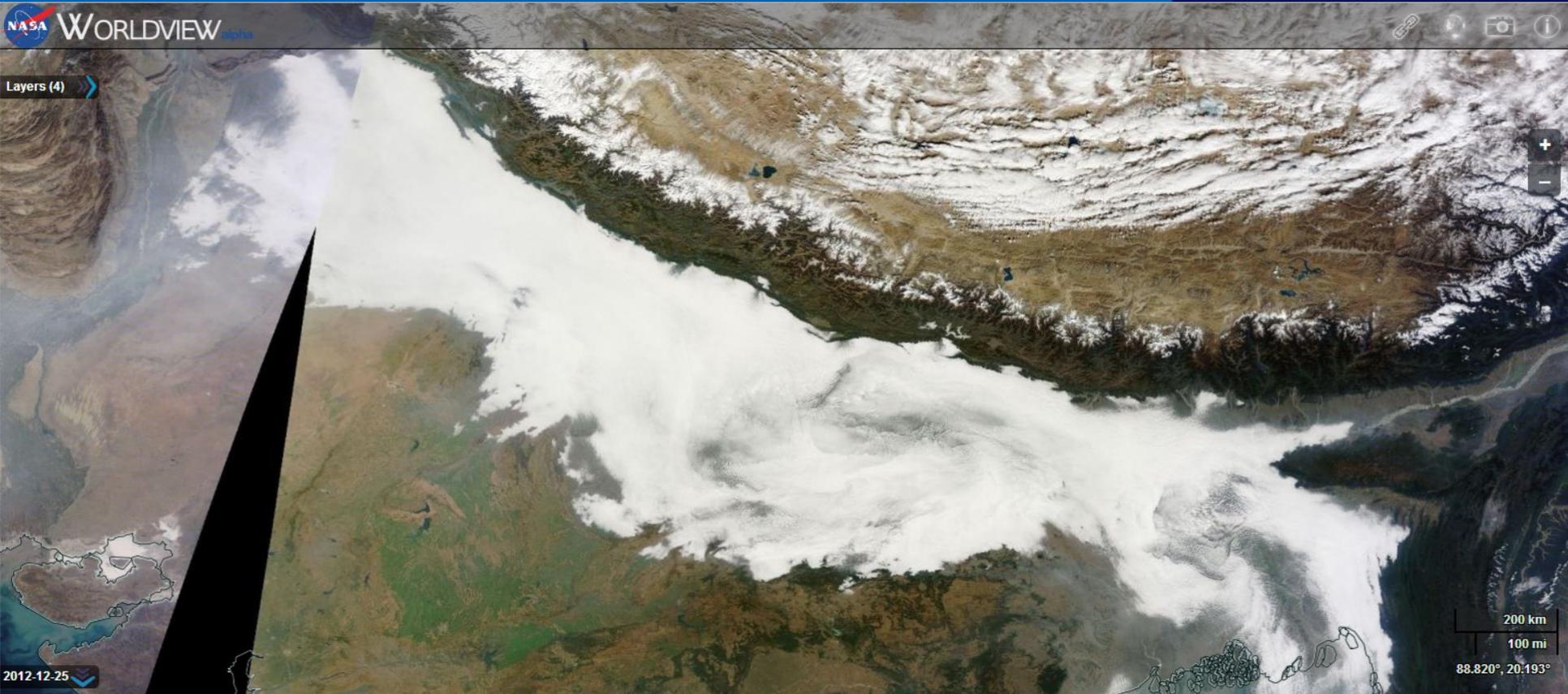




**2 Punjab but  
1 atmosphere**

# Winter fog across five countries

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Multiple sources.  
Wide range of scales.

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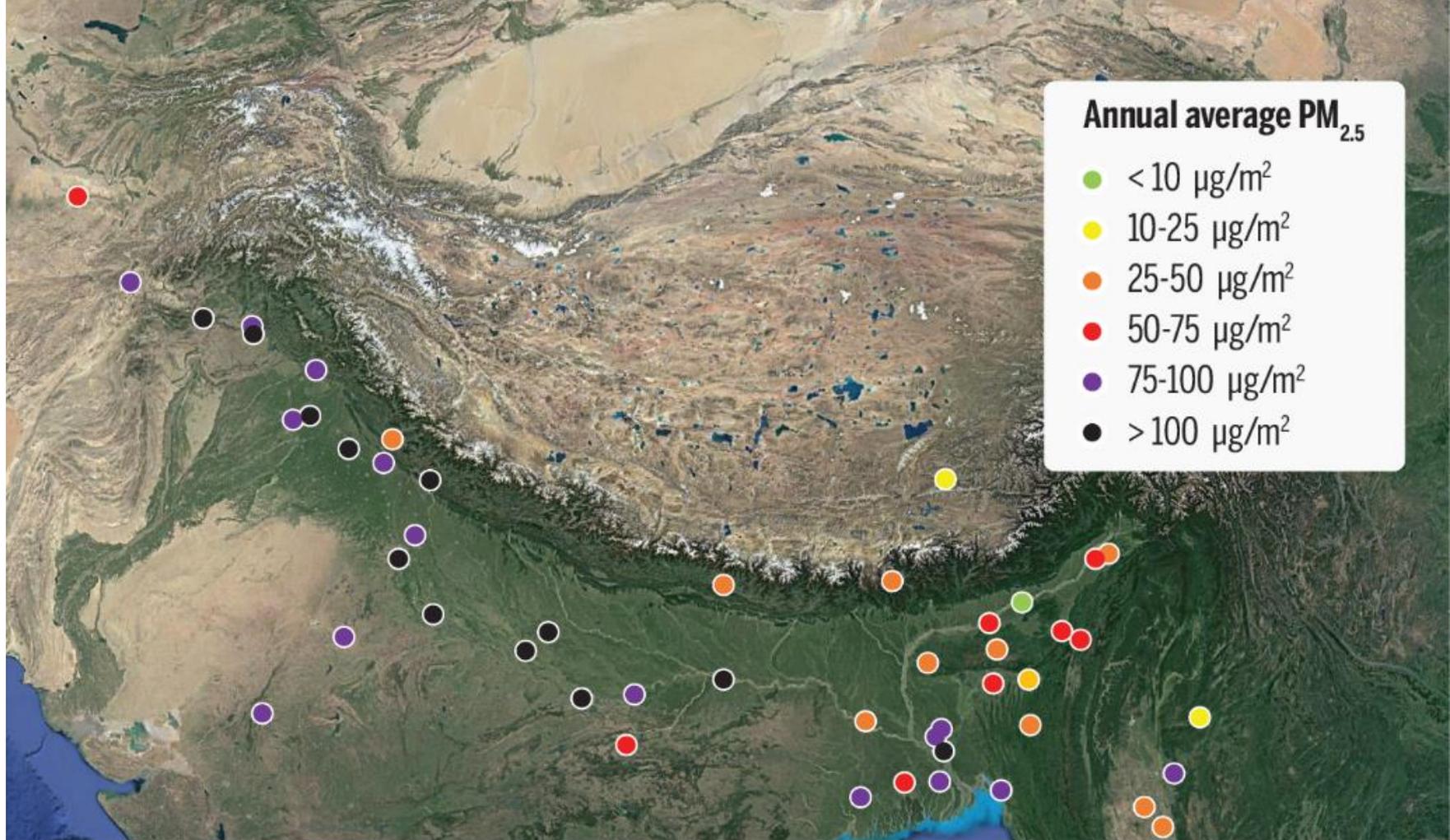
South Asia has some of the most polluted cities  
in the world

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New Delhi



*Photo © Arnico Panday, ICIMOD*



**Annual average PM<sub>2.5</sub>**

- < 10 µg/m<sup>2</sup>
- 10-25 µg/m<sup>2</sup>
- 25-50 µg/m<sup>2</sup>
- 50-75 µg/m<sup>2</sup>
- 75-100 µg/m<sup>2</sup>
- > 100 µg/m<sup>2</sup>

Kabul, Afghanistan	86	Sylhet, Bangladesh	61	Delhi, India	122	Luchnow, India	122	Tezpur, India	6	Namthu, Myanmar	17
Mazar-e Sharif, Afghanistan	68	Thimphu, Bhutan	43	Dibrugarh, India	30	Ludhiana, India	122	Tinsukia, India	30	Kathmandu, Nepal	49
Barisal, Bangladesh	85	Lhasa, China	24	Dimapur, India	48	Meerut, India	69	Tura, India	28	Islamabad, Pakistan	66
Chittagong, Bangladesh	95	Agra, India	105	Guwahati, India	49	Patiala, India	33	Udaipur, India	83	Lahore, Pakistan	68
Dhaka, Bangladesh	89	Aizawl, India	29	Jaipur, India	100	Patna, India	149	Varanasi, India	74	Peshawar, Pakistan	111
Gazipur, Bangladesh	88	Allahabad, India	170	Jammu, India	64	Rishikesh, India	58	Kyauk Pa Taung, Myanmar	50	Rawalpindi, Pakistan	107
Khulna, Bangladesh	61	Amritsar, India	108	Kanpur, India	115	Shillong, India	35	Pyin Oo Lwin, Myanmar	78		
Narayangonj, Bangladesh	106	Chandigarh, India	59	Kohima, India	44	Shimla, India	31	Meikhtila, Myanmar	33		
Rajshahi, Bangladesh	37	Dehradun, India	122	Kolkata, India	61	Silchar, India	48	Taungtha, Myanmar	44		

# HIMAP: Hindu Kush Himalaya Monitoring and Assessment Programme

ICIMOD

Full assessment launch on 11 December.

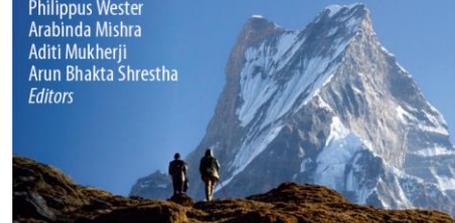
16 chapters.

210 authors, 125 reviewers.

Summary of current knowledge about the region's changes, vulnerabilities and opportunities.

**High mountain areas are warming faster!**

Philippus Wester  
Arabinda Mishra  
Aditi Mukherji  
Arun Bhakta Shrestha  
*Editors*



## The Hindu Kush Himalaya Assessment

Mountains, Climate Change,  
Sustainability and People

ICIMOD HIMAP

Springer Open



ipcc

INTERGOVERNMENTAL PANEL ON climate change

## GLOBAL WARMING OF 1.5 °C

an IPCC special report on the impacts of global warming of 1.5 °C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty

### *Summary for Policymakers*

This Summary for Policymakers was formally approved at the First Joint Session of Working Groups I, II and III of the IPCC and accepted by the 48<sup>th</sup> Session of the IPCC, Incheon, Republic of Korea, 6 October 2018.

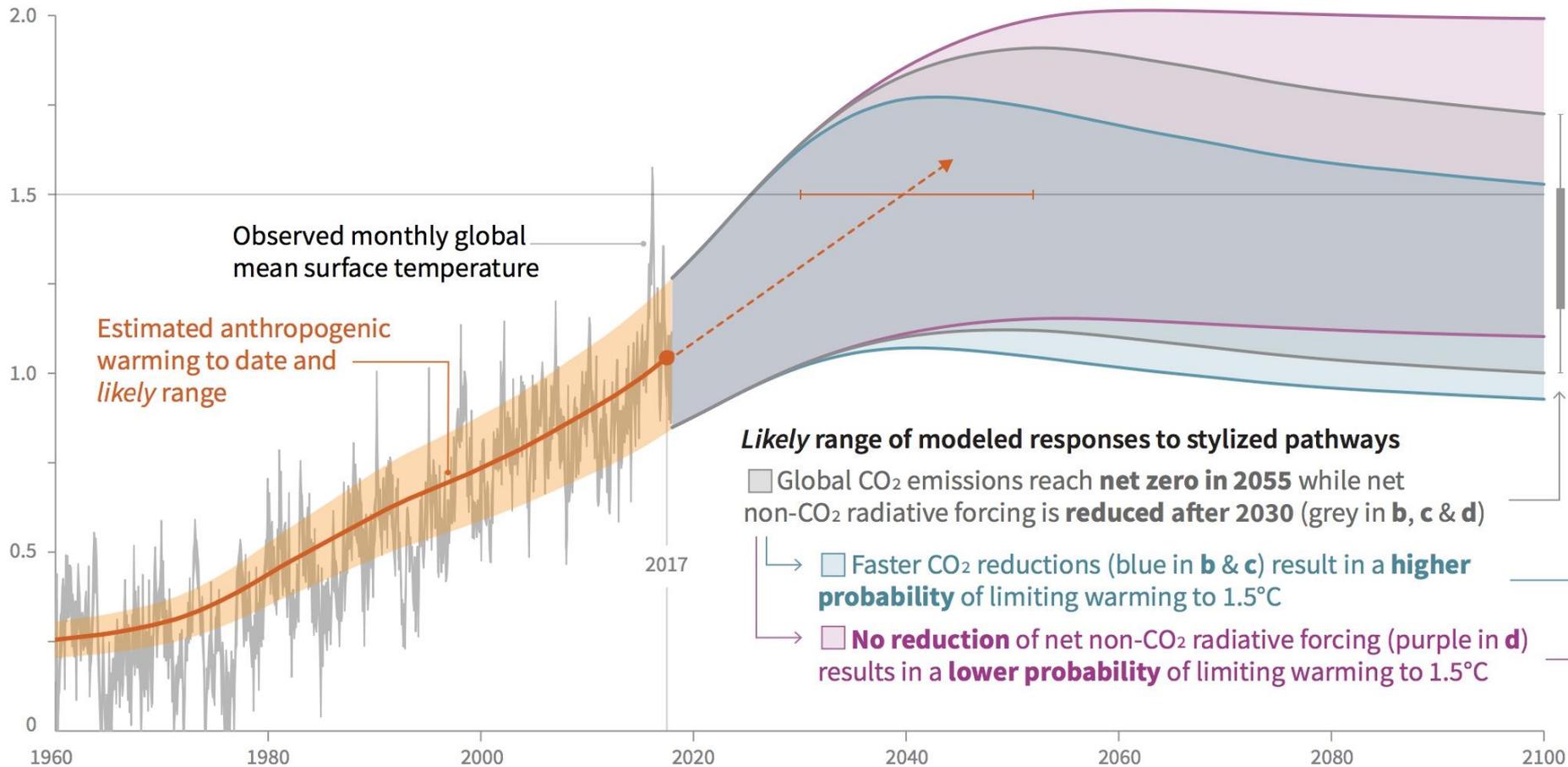
SUBJECT TO COPY EDIT



- The world needs to act now to avoid climate catastrophe!

# Mitigation air pollutants is essential to meet the 1.5 degree climate target.

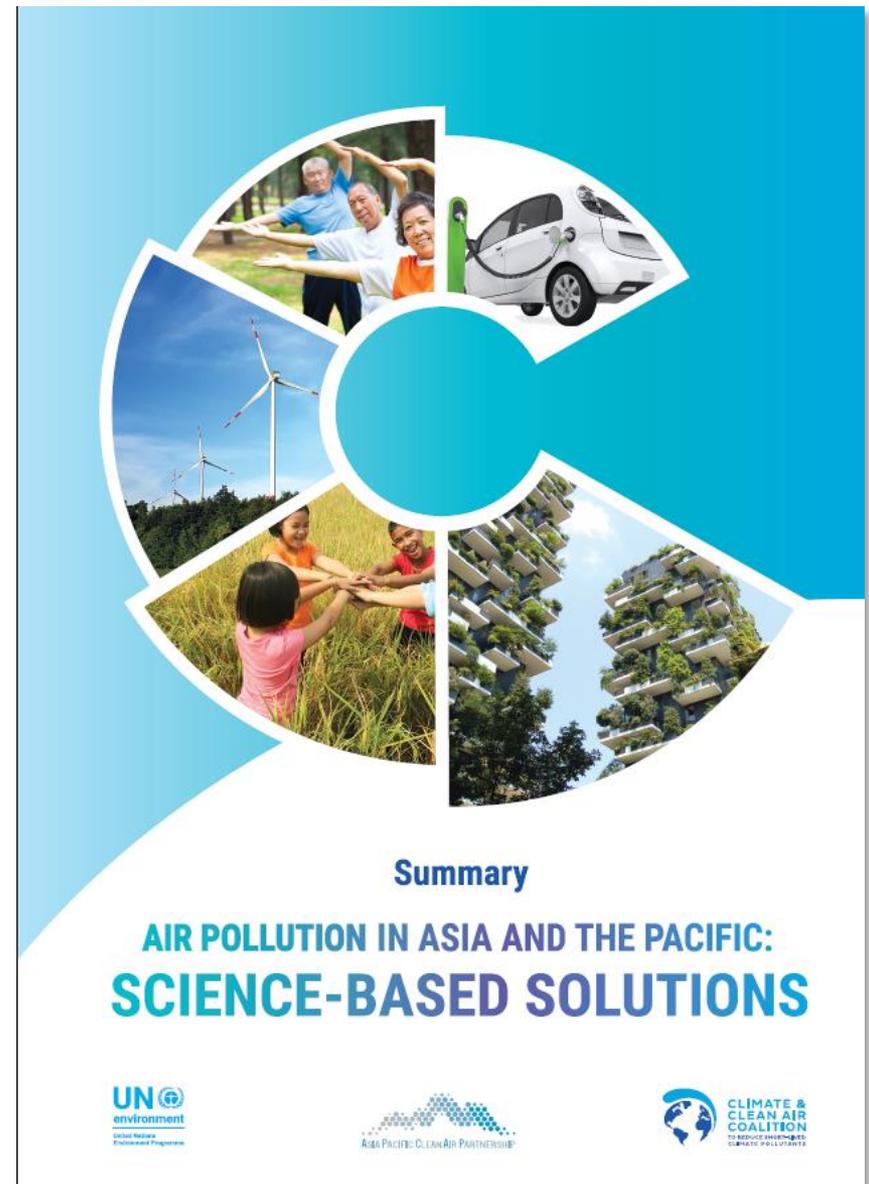
Global warming relative to 1850-1900 (°C)

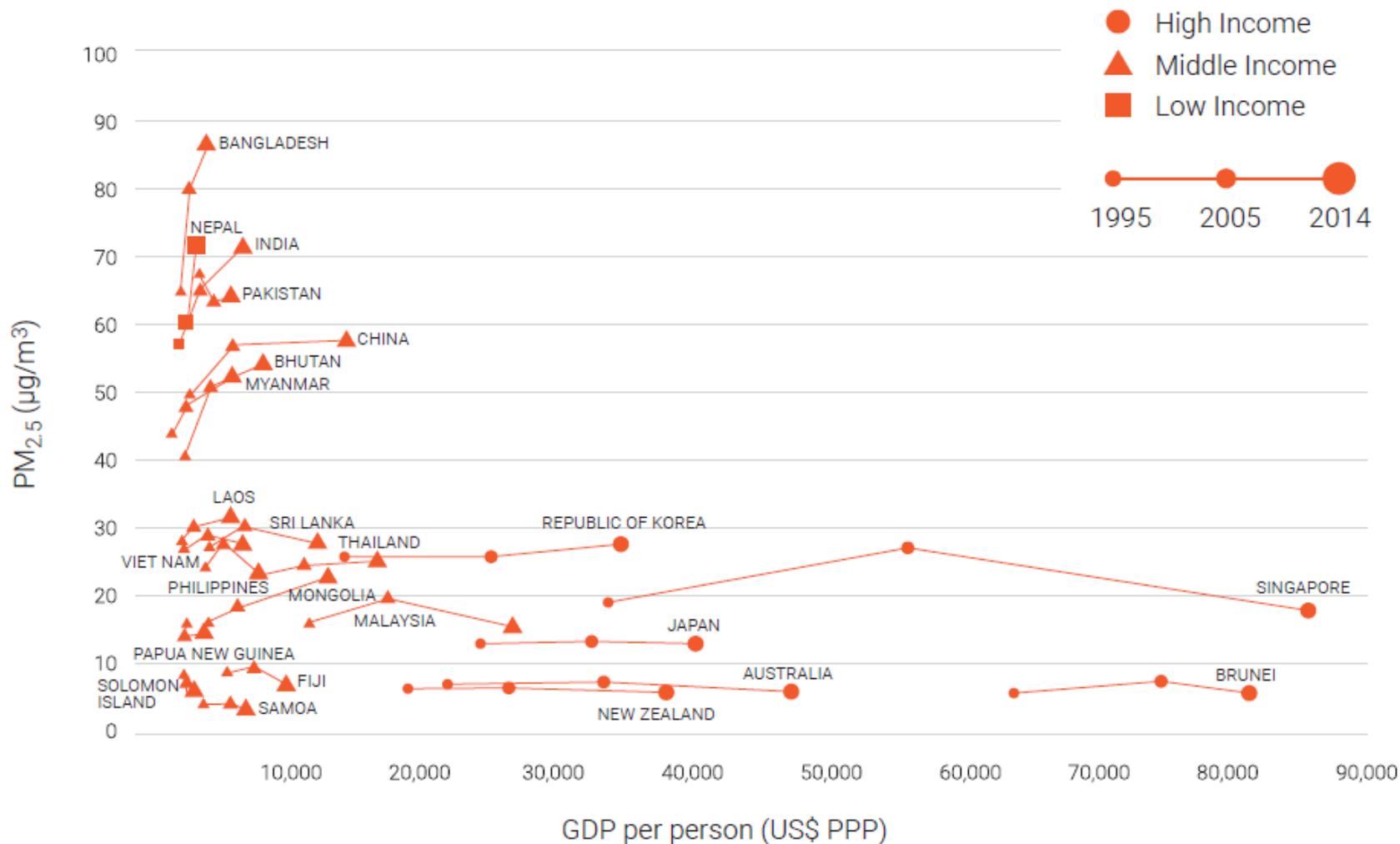


# Asia Regional Assessment

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- Released 30 October 2018.
- Identifies the 25 most promising measures for Asia to reduce air pollution and mitigate climate.





**PM<sub>2.5</sub> CONCENTRATIONS AND GROSS DOMESTIC PRODUCT PER PERSON BY COUNTRY, AND PATHWAYS OF PM<sub>2.5</sub> CONCENTRATION AND ECONOMIC DEVELOPMENT BY COUNTRY, 2014**

# Top 25 clean air measures for Asia

## Regional application of conventional measures

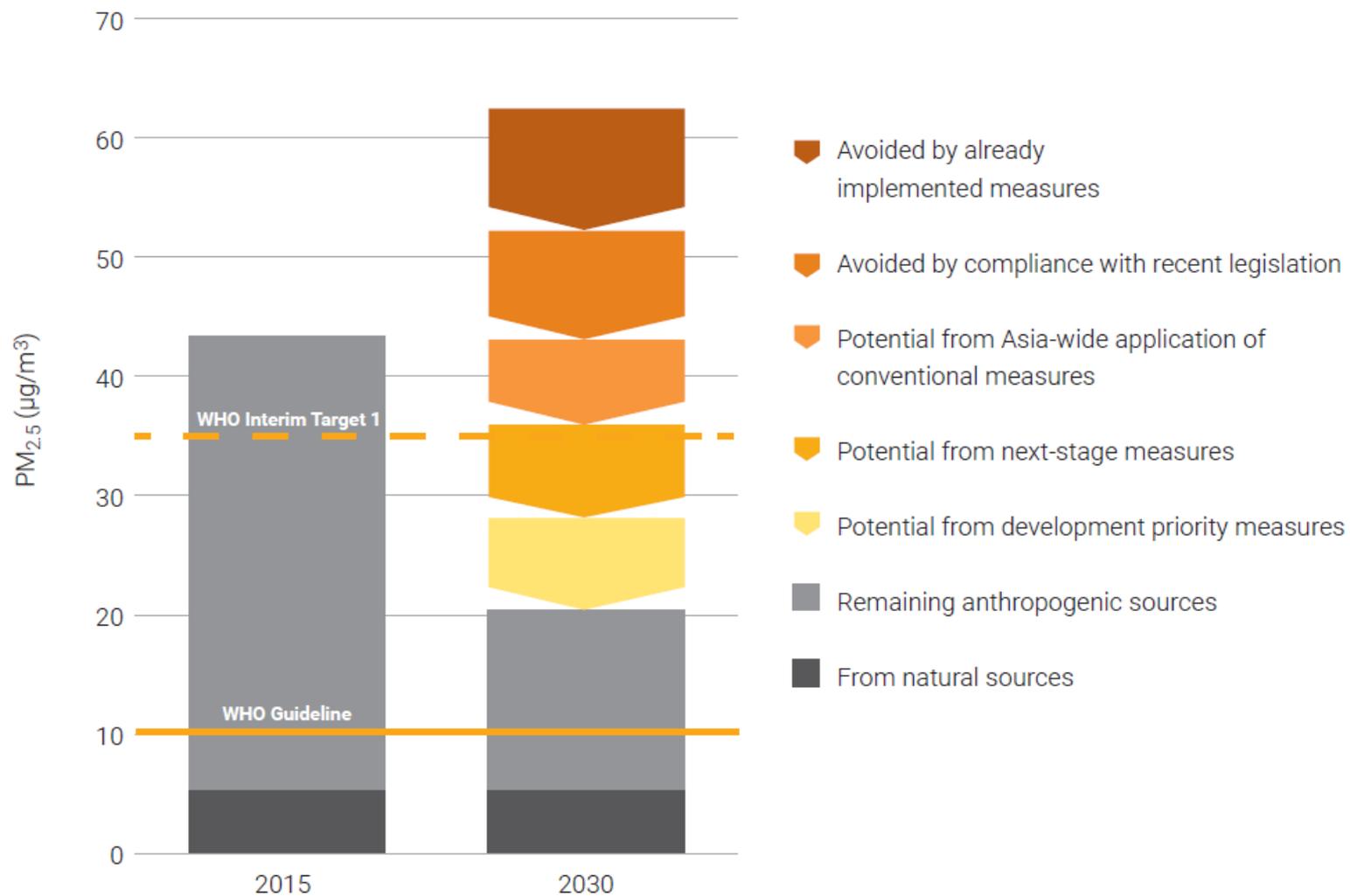
Post-combustion controls	Introduce state-of-the-art end-of-pipe measures to reduce sulphur dioxide, nitrogen oxides and particulate emissions at power stations and in large-scale industry
Industrial process emissions standards	Introduce advanced emissions standards in industries, e.g., iron and steel plants, cement factories, glass production, chemical industry, etc.
Emissions standards for road vehicles	Strengthen all emissions standards; special focus on regulation of light- and heavy-duty diesel vehicles
Vehicle inspection and maintenance	Enforce mandatory checks and repairs for vehicles
Dust control	Suppress construction and road dust; increase green areas

## Next-stage air quality measures that are not yet major components of clean air policies in many parts of Asia and the Pacific

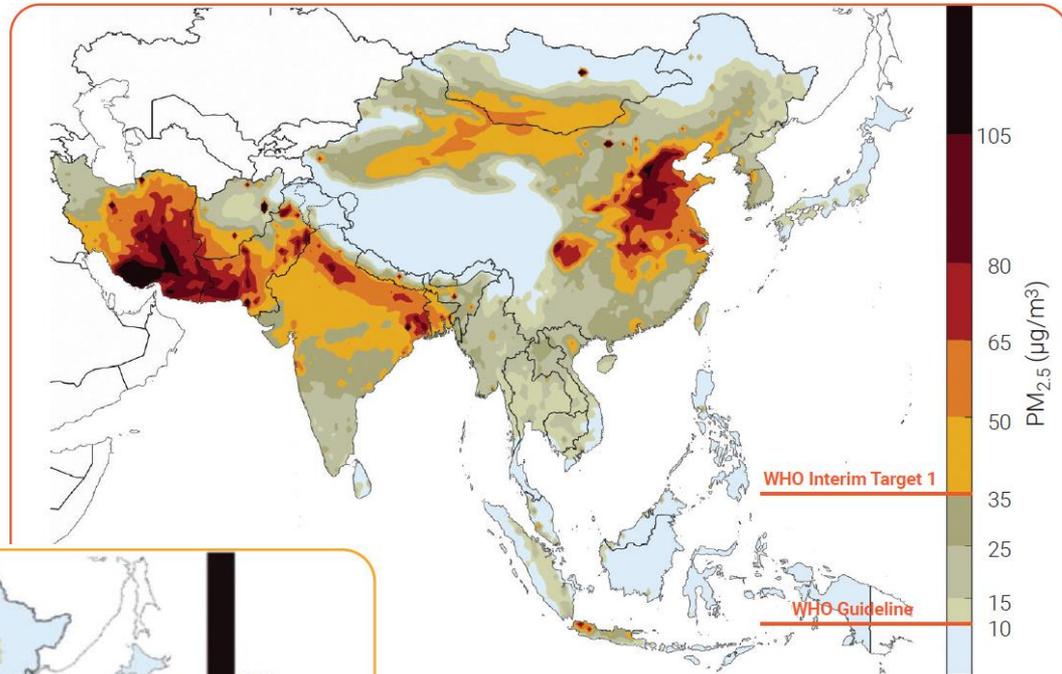
Agricultural crop residues	Manage agricultural residues, including strict enforcement of bans on open burning
Residential waste burning	Strictly enforce bans on open burning of household waste
Prevention of forest and peatland fires	Prevent forest and peatland fires through improved forest, land and water management and fire prevention strategies
Livestock manure management	Introduce covered storage and efficient application of manures; encourage anaerobic digestion
Nitrogen fertilizer application	Establish efficient application; for urea also use urease inhibitors and/or substitute with, for example, ammonium nitrate
Brick kilns	Improve efficiency and introduce emissions standards
International shipping	Require low-sulphur fuels and control of particulate emissions
Solvent use and refineries	Introduce low-solvent paints for industrial and do-it-yourself applications; leak detection; incineration and recovery

## Measures contributing to development priority goals with benefits for air quality

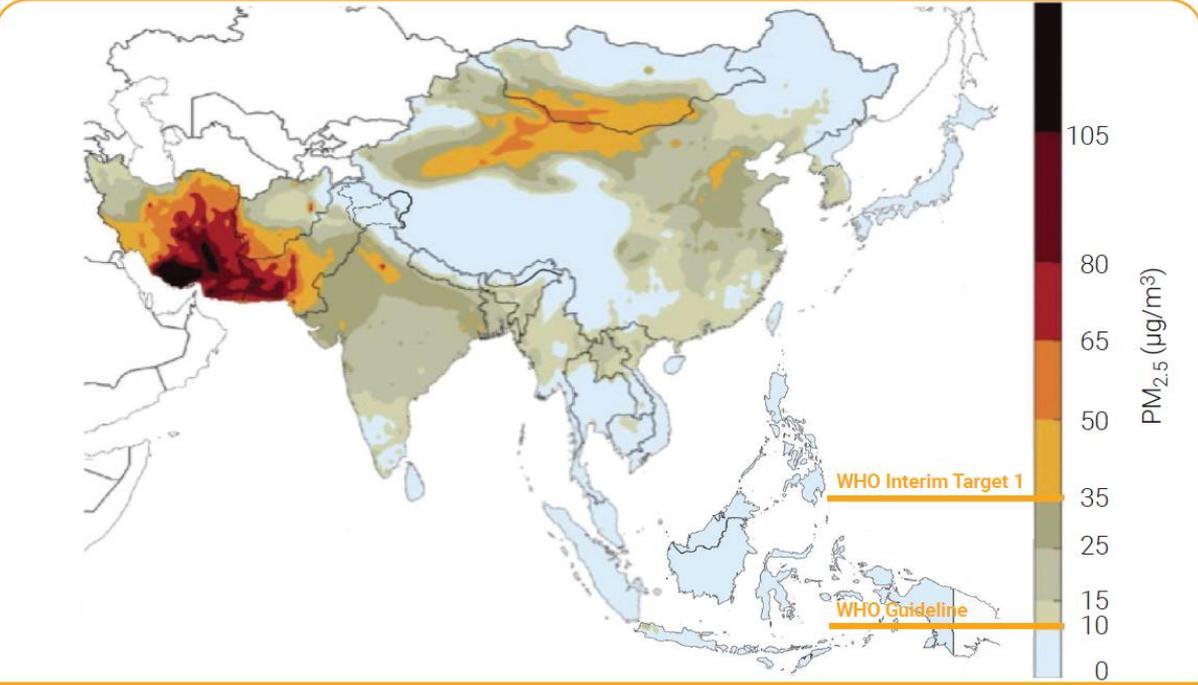
Clean cooking and heating	Use clean fuels – electricity, natural gas, liquefied petroleum gas (LPG) in cities, and LPG and advanced biomass cooking and heating stoves in rural areas; substitution of coal by briquettes
Renewables for power generation	Use incentives to foster extended use of wind, solar and hydro power for electricity generation and phase out the least efficient plants
Energy efficiency for households	Use incentives to improve the energy efficiency of household appliances, buildings, lighting, heating and cooling; encourage roof-top solar installations
Energy efficiency standards for industry	Introduce ambitious energy efficiency standards for industry
Electric vehicles	Promote the use of electric vehicles
Improved public transport	Encourage a shift from private passenger vehicles to public transport
Solid waste management	Encourage centralized waste collection with source separation and treatment, including gas utilization
Rice paddies	Encourage intermittent aeration of continuously flooded paddies
Wastewater treatment	Introduce well-managed two-stage treatment with biogas recovery
Coal mining	Encourage pre-mining recovery of coal mine gas
Oil and gas production	Encourage recovery of associated petroleum gas; stop routine flaring; improve leakage control
Hydrofluorocarbon (HFC) refrigerant replacement	Ensure full compliance with the Kigali Amendment



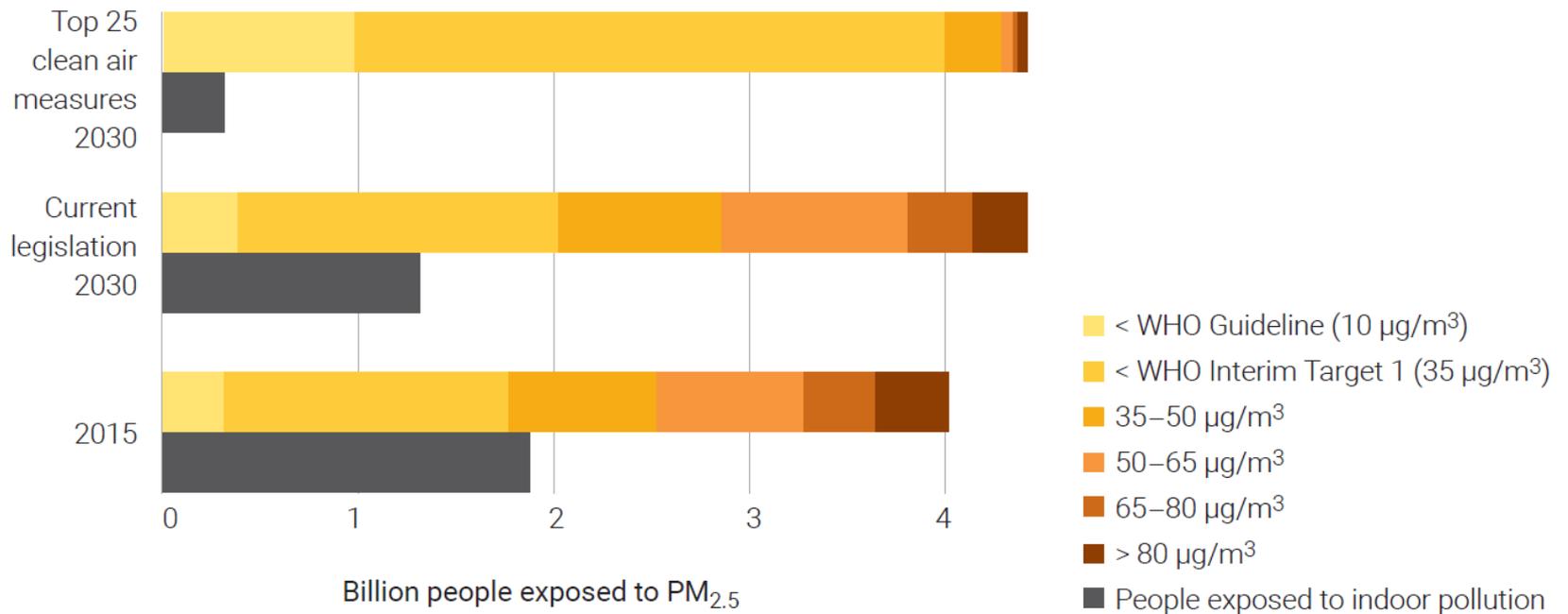
**FIGURE 2.3: POTENTIAL CONTRIBUTIONS OF THE THREE PORTFOLIOS OF MEASURES TO POPULATION-WEIGHTED MEAN EXPOSURE TO PM<sub>2.5</sub>**



**CURRENT LEVELS OF PM<sub>2.5</sub> IN ASIA IN 2015**



**FIGURE 2.5: PM<sub>2.5</sub> CONCENTRATIONS IN 2030 AFTER IMPLEMENTATION OF THE TOP 25 CLEAN AIR MEASURES**



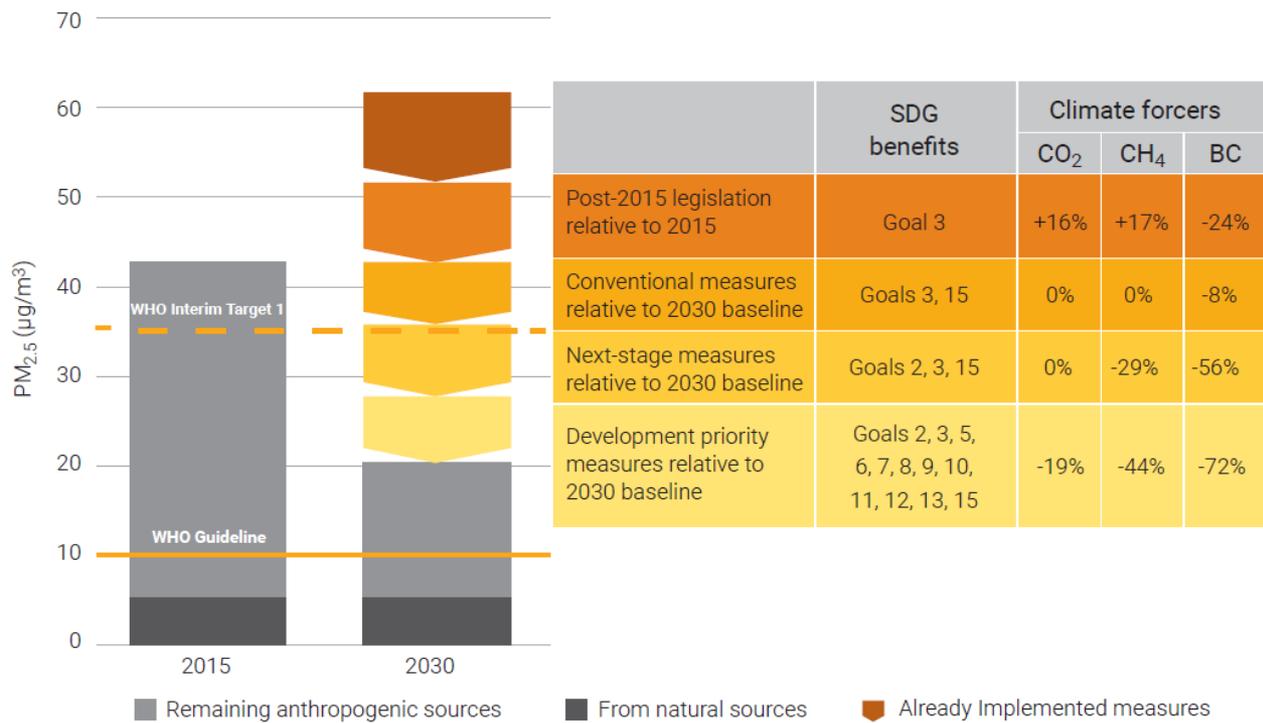
**FIGURE 2.6: ASIAN POPULATION EXPOSURE TO PM<sub>2.5</sub> FOR 2015 AND 2030**

- Do we have the institutions that can work across sectors, across borders and across the range of scales needed?
- What are the implications of our long-term infrastructure investments?
  - Walkability of cities.
  - Attractiveness of public transport.
  - Do clean power plants, transformers and wiring support peak load of cooking with electricity?

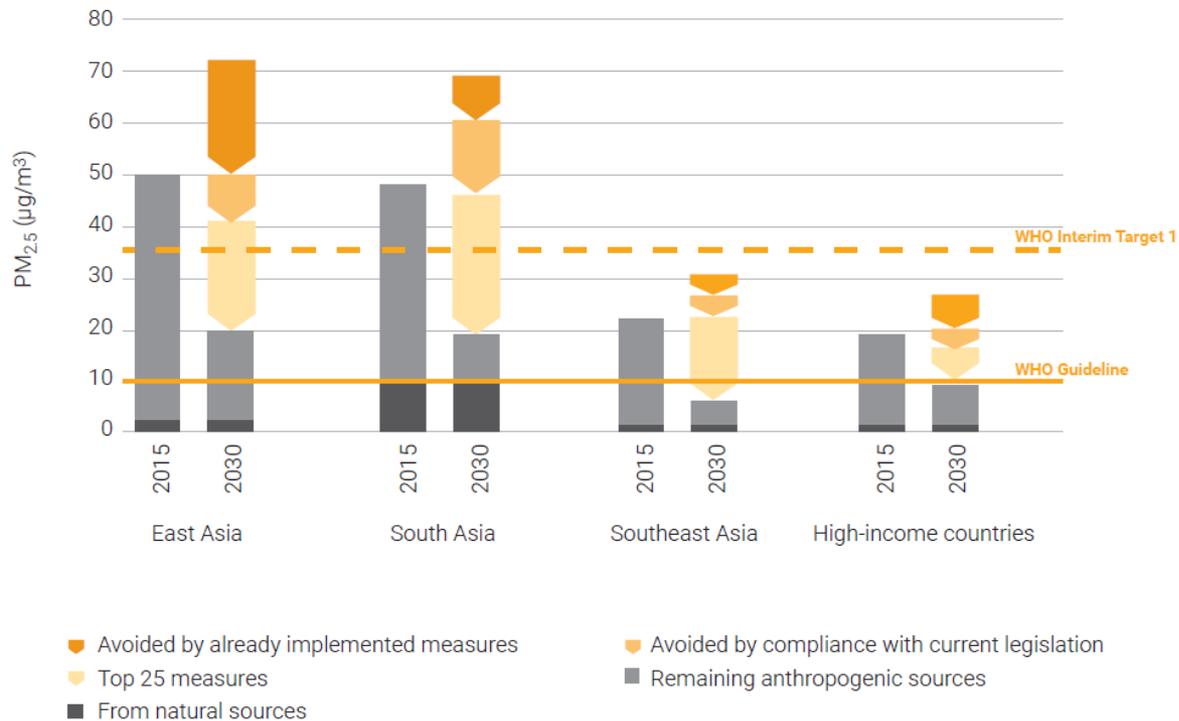
THANK YOU!

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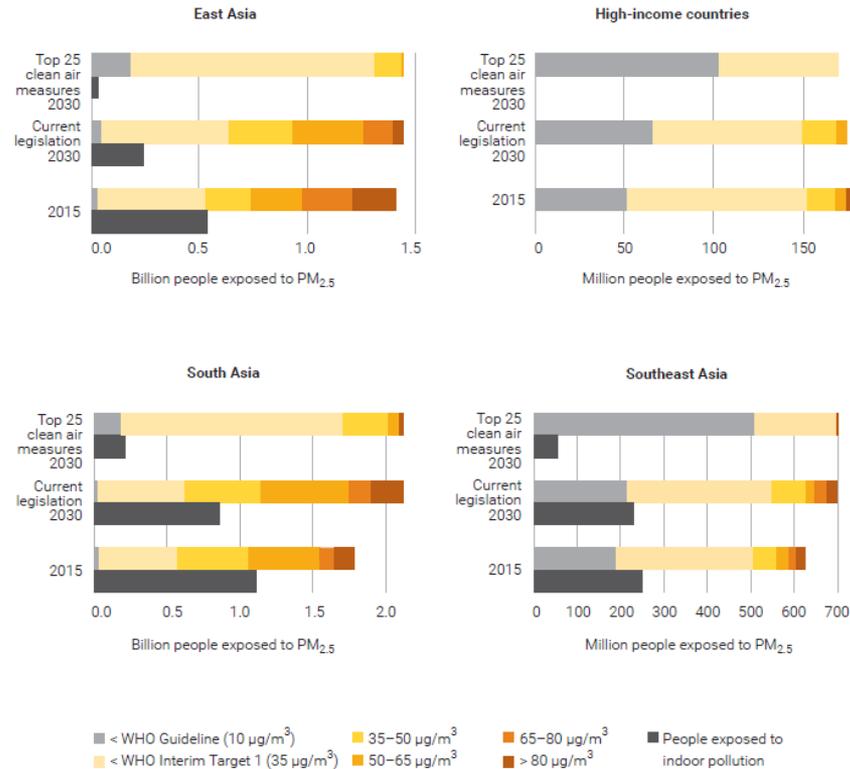




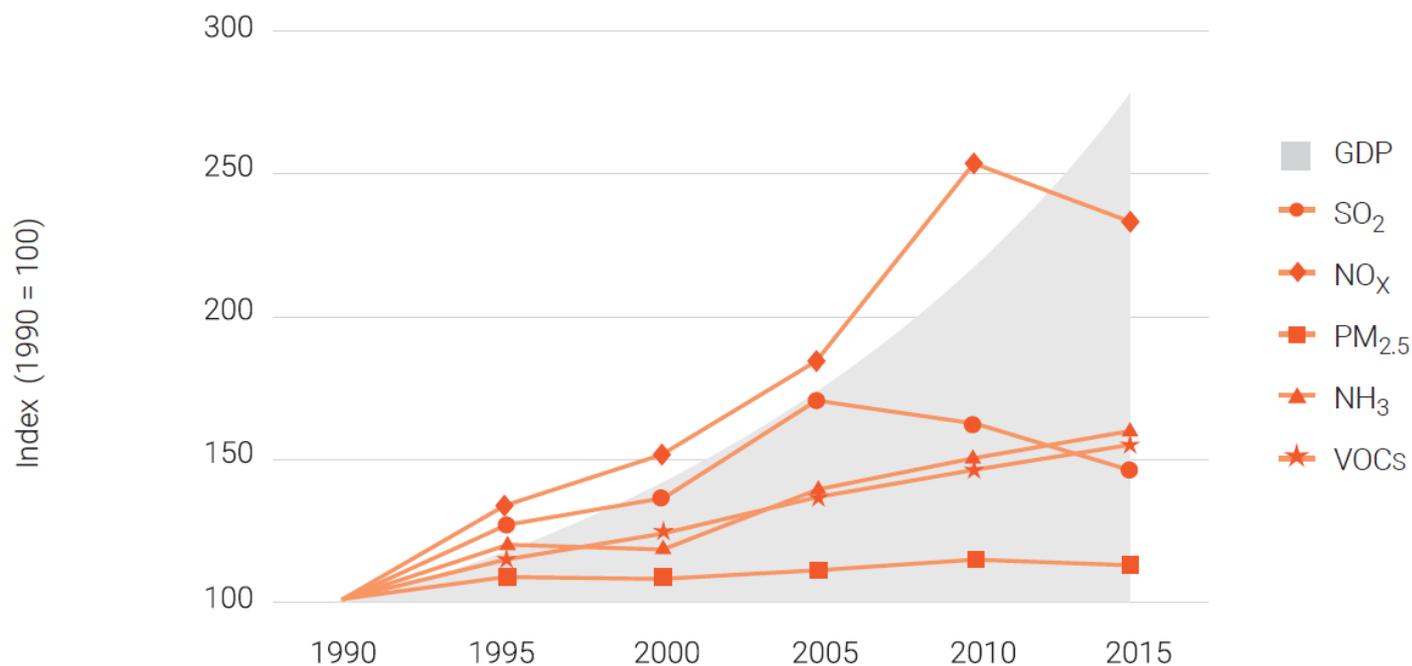
**FIGURE 2.10: IMPACT OF THE TOP 25 CLEAN AIR MEASURES IN REDUCING POPULATION EXPOSURE TO PM<sub>2.5</sub>, AND BENEFITS FOR CLIMATE AND THE SUSTAINABLE DEVELOPMENT GOALS**



**FIGURE 2.13: CHANGES IN POPULATION-WEIGHTED EXPOSURE TO PM<sub>2.5</sub> BETWEEN 2015 AND 2030: BENEFITS OF IMPLEMENTING THE TOP 25 CLEAN AIR MEASURES AND REMAINING EXPOSURE IN THE MODELLED SUB-REGIONS OF ASIA**



**FIGURE 2.14: NUMBERS OF PEOPLE EXPOSED TO DIFFERENT LEVELS OF PM<sub>2.5</sub> IN AMBIENT AND INDOOR AIR IN THE MODELLED SUB-REGIONS OF ASIA**



SO<sub>2</sub> – sulphur dioxide; NO<sub>x</sub> – nitrogen oxides; NH<sub>3</sub> – ammonia; VOCs – volatile organic compounds

**FIGURE 1.2: THE EVOLUTION OF GROSS DOMESTIC PRODUCT AND THE POLLUTANTS THAT CONTRIBUTE TO PM<sub>2.5</sub> FORMATION IN ASIA, 1990–2015**