

## COBENEFITS of the new energy world of renewables for the people of India

India is in the midst of an energy transition, with important social and economic implications depending on the pathways that are chosen. India's energy pathway will define the basis for its future development, including economic prosperity, business and employment opportunities as well as health impacts. At the same time, current investment decisions in India's energy sector will have a substantial impact on combatting global warming and securing the livelihoods of people in India and elsewhere.

With its bold decision to substantially ramp up renewable energy generation capacity, from 80 gigawatts as of May 2019 to 175 GW by 2022, the Government of India has sent a strong signal on both the direction and pace of India's energy transition. Political decisions on India's energy future link the missions and mandates of many government departments and agencies beyond energy and power, such as environment, industrial development and labour. Hence, the timely debate on India's energy future boils down to assessing how renewables can improve the lives of Indian people.

Employing scientifically rigorous methodologies and the most recent technical data, the study at hand contributes to estimating such co-benefits associated with the shift to renewables. It also provides guidance to government agencies on further shaping an enabling political environment to unlock the social and economic co-benefits of the new energy world of renewables for the people of India.

The Energy and Resource Institute (TERI), as the India Focal Point, together with the Institute for Advanced Sustainability Studies (IASS) invited ministries and government agencies such as the Ministry of New and Renewable Energy, Ministry of Environment, Forests and Climate Change, Ministry of Power, Ministry of Finance and NITI Aayog to join the COBENEFITS Council India, to provide their guidance to the COBENEFITS Assessment studies along with the COBENEFITS Training Programme and Enabling Policies Roundtables. Since its constitution in November 2017, the COBENEFITS Council India has guided the programme in framing its assessment topics for India and ensuring their direct connection to the current political deliberations and policy frameworks of their respective ministries.

We are also indebted to our highly valued research and knowledge partners, for their unwavering commitment and dedicated work on the technical implementation of this study. This COBENEFITS study was facilitated through financial support from the International Climate Initiative (IKI) of Germany.

India, among 185 parties to date, has ratified the Paris Agreement to combat climate change and provide current and future generations with opportunities to flourish. With this study, we seek to contribute to the success of this international endeavour by offering a scientific basis for harnessing the social and economic co-benefits of building a low-carbon, renewable energy system while facilitating a just transition, thereby **making the Paris Agreement a success for the planet and the people of India.**

We wish the reader inspiration for the important debate on a just and sustainable energy future for India!

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# Executive Summary

## Improving health and reducing costs through renewable energy in India

Assessing the co-benefits of decarbonising the power sector



India has experienced a remarkable transition in reducing absolute poverty, improving standards of living and creating livelihood opportunities for the impoverished, and enhancing access to cleaner and affordable energy. Through the National Action Plan on Climate Change (NAPCC), the Indian Government recognised that India needs a directional shift in its economic growth pathway in order to achieve its developmental objectives while effectively addressing the threat of climate change.

At the same time, ambient air pollution has emerged as the second leading health risk factor in India, contribute significantly to India's burden of cardiovascular diseases, chronic respiratory diseases and lower respiratory tract infections. Since electricity generation in India is still largely coal-based, the power sector is an important contributor to ambient air pollution. In view of the above, India's Nationally Determined Contribution (NDC) aims to base 40% of the total installed power generation capacity on non-fossil fuel resources by 2030 with international support on technology transfer and financing. This includes an ambitious target of achieving 175 GW of renewable energy by the year 2022 and reducing the emissions intensity of GDP by 33 to 35% from 2005 levels by 2030. In early 2019, the Ministry of New and Renewable Energy (MNRE) announced that this objective might be met earlier, by procuring 500 GW of additional RE capacity by 2028.

In this context, this study assesses the impact of ambient air pollution on human health in India. This is carried out in the context of the COBENEFITS project

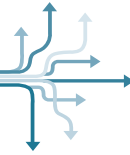
with the aim of assessing the range of additional benefits<sup>1</sup> resulting from a low-carbon energy transition in India. The report quantifies both the health and economic costs associated with PM<sub>2.5</sub>/PM<sub>10</sub> exposure. The analysis first assesses the impacts of ambient air pollution from all sectors of the Indian economy. It then quantifies the specific impact of the Indian power sector, assessing the health benefits of increased share of renewables in the Indian energy and power sector. The economic savings resulting from improvements in air quality are analysed based on three different energy scenarios for the years 2020, 2030, 2040 and 2050:

- **The Business-as-Usual scenario (BAU)**, representing India's present climate policies rolled out until 2016.
- **The NDC scenario (NDC)**, designed to chart out the strategies needed to achieve the targets laid out in India's NDCs.
- **The NDC PLUS scenario (NDC PLUS)**, adopting strategies for deeper decarbonisation over and above the NDC scenario.

This study employs a five-step methodological approach.

- **Step 1: Energy-scenario building.**
- **Step 2: Emissions modelling.**
- **Step 3: Air-quality modelling (dispersion).**
- **Step 4: Health impact assessment.**
- **Step 5: Economic impact assessment.**

<sup>1</sup> The term 'co-benefits' refers to simultaneously meeting several interests or objectives resulting from a political intervention, private-sector investment or a mix thereof (Helgenberger et al., 2019). It is thus essential that the co-benefits of climate change mitigation are mobilised strategically to accelerate the low-carbon energy transition (IASS 2017).



- **Key policy message 1:** India can markedly improve the livelihoods of its citizens by reducing ambient air pollution. In the business-as-usual scenario, during 2020 almost 500,000 people will die prematurely due to exposure to particulate matter (PM<sub>10</sub>); this number would rise to 600,000 premature deaths during 2030 and 830,000 during 2050. By moving to the NDC PLUS pathway, more than 200,000 premature deaths can be avoided in 2050.
- **Key policy message 2:** India can significantly cut economic losses by greening the economy and deploying renewable energy sources. Following the business-as-usual path, economic losses related to health costs could increase from INR 4.6 trillion (USD 64.6 billion<sup>2</sup>) in 2020 more than two-fold in 2030 and more than ten-fold to INR 47 trillion (USD 660.3 billion) in 2050. However, by following the NDC PLUS pathway, economic losses in 2050 could be reduced by as much as INR 12 trillion (USD 168.6 billion).
- **Key policy message 3:** India should consider building and following even more ambitious energy pathways. Even the most far-reaching scenario presented in this report (NDC PLUS) is insufficiently ambitious to prevent a 4.3% reduction in Indian GDP and an increase in premature deaths in 2050 compared with 2020 levels.

#### KEY FIGURES:

- Mean concentration of particulate matter in India is five times higher than the levels recommended by the World Health Organization.
- Air pollution accounts for 4–5% of total mortality in India.
- The power sector accounts for about 8% of premature deaths related to air pollution.
- The economic costs of ambient air pollution will reduce India's GDP by up to 5.7% in 2050 (BAU scenario).

**COBENEFITS**  
Improving health and reducing costs through renewable energy in India. Assessing the co-benefits of decarbonising the power sector

available on  
[www.cobenefits.info](http://www.cobenefits.info)

#### KEY FINDINGS:

##### Concentration levels of pollutants

- In the BAU scenario, the mean PM<sub>2.5</sub> concentration in 2020 is five times higher than that recommended by the World Health Organization (10 Qg/m<sup>3</sup>). The PM<sub>2.5</sub> concentration will remain very high in the BAU scenario all the way until 2050 (60 µg/m<sup>3</sup> in 2030, 54 µg/m<sup>3</sup> in 2040 and 60 µg/m<sup>3</sup> in 2050).
- Even in the NDC and NDC PLUS scenarios, PM<sub>2.5</sub> concentrations will remain dangerously high. In the best case, the population-weighted mean PM<sub>2.5</sub> concentration will decrease to 48 µg/m<sup>3</sup> (NDC PLUS scenario in 2050). However, this is still almost five times higher than the values recommended by the WHO. This indicates that **even more ambitious scenarios will need to be modelled (and followed) in order to significantly reduce the health impacts of air pollution on the Indian population.**
- The power sector has limited contribution to overall emissions, mainly due to increasingly stringent controls; However, its contribution increases significantly in cities, and within zones of influence around power plants.

<sup>2</sup> 1 INR = 0,01405030 USD as of October 2019.

### Mortality and disability-adjusted life years:

- Air pollution will account for 4–5% of total mortality in India between 2020 and 2050.
- **In the business-as-usual scenario, in 2020 almost 500,000 people will die prematurely due to exposure to airborne particulate matter (PM<sub>10</sub>).** This number would rise to 830,000 premature deaths by 2050.
- By following the NDC pathway, India can reduce all-cause mortality from PM10 by about 75,000 in 2050. **By going beyond the NDC scenario (NDC Plus), all-cause mortality resulting from PM10 can be further reduced to 613,000 in 2050, which is 25% less than in the BAU scenario and around 17% less than the NDC scenario.** However, it should be noted that, compared with 2020 levels, even the NDC PLUS pathway would not prevent an increase in all-cause mortality by 2050.
- The power sector is responsible for about 8% of mortality related to air pollution (PM<sub>10</sub>). **By moving from BAU to the NDC PLUS pathway, the number of premature deaths in 2050 can be reduced by 58%, from 57,000 to 24,000.**
- The five most severely affected states (Uttar Pradesh, Maharashtra, Gujarat, Bihar and West Bengal) alone constitute more than 50% of the total deaths projected in different years under all three scenarios (all-cause mortality). Focusing on the power sector, these five states account for 60% of mortality related to PM emissions.
- **Disability-adjusted life years (DALY: a single metric to record the combined burden of mortality and morbidity) attributable to ambient PM<sub>2.5</sub>/PM<sub>10</sub> under the BAU scenario is estimated to be 14 million in the year 2020.**
- Under the BAU scenario, DALY would increase to 24 million in 2050. However, **this value could be reduced to 21 million under the NDC scenario and 17 million under the NDC PLUS pathway in 2050.**
- Focusing on the impact of the power sector, total DALY could increase to 1.7 million in 2050 following the BAU pathway. **However, by greening the power sector the NDC PLUS scenario could reduce total DALY by 1 million, down to 0.7 million in 2050.**

### Economic Impact

- Under the BAU scenario, total economic loss due to both disease-specific mortality and morbidity is estimated as INR 4.6 trillion (USD 64.7 billion) for the year 2020. **This already very high figure would increase more than ten-fold to INR 47 trillion (USD 660.3 billion) in 2050.**
- **Switching from the present energy scenario to NDC will lead to an estimated total economic benefit to the country of INR 2148 billion (USD 30.18 million) by 2050; a further economic benefit of INR 5421 billion (USD 76.16 million) can be realised if the country adopts the NDC PLUS trajectory.**
- Total economic losses due to ambient air pollution significantly reduce Indian GDP: This already cuts GDP by 2.9% in 2020 and could reach 5.7% in 2050. Even in the NDC PLUS scenario, the costs associated with air pollution will still reduce Indian GDP by 4.3% in 2050. **This indicates that India should consider even more ambitious pathways for greening the economy.**