COBENEFITS POLICY REPORT

September 2020

Making the Paris Agreement a success for the planet and the people of India

Unlocking the co-benefits of decarbonising India's power sector

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Imprint

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We also acknowledge the members of the organisational consortium, which comprised the Institute for Advanced Sustainability Studies (IASS, lead), the Renewables Academy AG (RENAC), the Independent Institute for Environmental Issues (UfU), and the International Energy Transition (IET). This COBENEFITS report was facilitated through financial support from the International Climate Initiative (IKI) of Germany.

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INTERNATIONAL CLIMATE INITIATIVE (IKI)

Reviving India's economy & health systems following the COVID-19 pandemic

Foreword in light of recent events

At the time this paper is being published, India along with many economies around the world is being severely affected by the spread and impacts of the global COVID-19 pandemic. The broader consequences have already been devastating for millions of families, workers, and businesses, as well as for local economies and national health systems. Similarly to many countries worldwide, substantial political efforts will be needed to rebuild national and local economies and job markets, as well as to increase the resilience of health systems.

Recovering from the economic shocks of the COVID-19 pandemic, and avoiding severe future shocks triggered through the climate crisis, do not represent conflicting interests but rather a mutually reinforcing coping strategy. This report and the recent studies on which it builds suggest that the new energy world of renewables and the decarbonisation of India's energy sector have strong roles to play in reviving the economy and the health system by boosting employment, fostering rural electrification as foundation of local value creation, and, importantly, unburdening national health systems by reducing the prevalence of respiratory diseases.

By fostering an enabling policy environment that succeeds in unlocking these co-benefits, the government can provide important stimuli toward recovery from the impacts of the COVID-19 pandemic and revive the health system and the national economy. The Paris Climate Agreement and the 2030 Agenda on Sustainable Development offer important internationally agreed frameworks to ensure economic recovery in the shorter term and for building resilient economies and health systems in the long run.

The Energy and Resources 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 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.

India, among 189 parties to date, has ratified the Paris Agreement, to combat climate change and provide current and future generations with opportunities to flourish. With this COBENEFITS policy report, 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 green recovery as part of a just and sustainable energy future for India!

Ajay Mathur
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Mini-grids may be utilised as natural extensions of the grid in areas where reliability of supply is a concern.

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Executive Summary

COBENEFITS

Making the Paris Agreement a success for the planet and the people of India

Unlocking the co-benefits of decarbonising India's power sector

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 substantial implications for combatting global warming and securing the livelihoods of people in India and elsewhere.

This COBENEFITS Policy Report for India compiles key findings from the COBENEFITS India Assessment series, quantifying the co-benefits of decarbonising India's power sector in view of future-oriented employment and skills development, economic prosperity in rural areas, and health benefits related to a less carbon-intensive power sector, which can be instrumental in reviving the national health system. The COBENEFITS India Assessment series can be accessed at: www.cobenefits.info. Building on the opportunities presented, the report formulates a set of policy actions to allow government institutions to create 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 policy options were generated through a series of roundtable dialogues and government consultations involving government institutions, industry associations, and expert and civil society organisations in the years 2019 and 2020.

In light of the current crisis, the study findings indicate that recovering from the economic shocks of the COVID-19 pandemic and avoiding severe future shocks triggered through the climate crisis do not represent conflicting interests but instead a mutually reinforcing coping strategy. The Paris Agreement and the 2030 Agenda on Sustainable Development offer important internationally agreed frameworks to ensure economic recovery in the shorter term and for building resilient economies and health systems in the long run.

UNLOCKING THE CO-BENEFITS OF RENEWABLE ENERGY FOR THE PEOPLE OF INDIA – 10 OPPORTUNITIES FOR POLICY MAKERS

1. **Enhance individual mini-grid capacities:** Solar-powered mini-grids of high installed power capacity can remain economically viable and cost-competitive with the centralised grid in rural areas of India. Solar mini-grid systems greater than 100 kW with interest rates as low as 8% and a 15% return on equity can achieve grid parity and provide a low cost electricity supply to rural consumers.

2. **Mechanism for co-existence of mini-grid with central-grid:** To drive the growth of higher power-capacity mini-grids, which are essential for reliable 24/7 rural electrification, mechanisms must be developed (in collaboration with the private sector) that enable mini-grid developers to transfer the system's assets to the state-owned utility when the central grid arrives at the area served by the mini-grid.

3. **Merit-based incentive scheme for mini-grids between 100 kW and 700 kW:** A special capital subsidy incentive scheme can be developed for viable mini-grid systems between 100 kW and 700 kW built in specific rural developmental zones defined by MNRE. The government would be advised to collaborate with rural developmental banks and national/international funding agencies in order to assist and achieve the overall process.

Fostering rural development: taking energy access to the next level

Developing future skills and boosting job creation

4. **Foster distributed generation of renewable energy sources:** Distributed renewable energy technologies such as small hydro, rooftop solar, and biomass create up to 25 times more employment for every MW of installed capacity than fossil-fuel-based power generation. Policy makers can therefore consider these advantages of distributed renewable energy technologies in seeking to accelerate employment creation in the renewable energy sector.

5. **Continuous increase in share of renewables:** India can significantly boost employment by increasing the share of renewables. These technologies tend to be more labour intensive than conventional technologies, and by 2050 more than 3.5 million people could be employed in the renewable energy sector (five times more than the entire Indian fossil-fuel sector [coal, gas, nuclear] employs in 2020).

6. **Establish a new authority to re-skill coal sector workers:** Creating a central authority/agency/body to train or re-skill workers from the coal sector will support workers in benefiting from direct employment in the renewable energy sector. It is estimated that the solar sector could require a total of 256,000 skilled, 320,000 semi-skilled, and another 570,000 unskilled workers by 2050 (REMap scenario). Considering the size of the coal sector in India and the future workforce requirements of the solar sector, this high-impact action would be championed by the Ministry of Skill Development and Entrepreneurship in close collaboration with other ministries and government departments.

Improving people's health and creating a resilient health system

7. **Adopting an accelerated decarbonisation pathway to avoid premature deaths:** 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 (PM10); this number would rise to 830,000 premature deaths during 2050. By moving to the accelerated decarbonisation pathway (NDC PLUS), more than 200,000 premature deaths can be avoided.

8. **Adding another level of ambition:** In view of ensuring economic and health system resilience, India is advised to formulate and pursue even more ambitious renewable energy pathways. Even the most far-reaching decarbonisation 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.

9. **Structured, indicator-driven decommissioning of coal-fired power plants:** The decommissioning of India's coal-fired power plants should be based on key structural indicators, i.e., plant emission levels, projected deaths due to air pollution, and the population densities of affected areas in close proximity to the plant. The government would expedite the process of decommissioning coal-fired power plants on the basis of these indicators. This process would be led by the Ministry of Power, and the indicators would be jointly developed with the Ministry of Environment, Forest and Climate Change, Ministry of Coal, and the Ministry of Health.

Making the Paris Agreement a success for the people of India

10. **Making co-benefits part of India's pledge to the planet and its people:** In terms of mitigating climate change, Nationally Determined Contributions (NDCs) are more than technical documents: They are also showcases, for national audiences, of the contribution and global responsibility a country is willing to take in reducing its GHG emissions. In addition, India's NDC also aims to exploit the co-benefits of addressing climate change along with promoting economic prosperity for its people.

In order to boost energy access through mini-grids: In addition to the above policy messages, the government along with industry stakeholders can take other crucial steps by starting to consider how to establish mini-grids as a complementary/supplementary extension to central grid services. The government can contribute by building a dialogue for short-, medium-, and long-term planning, and the development of suitable business models for mini-grids. Further issues for consideration include cross-subsidies for mini-grid consumers, along with skill development to maintain the growth of mini-grids in the country.

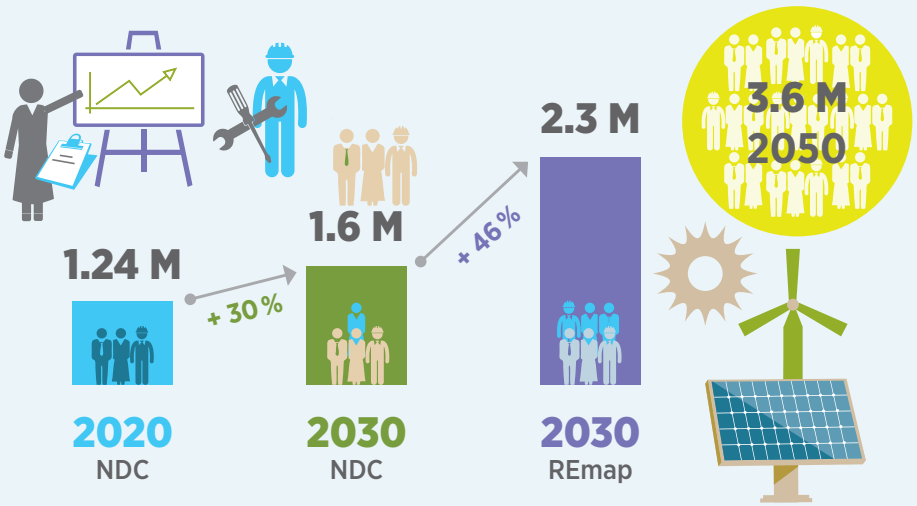
Understanding that more efforts will be required to maximise the employment benefits within the shift to a less carbon-intensive power sector, the government will be required to take additional steps. These start with improving data availability with respect to employment in the renewable energy sector; managing the energy transition in the coal and related sectors; including job opportunities for (community-owned) renewable energy projects. The government is also advised to make skilling and female employment a mandatory part of public renewable energy projects.

With many old coal power plants in India lacking emission control technology, the country is at a greater risk of health epidemics. More supportive steps are required, apart from the above policy messages. The government can give advance consideration to how it might include emission and air quality aspects within the retirement planning of power plants; improve independent emission monitoring and law enforcement through third-party assessments; and foster interdisciplinary exchange between researchers to ensure methodological standards and joint monitoring.

COBENEFITS Unlocking the co-benefits of decarbonising India's power sector

available on www.cobenefits.info

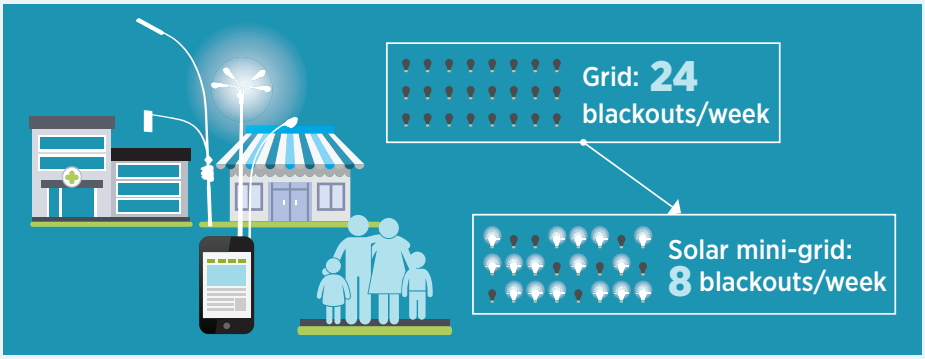
India can almost double the number of jobs through the power sector by 2030 by following an ambitious decarbonisation pathway.



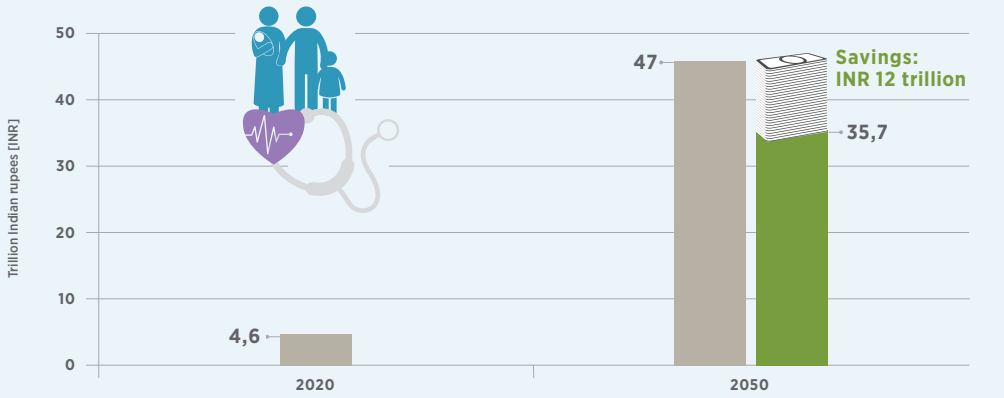
NDC: Scenario that highlights the strategies necessary for achieving the targets laid out in India's international climate commitment (NDC)

REmap: High ambition renewable energy roadmap for India by the International Renewable Energy Agency (IRENA)

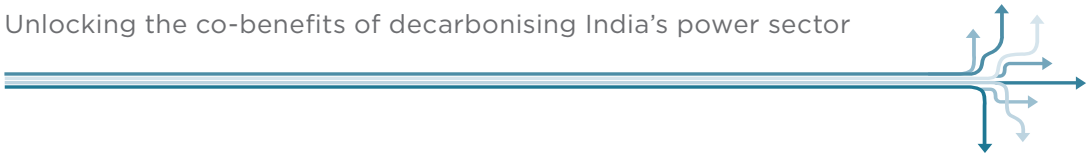
In rural India, mini-grids significantly improve the reliability of supply for municipal services and basic household energy needs.



India can significantly unburden health budgets by greening the economy and deploying renewable energy.



Health costs from the power sector



Contents

1. Creating opportunity and prosperity for the people of India in the new energy world of renewables

The term 'co-benefits' refers to simultaneously meeting several interests or objectives resulting from a political intervention, private-sector investment, or a mix thereof.

Sebastian Helgenberger, Martin Jänicke, & Konrad Gürtler (2019): Co-benefits of Climate Change Mitigation. Encyclopedia of the UN Sustainable Development Goals

In the climate and sustainable development literature, the co-benefits approach may be understood as studying, implementing, and replicating the positive externalities of an action.

Implementing this approach requires fostering an environment for problem solving, by encouraging the idea that the solution to global problems, such as climate change and development, have more synergies with each other than trade-offs. It aims to peel through the layers of international politics and diplomacy in order to actualise solutions on the ground.

For India, ensuring that its principal developmental challenges are met would require significant investment; not only in terms of infrastructure but also in terms of research and development. The co-benefits approach endorses an approach recommending multiple benefits, a significant one being economies of scale from collaborations, which would not be accrued by individual country action. Another benefit is that this approach can be studied at disaggregated levels and emulated successfully under similar circumstances.

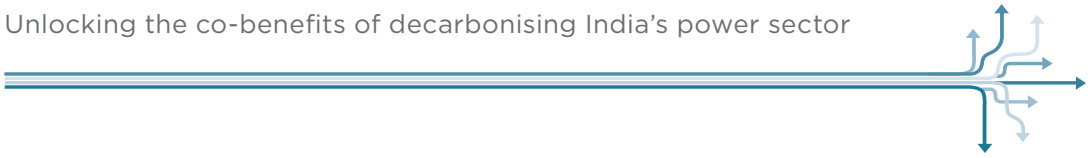
The key is to move our method of thinking away from burden sharing, and towards opportunity sharing.

Aayushi Awasty & Kavya Bajaj (2019): Implementing the co-benefits approach in India

India's renewable energy sector is at an interesting juncture, from becoming the cheapest producer of solar power in the world, it now ranks fifth globally for overall installed capacity of renewable power. 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.

As per its nationally determined contributions (NDCs) under the Paris Agreement, India has set targets by 2030, to: ensure 40% of its total installed capacity is based on non-fossil energy; and to reduce the emission intensity of its GDP by 33–35% compared with 2005 levels. To achieve its climate goals and accelerate the pace of energy transition, the Indian government has taken many formidable steps. In 2018 India ranked 4th globally for total investment ($11 billion) in renewable energy capacity.

India has greatly increased the share of clean energy and aims to achieve 175 gigawatts (GW) of renewable energy by 2022 (from 80 GW capacity as of May 2019), but has struggled to reverse rising pollution levels. The country still has difficulties to meet investors' expectations in the renewable energy sector. The regular cancellation of solar bids, uncertainty over import duty, issues related to land availability, and power evacuation have left solar developers and investors jittery. Despite the growth and opportunities that the renewable energy sector presents, a significant number of well-educated and skilled youth in India are either unemployed or underemployed.



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; and, in light of recent events, how the new energy world of renewables can play an important role in reviving India's economy and health systems in the wake of the COVID-19 pandemic.

In the context of the COBENEFITS project a series of assessment studies were conducted to identify potential social and economic co-benefits of renewable energy in India and to develop policy options for creating an enabling environment to unlock these opportunities for people, communities, and businesses in India. The key findings of this process are presented in this COBENEFITS Policy Report for India. The COBENEFITS programme co-operates with national authorities and knowledge partners in countries worldwide, to connect national socio-economic development objectives with the joint efforts to act on climate change in a mutually reinforcing co-benefits approach. The project supports efforts to develop enhanced NDCs with the ambition to deliver on the Paris Agreement and the 2030 Agenda on the Sustainable Development Goals (SDGs).

The COBENEFITS Policy Report for India compiles key findings from the COBENEFITS India Assessment series, quantifying the co-benefits of decarbonising India's power sector in view of future-oriented employment and skills development, economic prosperity in rural areas, and health benefits related to a less carbon-intensive power sector, which can be instrumental in reviving the national health system. In a bid to lower its dependence on coal and to limit rising pollution levels, the Indian government plans to add 500 gigawatts (GW) of renewable energy to its electricity grid by 2030. Considering the determination of the Indian government in making green energy the key enabler of future economic prosperity, the report shows that expanding the share of renewables, combined with certain improvements in the energy sector, can lead to significant opportunities:

Although India has achieved 100% household electrification according to official standards, poor reliability and quality of power supplies still present challenges for rural consumers throughout the country. Therefore, under the topic of Energy Access, COBENEFITS chose a case-study-based methodology to examine the business and economic profile of a practical mini-grid operating in India. Comparisons were drawn between the centralised grid and the decentralised mini-grid through primary survey and secondary data sources. The findings show that, to ensure round-the-clock energy access, mini-grids can play a pivotal role and improve service levels for last-mile consumers. As investment require replicable and sustainable models, the viability of mini-grids to both drive and support economic prosperity in India are also assessed.

The energy transition from conventional to non-conventional sources will lead to huge changes and new skill requirements in the Indian job market. Therefore, to understand future employment opportunities in the energy sector, the COBENEFITS study adopted a value-chain-based analysis. This captures employment created by different electricity-generating technologies, comprising coal, gas, nuclear, hydro, solar, wind, and biomass.

The third study quantifies both the health and economic costs arising from exposure to atmospheric particulate matter, and of ambient air pollution. India was recently found to have the highest SO_2 emissions in the world, as many of the country's coal-fired power plants lack emission control technologies. The study quantifies both the health and economic costs associated with $PM_{2.5}$/PM_{10} exposure. The findings show how an increased share of renewable energies can have considerable health benefits for workers and citizens.

Building on the opportunities presented, the report formulates a set of policy actions to allow government institutions to create 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 policy options were developed in a series of roundtable dialogues and government consultations with government institutions, industry associations, and expert and civil society organisations in the years 2019 and 2020.

In light of the current crisis, the results indicate that recovering from the economic shocks of the COVID-19 pandemic and avoiding severe future shocks triggered through the climate crisis do not represent conflicting interests but instead a mutually reinforcing coping strategy. The Paris Agreement and the 2030 Agenda offer important internationally agreed frameworks to ensure economic recovery in the shorter term and for building resilient economies and health systems in the long run.

2. Unveiling the co-benefits of decarbonising India's power sector

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. This policy report section synthesises key findings from the COBENEFITS India study series. The study results have been processed to provide direct and useful input for policy makers and policy implementers who are working to further progress the social and economic environment for communities, businesses, and citizens in India.

The various co-benefits areas for India (i.e. energy access; employment and skill development; air pollution and health) as well as the reference policy pathways, on which to build the co-benefit assessment, have been defined and specified in repeated consultation with the Ministry of Environment, Forest and Climate Change; Ministry of New and Renewable Energy; Ministry of Power; Ministry of Finance; Ministry of Health and Welfare; Ministry of Labour and Employment; and NITI Aayog. Additional information on the reference policy pathways is provided in Box 1. Key findings and figures are displayed in this section. The full reports, including detailed methodology and results sections, can be found at:

www.cobenefits.info

BOX 1: REFERENCE POLICY PATHWAY DEFINED FOR THE COBENEFITS INDIA STUDIES

In order to compare the socio-economic impacts of different ambition levels in decarbonising India's power system, four contrasting reference pathways based on different power generation sources were defined collaboratively with ministry partners and analysed for the future development of the power sector in India over the next 30 years until the year 2050.

The scenarios are based on partial end-use methods and/or econometric models of the basic drivers of population and economic prosperity in the country across sectors. The Energy and Resources Institute (TERI) developed three of the pathways, comprising: a current policy/Business-as-Usual (BAU) scenario and two pathways related to India's Nationally Determined Contributions (NDC) under the Paris Climate Agreement (NDC and NDC PLUS). In order to depict the additional socio-economic impacts of a decarbonisation pathway in line with the political target of the Paris Agreement of limiting global temperature rise to well below 2° Celsius by 2100, a high-ambition decarbonisation pathway, developed within the REmap programme of the International Renewable Energy Association (IRENA), was added to the list.

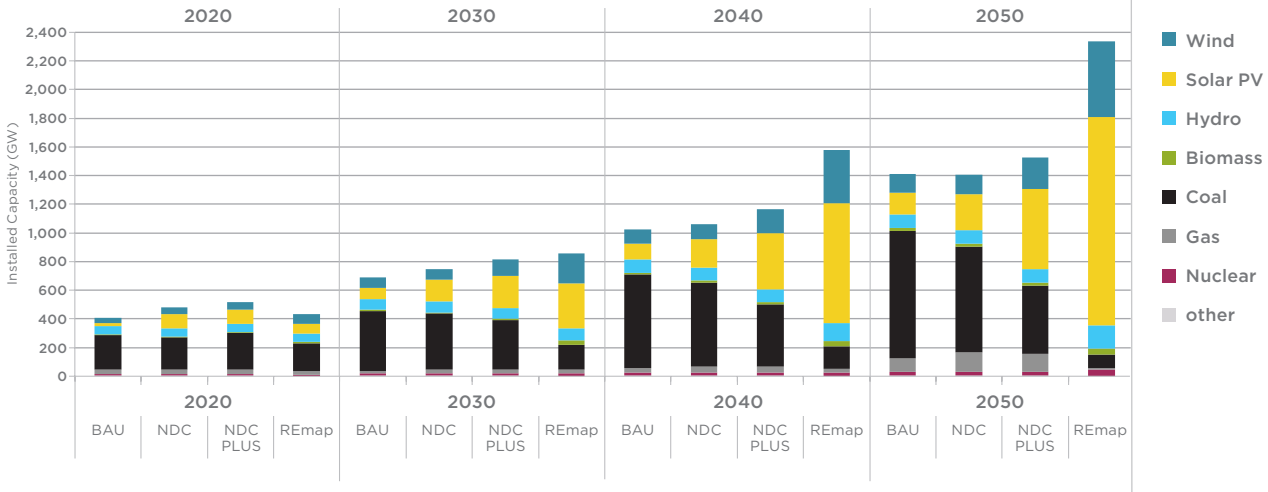
Business-as-Usual scenario (BAU)
The Business-as-Usual scenario (BAU) represents India's present climate policies rolled out until 2016. The BAU scenario assumes the uptake of more efficient technologies based on past trends, existing policies and targets rolled out by 2016. As a result, the current renewable energy targets are only partially achieved. In 2050, coal remains the dominant source with an installed capacity of 888 GW; Solar and wind installations are estimated at 156 GW and 126 GW respectively; Total generation capacity reaches 1,409 GW.

NDC scenario
The NDC scenario (NDC) has been designed to chart out the strategies needed to achieve the targets laid out in India's Nationally Determined Contributions under the Paris Climate Agreement. The major targets accounted for in the scenario are: reducing the emissions intensity of GDP by 33–35% of 2005 levels, and deploying 40% non-fossil energy capacity by 2030. Achieving these targets requires a multi-dimensional development action plan. In this scenario, coal retains the largest installed capacity (739 GW) in 2050. The overall decline in coal is substituted with cleaner sources of generation, comprising 250 GW solar and 135 GW wind capacity. Gas-based generation capacity also increases to 134 GW in this scenario.

NDC PLUS scenario
The NDC PLUS scenario (NDC PLUS) adopts strategies for deeper decarbonisation than the NDC scenario. Consequently, the scenario assumes rapid uptake of efficient technologies across all sectors, accelerated efficiency improvements for both appliances and vehicles, and aggressive efforts towards improved energy efficiency across the industrial sector. This scenario therefore assumes higher penetration of efficient and low-carbon options such as electric vehicles over petroleum-based vehicles, use of public modes of transportation over private vehicles, use of five-star-rated air conditioners, and enhanced renewable capacity. In this scenario, with deep decarbonisation priorities, installed solar capacity reaches 557 GW in 2050 followed by coal at 478 GW and wind at 222 GW.

REmap India Scenario
The International Renewable Energy Association (IRENA) REmap (REmap) scenario provides a power sector decarbonisation pathway for India to contribute towards limiting global temperature rise to well below 2° Celsius by 2100. The IRENA REmap scenario (REmap) assesses the renewable energy potential assembled from the bottom-up, starting with country analyses conducted in collaboration with country experts. In this scenario, the share of coal in the Indian power system is reduced from more than 70% today to less than 8% of power generation in 2050. At the same time, the installed solar PV capacity would reach 940 GW in 2050. This is based on the sum of both utility- and rooftop-scale capacities, while ensuring technical feasibility (i.e., that the total installed capacity of utility-scale solar PV proposed in the scenario remains well below the technical potential limit of 750 GW). The IRENA REmap model applies a simplified approach to assess power generation adequacy and flexibility requirements.

COBENEFITS India: Power System Reference Scenarios
Installed Capacities (GW)



2.1 Fostering rural development and securing electricity access with renewable energy

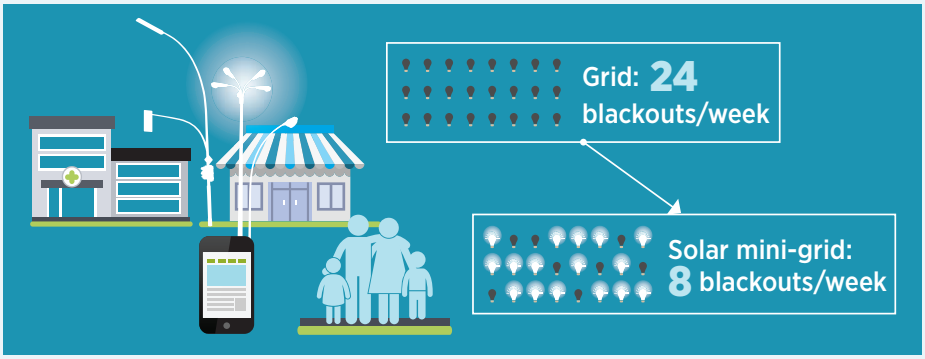
KEY FIGURES

- The average unit cost of supply from a standard[1] solar mini-grid in rural India is approximately Rs 29 (USD 0.38/kWh)[2] while consumers pay a unit cost of Rs 40 (USD 0.53/kWh). The reverse is the case for grid consumers, who pay a government-subsidised unit cost of approximately Rs 3 (USD 0.04/kWh) from a unit cost of Rs 6.4 (USD 0.09/kWh) incurred by the grid supplier.
- By gradually increasing mini-grid capacity while reducing the levelised cost's interest rate from 12% to 8%, the unit cost supply from the mini-grid drops to as low as Rs 6.26 (USD 0.08/kWh), which is cheaper than and also cost-competitive with the grid supply cost.
- For a typical 700 kW capacity solar mini-grid, the average unit cost of supply of Rs 7.62 (USD 0.10/kWh) can be realised, while for a typical 1 MW solar mini-grid, an average unit cost of supply of Rs 6.88 (USD 0.09/kWh) can be achieved.

KEY FINDINGS

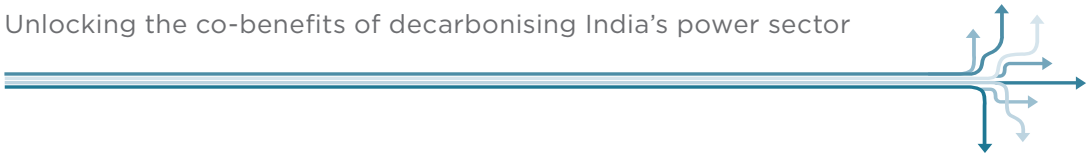
- Practically, the overall experiences of mini-grid and grid consumers in terms of evening lighting in rural areas are broadly similar; however, grid consumers could use electricity for purposes beyond lighting and ventilation which are the major electricity consuming appliances that can be used by mini-grid-consumers.

In rural India, mini-grids significantly improve the reliability of supply for municipal services and basic household energy needs.



[1] A standard solar mini-grid in rural India has a system capacity of 27 kW.

[2] In this report conversions into US Dollar (USD) are calculated based on the official exchange rate as of 30.06.2020 (1 US Dollar – 75.51 Rupees/Rs).



- Fewer blackouts experienced by consumers supplied by solar mini-grids. Mini-grids provided reliable electricity supply to rural households and load centres, with only one-third of the blackouts experienced under grid electrification; and, in terms of supply quality, showed only minimal voltage fluctuations (grid consumers reported an average of 24 blackouts/week, for over 5 hours per day; mini-grid consumers reported an average of 8 blackouts/week ranging from 20 minutes to 2 hours)

- Establish mini-grids as a complementary/supplementary extension of grid services. In the Indian context with almost 100% grid coverage at the village and household levels, mini-grids may be utilised as natural extensions of the grid in areas where reliability of supply is a concern. This would require clear guidelines for grid-integration, making it an attractive business opportunity for investors.

- Pricing of mini-grid services with cross-subsidies for mini-grid consumers. In a scenario where medium- or MW-scale mini-grids are deployed, a mechanism to extend cross-subsidy to mini-grid consumers can ensure cost parity with grid tariffs. This would not only make reliable and quality supply through mini-grids affordable, but also serve to meet the government's objective of transitioning to clean sources of energy.

- Skills development to service scaled-up mini-grids. In the event of national-level expansion and scale-up of mini-grids in India, skilled technicians would be required for operation and maintenance of the plant and for business operations. To this end, skill development programmes are essential for creating local employment opportunities for the community.

2.2 Future skills and job creation with renewable energy

KEY FIGURES

- Up to 3.5 million people could be employed in the Indian power sector by 2050.

- More than 3.2 million people could be employed in the renewable energy sector by 2050.

- The renewable energy sector could employ five times more people in 2050 than the entire Indian fossil-fuel sector employs today.

KEY FINDINGS

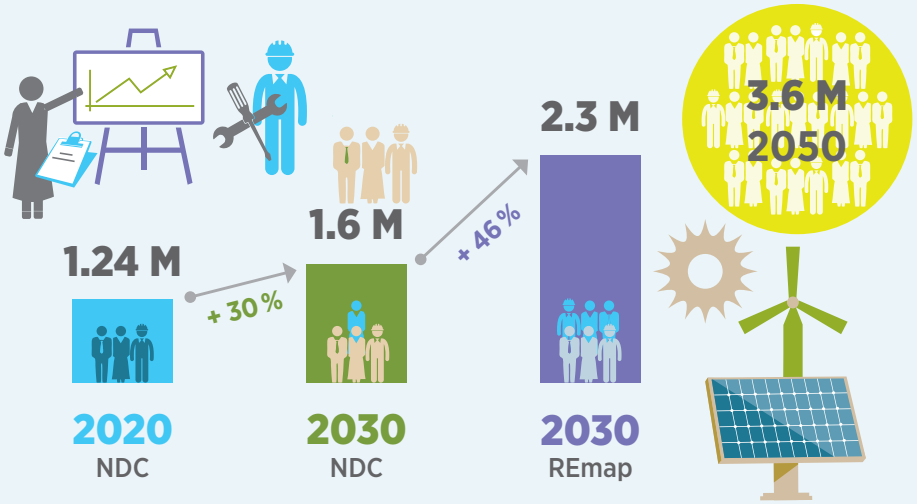
- In all scenarios, the workforce[3] required in the Indian power sector will increase considerably and may reach 3.5 million by 2050. The renewable energy sector could employ five times more people in 2050 than the entire Indian fossil-fuel sector (coal, gas, nuclear) employs in 2020.

- Renewable energy technologies tend to be more labour intensive than conventional energy technologies. At the same time, distributed renewables such as small-scale hydro, rooftop solar, and biomass create maximum employment for every MW of installed capacity. Rooftop solar employs 24.72 persons, small hydro employs 13.84 persons, and biomass employs 16.24 persons for constructing and running a one-megawatt plant.

[3] The workforce numbers presented in this report include direct and indirect jobs along the electricity value chain (direct jobs in fuel supply, plant construction, operations and maintenance and indirect jobs for

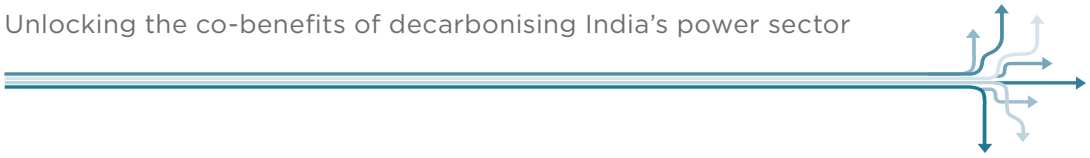
- The renewable energy sector will be the largest employer in the future Indian power sector. Already in 2020, 264,000 supplementary renewable energy jobs can be created by shifting from BAU to the NDC scenario. Under the REmap scenario, more than 3.2 million people would be employed in the renewable energy sector alone by 2050.
- Biomass and solar energy will be the major drivers of employment, with up to 2 million and 1.1 million employees, respectively, by 2050.
- Skilling is the primary future challenge. To meet its NDC, India requires 170,000 high- and semi-skilled experts and another approximately 180,000 lower skilled technicians in the solar sector by the year 2030. Under the REmap scenario, these numbers will increase substantially to 370,000 high- and semi skilled experts and 570,000 lower skilled technicians in 2050.
- The number of employees in the coal sector has already decreased considerably in past decades due to increasing mechanisation. In the coal-mining sector alone, approximately 105,000 jobs have been lost due to mechanisation between 2000 and 2015.

India can almost double the number of jobs through the power sector by **2030** by following an ambitious decarbonisation pathway.



NDC: Scenario that highlights the strategies necessary for achieving the targets laid out in India's international climate commitment (NDC)

REmap: High ambition renewable energy roadmap for India by the International Renewable Energy Agency (IRENA)



2.3 Improving people's health and reducing costs with renewable energy

KEY FIGURES

- Annual mean particular matter concentration in India is five times higher than the levels recommended by the World Health Organization.
- Air pollution accounts for 4% to 5% of total mortality in India.
- The power sector accounts for about 8% of premature deaths related to air pollution.
- The health costs of ambient air pollution will reduce India's GDP by as much as 5.7% in 2050.

KEY FINDINGS

Concentration levels of pollutants

- In comparison to the industrial and residential sector the power sector makes a smaller contribution to overall emissions, which is mainly due to increasingly stringent controls; however, their contribution grows significantly in cities or at locations in their zone of influence.
- In the BAU scenario, the mean $PM_{2.5}$ concentration in 2020 is five times higher than the maximum annual mean $PM_{2.5}$ concentration that is recommended by the World Health Organization (10 µg/m³) and will remain very high until 2050 (60 µg/m³ in 2030, 54 µg/m³ in 2040, and 60 µg/m³ in 2050).
- However, even in the NDC and NDC PLUS scenarios, $PM_{2.5}$ concentrations will remain dangerously high. In the best case, the population-weighted mean $PM_{2.5}$ concentration will decrease to 48 µg/m³ (NDC PLUS scenario in 2050). However, this is still almost five times higher than the concentrations recommended by the WHO. This indicates that more ambitious scenarios are necessary to significantly reduce the health impacts on the Indian population.

Premature deaths and disability-adjusted life years

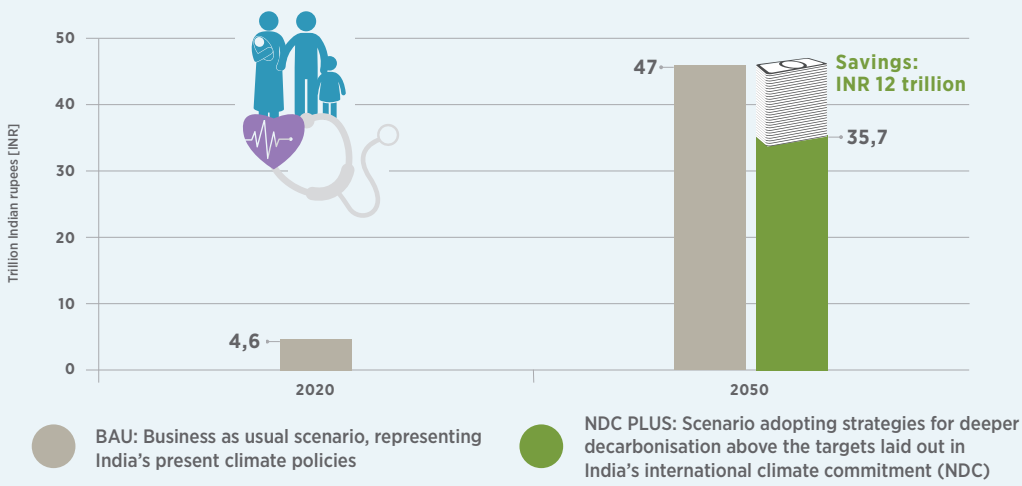
- Air pollution will account for 4% to 5% of total mortality in India between 2020 and 2050. In the business-as-usual scenario, in 2020 almost 500,000 people will die prematurely due to exposure to particular matter (PM_{10}). This number would rise to 830,000 premature deaths by 2050.
- Following the NDC pathway, India can reduce the number of premature deaths from PM_{10} by about 75,000 in 2050. By going beyond the NDC scenario (NDC Plus), premature deaths resulting from PM_{10} can be further reduced to 613,000 in 2050, which is 25% less than under the BAU scenario and around 17% below the NDC scenario. However, it should be noted that, compared with 2020 levels, even the NDC PLUS pathway would see an increase in the number of premature deaths by 2050.
- The top five states (Uttar Pradesh, Maharashtra, Gujarat, Bihar, and West Bengal) alone account for 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 all premature deaths.
- The power sector accounts for about 8% of premature deaths related to air pollution (PM_{10}). By moving from BAU to the NDC PLUS pathway, the number of premature deaths can be reduced from 57,000 to 24,000 in 2050 (a reduction of 58%).

- Disability-adjusted life years (DALY) is a single metric to record the combined burden of mortality and morbidity. Under the BAU scenario, DALY attributable to ambient $PM_{2.5}$/ PM_{10} exposure is estimated as 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 power sector, total DALY could increase to 1.7 million in 2050 following the BAU pathway. However, by greening the power sector total DALY could be reduced by 1 million, down to 0.7 million in 2050 (NDC PLUS scenario).

Economic impact

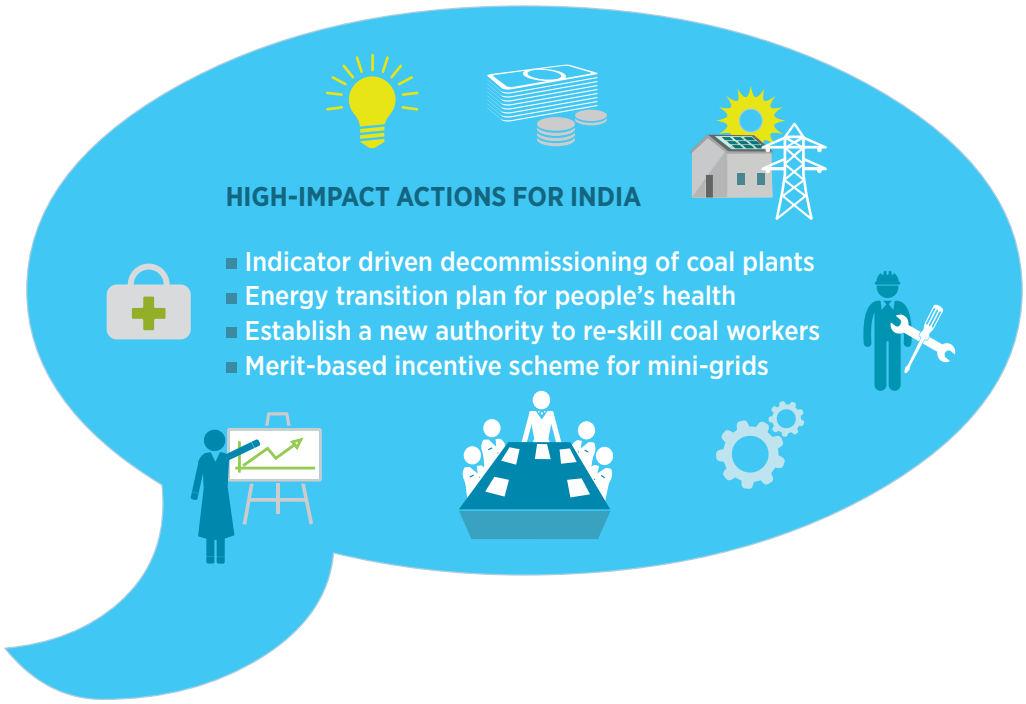
- Under the BAU scenario the total economic loss resulting from both disease-specific mortality and morbidity for the year 2020 is estimated as Rs 4,604 billion (i.e., 4.6 trillion/ USD 61 billion). This is already a very high figure, and would increase more than ten-fold to Rs 47 trillion (USD 632 billion) in 2050.
- Switching from the present energy scenario to NDC will lead to an estimated total economic benefit to the country of Rs 2,148 billion (USD 28 billion) by 2050, and an additional economic benefit of Rs 5,421 billion (USD 72 billion) can be realised if the country moves to the NDC PLUS trajectory.
- Total economic losses due to ambient air pollution significantly reduce Indian GDP. Already in 2020, total economic losses will reduce GDP by 2.9%, and this figure could increase to 5.7% in 2050. Even in the NDC PLUS scenario, Indian GDP will be reduced by 4.3% in 2050. This indicates that India should consider even more ambitious pathways for greening the economy.

India can significantly unburden health budgets by greening the economy and deploying renewable energy.



Health costs from the power sector

3. Unlocking the co-benefits of renewable energy for the people of India



Fostering rural electrification, creating future-oriented skill sets and employment opportunities, improving people's health, and unburdening the public health system – the COBENEFITS studies for India compiled and quantified the evidence that decarbonising India's electricity sector with renewable energy can yield considerable social and economic co-benefits. In that, the findings also substantiate the strong interrelatedness of energy and climate policy with development action in India.

How can policy makers and ministerial policy implementers shape an enabling political environment to unlock and maximise the social and economic opportunities for communities, businesses, and families?

Quantifiable evidence and knowledge on the socio-economic potentials are pivotal to developing enabling policies to unlock the identified co-benefits. Thereby, Ministries and further government institutions can shape an enabling political environment to unlock and maximise the social and economic opportunities for communities, businesses, and families in India.

Building on the evidence from the COBENEFITS studies, a broad and intensive consultation process with government institutions, industry associations, and expert and civil society organisations has yielded tangible policy opportunities to deliver on the identified co-benefits for the people of India. A series of roundtable consultations was hosted by TERI in partnership with the Independent Institute for Environmental Issues in 2019, subsequently complemented by bilateral consultations with government ministries until March 2020.

In this section, these policy opportunities are presented according to the three main co-benefits areas. After outlining stimuli for shaping favourable policy environments, selected high-impact actions are defined and described in detail, along with the political institution suggested to champion the HI-Action and collaborative bodies to successfully implement the policy opportunity.

3.1 Creating an enabling environment to foster rural electrification: Impulses for furthering the debate

The COBENEFITS study showed that solar-powered mini-grids can become cost-competitive with the grid, and can aid in improving the reliability of rural electrification in India. The cost-of-supply and equivalent tariff analyses show that scaling up mini-grids to higher power capacities (as either single, standalone systems or a cluster of multiple projects within a single portfolio) can make them more cost effective while maintaining their economic viability.

Establish mini-grids as a complementary/supplementary extension of grid services

In the Indian context of fast-expanding and policy-driven grid extension throughout the country, the electricity distribution companies, which were already struggling with issues of unreliable supply and network maintenance, now face the added burden of numerous new connections. In such a situation, instead of viewing mini-grids as an alternative to grid supply, by scaling up mini-grids and the corresponding services they can then offer, mini-grids may be utilised as natural extensions of the grid in areas

Solar-powered mini-grids can remain economically viable and cost-competitive with the centralised grid in rural areas of India.

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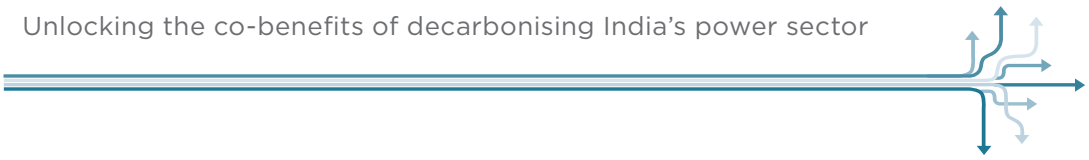

where reliability of supply is a concern. This will not only help to counteract the perceptions of mini-grid supply being sub-par and more expensive than grid supply, but will essentially refocus on the electricity service rather than its source. This will also make a much stronger business/investment case for mini-grids in India.

Surplus energy from mini-grids can be fed back into the grid, as well as provided to complement daytime supply in places where the grid supply is unreliable. Although the technicalities of such connection are beyond the scope of this study, these interconnections can also reduce the pressure on distribution companies struggling with demand management and network maintenance issues in rural areas. Thus, we recommend that clear guidelines for interconnecting mini-grids with the grid network will be formulated, making it easier and more attractive for investors to consider this as a viable business opportunity.

What can government agencies and political decision makers do to harness and maximise the combined benefits of grid/mini-grid solutions for rural India?

- Enhance individual mini-grid capacities (500 kW and above) to make supply for community institutions possible.
- Establish mini-grids as a complementary/supplementary extension of grid services.
- Establish a dialogue for short-, medium-, and long-term planning and the development of suitable business models for mini-grids.
- Pricing of mini-grid services: Cross-subsidies for mini-grid consumers. Skill development to maintain the growth of mini-grids in the country.
- High-Impact Action: Merit-based incentive scheme for mini-grids between 100 kW and 1 MW

Enhance individual mini-grid capacities (500 kW and above)

One of the key study findings is the limited capacity offered by the studied mini-grid systems. The present capacities not only fall short of the desire for lighting alone, but also limit the types of electrical appliances that consumers can use at home to improve their quality of life. This limitation also extends to the possibility of starting new enterprises or mechanising/enhancing pre-existing ones, and to support important community institutions such as schools, markets, public health, and community centres with electricity. This upscaling will make mini-grids more economically viable and bring down the per-unit tariff for consumers. Therefore, for future solar mini-grid projects, we recommend that appropriate policy guidelines mandate that mini-grids connect not only to local households but also key public institutions. As suggested by the scenarios developed in the study, medium-scale mini-grids serve the dual purposes of providing higher available load as well as longer duration of reliable supply. It is recommended to promote this novel concept for electrifying clusters of villages. However, such systems would be designed to accommodate growing energy demand among consumers.

Another way of increasing the load available to various types of consumers is to install multiple, small mini-grids, such as the ones surveyed, connected together to form a grid-like network. This can vastly enhance the provision of power to multiple locations, and also reduce the losses associated with extending power lines to distant households. The management of these numerous systems would require additional personnel, thereby potentially creating employment opportunities. However, such a system would present its own technical challenges. Limitations may also be present in integrating this network into the grid as the study proposes. Therefore, further research and pilot models would be required to study the on-the-ground realities of deploying this technology.

Establish a dialogue for short-, medium-, and long-term planning and the development of suitable business models for mini-grids

As pointed out, there are several opportunities to use mini-grids as a complementary extension to the grid or as a supplementary source of electricity, even when grid-supplied electricity is eventually expanded to include remote communities. However, the political discussion concerning the most appropriate options is only slowly gaining momentum, especially with the growing consensus on transitioning to clean technologies for decarbonising the power sector, and promising approaches are often not yet apparent for decision makers, distribution companies, or mini-grid developers.

The initiation of multi-stakeholder dialogue — for example in the form of round tables comprising state governments, distribution companies, mini-grid developers, and civil society representatives — can serve as a joint hub for planning future approaches to mini-grid use. Besides being a platform for sharing data and experiences between business and state agencies as a basis for joint planning, strategies elaborated with the participation of all important stakeholders have strong potential to serve as a blueprint for the development and political support of new and suitable business models for mini-grids in India. Mini-grid planning hubs would be supported by further research on appropriate options and models, to examine approaches for growth and expansion, to reduce stress on distribution companies, and to reimagine the consumer base for mini-grids.

Pricing of mini-grid services: Cross subsidies for mini-grid consumers

Successive governments have sought to make electricity access affordable to even the poorest sections of society; to achieve this, a number of subsidies have been rolled out. Rural domestic consumers are cross-subsidised by industrial and commercial consumers, making tariffs very low and affordable. However, this benefit is not available to mini-grid consumers within the same economic strata, who presently pay much higher per-unit tariffs for much more limited energy services.

We therefore recommend that in a scenario of medium- or MW-scale mini-grids, where the cost of supply is comparable to that of the grid (as established in this study), consumer tariffs also become comparable and some provision would be made to cross-subsidise rural mini-grid consumers to achieve parity in electricity pricing for consumers reliant on grid and non-grid electricity sources. This would not only make reliable and quality supply through mini-grids affordable, but also serve to fulfil the government's objective of achieving a widespread transition to clean energy sources.

Develop skills to foster prosperity

Direct employment created by mini-grid projects in host communities is currently limited to semi-skilled operators and technicians, which are often few in the current scenario. Opportunities for increased direct employment in the mini-grid value chain will be fostered with the development of a large number of high-capacity systems; this essentially aids "localisation of industry", which in turn drives local employment creation and skills transfer. Premised on an expansion and scale-up of mini-grids in India, skilled technicians would be required for operating and maintaining plants, and revenue staff for collecting tariffs. Thus, it is recommended to mandate skill development programmes to create employment opportunities within local communities.

3.2 High-Impact Action for fostering rural energy security

High-Impact Action: Merit-based incentive scheme for mini-grids between 100 kW and 1 MW

Institution to champion the HI-Action	Collaborative bodies to successfully implement the HI-Action	Timeframe of the HI-Action
Ministry for New and Renewable Energy (MNRE)	■ Ministry of Rural Development ■ State Government and rural Energy departments ■ Ministry of Finance ■ Rural Electrification Corporation (REC) ■ Indian Renewable Energy Development Agency (IREDA)	Short term, over the next five years

For this High-Impact Action the Government of India develop a special capital subsidy scheme for viable medium-sized mini-grid systems of higher capacities (between 100 kW and 1 MW) that are located in specific rural developmental zones defined by the MNRE. The government would also collaborate with the rural developmental bank and national/international funding agencies in order to facilitate and fulfil the overall process.

For effective implementation of this scheme MNRE, in consultation with the Ministry of Power, would take the following actions:

a. Designing an accurate tendering system to select appropriate mini-grid models.

b. Ensuring that the cost of electricity supplied through mini-grid services does not exceed the average cost of supply, which was calculated as Rs 7.6 per kWh in the study (This is considered the lowest cost at which large-scale mini-grids are viable).

c. Extending cross-subsidies to mini-grid consumers to make tariffs affordable: Cross-subsidising rural mini-grid consumers to achieve parity in electricity pricing for consumers reliant on grid and non-grid electricity sources.

d. Simplifying the process of disbursing funds.

e. Effective impact monitoring.

This scheme focuses on mini-grids, which serve as the tail-end generators to the centralised grid in rural areas, and are capable of delivering franchise energy services to distribution companies in un-electrified areas.

India can markedly improve the livelihoods of its citizens by reducing ambient air pollution through an accelerated decarbonisation pathway.

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Additional impact action: Implement policy regulation on co-existence of mini-grid with central-grid

Institution to champion the HI-Action	Collaborative bodies to successfully implement the HI-Action	Timeframe of the HI-Action
Ministry of Power	■ MNRE ■ State Electricity Boards (SEBs) ■ State electricity agencies/energy departments ■ State-owned power distribution companies	Short term, over the next five years

Under this additional impact action the Ministry of Power and MNRE establish regulations concerning the co-existence of mini-grids with the central grid in desired areas.

For such areas where mini-grids and the central grid are connected to the same consumer pool, the policy regulation highlights the technical requirement based on grid studies, changes to system design, and financial models that encompass the methodology for tariff collection and profit sharing. This would be initiated by approaching the public utility with the existing private mini grid in the area. Successful guidelines will be defined on a state-to-state level.

The following steps can be taken for effective implementation of these guidelines:

a. Agreement between the mini-grid owner and the central grid operators, on the timings of electricity supply, revenue sharing model, etc.

b. A new power purchase agreement (PPA) is developed and signed to reset the tariff and the procurement price by the utilities.

c. The tariff collection process would be digitally enabled by smart meters to reduce inaccuracy in the profit sharing model between the mini-grid and the central grid operating simultaneously in the same region (one such smart meter will serve only one community, and will not be used for consumer billing).

Fostering rural development and securing electricity access with renewable energy.

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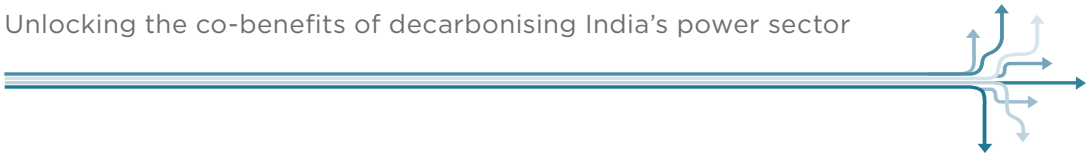


3.3 Creating an enabling environment to boost employment with renewables: Impulses for furthering the debate

The study showed that the renewable energy sector provides huge employment potential, with up to 3.7 million employees in 2050. At the same time, total employment in the renewable energy sector will far exceed current employment in the fossil fuel sector. The study findings also highlighted that the transition within the labour-intensive Indian coal sector needs to be managed carefully. Skilling and re-skilling of the new workforce in the Indian electricity sector will be most crucial.

How can other stakeholders harness the social and economic co-benefits of building a low-carbon, renewable energy system while facilitating employment opportunities through a just energy transition?

Building on the study results and the surrounding discussions with political partners and knowledge partners during the COBENEFITS Round Tables, we propose to direct the debate in the following five areas where policy and regulations could be put in place or enforced in order to maximise employment benefits within the shift to a less carbon-intensive power sector:

- Make skilling and female employment a mandatory part of public renewable energy projects.
- Improve data availability concerning employment in the renewable energy sector.
- Foster distributed generation that utilises renewable energy sources.
- Manage the energy transition in the coal sector and coal-producing regions.
- Include job opportunities for (community-owned) renewable energy projects within the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA).
- High-Impact Action: Establish a new authority to reskill workers from the coal sector

Make skilling and female employment a mandatory part of public renewable energy projects

The developers of renewable energy projects in India operate on very tight profit margins. Many project developers try to save money by focusing on the installation of renewable energies, while reducing the budget for skilling and maintenance and the integration of female workforce. Consequently, there is a risk that qualified maintenance might be neglected; and female employees are underrepresented in the sector.

Renewable energy projects promoted by the central and state governments could contribute to resolving both these issues, by introducing mandatory project obligations to train local workforces to maintain renewable energy installations, and to establish favourable conditions for women to join and succeed in the workplace.

The financial sustainability of these measures could be ensured by revising auction regulations, so that a certain percentage of each project budget is assigned to training low- and semi-skilled workers and to supporting female employees.

Improve availability of employment data in the renewable energy sector

There is limited scope of analysing employment numbers and trends in India, since there is a lack of granular data. More granular data on employment would help researchers and policymakers to track total employment in the sector. Policymakers could then design policies in ways that maximise job creation (e.g., best technology mix, national manufacturing, etc.).

Individual organisations across the sector value chain can also be encouraged to report employment generation, in order to create a transparent data system for future analysis. Making job- and skill-reporting a mandatory part of project reporting for renewable energy projects advertised by central and state governments would provide a way to collect valuable data from renewable energy project developers. Such a

policy would require the Ministry of New and Renewable Energy and the Ministry of Power to review and adapt their auction conditions for RE projects.

In order to utilise the resulting data for assessment, evaluation, and planning purposes, it is recommended that a regular joint working group should be established between the Ministry of New and Renewable Energy, the Ministry of Skill Development and Entrepreneurship (MSDE), and the Skill Council for Green Jobs. Another option would be to collect employment data as part of the household survey within the Employment and Unemployment section of the National Sample Survey (NSS). This could be implemented through a joint initiative by the Ministry of Labour and Employment, the Ministry of Statistics and Programme Implementation, and the Ministry of New and Renewable Energies.

Foster distributed generation of renewable energy sources

Distributed renewable energy technologies such as small hydro, rooftop-scale solar, and biomass create maximum employment for every MW of installed capacity. Rooftop solar employs 24.72 persons, small hydro 13.84 persons, and biomass 16.24 persons for constructing and running a one-megawatt plant. This suggests huge potential for job growth in distributed RE technologies. Policy makers can prioritise distributed forms of renewable energy technologies in order to accelerate employment creation in the renewable energy sector.

Distributed renewable energy technologies such as biomass, rooftop solar, and small hydro have the potential to provide employment in rural areas. Biomass energy facilities have an employment coefficient of 9.28 FTE jobs per year per megawatt during the operation and maintenance phase, and another 34.5 people per ton of biomass are employed in sourcing this fuel. Biomass also provides additional income to farmers for their crop residues.

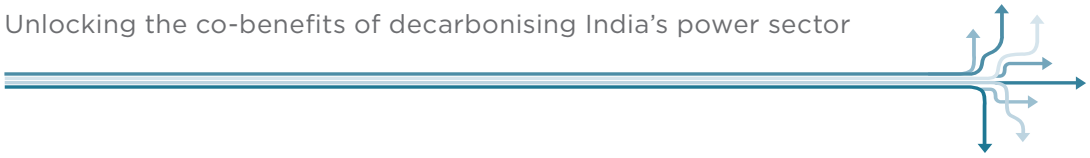
Manage the transition in the coal sector and coal-producing regions

As discussed in Section 3.6, deeper decarbonisation of the Indian power sector would eventually result in reduced employment in the coal sector. To alleviate the social impacts of the energy transition in the Indian coal regions, specific measures can be taken that have proven successful in other countries around the world. In a first step, India could assess the renewable energy potential in the coal regions; deploying renewables in the (former) coal regions can generate employment and economic activities in those regions. Secondly, policy makers could plan location-specific renewable energy auctions in (former) coal regions. Re-skilling of existing workforces would ensure their employability in emerging renewable energy technologies. Implementation of re-skilling programmes would be imperative in the medium- to long-term.

Include job opportunities for (community-owned) renewable energy projects within the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA)

Renewable energy projects have the potential to create new jobs in India's rural areas that go beyond the agricultural sector. However, incentives can be provided to ensure that jobs are also offered for unskilled and low-skilled workers from the communities where renewable energy installations are located.

The integration of employment opportunities for the joint installation, operation, and management of (community owned) renewable energy projects into the MGNREGA scheme would give low- and unskilled workers and women the opportunity to access, through this established employment scheme, the opportunities offered by renewable energies, and to create a sense of ownership for renewable energy in their communities. Furthermore, the combination of renewable energy projects with the scheme would ensure the maintenance of renewable energy installations in the medium and long term and might lead to cost reductions and synergies, e.g., in biomass projects.



3.4 High-Impact Action for boosting job creation in the renewable energy sector

High-Impact Action: Establish a new authority to re-skill workers from the coal sector

Institution to champion the HI-Action	Collaborative bodies to successfully implement the HI-Action	Timeframe of the HI-Action
Ministry of Skill Development And Entrepreneurship	■ Ministry of Human Resource Development ■ Ministry of New and Renewable Energy ■ State governments' rural and energy departments ■ Skill Council for Green Jobs (SKGJ)	Short term, over the next five years

For this High-Impact Action the government creates a central authority/agency/body to gather data on employment trends in the renewable energy sector. This would focus on addressing the shortfall of skilled labour that will occur in the renewable energy sector in the short (5 years) and medium (10 years) terms. The authority can consider the possibility of closing the skills gap in the RE sector by hiring retrained workers from the coal sector.

Based on the urgency for skills development, major emphasis is given to those states that have very low literacy rates, but the government has earmarked funds for the installation of large-scale renewable energy projects.

Additional impact action: Accreditation and certification of local workers in procurement of RE projects

Institution to champion the Impact Action	Collaborative bodies to successfully implement the Impact Action	Timeframe of the Impact Action
Ministry for New and Renewable Energy (MNRE)	■ Ministry of Skill Development and Entrepreneurship ■ Minister of Rural Development ■ Ministry of Human Resource Development ■ State Government and Rural Energy departments	Medium term (5 to 10 years)

Accreditation and certification of local workers is needed in the procurement of RE projects driven by public institutions in alignment with the private sector, under coordination of MNRE and the Ministry of Human Resource Development.

It is recommended that the government's agenda should give high priority to publicising and addressing the urgent need for an appropriately skilled workforce in the renewable energy sector. The government can enlist the help of the existing network of distribution companies in disseminating information about opportunities within the renewable energy sector.

Additional impact action: Online tracker to expedite skills development in RE sector

Institution to champion the Impact Action	Collaborative bodies to successfully implement the Impact Action	Timeframe of the Impact Action
Ministry for New and Renewable Energy (MNRE)	■ Ministry of Skill Development and Entrepreneurship ■ Ministry of Human Resource Development ■ Skill Council for Green Jobs (SKGJ)	Immediate (in the next 2 years)

Under this additional impact action the Ministry for New and Renewable Energy makes data on employment within the RE sector available on a quarterly basis, through an online platform. This will help in creating a sense of urgency for the responsible institutions and the private sector, toward closing the skills gap in the RE sector. It will also help in bringing transparency to the diverse stakeholders of this sector.

The portal would show the spatial distribution of renewable energy projects, together with progress in employment and skills development. A very similar portal, which provides a clear perspective on how this could be developed, is available at: www.saubhagya.gov.in. The portal was launched by MNRE to show the country's progress on household electrification. The data on the portal are based on field reports and are uploaded regularly by the individual states' power distribution companies.

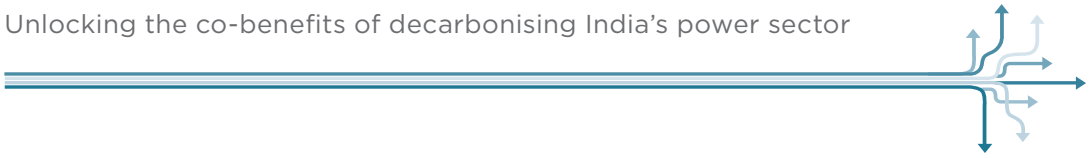
3.5 Creating an enabling environment to improve people's health and unburden the health system: Impulses for furthering the debate

This COBENEFITS study assesses the impact of ambient air pollution on human health in India. It quantifies both the health and economic costs arising from PM2.5/PM10 emissions. The study assesses the impacts of ambient air pollution from all sectors of the Indian economy. For the power sector specifically, the health benefits are quantified resulting from increased share of renewable energies in the Indian energy and power sector.

The study finds that India can markedly improve the livelihoods of its citizens by reducing ambient air pollution. In the business-as-usual scenario, in 2020 all-cause mortality will amount to 500,000 people due to exposure to particulate matter (PM10), increasing to 830,000 by 2050. By moving to the NDC PLUS PATHWAY, more than 200,000 deaths can be avoided. At the same time, India can significantly cut economic losses by greening the economy and deploying renewable energy sources. Following the business-as-usual pathway, total economic costs could increase from INR 4.6 trillion (USD 58 billion) in 2020 more than ten-fold to INR 47 trillion (USD 629 billion) in 2050. However, by following the NDC PLUS pathway, economic costs in 2050 could be reduced by as much as INR 12 trillion (USD 161 billion).

What can government agencies and political decision makers do to create a suitable enabling environment to maximise health benefits for the Indian people and unburden the health system?

- Include emission and air quality aspects in the retirement planning of power plants.



- Improve independent emission monitoring and law enforcement through third-party assessments.
- Foster interdisciplinary exchange between researchers and ensure methodological standards and joint monitoring.
- High-Impact Action: Replacing outdated coal-fired power plants with renewables; and structured, indicator-driven decommissioning of coal-fired power plants

Include emission and air quality aspects in the retirement planning of power plants

The retirement of ageing (coal-fired) power plants does not currently depend on standards or guidelines based on national or state regulations, but is instead subject to case-by-case decisions by state and central governments. This discretionary system might delay the retirement of old and emission-intensive coal power plants, even when they have major negative impacts on public health. Such decisions could be made more consistent by developing and adopting regulations at the state level, e.g., a decision matrix covering factors such power plant age, emission intensity, proximity to densely populated areas, options for replacing its power output, etc. Such decision matrices shall consider existing realities and limitations, but yet be sufficiently ambitious that a certain percentage of current power plants are likely to fall below the standards and therefore be retired. The decision matrix shall also include a mechanism to introduce progressively stricter environmental performance standards (including emissions) over time.

However, the implementation of robust retirement planning is only effective in combination with enforcement of emission standards, as outlined below.

Improve independent emission monitoring and law enforcement through third-party assessments and extended mandates for CPCB and SPCBs

Although emission standards have been introduced in India, robust monitoring of these power plant emissions remains a challenge. A shortage of staff in nearly all State Pollution Control Boards (SPCBs) results in insufficient control visits by SPCB officers to power plants. Therefore, reports from experts hired by power plant operators are used as a primary information source. The SPCBs' restricted mandate for enforcing compliance with emission regulations further hinders effective measures in this area.

Providing the Central and State Pollution Control Boards with more staff and a mandate to establish a system of progressive financial penalties for violations against emission regulations might establish financial incentives for operators to comply with emission standards or even retire power plants when they are no longer financially viable.

Monitoring of power plant emissions by a third party would further contribute to obtaining more reliable emission data, as demonstrated by experiences gained in a flagship project in Gujarat. The Central Pollution Control Board (CPCB) might be the most appropriate organisation to establish third-party assessments of power plant emissions and to hire independent scientific institutes and resource centres to conduct field research.

Foster interdisciplinary exchange between researchers and ensure methodological standards and joint monitoring

Studies and assessments carried out in the nexus of energy planning, renewable energies, air quality, and health research in India vary widely regarding the scientific methods and approaches used. While digitalisation and new technologies provide opportunities to gain new knowledge through the use of innovative research approaches, it remains a challenge to assess the scientific reliability of different methodologies. Consequently, it is often difficult for policymakers and officials to judge the validity of such assessments.

The sharing of data, existing studies and results, as well as further strengthening networks of renowned experts tasked with ensuring the quality of scientific studies through peer review, are therefore crucial steps towards more coordinated and targeted research to identify synergies in the energy planning/air quality/health nexus.

Setting up a shared research platform — ideally supported by the responsible line ministries —

encourages interdisciplinary exchange among researchers from different backgrounds and fosters transparency by assembling and organising existing data and studies within the nexus. Through forums and other functions for gaining feedback from other experts on the methodologies used, such platforms also enhance transparency and contribute to ensuring robust scientific standards throughout the nexus.

3.6 High-Impact Action for improving people's health and unburdening the health system

High-Impact Action: Energy transition plan for the people of India

Institution to champion the HI-Action	Collaborative bodies to successfully implement the HI-Action	Timeframe of the HI-Action
Ministry of Power and State Government	■ Ministry of Finance ■ Ministry of New and Renewable Energy ■ Ministry of Coal ■ Ministry of Health ■ State-owned power distribution companies and energy departments	Immediate, starting within a year

For this High-Impact Action the Ministry of Power along with State Governments sets out a cohesive plan to establish renewable energy technologies as the alternative for decommissioned or soon-to-be-decommissioned coal-fired plants. Amidst global decline in the cost of RE technologies, this will not only emerge as a cost-effective option for the country, but will also decrease the negative health impacts from the power sector created by coal-centric path dependences. Under such an energy transition plan for the people of India, commitments, as by the government of Delhi to officially shut down a 135 MW coal-powered thermal power plant and replace it with a 5 MW solar power plant (though still insufficient), can to be driven further for an holistic transformation of the power sector. Such actions can be replicated in other parts of the country, especially in areas that are very densely populated. Decommissioning old coal plants but simply replacing them with newer coal-fired plants will again lead to pollution in the long run and drive emission to unsustainable levels.

High-Impact Action: Structured indicator driven decommissioning of coal-fired power plants

Institution to champion the HI-Action	Collaborative bodies to successfully implement the HI-Action	Timeframe of the HI-Action
Ministry of Power and State Government	■ Ministry of Finance ■ Ministry of New and Renewable Energy ■ Ministry of Coal ■ State-owned power distribution companies and energy departments	Immediate, starting within a year

To meet its climate commitments, India requires 170,000 high and semi-skilled experts in the solar sector by the year 2030.

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For this High-Impact Action the Ministry of Power expedites the process of decommissioning coal-fired power plants on the basis of structured indicators. This process would be championed by the Ministry of Power and the indicators would be developed jointly with the Ministry of Environment, Ministry of Coal, and the Ministry of Health.

It is recommended that the process should consider the following indicators:

- Population density of the area where the coal plant is located.
- Emission levels of the plants.
- Disability-adjusted life years (DALY) – at 1 km² spatial resolution.
- Projected deaths per square km induced by the power plant.
- The percentage contribution of the power plant to power supply security.

On the basis of these indicators power plants older than 25 years with the worst environmental and health impacts would be decommissioned first, beginning immediately.

For transparency, it is recommended that the assessment of each power plant is undertaken by an independent body (especially experts from research institutions) approved by the steering ministries.

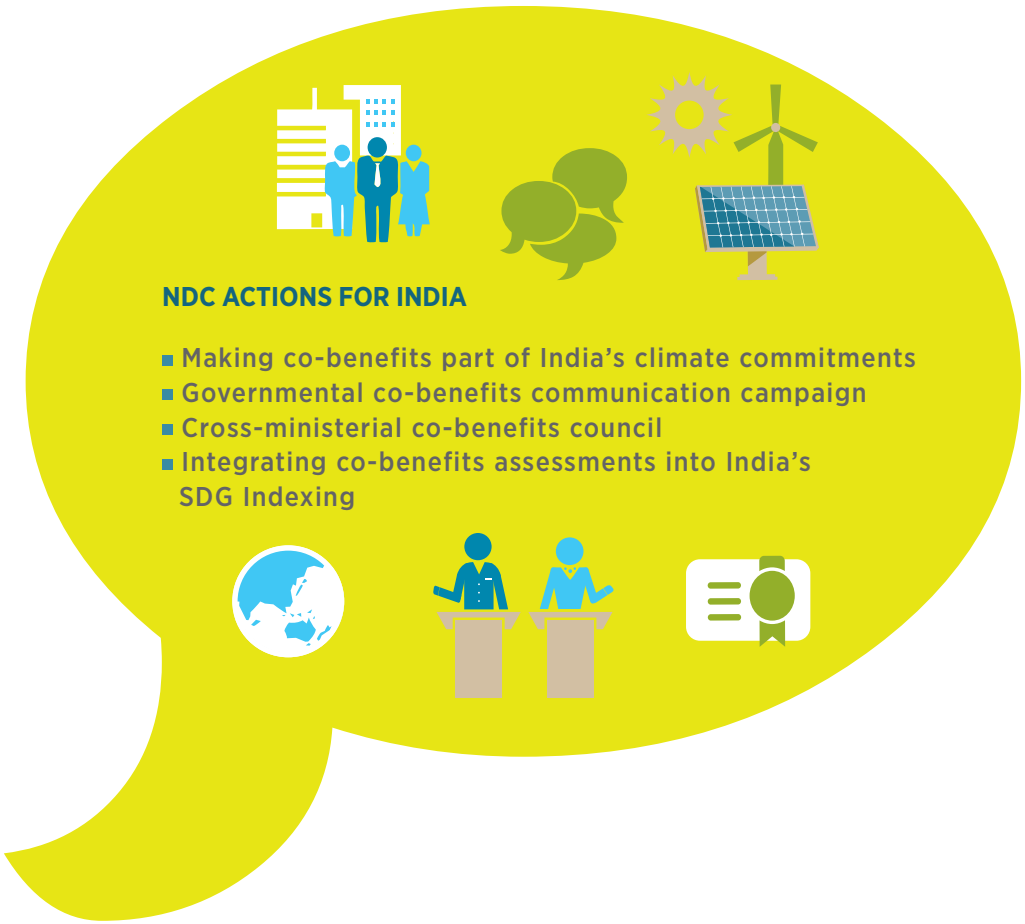
Additional Impact Action: Strict implementation of emission standards by old power plants

Institution to champion the HI-Action	Collaborative bodies to successfully implement the HI-Action	Timeframe of the HI-Action
Ministry of Environment, Forest, and Climate Change (MoEFCC)	■ Ministry of Finance ■ Ministry of Power ■ Ministry of New and Renewable Energy ■ Central Pollution Control Board	Immediate, starting within a year

In 2015 the Ministry of Environment, Forest, and Climate Change (MoEFCC) announced new emission standards for coal-fired power plants. However, most thermal power plants in India still lack flue-gas desulfurisation (FGD) systems to remove SO_2 emissions. Up to December 2018 very few plants (<60%) had complied with the new standards, but rather than enforcing them, the deadline for compliance was later extended to 2022. The COBENEFITS study has revealed the enormous health, mortality, and economic impacts arising from coal-fired power plants, thereby emphasising the importance of strict compliance with more stringent emission standards. It is recommended that the responsibility for monitoring emissions from power plants struggling with staff shortages should be outsourced to research institutions in order to ensure compliance before such plants are decommissioned.

Additionally, it is recommended that the government should develop a financial model so that power plants could install FGD and other emission control technologies within specified timelines.

4. Making the Paris Agreement a success for the planet and the people of India



India, among 189 parties to date, has ratified the Paris Agreement to combat climate change and provide current and future generations with opportunities to flourish. With this COBENEFITS policy report, 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.*

Recovering from the economic shocks of the COVID-19 pandemic and avoiding severe future shocks triggered through the climate crisis do not represent conflicting interests but instead a mutually reinforcing coping strategy. The Paris Agreement and the 2030 Agenda offer important, internationally agreed frameworks to ensure economic recovery in the shorter term and to build resilient economies and health systems in the long run.

This section of the report suggests and develops promising policy options that make use of the strengths of the Paris Agreement and NDCs as well as the 2030 Agenda on Sustainable Development and which contribute to a mutually reinforcing coping strategy for the Government of India.

4.1 NDC Action: Making co-benefits part of India's pledge to the planet and its people

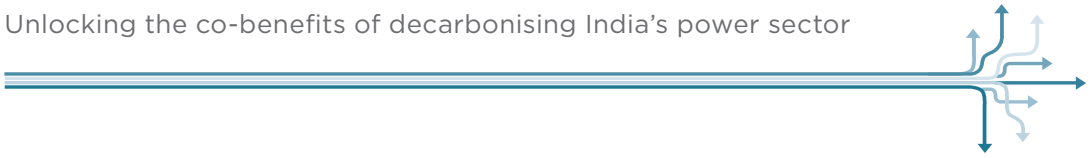
Institution to champion the NDC Action	Collaborative bodies to successfully implement the NDC Action	Timeframe of the NDC Action
Ministry of Environment, Forestry, and Climate Change (MoEFCC)	■ Ministry of New and Renewable Energy ■ Minister of Power ■ Prime Minister's Office	Short term, until 2023 (as well as future NDC revision rounds)

In terms of mitigating climate change, Nationally Determined Contributions (NDCs) are more than technical documents: they are also showcases, for national audiences, of the contribution and global responsibility a country is willing to take in reducing its GHG emissions. In addition, India's NDC also aims to exploit the co-benefits of addressing climate change along with promoting economic prosperity for its people.

Building on India's co-benefit approach in its NDC: including a "co-benefits" section in India's NDC will display and communicate the social and economic opportunities of the commitment to the Indian people in a powerful manner. Besides unveiling the opportunities to be unlocked for India's people and rallying domestic support for climate action, addressing co-benefits in NDCs and NDC communication can spark imitation and contribute to generating global momentum toward building a strong alliance for ambitious and early climate action.

4.2 NDC Action: Communication campaign "Co-benefits of climate action for the people of India"

Institution to champion the NDC Action	Collaborative bodies to successfully implement the NDC Action	Timeframe of the NDC Action
Prime Minister's Office	■ Ministry of Environment, Forestry, and Climate Change (MoEFCC) ■ International Solar Alliance ■ Ministry of New and Renewable Energy/National Solar Mission ■ Climate Parliament	Short term, over the next 3 years



The success of domestic climate policies depends on broad public support for and ownership of the actions taken. Actively communicating the social and economic opportunities connected to climate policies (e.g., in the energy sector) not only helps to rally citizens, communities, and businesses behind these policies; it also invites them to participate economically and socially.

Just as the government's strong message, in increasing renewable the power generation capacity to 175 GW by the year 2022, has invited businesses and entrepreneurs to build and benefit from the new energy world in India, a governmental co-benefits communication campaign, to make the Paris Agreement a success for the planet and the people of India, can encourage entrepreneurs, businesses, and communities to take ownership of climate action measures beyond the energy sector, such as in agriculture, transport, and the housing sector.

Such a communication campaign, which would again underline India's the strong international role, could be launched in the context of the upcoming UNFCCC Conference of the Parties (COP) as early as 2021.

4.3 NDC Action: Cross-ministerial co-benefits council to coordinate efforts and connect to SDGs

Institution to champion the NDC Action	Collaborative bodies to successfully implement the NDC Action	Timeframe of the NDC Action
Ministry of Environment, Forestry, and Climate Change (MoEFCC), NITI Aayog (Co-Chairs)	■ Ministry of New and Renewable Energy ■ Ministry of Power ■ Ministry of Health ■ Ministry of Rural Development ■ Ministry of Finance ■ Ministry of Skill Development and Entrepreneurship ■ Ministry of Human Resource Development	Short term, over the next 5 years

The Ministry of Environment, Forestry, and Climate Change (MoEFCC) can champion and facilitate the process of harnessing the social and economic development potential of the Paris Agreement and climate action in the energy sector and beyond. If India's climate actions are understood as drivers for social and economic prosperity and for adapting the government's role in order to shape a nurturing policy environment, then a cross-ministerial working group could facilitate joint and coordinated policy to successfully harness the co-benefits of India's NDCs.

Co-benefits, by definition, arise across multiple sectors; they are therefore best harnessed through joint and coordinated action across different political divisions and ministries. This is exemplified by the need for high-impact action on "Accreditation and certification of local workers in procurement of RE projects" to address the urgent need for a skilled workforce in the renewable energy sector. This would require joint action across the Ministry for New and Renewable Energy (MNRE), Ministry of Skill Development and Entrepreneurship, the Ministry of Rural Development, and the Ministry of Human Resource Development, in cooperation with state-level government departments.

On the other hand, co-benefits appear in the form of performance spill-overs across ministries. To provide an illustration, renewable energy deployment under the MNRE's frameworks are accompanied by important health benefits, which will contribute positively to the performance objectives of the Ministry of Health and the Central Pollution Control Board.

Informed by the *Strategy for New India* the proposed National cross-ministerial Co-Benefits Council can draw on the 2030 Agenda and the Sustainable Development Goals (SDG) as both a source of inspiration and an opportunity to share progress with the international community. This could be actively supported by NITI Aayog as Co-Chair of the Co-Benefits Council.

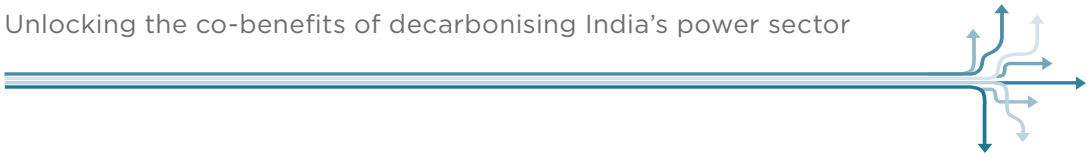
The Co-Benefits Council, as a cross-ministerial working group, could be opened for contributions by key expert organisations, such as The Energy and Resources Institute (TERI) and the Council on Energy, Environment, and Water (CEEW) as technical implementers of co-benefits assessments in India; or the Centre for Policy Research (CPR) for their conceptual groundwork to align multiple policy objectives under a co-benefits approach. Furthermore, the Co-Benefits Council could be additionally powered by international partnerships, such as the Indo-German Energy Forum (IGEF).

4.4 SDG Action: Integrating co-benefits assessments into India's SDG Indexing

Institution to champion the SDG Action	Collaborative bodies to successfully implement the SDG Action	Timeframe of the SDG Action
NITI Aayog	■ Ministry of Environment, Forestry, and Climate Change ■ Ministry of New and Renewable Energy ■ Expert organisations involved in assessments and stocktaking efforts	Short term, until 2023

Under the leadership of NITI Aayog, India has launched the SDG India Index schemes to track and communicate progress on the 2030 Agenda for sustainable development. The Government of India is also preparing for the Global NDC stocktake schemes to track and communicate progress in view of the Paris Climate Agreement. These parallel processes present an excellent opportunity to tap into synergies in taking stock as well as to communicate a strong and consistent narrative on the social and economic opportunities that can be catalysed for the people of India by the 2030 Agenda and the Paris Agreement.

Hence, the SDG indexing could provide systematic and continuous data for tracking and communicating the sustainable development co-benefits of India's climate policies (see this report, section 4.2: NDC Action). The SDG indexing tool and the SDG Index report could be extended by a special NDC section related to the co-benefits of India's climate policies, providing an excellent opportunity for domestic and international communication in the context of the annual UNFCCC COPs. This special NDC section could draw on co-benefit assessments beyond the energy sector (covered in this report), and contribute to continuously building a co-benefits resource and database for India.



References

Awasthy, Aayushi and Kavya Bajaj. "Implementing the co-benefits approach in India." Akshay Urja Magazine, April 2019. Ministry of New and Renewable Energy, p. 30–32. https://mnre.gov.in/img/documents/uploads/449bedb6afc4867b5b65c8ef9a22522.pdf.

Helgenberger, Sebastian, Martin Jänicke and Konrad Gürtler. 2019. "Co-benefits of Climate Change Mitigation." In Climate Action. Encyclopedia of the UN Sustainable Development Goals. Cham: Springer. DOI: 10.1007/978-3-319-71063-1.

IASS/TERI/IET. 2019. "Future skills and job creation with renewable energy in India. Assessing the co-benefits of decarbonising the power sector." COBENEFITS Study. Potsdam/New Delhi. www.cobenefits.info.

IASS/TERI/IET. 2019. "Improving health and reducing costs through renewable energy. Assessing the co-benefits of decarbonising the power sector." COBENEFITS Study. Potsdam/New Delhi. www.cobenefits.info.

IASS/TERI. 2019. "Secure and reliable electricity access with renewable energy mini-grids in rural India. Assessing the co-benefits of decarbonising the power sector." COBENEFITS Study. Potsdam/New Delhi. www.cobenefits.info.

IASS. 2017. "Mobilizing the co-benefits of climate change mitigation: Connecting opportunities with interests in the new energy world of renewables." Potsdam. DOI: 10.2312/iass.2017.015.

IASS. 2020. "REviving national economies and health systems following the COVID-19 pandemic. COBENEFITS Factsheet." Potsdam. www.cobenefits.info.

Khosla, Radhika et al. 2015. "Towards Methodologies for Multiple Objective-Based Energy and Climate Policy." Economic and Political Weekly, L (49): 49–59. Accessed July 1, 2020. https://www.cprindia.org/articles/towards-methodologies-multiple-objective-based-energy-and-climate-policy.

Ministry of Environment, Forest and Climate Change. 2008. "National Action Plan on Climate Change. Government of India." http://www.moef.nic.in/downloads/home/Pg01–52.pdf.

Ministry of New and Renewable Energy. 2016. "National Policy on renewable energy based mini/micro grids (draft)". New Delhi, India.

Ministry of Power. 2016. "Draft National Electricity Plan. Government of India." http://www.cea.nic.in/reports/committee/nep/nep_dec.pdf.

Ministry of Power. 2019. "Power Sector at a Glance All India. Central Electricity Authority (2019)." Accessed July 1, 2020. https://powermin.nic.in/en/content/power-sector-glance-all-india.

Ministry of Skill Development and Entrepreneurship. 2013. "National Skills Qualifications Framework." New Delhi.

Ministry of New and Renewable Energy/Confederation of Indian Industry. 2010. "Human Resource Development Strategies for Indian Renewable Energy Sector: Final Report October 2010."

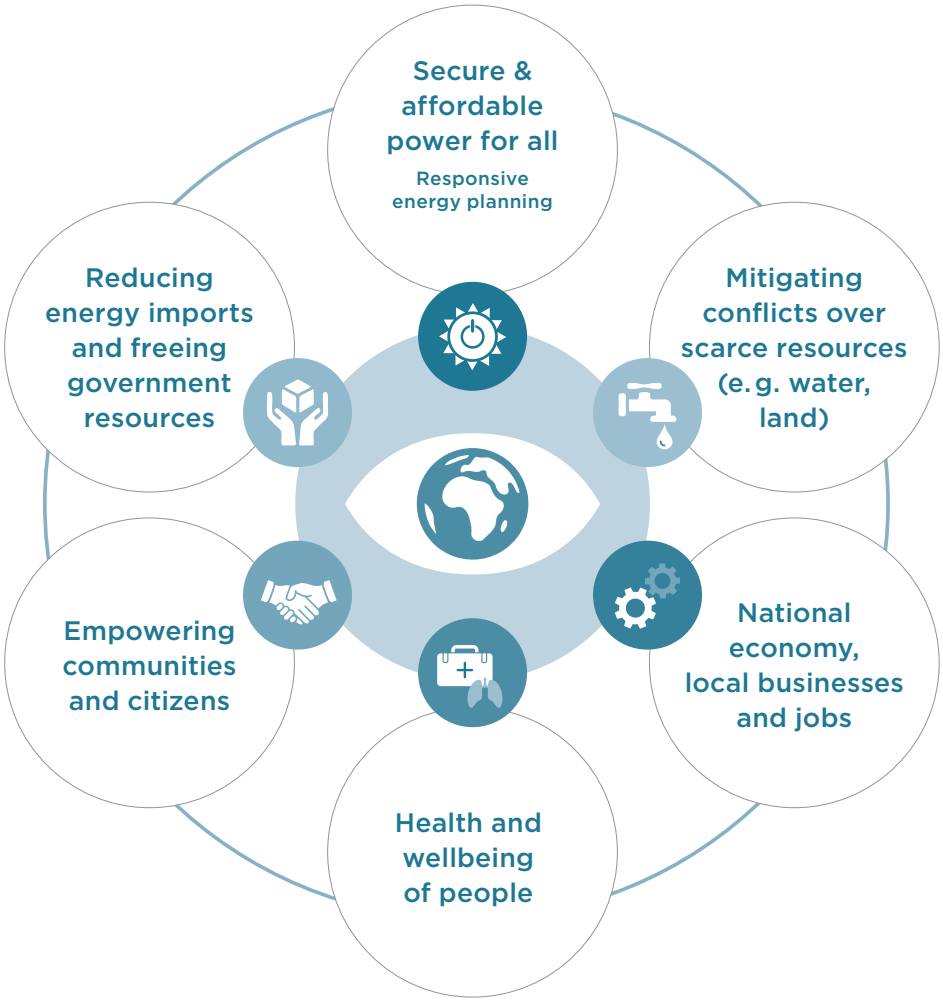
Ministry of Environment, Forest, and Climate Change. 2015. "India's Intended Nationally Determined Contribution: Working Towards Climate Justice." http://moef.gov.in/wp-content/uploads/2017/08/INDIA-INDC-TO-UNFCCC.pdf.

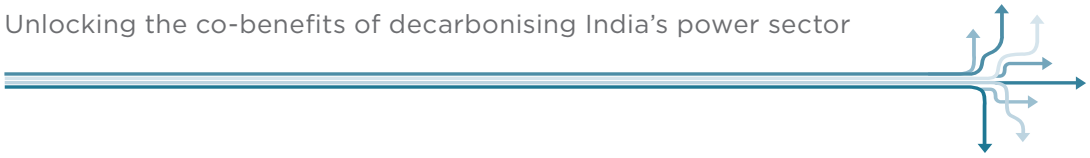
NITI Aayog. 2015. "India Energy Security Scenarios 2047. Government of India." Accessed July 1, 2020. http://iess2047.gov.in/.

NITI Aayog. 2018. "Strategy for New India @ 75." https://niti.gov.in/sites/default/files/2019-01/Strategy_for_New_India_2.pdf.

NITI Aayog. 2019. "SDG India. Index and Dashboard Report." Accessed July 1, 2020. https://sdgindiaindex.niti.gov.in/.

TERI. 2018. "MARKAL scenarios, developed in the context of the CD-Links project." Accessed July 1, 2020. http://www.cd-links.org/?page_id=110.





Abbreviations

BAU	Business-as-Usual
CEA	Central Electricity Authority
CEEW	Council on Energy, Environment and Water
COP	Conference of the Parties
CPBS	Central Pollution Control Board
CPR	Centre for Policy Research
CSE	Centre for Science and Environment
DALY	Disability-adjusted life years
FGD	Flue-Gas Desulfurisation
FTE	Full time equivalent
GW	Gigawatt
HI-Action	High-Impact Action
IASS	Institute for Advanced Sustainability Studies
IET	International Energy Transition GmbH
IGEF	Indo-German Energy Forum
INR	Indian rupee
IREDA	Indian Renewable Energy Development Agency
IRENA	International Renewable Energy Association
kW	Kilowatt
kWh	Kilowatt hours
MGNREGA	Mahatma Gandhi National Rural Employment Guarantee Act
MNRE	Ministry of New and Renewable Energy
MoC	Ministry of Coal
MoEFCC	Ministry of Environment, Forest and Climate Change
MoHFW	Ministry of Health and Family Welfare
MOL&E	Ministry of Labour and Employment
MoP	Ministry of Power
MSDE	Ministry of Skill Development and Entrepreneurship
MW	Megawatt
NDC	Nationally Determined Contribution
NRDC	Natural Resources Defense Council
NSS	National Sample Survey
PIB	Press Information Bureau
PM	Particulate Matter
PPA	Power Purchase Agreement
RE	Renewable Energy
REC	Rural Electrification Corporation
RENAC	Renewables Academy AG
SCGJ	Skill Council for Green Jobs
SDG	Sustainable Development Goals
SEB	State Electricity Boards
SO2	Sulfur dioxide
SPCB	State Pollution Control Board
TERI	The Energy and Resources Institute
UfU	Independent Institute for Environmental Issues
UNFCCC	United Nations Framework Convention on Climate Change
UPNEDA	Uttar Pradesh New and Renewable Energy Development Agency
USD	US Dollar
WHO	World Health Organization

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COBENEFITS
Connecting the social and economic opportunities of renewable energies to climate change mitigation strategies

COBENEFITS cooperates with national authorities and knowledge partners in countries across the globe such as Germany, India, Mexico, South Africa, Vietnam, and Turkey to help them mobilise the co-benefits of early climate action in their countries. The project supports efforts to develop enhanced NDCs with the ambition to deliver on the Paris Agreement and the 2030 Agenda on Sustainable Development (SDGs). COBENEFITS facilitates international mutual learning and capacity building among policymakers, knowledge partners, and multipliers through a range of connected measures: country-specific co-benefits assessments, online and face-to-face trainings, and policy dialogue sessions on enabling political environments and overcoming barriers to seize the co-benefits.

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