Mitigation Talks

Series on Nationally Determined Contributions

January–March 2019 Volume 3 | Issue 1

Contents

EDITOR
Neha Pahuja

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From the Series Editor's Desk

The outcome of COP24, held in Katowice, was a 'rulebook' to operationalize the Paris Agreement. Keeping the timelines agreed in Paris, the Parties agreed to review their NDCs and share the respective national plans to implement climate action by 2020. The rulebook includes a set of transparency rules applicable to all Parties with regulated flexibility. It also makes loss and damage part of the Global Stocktake. However, there was no agreement on new market mechanisms, specifically due to divergence on issues such as the corresponding adjustments and double counting. The major setback was the failure to unanimously recognize and welcome the IPCC special report on the impacts of global warming of 1.5 °C (SR1.5), which was merely 'noted' in the final decisions. This was a big blow to the global community's efforts to safeguard the rights of the most vulnerable. Against this background, the first article of this issue assesses the important decisions of COP24, specifically related to transparency, finance, and enhancing ambition.

The second article delves into how developing countries need to implement mitigation actions even in the face of other developmental challenges. The authors suggest adopting a co-benefits approach to achieve multiple benefits from policies and actions. Citing India's example, they discuss what it would take to address the objectives of energy access, valuable employment generation, and ensuring the basic environmental services for all through a co-benefits approach.

The next article notes that while there is no agreement yet on the form of market mechanisms, there has been a recent proliferation of domestic carbon pricing and market instruments. To sustain these, it is important that countries raise their ambition and that linking the emerging carbon markets across countries, sectors, and jurisdictions is made possible. The article exemplifies how the future carbon markets can be linked, citing examples of the two ongoing market-based instruments in India, namely, Perform, Achieve and Trade (PAT) and Renewable Energy Certificate (REC).

The last article presents a decomposition analysis of India's NDC by using publicly available data and stresses that data uncertainties should not impede policymaking and climate action plans. The authors also present a number of priorities for policymaking in India to help achieve its NDC.

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This series on Nationally Determined Contributions is supported through the project 'Developing Country Participation in Addressing Climate Change: Policy Instruments for Achieving NDCs' by The Royal Norwegian Embassy in India.

The Katowice Package

The Rulebook Is out, the Real Work Starts Now!

Kavya Bajaj, Project Associate, TERI | Vani Rijhwani, Research Associate, TERI

Email: vani.rijhwani@teri.res.in

COP24 in Katowice, Poland, has concluded the three-year process[1] of international negotiations by agreeing on a rulebook to operationalize the Paris Agreement (PA). The year 2018 saw the climate-policy landscape evolving with a growing consensus for proactive and concrete action to mitigate the risks and impacts of climate change. This was the first COP to allow participation from the general public, through the Talanoa Dialogue submissions and the People's Seat initiative, enabling voices on climate action globally to be heard. The Katowice rulebook will apply equally to both developed and developing countries, and it lays down a transparent framework (decision 18/CMA.1) for assessing, reporting, and publicly accounting for greenhouse gas emissions (GHGs). These will take effect in 2024, along with Global Stocktake (GST) every five years, starting from 2023 (decision 19/CMA.1). This development is promising, as the consensus-based rulebook lays down guidelines for communication of plans and the progress of Nationally Determined Contributions (NDCs) for all the countries, strengthening the accountability for their commitments, enabling feedback for continuous improvement, and public tracking of every country's performance. However, uniform standards for reporting (although with flexibility) may overburden developing countries that already face challenges with climate finance. It has, thus, brought to a close the wrangling about implementation procedures pertaining to transparency and accountability of country pledges, making way for the real task at hand: strengthening of national activities to protect the climate and implementation of the existing pledges.

A major area overlooked in the negotiations was the adequacy of the existing commitments made by countries, with respect to limiting global warming to the desired levels and the need for enhanced ambition. The Talanoa Dialogue, the facilitative dialogue mandated by the PA, was a process crucial to the developing country Parties (particularly to the small island and least developing states) to identify options for enhanced ambition and instigate more action from developed economies. Parties hoping for a positive conclusion of this dialogue were left disappointed, as none of the major emitting economies were ready to step up (paras 35 and 36, decision 1/CP.24). Further, a key input to the dialogue was the IPCC's special report on the 1.5 °C warming limit laid down in the PA. The report, an integral instrument that concluded 'every bit of warming matters', was met with divergent views and a great reluctance to 'welcome' the report by the major developed world capitals, signalling an urgency for greater climate ambition. These discussions will now take place at the next session of the Subsidiary Body of Scientific and Technological Advice (SBSTA).

Developed countries were hesitant to enhance their emission reductions and support commitments, while developing countries were disappointed with the lack of emphasis on equity during the GST. The failure to arrive at a consensus on financial support and market mechanisms (decision 8/CMA.1), for instance, demonstrates the divide between developed and developing economies. For instance, a non-decision on market mechanisms has led to a postponement of several market-related decisions globally; the process to link domestic emission trading mechanisms (ETS) with the international market mechanism post 2020, and further, the decisions on the carryover of the Kyoto regime remain uncertain. This article discusses the key issues of ambition: transparency and finance.

Building Trust through Transparent Flow of Information

A robust and transparent 'information' base forms the core strength of the Rulebook, building trust and confidence amongst parties in order to stimulate future climate actions. Decisions on transparency detail procedures and guidelines for a framework with trifurcated flexibility, set common reporting rules for countries, and establish an international process to review these reports. They agreed on rules for the transparency framework, which necessitate all countries to submit GHG inventories, provide information on the progress towards meeting their NDCs, finance required for climate action, amongst others. However, the Parties are yet to decide on the common reporting structure and the outline for biennial transparency reports. These reports are, then, to be reviewed by the technical expert review committee. In line with the bottom-up spirit of the PA, there is an urgent need for all Parties to build robust domestic monitoring, reporting, and verification (MRV) frameworks, to report

[1] Details of the decisions adopted at the Climate Change Conference, 2–14 December 2018, held in Katowice, Poland, are available at https://unfccc.int/decisions_katowice (last accessed on 26 March 2019).

on GHG emissions, adequacy of domestic action, and progress of NDC implementation. This further informs the need to strengthen and streamline capacities and capabilities of the relevant national institutions (including central, state, district, and research institutions; civil societies; and so on) with national priorities, and bring in suitable mechanisms that improve transparency over time. A robust MRV framework builds a strong basis thereon for GST progress, which is an integral component to regulate ambition.

The GST modalities foresee three phases: information collection and preparation; technical assessment and a political phase of the 'consideration of outputs'; focusing on three 'thematic areas'—mitigation, adaptation, and means of implementation and support. Notably, and after substantial controversy, the Parties agreed to open up the process to also consider the loss and damage associated with the adverse impacts of climate change. The GST will be held in a 'transparent manner', with participation from non-Party stakeholders, but the inputs will be 'fully accessible' only to the Parties—a cause of concern for non-Party stakeholders. This, of course, would contradict the GST's purpose: to foster a constructive debate on ambitious climate action and to (re)align national political agendas for the subsequent NDCs with the PA's goals. To this end, inclusive and extensive stakeholder engagement is absolutely essential.

Financing Ambition: Is It Enough?

The Rulebook, through provisions such as common timeframes for NDCs post 2030, is initiating work on ratcheting up ambition in a transparent and measurable manner. However, ambition raising has inevitable financial burdens for developing countries. Developing economies need external financial support in order to participate in the 'ratchet up mechanism' and become more transparent in their climate actions over time.

The text gives equal weightage to both mitigation and adaptation in the scope of reporting and accounting for NDCs, through the decision on the public registry on mitigation and adaptation efforts, and the focus on mitigation co-benefits of adaptation action. This, along with the delineations in the purpose and elements of adaptation communication, reflects the key considerations of developing countries with vulnerable regions. This visibility is provided to bootstrapped areas with the aim to facilitate finance flows towards developing country needs, and to enable them to strive for more 'ambition'.

Further, the detailed focus on the information required for NDC reporting and the guidance on NDC features shift the focus to developed country Parties with flexibility for developing countries, in line with the principle of 'common but differentiated responsibilities' that India strongly advocates. By including voluntary Parties for support provision, the text allows for a greater level of financial support as well. However, a uniform framework, as imposed by NDC features, may mean changing NDC units and aligning institutions for many developing countries, building the pressure on finance. Considering a non-decision on ex-post communication for developed country Parties, which would have facilitated finance inflows to the developing world, would it really be fair to impose similar sanctions on developing countries?

The text on finance, through its categories for information provision, is likely to strengthen the transparency framework—particularly the national biennial transparency reports (BTRs). To ensure this, adequate assessment and updation of these categories will be carried out during the next GST process (to be held in 2023). This will track progress related to both climate finance mobilization and finance-flows alignment, enabling a process to facilitate climate finance review and transparency. However, this progress is not enough. In order to meet the finance goals, a timely and steady implementation of the finance framework is needed. There should also be a steady flow of information on climate actions taken up by individual countries (developed and developing) for a better and methodological implementation. Further, technology and finance mechanisms should be linked in order to aid developing economies in enhancing their future technological action plans. Finally, a unanimous definition in terms of scale, scope, and speed of climate finance, to bring it all together, is yet to come.

The year also saw several climate finance pledges from Party and non-Party stakeholders to various funds: USD 129 million to the Adaptation Fund, about USD 2.2 billion to the Green Climate Fund, USD 28.2 million to the Least Developed Countries Fund, and the World Bank's increased target of USD 200 billion for 2021–2025 with a commitment to align its investments with the Paris goals. Though these targets mark a substantial progress for climate finance, there is still a need to develop sustainable replenishment mechanisms for these funds. For instance, the Adaptation Fund, which is to be continued post 2020 (decision 13/CMA.1), has been an integral financing source for developing country actions since the Kyoto era. The indecision of Paris market mechanisms seeps into the uncertainty on how the Adaptation Fund can be replenished, posing a risk for implementing climate actions in the developing world, thus increasing their susceptibility to adverse climate impacts.

Run-up to COP25: Need for Scaling Climate Action?

Overall, the COP showed a slowing political will and growing commitment from civil societies. Reaching a collective decision on the Rulebook adopted in Katowice, undoubtedly, carries an important global message: the Paris Agreement is ready to take off. The process also indicated that a consensus-based approach in the climate regime can deliver common rules for assessing, monitoring, and reporting of information. This is no mean achievement, considering that a sound information base

is essential for any serious action. However, the debate on rising ambition still continues, and the Parties should now shift the focus to implementation and setting higher ambitions to effectively keep the global temperature well below 1.5 °C from pre-industrial levels.

Moving ahead, streamlining national institutional capacities will play a significant role in shaping the overall PA implementation, majorly transparency-related actions. In many countries, decisions that determine the emission pathways are mostly taken by the energy, transport, and other ministries, rather than the nodal environment body. Therefore, the COP should seek methods to mobilize participation of these ministries in order to discuss how to transform the respective sectors for greater climate action. In this context, there could be a case for establishment of national institutional bodies to the COP, some extend similar to the example of how the World Trade Organization (WTO) was formed, replacing the General Agreement of Tariffs and Trade (GATT). The regular meetings of country representatives under the GATT were transformed into a standing body (WTO) that was able to respond to the continuing demands for fast reaction and regulation of the world's trade affairs. Further, the non-decision on Article 6 reflects the impending work for 2019. This translates to the need to build new methodologies, re-approve previously verified projects in these economies, and further, develop new private sector incentives, which may be a heavy burden. This raises an integral question for the Parties to address this year: who will be responsible for it?

There are several important events lined up before COP25, such as the UN Secretary General Climate Summit set to take place in New York, September 2019. These are key opportunities for the Parties to gauge the need for stronger climate actions as well as to inform and strengthen the political will in order to steer the necessary resources for concrete PA implementation. These collective instances reflect the amount of work to be undertaken to see the PA objective through, that is, engaging all Parties in a process that leads to GHG reduction fast enough to keep the world on a safe trajectory.

Implementing the Co-benefits Approach in India

Aayushi Awasthy, PhD Scholar, University of East Anglia | Kavya Bajaj, Project Associate, TERI, New Delhi
Email: kavyabajaj.c@teri.res.in

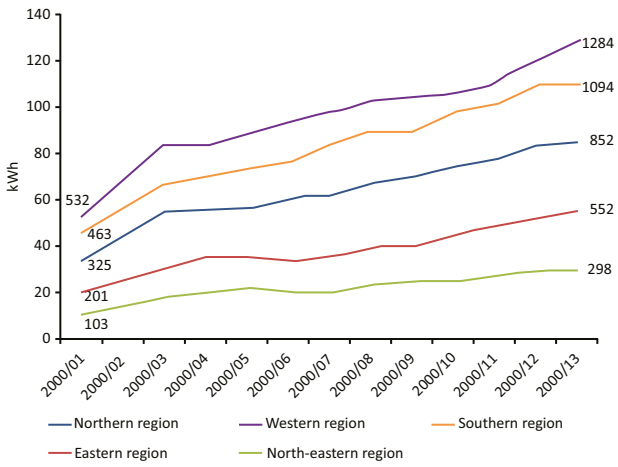
In climate and sustainable development literature, the approach of studying, implementing, and replicating positive externalities of an action is what we may understand as the co-benefits approach. Implementing this approach requires fostering an environment for problem-solving by encouraging the idea that the solution to global problems like 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 to enact solutions on-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 recommending multiple benefits, a significant one being economies of scale from collaborations, which would not be accrued by individual country actions. Another benefit is that this approach can be studied at disaggregated levels and emulated successfully under similar circumstances.

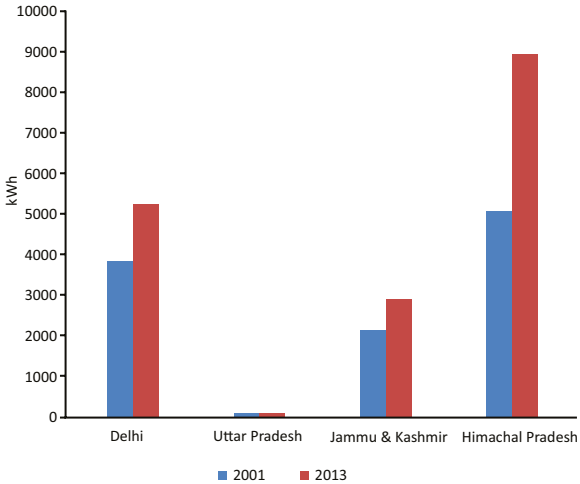
For a large developing country like India, climate mitigation presents unique challenges. There already exist challenges of basic provision to the people, and bearing in mind India's size, these provisions further add up. Given the current state of mature technologies in the country, India continues to rely on fossil fuels for these provisions. Further, the rate of inequality remains high; despite being the third-largest economy of the world, India's per capita income is a measly 6000 USD per annum, and per capita energy consumption is approximately 1000 kWh, a third of the global average. To address the problem of basic provisioning, India needs to work on three vital fronts: energy access, valuable employment generation, and ensuring basic environmental services for all. Ahead, we discuss what it would take to address these objectives through a co-benefits lens.

Challenge 1: Energy Access

Significant efforts have been made towards improving energy access, particularly electricity access—one of India's foremost challenges. As of March 2018, the Ministry of Power (MoP) claims, on average, complete electrification of villages in India. India has also set the ambitious target of complete household electrification by 2018 end. Despite these laudable goals, energy-access surveys conducted by the Council on Energy, Environment and Water (CEEW) and The Energy and Resources Institute (TERI) suggest that the current state of 'electricity access' to these villages is not enough for households to sufficiently consume and utilize electricity.

Electricity consumption in India has increased threefold in the past decade. However, this increase is not uniform across sectors. Despite the MoP claim, a close examination of the electricity-consumption figures presents a grim picture. Figure 1 (a) tracks the electricity consumption per capita by the five regions of the country. A few observations can be made from this graph: firstly, consumption has increased across all regions; secondly, the variation amongst the regions is quite significant; and thirdly, the gap does not seem to be bridging. It seems that there is little scope for convergence of consumption amongst different regions in the near future. Upon looking into one region in detail (Figure 1 [b]), significant contrasts in consumption even within regions were observed.





The 2015 survey[1] conducted by the CEEW for the poorest six states, covering about 8500 households, found that 50% of these households fall in the lowest tier of electricity access despite having an electricity connection. Further, more than half of the other 50% households that did not have an electricity connection had grid connectivity near them. This indicates that despite being classified as electrified, the majority of households in these villages have not gained the benefits of electrification. Another analysis[2] done by TERI, which combines the National Sample Survey Office's (NSSO) data with a survey for 6500 households, tried to understand the factors affecting transition towards modern energy. It found that energy transition is a complex decision, which is influenced not only by the price of the fuel but also by other demographic factors such as type of house, influence of woman in decision making in the households, social status, occupation, amongst others (TERI, 2014).[3]

The co-benefit approach, in this case, would entail that instead of a complete grid-based electrification approach, India should target distributed generation to compensate for the grid's inability to provide the complete electrification benefits at certain places. The Electricity Act, 2005, has provisions to ensure that investments made in off-grid systems are protected. Over and above this investment requirement, the viability of off-grid systems needs to be revaluated. Given the potential to supplement RE-based systems into distributed generation, it is possible to subsidize these systems to ensure economic affordability. The approach, thus, implies providing solutions to both these challenges, and hence drawing resources mutually—from investment and mitigation.

Challenge 2: Aligning Employment Generation to the Future Needs

Considering the high employment generated in the energy sector, especially in the coal-mining sector, a transition towards low-carbon solutions for India has been looked at in askance by many.

The co-benefit approach proposes a solution here by expanding the horizon of our thinking—to look at the problem of carbon lock-ins through a human lens. There will be a significant lag between freezing financial investments in the fossil technologies and employment in these fields. It is also true that the skills required for these jobs would be different. Therefore, the earlier we transition from fossils to renewables, the less encumbering it would be for the labour force to adapt to this change. About 1 million jobs[4] would be generated to achieve India's solar and wind energy targets, most of which would be in the solar-rooftop space.

India urgently needs to start capacity-building programmes to ensure that the people who will be joining the labour force in the next 2–3 years are prepared for it. Moreover, it should be ensured that there is no expansion of the labour force in the fossil sector. Additional governmental resources should be provisioned for future jobs, considering the fast-paced changes in technologies as well as to avoid fossil-industry-relevant skill lock-ins. With challenges relating to robotics, automation, and sustainability today, there arises the vital challenge of disseminating appropriate skills when creating jobs.

Challenge 3: Ensuring Environmental Quality

Ensuring environmental quality, an integral aspect of well-being, has been falling down the priority order for India, which currently ranks 177 (of 180 countries) on the Environmental Performance Index.[5] The two most pressing issues that threaten India's environmental quality relate to air quality and water availability. Air pollution and water scarcity have detrimental developmental impacts, and can be seen to directly affect human health and well-being. This, when considered along with the 1.3 billion-strong population, becomes a particularly gruelling challenge. With the issues of urbanization and climate change exacerbating, these accompanying issues are reaching a crisis level, needing to be dealt with urgently.

Multiple studies conducted by TERI on air and water underline the gravitas of this challenge. According to the WHO, several Indian cities are amongst the world's most polluted cities. The TERI study[6] on the nationwide urban air quality points at several factors: rapid urbanization, transportation, industrialization, power generation, and agricultural activities. On studying water availability, TERI observed that India had very rapidly gone from water-abundant to water-stressed, and is heading towards being water-scarce considering the rate at which the per capita water availability is declining.[7] The catalysts of

1 Jain Abhishek et al. 2015. 'The Access to Clean Cooking Energy and Electricity – Survey of States (ACCESS), CEEW, available at http://ceew.in/access-survey (last accessed on 20 March 2019).

2 TERI. 2008. 'Supply of Clean Energy Services to Urban and Peri-Urban Poor'. Global Network on Energy for Sustainable Development

3 Ramji Aditya and Ritika Sehjpal.2013. TERI. 'Energy Inequality across Regions in India', Green Growth and Development Quarterly 2 (1): October 2013: 32–35.

4 Kuldeep, Neeraj, Kanika Chawla, and Arunabha Ghosh. 2017. 'Greening India's Workforce: Gearing Up for Expansion of Solar and Wind Power in India'. CEEW

5 Environmental Performance Index. 2018. Yale Center for Environmental Law & Policy, Center for International Earth Science Information Network, World Economic Forum, available at https://epi.envirocenter.yale.edu/node/36476/book (last accessed on 20 March 2019).

6 Sharma Sumit et al. TERI. 2018. 'Measures to Control Air Pollution in Urban Centres of India: Policy and Institutional Framework'.

7 TERI. 2017. *Assessment of Water Foot Prints of India's Long Term Energy Scenarios*. Sponsored by NITI Aayog.

this issue are pointed towards inefficient water use and supply across several sectors, and water pollution.

The synergies under the ambit of air and water are clearer and need immediate action. Appropriate interventions are, hence, necessary to address these linkages. Further, we observe common sectors between water and air, that is, industry and agriculture. Incorporation of renewables and technological and efficiency improvements in the key contributing sectors can significantly improve both air quality and water availability. For example, installing solar pumps in agriculture can directly bring about the co-benefits of water-use efficiency and air-quality improvements.

Conclusion

While these are the broader and more upfront challenges, the buck definitely does not stop here. Even from a human-rights viewpoint, in order to have the 'opportunity' to exercise the rights to freedom, protection from exploitation, education and, foremostly, to equality, citizens should be provided access to electricity, jobs, and mobility. The provision of these aforementioned rights at the cost of the environment would be a violation of these very rights. The co-benefits approach addresses this trade-off, presenting itself as an apt mainstreaming practice where resources can be pooled to streamline multiple goals and ensure that we have true accounts of sustainable development. Further, the approach, like and along the lines of the Talanoa Dialogue, inspires problem-solving through the outlook of sharing benefits, and hence must also be looked at through the lens of the three Talanoa questions: where are we, where do we want to go, and how do we get there? The key is to shift our way of thinking away from burden sharing, and towards opportunity sharing.

Preparing for the Future

Building on India's PAT and REC Schemes for the Post-2020 Carbon Markets

Tamiksha Singh, Associate Fellow, TERI
Email: tamiksha.singh@teri.res.in

India has shown leadership with its climate commitments and has been assessed as one of the few large economies on track to meet its goals, which are relatively ambitious and also in line with the 'well below 2 degree' target. However, although India's per capita emission currently remains amongst the lowest in the world, its absolute emissions are slated to grow significantly along with its economic growth and development.

Carbon markets and carbon pricing are known to be amongst the most effective measures to enhance the use of renewables and promote energy efficiency. India, too, has had experience with the international carbon markets and pricing, with the Clean Development Mechanism (CDM). The CDM is probably the most significant carbon-market instrument to have been implemented till date. India played a pivotal role in the development of implementable projects for the CDM, gaining strong buy-in from the Indian industry and private sector, thus becoming the world's second-largest supplier of Certified Emission Reductions (CERs) with over 1660 registered projects. However, many of these projects were stranded midway, with the CDM market crashing in 2012 and not managing to recover thereafter. This is likely to result in a possible lack of trust in the emerging international carbon markets under the Paris Agreement (PA). This necessitates support and credibility measures at the national level, to facilitate full participation by India and other countries in the international carbon markets and to help it strengthen and raise the ambition of its climate actions going forward.

The carbon-market mechanisms envisaged under the PA are distinct from those under the Kyoto Protocol—with the PA approach being bottom-up and thus more decentralized. This gives countries the chance to be proactive and design their own mechanisms as per their requirements and priorities.

Take the case of India whose Nationally Determined Contributions (NDCs) under the PA are wide-ranging and comprehensive. Two of its three key quantifiable targets to be achieved by 2030 are: 1) reducing the carbon intensity of its GDP by 33–35 per cent; and 2) achieving 40 per cent non-fossil fuel based generation capacity. To contribute towards the achievement of these goals, there are two ongoing market-based mechanisms, which can be seen as India's 'proxy' carbon markets—the Perform, Achieve and Trade (PAT) scheme, which aims at accelerating the adoption and implementation of energy efficiency (EE) measures in large energy-intensive industries; and the Renewable Energy Certificate (REC) mechanism, which aims at promoting the generation of renewable energy (RE) in India, the objectives of both being central to India's climate actions (see box).

The Approach under PAT

- Mandatory specific energy consumption (SEC) targets for the identified and notified energy-intensive sectors
- Targets based on the current efficiency of the industrial units, averaging the best and worst in class EE measures
- Gives the designated units flexibility regarding how best to achieve their mandated efficiency targets.

The Approach under REC

- Mandated specific Renewable Purchase Obligations (RPOs) for each State Electricity Regulatory Commission (SERC) based on their RE potential
- Option to buy RECs from other states in case of shortfall from the RPO target; so it has a trading mechanism which facilitates the interstate exchange of RE
- Provides an additional financing mechanism for driving investments in RE

Similarly, there are emerging domestic market and pricing instruments in other countries, for example, the regional and national emission trading schemes (ETS) in China, Republic of Korea, Kazakhstan, and so on.[1] With such emerging domestic and international instruments, it is becoming clear that linking carbon markets across countries, sectors, and jurisdictions will soon be a necessity. With the aim of understanding how to use the existing national- and regional-level markets to prepare the relevant national stakeholders for the carbon markets emerging under Article 6 of the PA, The Energy and Resources Institute (TERI) initiated a study for analysing the challenges to linking the existing domestic markets, PAT and REC.[2]

To begin with, an analysis of the prevailing prices and the demand and supply for PAT and REC certificates,

[1] Details available on https://icapcarbonaction.com/en/?option=com_attach&task=download&id=528 (last accessed on 18 March 2019).

[2] TERI. 2019. 'Preparing India for the Future Carbon Markets'. Working paper.

based on their trading data, was done. This showed that the regulatory mandates leveraged were necessary for generating demand, especially in the initial stages, for both. Still, the supply outpaced the demand in both PAT and REC, leading to lower than the projected prices. This indicates the scope for more stringent targets and ambitious actions.

- PAT has completed its Cycle 1 (currently Cycles 2 and 3 are underway). The price for an ECert in PAT Cycle 1 ranged from INR 200 to INR 1200, with the weighted average price being INR 770 (~ US$ 11) and supply of ECerts being, on an average, nearly three times the demand.
- As for REC, the prices of the two categories of certificates in 2018 averaged at INR 1249 (~ US$ 18) for non-solar REC and INR 1060 (~ US$ 15) for solar REC, with the supply being five times the demand.

Next, the mechanisms were compared across three categories of parameters: institutional, implementation, and design. The comparison of PAT and REC on the institutional parameters (nodal body, regulatory body, registry, and trading platform) showed that the two were very similar to each other—both being government-mandated schemes under their nodal ministries. This also makes it fairly simple to link the two mechanisms. Further, a comparison of the two on the implementation parameters (timeframe, participants, objectives, and impact) showed that the two markets are largely complementary to each other, with the potential of enhancing the scope and impact of both through linkage. For instance, while PAT covers 11 energy-intensive sectors (Aluminium, Cement, Chlor-Alkali, Fertilizer, Iron and Steel, Paper and Pulp, Thermal Power Plants, Textile, Railways, Refineries, and Electricity Distribution Companies), REC covers electricity distributors/suppliers such as Distribution Licensees, Captive Consumers, and Open Access users, with minimal overlaps. However, the comparison of PAT and REC on the design parameters (metric of measurement, trading mechanism, and approach to determining the goals/targets) highlighted the critical differences between the two mechanisms, wherein lie the challenge of building fungibility between them. For instance:

- A PAT ECert is equivalent to one TOE (ton of oil equivalent), while one REC equals one MWh (megawatt hour).
- PAT's trading mechanism is designed as a 'cap and trade' system, while REC's is on the lines of a non-ETS (emission trading system) type of mechanism.
- The approach for setting targets under PAT is 'benchmarking', (based on averaging), while under REC its 'grandfathering' (RPOs allocated to states on the basis of national goals).

Resolving these differences through a common approach or conversion methodology would be the key to linking the two markets.

Since both PAT and REC are expressed in non-CO_2 units, the first step is to convert them from their respective energy- and electricity-based units to CO_2 equivalent ones. This is then equated to an estimated 'carbon price' based on the average prevailing price of the certificates. Using a direct approach for this, with internationally accepted conversion formulas, results in derived values of USD 1.15 for PAT and USD 18.5–22 for REC.[3] The

[3] **PAT**:

- 1 PAT ECert = 11630 kWh (IEA given conversion rate).
- 1 PAT ECert = 9.5366 tonne CO_2e (the grid emission factor of the Indian grid equals 0.82 kg CO_2e/kWh).
- Weighted (by trade volume) average price of ECert = ~₹770
- 1 tonne CO_2e under PAT = ₹80.6 (~USD 1.15)

REC:

- 1 REC = 1 MWh
- 1 REC = 820 kg CO_2e (the grid emission factor of the Indian grid equals 0.82 kg CO_2e/kWh)

wide range of the prices derived through this approach highlighted the issues with it, such as its dependence on estimations and generalizations, which may not be accurate. For instance, both calculations were dependent on India's grid emission factor (that is, 0.82 kg CO_2e/kWh), which was last updated in 2014. Further, the pricing of the certificates, too, is not comparable, as REC has a controlled trading band with fixed floor and ceiling prices; and the price-discovery process under PAT was not robust, as it was implemented with a 'pilot' case-study approach.

Thus, an indirect approach—or 'networking'—in which the outcomes of two programmes or mechanisms are linked and then traded, needs to be explored. Networking will require a conversion factor, which accounts for the different costs of undertaking specific mitigation actions and their impact on India's long-term mitigation and development strategy. This can be strengthened by conducting a co-benefits analysis, using the existing methodologies and tools, which unbundle the CO_2 from co-benefits to arrive at a comprehensive mitigation value. It should be noted that such an approach would not be purely objective and would likely require stakeholder consultations and negotiations to finalize the conversion factor which is agreeable to all.

Lack of transparency and environmental integrity have been the key weaknesses of past carbon markets, with serious concerns being raised about the quality and verifiability of certain carbon credits being traded and issues of double-counting of carbon credits by both the host country and the buyer countries,[4] and these are to be corrected under the PA. To support this, the role of registries will be central to the emerging carbon markets. For instance, in case of PAT and REC the registries are managed by a common government entity, POSOCO. This may make the networking approach mentioned earlier plausible by directly linking these through a common metric, such as calculating the GHG emission mitigation achieved by using standardized methodologies, and including that in the existing registries. Further, a common template for identifying and reporting the co-benefits arising from PAT and REC could also be included in the registries, which would help in better understanding the comprehensive value of each type of certificate and act as a basis for qualifying and supporting the differential pricing.

In this case study, we have explored the possibility and challenges of linking only two domestic mechanisms, with a single entity managing or coordinating both. However, there are several emerging domestic, regional, and global carbon-market instruments, which will cut across geographies and mandates, making their linkage significantly more challenging. All these are increasing the supply of carbon assets, but the issue of lagging demand plagues these markets in varying degrees. There is a need to deliberate on these issues at an international level and also to pilot market linkages to better understand the issues of implementation.

Finally, the emerging carbon markets indicate the need for a large, focused endeavour to build capacity of the key stakeholders involved. While discussions on Article 6 are being finalized and the new market mechanisms being detailed, it would be advantageous for countries to start building their domestic capacity and familiarizing themselves by implementing the new required processes.

- The average price for Solar REC in 2018 was ₹1060 and the average price for Non-Solar REC was ₹1249.
- 1 tonne CO_2e under Solar REC = ₹ 1293 (~USD 18.5); and under Non-Solar REC = ₹1523 (~USD 21.8)

[4] Details available on https://www.u4.no/publications/carbon-market-corruption-risks-and-mitigation-strategies.pdf (last accessed on 19 March 2019).

Decomposing India's NDC

Thomas Spencer, Fellow, TERI | Karan Mangotra, Fellow and Associate Director, TERI

Email: Thomas.spencer@teri.res.in

Introduction and Rationale

India's Nationally Determined Contribution (NDC) under the Paris Agreement aims to reduce the greenhouse gas (GHG) intensity of its gross domestic product (GDP) by 33–35% by 2030, compared to the base year of 2005. India, like other developing countries, is going through a number of structural and endogenous transitions, which are intrinsic to the development process. In parallel, the Government of India aims to introduce a number of policy-driven transitions. These include:

- Structural economic transition involving the decline of the share of agriculture in GDP, and an increase in the share of services. For example, the share of agriculture in GDP declined from 23% in 2005 to 16% in 2014, while the GDP share of services increased from 42% to 48% in the same period.
- Structural energy-system transition away from traditional biomass towards commercial fuels and energy carriers like liquid petroleum gas (LPG) and electricity. Of course, this structural transition also has a policy-driven element to it. Policies such as the Ujjwala programme to substitute traditional biomass in cooking with LPG will accelerate the transition away from traditional biomass to commercial (fossil) fuels. But transition in the household-fuel matrix is also an inevitable part of the development process. As incomes grow, people prefer more convenient modern fuels; thus, this transition is an inevitable part of the development process, and has been observed in country after country since the Industrial Revolution (Smil, 2017).
- Policy-driven improvements in energy efficiency, through, for example, the Perform Achieve and Trade Scheme, as well as appliance labelling and minimum energy-performance standards.
- Policy-driven transitions in the energy matrix, notably due to the increase of renewables in electricity, through, for example, the target of installing 175 GW of renewables by 2022.

These transitions impact the GHG intensity of GDP. For example, a macroeconomic transition in the GDP structure, out of one sector (agriculture) into another (industry or services), will impact the GHG intensity of GDP, if the sectors have different GHG intensities of value added (VA). Likewise, the transition out of traditional biomass and into commercial fossil fuels, while deeply desirable from a development perspective, will raise the carbon intensity of the energy supply, potentially impacting the GHG intensity of GDP.

Thus, when thinking about the historical and future pathway for the GHG intensity of GDP, it is important to consider what occurs endogenously as part of the development process, and what occurs exogenously, that is, driven by the climate and energy policies. Such an analysis provides a richer explanation of what has occurred in the past and what may occur in the future.

In this context, this article aims to summarize the results of a detailed analysis of the drivers of the observed change in the GHG intensity of the Indian GDP during 2005–14. The GHG intensity of India's GDP is estimated to have fallen by 22% between 2005 and 2014, as against the target of 33–35% by 2030. The question is: What is driving this change?

On the basis of this analysis, we can also provide some insights about the potential future policies and targets.

Data Sources and Methodology

Methodology

This paper aims to decompose changes in the GHG intensity of GDP into its constituent drivers, and apportion to each of these drivers a quantified contribution to the observed change. The analysis proceeds in terms of ever-deepening detail: we start with the highest level of decomposition, and then further decompose its parts. One can think of it as a 'tree of causation', represented schematically in Figure 1.

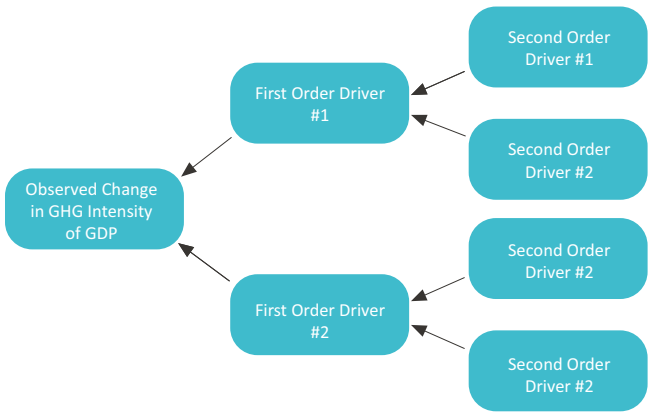


Figure 1: Conceptual Framework for Successive Decomposition Analysis

Source: Authors

Two recurring concepts that require explication at the outset are 'structural effect' and 'intensity effect'. Suppose an economy is composed of only two sectors, which have different GHG emissions intensities. The GHG intensity of this economy could change if its composition changed (structural effect), or if the intensity of the different sectors changed (intensity effect), or a combination of both.

This distinction can be applied at the macroeconomic level between sectors such as agriculture, industry, and services; within sectors, between more and less GHG-intensive subsectors; and within the energy mix between different end-use sectors depending on their relative carbon intensities (e.g. industry, transport, residential, and so on).

Data

There is as yet no publicly available government-released GHG inventory for the base year of India's NDC, 2005. Therefore, we use the 2005 GHG inventory developed by the research initiative GHG Platform India (GHG-PI).[1] For 2014, the terminal year of our analysis, we use the officially released GHG inventory from India's second Biennial Update Report (BUR2) submitted to the United Nations Convention on Climate Change (UNFCCC) (MoEFCC, 2018).[2] For GDP and sectoral VA data, we use the data of the Central Statistical Office, as available at the Reserve Bank of India's (RBI) online database.[3] We convert the 2004–5 constant price series into the 2011–12 constant price series using the price ratio in the common year of both series. For the primary and final energy-consumption data, including biomass, we use the energy balances of the International Energy Agency (IEA). We complement and compare the emissions data available in the aforementioned sources with the IEA data on the CO_2 emissions from fuel combustion. In terms of the scope of the NDC, we assume that both agriculture and land-use, land-use change and forestry (LULUCF) are included, given that the NDC's wording does not explicitly exclude them.

A Three-Term Decomposition Analysis

Here, we present a three-term decomposition, which explains the observed change in the GHG intensity of GDP from 2005–14 as the cumulative effect of changes in three parameters:

- Non-Energy GHG Intensity of GDP ($GHG_{non\text{-}energy}$/GDP): This is obtained by taking the sum of all non-energy GHG emissions from the agriculture, LULUCF, waste, and industrial processes and product use (IPPU) sectors, and then dividing them by GDP.
- Primary Energy Intensity of GDP (PE/GDP): This is obtained by dividing the total primary energy consumption, including estimates of traditional biomass consumption, by GDP.
- GHG Intensity of Energy Supply (GHG_{energy}/PE): This is obtained by dividing the total GHG emissions from the energy sector, including non-CO_2 fugitive emissions, by the total primary energy consumption.

In 2005, the GHG intensity, including energy and non-energy sources, of India's GDP was 28.15 tCO_2eq per million Rs 2011–12. By 2014, the GHG intensity of India's GDP was 21.91.

Thus, the GHG intensity of India's GDP is estimated to have fallen by 22% between 2005 and 2014, as against the target of 33–35% by 2030. The decomposition analysis gives the following contributions to this observed change:

- The non-energy GHG intensity of India's GDP is estimated to have contributed 10.25 percentage points to the observed decline of 22%.
- The primary energy intensity of India's GDP has fallen significantly across the period 2005–14, and is estimated to have contributed 12.55 percentage points to the observed decline in the GHG intensity of GDP.
- The GHG intensity of India's energy supply has risen somewhat across the period, and is estimated to have contributed an increase of 0.75 percentage points to the GHG intensity of GDP.

The net effect of these three factors is the observed change of -22% in the GHG intensity of GDP. Figure 2 presents the results of the decomposition analysis.

Thus, about half of the observed decline in the GHG intensity has been driven by the reduction in the non-energy GHG intensity of GDP, and a further half has been driven by a reduction in the energy intensity of GDP.

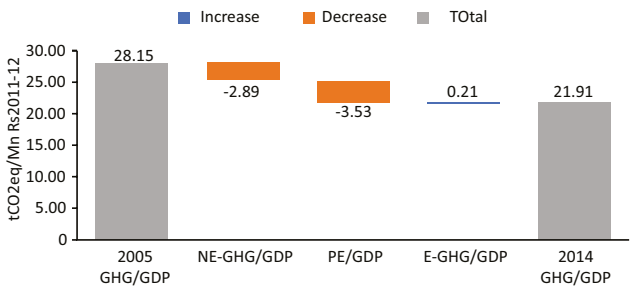


Figure 2: Three-Term Decomposition Analysis of the GHG Intensity of India's GDP

Source: Authors, based on data from RBI; GHG-PI; MoEFCC, 2018. NE-GHG = $GHG_{non\text{-}energy}$. PE = primary energy consumption. E-GHG = GHG_{energy}

[1] Details available at http://www.ghgplatform-india.org/ (last accessed on 22 March 2019).

[2] Details available at https://unfccc.int/sites/default/files/resource/INDIA%20SECOND%20BUR%20High%20Res.pdf (last accessed on 22 March 2019).

[3] Details available at https://dbie.rbi.org.in/DBIE/dbie.rbi?site=statistics (last accessed on 22 March 2019).

Conclusion

This detailed article has analysed the past trend of GHG intensity of GDP, decomposing it into its structural and intensity-effect drivers. The objective was to learn how the GHG intensity of the Indian economy has changed over time, and what factors have driven this change. Ultimately, such insights can also provide a guide to the future, to the extent that the drivers identified are seen to be anchored in persistent, structural processes, and not one-off events. The following paragraphs offer some concluding reflections on the bigger picture that emerges from the analysis presented earlier, and on future directions for research and policy.

Data Uncertainties Do Not Invalidate the Bigger Picture

The aforementioned analysis is based on publicly available data. Clearly, there are uncertainties with regard to both the accuracy of the data, or the choice of the dataset. However, we do not believe that such uncertainties invalidate the bigger picture that emerges from this article. The structural transitions in India's economy and energy-supply matrix are well-studied aspects of the development process. Their impact on the different drivers of GHG intensity is also well known and robust.

Structural Change Will Continue to Drive Down the GHG Intensity of GDP

The share of agriculture in GDP will continue to decline to around 10–12% by 2030. Given the high GHG intensity of agriculture, and the low GHG intensity of what appears likely to grow in its place (services), this structural change will continue to have significant downward impacts on the GHG intensity of GDP. Additionally, the transition away from residential biomass will continue, and may even accelerate now that near 100% electrification has been achieved. This will continue to drive down the primary energy intensity of GDP, alongside more specific energy-efficiency policies. In the period 2005–14, these two drivers contributed ca. 10 percentage points each to the observed decline in the GHG intensity of GDP. It may be reasonable to expect a similar scale of contribution in the period remaining to 2030, which would cumulatively imply a GHG intensity decline in the order of 40%.

Increasing Carbon Intensity of Energy and Potentially Faster Industrialization Are Wild Cards on the Upside

The carbon intensity of India's energy supply is likely to continue to rise, as the transition away from traditional biomass accelerates. However, the observed cost declines in renewables and other low-carbon technologies hold out the possibility that India could leapfrog into a lower carbon energy system than was achieved by China. In the context of these new technology trends and the policy push for renewables, the future trajectory of the carbon intensity of India's energy supply required renewed study. This parameter appears to be the key one which could threaten the likely overachievement of the GHG intensity target.

From a development perspective, it would also be highly desirable that India raise the share of industry in its GDP, as this sector has the capacity to provide broad-based low-skill employment and fast productivity growth. An increase in the share of industry would raise both the GHG and primary energy intensity of GDP. The share of industry in GDP is, therefore, a wildcard which could potentially counteract the other structural change at work, namely the transition away from GHG-intensive agriculture.

Policies to Be Considered on the Basis of This Analysis

Structural change in the macroeconomy should be subordinate to India's development goals, not climate policy. In this regard, there are cases where the desired structural change and climate goals converge (e.g. raising the VA of agriculture through transition to higher value-added crops); and cases where they may diverge (increasing the share of industry). But development is the priority. It simply appears likely that structural change will work in favour of India's GHG-intensity goal, that is, decline of agriculture in GDP and more services than industry-led development.

Within the purview of the climate policy, a number of priorities can be identified from this analysis:

- Continuing improvements in the technical efficiency of different sectors, particularly in the agriculture and residential sectors where intensities have been on the rise.
- Further improving the non-energy GHG intensity of the economy, for example, in the air-conditioning sector.
- Curbing and even potentially reversing the increase in the carbon intensity of energy through the deployment of renewable energy and sustainable transport, including EVs.
- Focusing on reducing the carbon intensity of industry energy supply, through the use of biomass and electricity wherever possible. Industry was found to be the sector with the highest contribution to the rising carbon intensity of energy supply.

Lower Healthcare Costs, More Jobs among Co-benefits of Higher Renewables' Share in India*

Arunima Hakhu, Research Associate, TERI

International discussions and the Intergovernmental Panel on Climate Change (IPCC) special report titled *Global Warming of 1.5°C* have yielded a common consensus—that business as usual (BAU) cannot be sustained in a carbon-constrained world. To that effect, India's Nationally Determined Contributions (NDCs) target an unconditional 33–35 per cent reduction in emission intensity from the 2005 levels and a conditional 40 per cent non-fossil fuel based power-generation capacity installation by 2030. While this translates to a changing energy portfolio, the scope of climate action is defined by an overarching development prerogative.

Partnering with the Institute for Advance Sustainability Studies (IASS), The Energy and Resources Institute (TERI) and the Council on Energy, Environment and Water (CEEW) have undertaken research that offers grounds for customized policy solutions that maximize the socio-economic 'co-benefits' of renewable energy deployment.

The co-benefits approach seeks to capture and maximize the indirect impacts of climate action. In India, by involving political influencers in the research process, the project 'Leveraging the Co-benefits of Renewable Energy in India (COBENEFITS)' focuses on the impact renewable energy will have in the areas of energy access, rural development, energy security, clean air and health, business opportunities, and employment generation. It aims to offer policy interventions that capture the impacts of climate change mitigation actions that further Sustainable Development Goals (SDGs).

TERI has hosted a series of COBENEFITS Council meetings with the relevant ministry stakeholders. These collaborative deliberations identified gaps and areas of potential intervention in climate change mitigation that align with India's developmental prerogative. In these meetings, points of intervention were narrowed down to three fields on which sector experts were commissioned research opportunities:

- Co-benefits of transitioning to renewable energy in employment generation (CEEW)
- Co-benefits of transitioning to renewable energy in energy access (TERI)
- Co-benefits of transitioning to renewable energy in air pollution and health (TERI)

These deliberations were followed by workshops that discussed preliminary findings from each study with sectoral experts from legislative and research backgrounds. These workshops aimed to get political stakeholders on board and ensure academic rigour.

Findings

The CEEW and the Skill Council for Green Jobs (SCGJ) conducted a study titled 'A Long-Term Assessment of Net Employment in Power Sector in India'. It captured co-benefits in terms of net employment that would be generated by shifting to renewables in the power sector.

The study aimed to define the simultaneous evolution of jobs, skills, and education required to achieve the shift and to quantify jobs created annually till 2035, then for time slices of 2040 and 2050. These results were based on three scenarios respectively: i) Reference (outlining BAU), ii) NDC (where projections are made assuming that India will deliver on all its renewable commitments outlined in the current policies and schemes), and iii) Ambition (which makes projections based on the idea that India goes over and above its current commitments to tackle climate change).

Some of the key findings to emerge were that rooftop solar and small hydro projects will create the maximum number of jobs for every megawatt (MW) of capacity installed— approximately 25 and 14 jobs/MW, respectively. The study also notes higher employment in renewable energy in INDCs and Ambition scenarios to the order of 25 per cent higher employment in the Ambition scenario compared to the Reference scenario. It also notes that net employment in coal-mining activities decreases in the Ambition scenario.

The objective of TERI's study on energy access was to assess the feasibility of decentralized renewable energy systems to provide enhanced, affordable, and reliable electricity services to rural households. It also aimed to examine the business case for scaling up solar mini-grids in India.

Among other results, the study found that reliability of power supply was a major issue in the grid-connected villages. While mini-grids were found to provide more reliable supply, the households were paying much

* This article was supported by the COBENEFITS Project and was earlier published at https://www.teriin.org/blog/lower-healthcare-costs-more-jobs-among-cobenefits-higher-renewables-share-india.

more (~ Rs 37/kWh) for basic electricity services such as lighting and mobile charging, compared to the grid-connected households. The study noted that at the currently deployed scale (10–300 kW) mini-grids are unviable due to their high tariffs and low capacity, which makes them incapable of providing services at par with the grid. Therefore, the study advocates the need for scaling up mini-grids to medium scale (500 kW to ~1 MW) that can cover clusters of villages and service the residential loads—basic and aspirational support public services as well as productive loads in villages.

Other co-benefits of these mini-grids would be local employment creation for the management of systems. The study also found that while scaling up mini-grids makes them more cost-effective and significantly lowers their tariffs, the reduced tariffs are found to be higher than grid-electricity tariffs. This is because rural grid consumers are significantly cross-subsidized by other consumer categories (such as industrial and commercial) and direct subsidy by the state governments' design. This mechanism does not currently exist in the mini-grid sector. Therefore, the study makes a case for extending the benefit of cross-subsidies to mini-grid consumers as well in order to bring tariffs at par with those of the grid. The study posits that mini-grids be treated as natural extensions of the grid, thereby addressing issues of grid stability and reliability as well as enabling mini-grid developers to sell surplus power to the grid.

TERI's air pollution and health study aimed to ascertain the regional disparity and quantum of emissions from the energy sector; prediction of particulate matter (PM) concentrations; assessing impacts of PM concentrations on human health; and associated savings from moving to renewables.

The study created models along scenarios delineated above and painted a harsh picture, noting that deaths attributable to ambient $PM_{2.5}$ in 2015 were the highest in residential biomass consumption (42 per cent), meaning that the usage of firewood or dung cakes to cook in households was a significant cause of deaths related to respiratory issues. Results indicated that these deaths would reduce to 20 per cent in 2050 if there is increased LPG uptake.

While emissions in domestic, industrial, energy, and transport sectors would continue to increase in the BAU scenario between 2016 and 2021, these would decline in the INDC and Ambitious scenarios by 16 and 22 per cent respectively, compared to the BAU scenario. Further, TERI's study found that by 2020, mortality attributable to thermal power plants would reach to 36,174 under the BAU scenario. It estimates that by 2020, BAU will translate to a loss of 0.39 million healthy years of life, which worsens by 69 per cent to reach up to a loss of 0.66 million healthy years in 2050. These figures reduce by 10 per cent in the Ambition scenario. In economic terms, this loss totals up to Rs 110 billion in 2020, and Rs 838 billion by 2050. The study also noted that $PM_{2.5}$ emissions will be concentrated in the Indo-Gangetic plain and the Himalayan regions.

Key Takeaways

Discussions at the workshops highlighted the need to frame a national narrative using the three studies, possibly along renewable energy technology verticals. A national narrative would encapsulate socio-economic development due to climate action and make a case for raising ambitions in framing climate policies. That coal will remain relevant in India's near future was discussed and deliberated upon. While coal labour intensity (direct or indirect jobs related to coal, per 1,000 tonne of production) historically has been declining due to efficiency gains in the sector, it remains one of the most significant employers in India. In addition, the problem of electricity access has morphed into that of reliable electricity supply due to numerous reasons such as the financial health of power distribution companies (discoms) and their practice of end-user targeting, among others.

The loss of life and livelihoods and the resultant economic cost of air pollution also reiterated the case for greater and urgent climate action. The COBENEFITS team believes that there are synergies between the existing policies, such as Make in India and Skill India, and a shift to renewables, which can be capitalized upon. The team also believes that the studies offer multiple points of policy intervention that make the case for capacity building and awareness creation to aid the country's development agenda.

Way Forward

As 2019 progresses, the COBENEFITS project intends to deepen the engagement of stakeholders related to each of its studies. These studies intend to offer stakeholder trainings, organize more council meetings to discuss results and policy recommendations stemming from the studies, identify points of intervention, and hold deliberations to acknowledge limitations in mainstreaming the co-benefits approach in policymaking. These activities are envisioned to extend the outreach of the project, which ultimately will include publications synthesizing results and stakeholder inputs into a national narrative.

The Paris Agreement sets an ambitious goal of keeping the increase in temperature rise well below 2°C. Almost all countries put forward their INDCs as a start towards meeting this goal, which will be further revised as NDCs. Further, countries also agreed to undertake regular stock-taking to assess whether they will be able to reach their commitment and to what extent their efforts are enabling them to keep the GHG emissions trajectory on track with the above-mentioned goal. The achievement of these goals will depend on: i) effective implementation and ii) enabling means of implementation or support. Continued analysis, deliberations, and knowledge sharing is imperative for countries to implement their 'nationally determined contributions' along with identifying specific international cooperation needs. This project aims to contribute to this effort. The focus of the project is on issues related to implementing NDCs in both the international and domestic context. The following activities will be undertaken under this project:

1. Tracking of Nationally Determined Contributions and domestic linkages with SDGs
2. Role of international cooperation and domestic innovation on climate finance
3. Technology cooperation needs for implementing and enhancing India's NDC
4. Understanding gender dimension in mitigation actions

This series of Mitigation Talks acts as a platform to initiate discussions on various issues under these four themes.

For more information, contact:

Neha Pahuja

Fellow, TERI

The Energy and Resources Institute (TERI)

Darbari Seth Block,
IHC Complex, Lodhi Road,
New Delhi 110 003

Tel: 24682100 or 41504900

Fax: 24682144 or 24682145

Web: www.teriin.org

E-mail: neha.pahuja@teri.res.in