SHAKTI
SUSTAINABLE ENERGY FOUNDATION

STAYING ON TRACK FROM PARIS: MEETING INDIA'S CLIMATE & ENERGY GOALS

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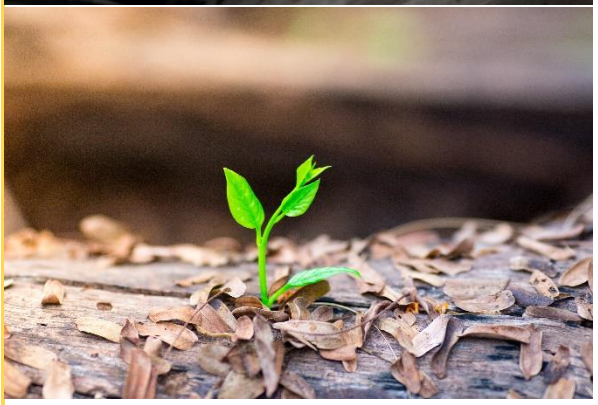

Shakti Sustainable Energy Foundation works to strengthen the energy security of India by aiding the design and implementation of policies that support renewable energy, energy efficiency and the adoption of sustainable transport solutions.

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Summary

Now that the Paris Agreement on climate change has been ratified, India must plan on making good on its Nationally Determined Contributions (NDCs). Implementing the NDCs will require India to develop innovative policies, legislative and institutional frameworks, mobilize the required resources and find solutions to promote newer, cleaner technologies. Shifting the energy curve from coal-based energy to cleaner and more sustainable energy. must take top priority. All this will require significant resources, a strong policy push, and a great deal of political will. It will also draw significantly on India's technical and entrepreneurial abilities.

Recent initiatives by the Government of India, such as the Smart Cities Mission and the announcement of ambitious renewable energy targets, present significant opportunities for future growth to be cleaner and greener. This paper provides an overview of India's approach to climate action, its polices, as well as the landscape of challenges and opportunities that lie ahead. One of the key imperatives for India is to mobilize high financial flows given that USD 2.5 trillion is required for the implementation of the NDCs up to 2030. Leveraging private finance along with public finance, both international and national, will be critical.

This paper discusses early action opportunities under the Post Paris agenda. These include:

(i) Developing concrete roadmaps to meet India's NDCs

(ii) (ii) Strengthening the Measuring, Reporting and Verification (MRV) framework to comply with the enhanced transparency mechanism established under the Paris Agreement

(iii) (iii) Enabling states to play a meaningful role in achieving the NDCs and

(iv) (iv) Capitalizing on the opportunity to leap-frog to hydrofluorocarbons (HFCs) in sectors such as air conditioning.

Following this, the paper provides an assessment of energy saving and climate action opportunities in the domains of Power, Energy Efficiency, Cities and Transport.

STAYING ON TRACK FROM PARIS: Meeting India's Climate and Energy Goals

INTRODUCTION

India reached a key climate milestone with the ratification of the Paris Agreement, in early November 2016, just a few days before the 22nd Conference of the Parties began in Morocco. As the world's third largest carbon emitter, the ratification is a strong affirmation of India's commitment to sustainable development and carbon emission reduction goals. Just a few days later, India along with 190 other countries, adopted a binding agreement in Kigali, Rwanda to phase out the use of hydrofluorocarbon (HFC) gases – reinforcing yet again the spirit and substance of the Paris Agreement, that is, it is in countries' national and global interest to tackle climate change.

By ratifying the Paris Agreement, India has committed to meeting the goals set out in its Nationally Determined Contributions (NDCs). Being both ambitious and noteworthy, the NDCs are expected to generate transformational changes in the country. India has pledged to (i) reduce the emissions intensity of its GDP by 33- 35% by 2030, from the 2005 level (ii) achieve around 40% cumulative electric power installed capacity from non-fossil-fuel-based energy resources by 2030 with the help of transfer of technology and low-cost international finance, including from the Green Climate Fund (iii) create an additional carbon sink of 2.5 to 3 billion tonnes of CO2 equivalent, through additional forest and tree cover by 2030. The NDCs prioritize efforts to build resilience to climate change impact, and provide a broad indication of the financing necessary to reach its goals.

India's ratification of the Paris Agreement has been welcomed by world leaders as an important step for global climate action. But despite all the rhetoric and excitement, what comes next will be the process of meeting the targets. India's NDCs are only the start. While India has laid out the essential goals, the ability to achieve these goals will depend on the rules, guidelines and processes adopted to implement the NDCs. Shifting the energy curve from coal-based energy to renewable and non-fossil fuels must take top priority. All this will require significant resources, a strong policy push, and a great deal of political will. It will also

draw significantly on India's technical and entrepreneurial capabilities. As a fast-growing economy that has demonstrated considerable leadership in climate action, India must capitalize on the opportunity to frame stringent laws and policies that will make it an example for other developing countries.

MARRAKESH – TOWARDS ENABLING ACTION

This November 2016, delegates from around the world gathered in Marrakesh, Morocco for the 22nd Conference of the Parties as well as the highly anticipated first session of the meeting of the Parties to the Paris Agreement (CMA 1). Marrakesh built on the collective spirit shaped at Paris as countries, including India, progressed from vision to a roadmap for ambitious action. Overall, Marrakesh held up to its expectations of continuing global momentum on climate change allowing countries the opportunity to engage with the nuts and bolts of the Paris Agreement.

As expected, India reiterated its stand that developed nations must contribute significant financial assistance for its NDCs to be met, underscoring the position of less-privileged nations that developed countries should assume a greater role in fighting global warming since they have been the major polluters over the years. Climate finance topped India's agenda as India emphasized the need for a concrete roadmap from developed nations to mobilize funds to help developing countries move to a low-carbon growth pathway. One of the key actions forward is to mobilize the high financial flows required for the implementation of the NDCs—USD 2.5 trillion up to 2030. The scale of investment will require the infusion of significant finance at more attractive terms. In India's case, new developments in sectors such as construction, transport, energy production, waste and water management, as well as agriculture, will benefit from fresh funding. Innovative financial mechanisms and institutions will be critical. The Intended Nationally Determined Contributions (INDC) submission announced the introduction of tax-free infrastructure bonds worth USD 794 million for the funding of renewable energy projects during the financial year 2015-16. It also focused on technical support and broadening investor opportunities, including allowing 100% foreign ownership of renewable projects. One important area of opportunity is India's emerging

green bond market. Within a year of India's first green bond issuances by public and private banks, three private corporations issued their own green bonds, demonstrating the market's quick maturation and diversification into the corporate sector.[1] Another promising source of finance is institutional investors such as life and non-life insurance companies, employee provident funds, national pension schemes, sovereign wealth funds, university endowments. Research reveals that institutional investors, with their distinctive risk and return requirements and longer-term objectives, are a better match for renewable energy projects. When tapped effectively, they can provide the long-term, low-cost capital required. [2]

GROUND REALITIES

India's most significant test lies ahead as it begins to wrestle with implementing the NDCs. Energy and climate change are at the forefront of the many challenges facing India today. It is no secret that India has enjoyed rapid economic growth over the last decade. With India's population projected to surpass China by 2022, energy demand and increasing climate vulnerability will only accelerate. Urbanization will be a key driver of energy trends: by 2030, India's cities are expected to grow from 377 million people in 2011 to 600 million. During the same time, several new cities will be built from ground up and increase the demand for urban infrastructure. These trends will drive up the use of fossil fuels, and increase pollution and greenhouse gas emissions.

Another caveat is the huge dependence on the imports of oil, gas and coal to meet the energy demand. Greater import dependence has driven up India's import bill and exposure to volatile energy prices. In 2012, India spent 55% of its goods export revenue on financing energy imports alone.[3] The figure has declined in recent years with a dip in global oil prices, but increasing imports and fluctuating prices continue to pose risks. [4] According to the

[1] NRDC International: India. Greening India's Financial Market: How Green Bonds Can Drive Clean Energy Deployment (Interim Report April 2016).
[2]Climate Policy Initiative. The Challenge of Institutional Investment in Renewable Energy. (2013). http://climatepolicyinitiative.org/wp-content/uploads/2013/03/The-Challenge-of-Institutional-Investment-in-Renewable-Energy.pdf
[3] McKinsey & Company. An Energy Security Index for India. (2016)
[4] Ibid

International Energy Agency (IEA), India will account for 25% of the rise in global energy use to 2040, (more than any other country), and the largest absolute growth in both coal and oil consumption.[5] This is expected to increase the strain on India's balance of payments and will impact energy security. This view certainly holds merit, but there may be another way to look at the country's import scenario. Recent research has put forth the view that "India should not be afraid of high import dependence".[6] However, it should intelligently evaluate the benefits and trade-offs from investing in the domestic production versus imports over the next few decades in planning its fuel and technology transitions."[7] India should positively welcome the greater flexibility that imports provide to react to a very uncertain future for global energy.[8] As in all risk management the issue is to shape a portfolio, not to be beguiled by absolutes.[9] This could fundamentally alter the approach to India's development paradigm.

Other challenges need attention. The lack of adequate rural electrification continues to hinder economic and social development. Even with the increase in installed capacity, close to 300 million people lack access to energy. In urban areas, as well, power outages occur because of inefficiencies in power generation, distribution and end-use. As one of the most vulnerable countries to climate change, the millions of people who live along India's 7,500 km coastline face a high risk of sea level rise and extreme weather events. Even as the National Oceanic and Atmospheric Administration (NOOA) in the US said that 2016 was on course to beat 2015 as the hottest year on record globally, the Ministry of Earth Sciences reiterated that for India too it "could be one of the warmest years of the century." [10]

The most pressing challenge is how economic growth and environmental sustainability will go hand in hand. India houses the largest population of global poor and as indicated earlier, almost 300 million people without access to electricity. As the INDC submission points out,

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[5]International Energy Agency. India Energy Outlook. (2016). http://www.worldenergyoutlook.org/media/weowebsite/2015/IndiaEnergyOutlook_WEO2015.pdf

[6] Bery, Suman, Arunabha Ghosh, Ritu Mathur, Subrata Basu, Karthik Ganesam, and Rhodri Owen-Jones. Energizing India: Towards a Resilient and Equitable Energy System. Sage Publications India (2016).

[7] Ibid

[8] Bery, Suman. "Why Is Energy Different." Business Standard. 2016. http://www.business-standard.com/article/opinion/suman-bery-why-is-energy-different-116102701678_1.html

[9] Ibid

10 Nambiar, Nisha. "Why 2016 May Be the Hottest Year for India. 2016. http://indianexpress.com/article/india/india-news-india/hottest-summer-2016-el-nino-temperature-india-meteorological-department2764309/

"India's development process is doubly challenging. It not only has to complete the current unfinished development agenda, it has to strategize for future pressures that may increase the magnitude of this development gap. India realizes that economic growth and development must be guided by the key concerns of sustainability, because none of us have the luxury, any longer, of ignoring the economic as well as the environmental threat that a fast-deteriorating ecosystem poses to our fragile planet. India believes that development and environment are not adversaries but can go hand in hand, if environmental sensibilities can be imbibed." [11]

It is apparent that India must find a way to carve out a development pathway in a carbon-constrained world. What begs scrutiny is the action required to steer the country to a less emissions-intensive pathway. The following sections provide an overview of the critical opportunities that stand out to motivate climate action in India.

To begin with, four critical early action opportunities under the Post Paris agenda are discussed:

i) Developing concrete roadmaps to meet India's NDCs
ii) Strengthening the Measuring, Reporting and Verification (MRV) framework to comply with the enhanced transparency mechanism established under the Paris Agreement
iii) Enabling states to play a meaningful role in achieving the NDCs
iv) Capitalizing on the opportunity to leap-frog HFCs in several sectors, in particular air conditioners.

This is followed by an assessment of energy saving opportunities and climate action in the domains of Power, Energy Efficiency, Cities and Transport. Several potential intervention areas are discussed. Some key challenges are identified, which if addressed in a cohesive manner, can help drive ambitious implementation.

[11] GoI, India's INDC

EARLY ACTION OPPORTUNITIES

(i) Developing concrete roadmaps to meet India's NDCs

Given the scale of action required by 2030, a priority action is to develop a concrete national roadmap, which should define delivery mechanisms, proposed actions, and detailed resource and investment plans. The roadmap must lay out the options, the costs, implications, and the multiple benefits of meeting the NDCs, particularly when compared to a 'Business as Usual' (BAU) scenario. The development of sectoral action plans could be a pragmatic way to embed and mainstream NDC action in wider development policy and planning. As a minimum, both the national plan and the sectoral plans will require changes to existing policies or even the creation of new ones, to ensure that NDCs goal are met. For example, the NITI Aayog is in the process of preparing a draft energy policy for India. With the ratification in place, it makes sense to align the policy with the goals set out under the NDCs. While developing the roadmap, India must also consider the pre-2020 scenario to ensure that policies required to implement the NDCs in the country are put in place. Climate and energy action in the period after 2020 will depend on preparatory work undertaken before 2020.

Developing the roadmap will no doubt be challenging, but this will not be a first for the country. In 2014, the 'Expert Group on Low Carbon Strategies for Inclusive Growth' recommended a menu of options to reduce India's emission intensity by 20-25 percent over 2005 levels by the year 2020. The new NDC target commits India to go further – 33-35 percent from 2005 by 2030.

(ii) Strengthening the MRV framework to comply with the enhanced transparency mechanism established under the Paris Agreement

Measuring countries' emissions and the progress made toward reducing them is critical for evaluating whether the world is on track to meet the goals set out at Paris. At the UNFCCC climate negotiations in 2010, India along with other countries agreed to share information every two years about policies and actions to undertake to address climate change. Reporting for developing countries, including India, was implemented through national communications (NATCOMs) and biennial update reports (BURs).

Now, the Paris Agreement has taken a major step forward by establishing an enhanced system of transparency for MRV with flexibility to accommodate varying national

capacities. For the first time, countries will report regularly on their emissions and implementation efforts, and undergo international review. This is vital for building international trust and confidence that action is taking place as well as for assessing how to facilitate further action. India's role is critical in this regard since it has the opportunity to contribute to the international deliberations that will define the modalities for the new framework. Also, India will most likely need to strengthen its domestic MRV capability in order to comply with the requirements of the new transparency framework. This is an opportune time for India to review its existing climate MRV system and assess areas that need strengthening as a way to support the tracking and implementation of its NDCs.

Encouraging states to play a meaningful role to achieve climate targets

The federal structure of the country means that states have primary responsibility for governing several sectors that are pivotal to addressing climate change, including electricity supply, infrastructure and industries. According to the INDC submission, over 30 states and union territories have announced State Action Plans on Climate Change (SAPCCs) that attempt to make sure that climate change issues are integrated into the planning process. The SAPCCs, developed broadly on a framework like the National Action Plan on Climate Change (NAPCC), primarily focus on adaptation.[12] While an impressive step forward on mainstreaming climate change within development planning in India, the SAPCCs have faced delays and challenges. There are very few examples of a coordinated and concerted effort to implement the plan in any state. Also, the budget estimates vary significantly across states, with no consistent methodology being used. An important area of opportunity is developing state-level inventories of GHG emissions from different sectors, which can help prioritize climate action and allocate requisite funding. As of now, only Karnataka and Himachal Pradesh have submitted detailed sector-wise GHG inventory in the SAPCCs. This will help state governments take stock of their climate preparedness in the context of both their developmental and NDC goals.

Capitalizing on the opportunity to leap-frog HFCs in several sectors, in particular air conditioners

[12] India Climate Report (2016). http://shaktifoundation.in/wp-content/uploads/2015/07/India-Climate-Report-Vol.-1.pdf

In October 2016, India along with nearly 200 other countries agreed to phase down the use of hydrofluorocarbons (HFCs) refrigerant gases under the Montreal Protocol. HFCs—used mostly in air conditioning and refrigeration—have high global warming potential. Reducing their consumption by switching to more climate-friendly alternatives can lead to significant climate benefits. Alternatives to HFCs, such as natural hydrocarbons, are more energy efficient and can lead to performance gains in the range of 10-20%.[13] This potential is extremely relevant given that more than 32% of India's total electricity consumption is consumed by domestic (23.58%) and commercial (8.77%) sectors[14] and annual electricity consumption in air conditioning of buildings (2013) is around 60-80 billion KWh.[15] Even with a 10% average efficiency improvement, India will roughly save 6-8 billion kWh of electricity per annum or avoid about 1 GW of electricity generation capacity.[16] The total energy conservation savings potential is expected to be higher when other sectors (industry) and usages (refrigeration) are included. To maximize this opportunity, India must now systematically mainstream energy efficient and low GWP non-HFC based refrigerants through advancing policy, regulatory and market arrangements. One way forward to develop standards for hydrocarbon based (propane) air conditioners. This will enhance their case for commercial viability and address safety concerns around hydrocarbons. Another step ahead would be to conduct an economy wide impact assessment of introducing non-HFC based refrigerant in India, which in turn would help plan this shift in a more systematic manner.

ENERGY SAVING AND CLIMATE ACTION OPPORTUNITIES

The following section provides an assessment of energy saving and climate action opportunities in four critical domains: Power, Energy Efficiency, Cities and Transport. Several potential intervention areas for meeting India's NDCs are discussed. It is pertinent also to note

13 http://www.cooltechnologies.org/content/efficiency-comparisons-between-hydrocarbons-and-fluorocarbons
14 Growth of Electricity Sector in India from 1947-2015
15https://beeindia.gov.in/sites/default/files/ctools/Mr%20Saurabh%20Diddi%20Space%20Cooling%20India.pdf
16 Considering 62.99% PLF. Government of India. Ministry of Power. Central Electrical Authority. Executive Summary Power Sector March-15.
http://cea.nic.in/reports/monthly/executivesummary/2015/exe_summary-03.pdf

the challenges that must be addressed before implementation efforts can take off, so that impactful results can be achieved.

Power

India's power system needs to almost quadruple in size by 2040 to catch up and keep pace with electricity demand that – boosted by rising incomes and new connections to the grid – increases at almost 5% per year.[17] While significant progress has been made in the sector, the poor financial health of distribution companies is a key weakness: low average end-user tariffs, aggregate technical and commercial (AT&C) losses in the network, and high levels of non-payment for electricity bills by consumers mean that distribution company revenue often fails to cover the costs owed to generators.[18]

While there is emphasis on a cleaner growth trajectory, the fact remains that coal-based power has been and will remain critical to India's energy infrastructure and development. India's INDC submission categorically highlights "coal will continue to dominate power generation in [the] future."[19] The target to provide every household with electricity by 2019 will be dependent on coal-based power given that coal will remain the most significant source of energy. Recognizing that CO2 emissions from coal need to be addressed, India has already announced several initiatives to improve the efficiency of coal-based power plants and reduce their emissions.[20]

Efforts to mainstream renewable energy are a very positive sign. India currently has an installed electricity generation capacity of around 275 GW, with over 36 GW of renewable energy capacity, which contributes to around 13% of the installed base (this includes wind, solar, biomass, small hydro and other sources). With a target of *175* GW of *renewable* energy capacity by 2022, the renewable energy sector hit a tipping point.

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17 International Energy Agency. India Energy Outlook. (2016). http://www.worldenergyoutlook.org/media/weowebsite/2015/IndiaEnergyOutlook_WEO2015.pdf

18 Ibid

19 GoI, India's INDC.

20 GoI, India's INDC. Some of these include: all new, large coal-based generating stations are mandated to use the highly efficient supercritical technology. Coal beneficiation is mandatory, and stringent emission standards being contemplated for thermal plants would significantly reduce emissions.

Steady gains are being made on the solar front. The India-led International Solar Alliance (ISA) is on its way to becoming an intergovernmental treaty-based organization, with its headquarters in India. It is expected to promote solar energy deployment in the developing world. India's solar sector crossed 5 GW of installed capacity in early 2016.[21] But this is still a long way off from the 2022 target of 100 GW from solar photovoltaic (PV), and the country must significantly ramp up its pace. A positive step in this direction are India's year-on-year targets that chart a roadmap for achieving the country's 2022 solar goal.[22] Several other initiatives focus on the development of solar rooftop projects, ambitious solar parks and solar pumps for farmers.

The case for wind energy is bolstered by the fact that India is already the fifth-largest wind energy producer in the world with an installed capacity of 25 GW, accounting for about 67% of India's total installed renewables capacity. The reinstatement of the generation-based incentive (GBI) in 2013 and its subsequent disbursement toward the end of FY 2013–14 appears to have restored investors' faith and led to the addition of 2,212 MW of wind capacity in 2013. As a further boost to the sector, India announced plans to restore the accelerated depreciation (AD) benefits.

Despite these positives, more progress has to be made. Accessing affordable finance, the poor financial health of state electricity distribution companies and technological challenges — be it grid stability, balancing capacity or storage — head the list of challenges facing India's power sector. The total investment required to make good on the promise of 100 GW of solar energy capacity is estimated at about USD 100 billion.[23] A financial boost in the 2016 Budget is a positive sign, but greater diversity of financing, especially private capital, is necessary. It is also anticipated that the draft National Renewable Energy Bill 2015, once enacted, will enable a supportive ecosystem for growth of the sector. Also, actions that can reduce the uncertainties associated with regulation and project development — such as the

21 Ministry of New and Renewable Energy. Solar Power Capacity Crosses Milestone of 5,000 MW in India. Press Information Bureau. http://pib.nic.in/newsite/printrelease.aspx?relid=134497
22 Ministry of New and Renewable Energy. Year wise cumulative target to achieve 1,00,000 MW grid connected solar power project by the year 2021-22. http://mnre.gov.in/file-manager/UserFiles/OM-year-wise-cumulative-target-for-100000MW-grid-connected-SP-project.pdf
23 Renewable Energy Country Attractiveness Index," Issue 43, Ernst & Young Global Limited 2015 http://www.ey.com/Publication/vwLUAssets/Renewable_Energy_Country_Attractiveness_Index_43/$FILE/RECAI%2043_March%202015.pdf.

process around land acquisitions and connectivity to the grid —will increase the share of renewables in the power mix. Finally, given the policy priority to develop India's manufacturing base, ramping up installations will require coordinated effort across policymakers, manufacturers, engineering contractors and other stakeholders.

Energy Efficiency

Recognizing that enhancing energy efficiency is a low hanging fruit for action, India has steadily been launching several policy initiatives over the last few years. The National Mission for Enhanced Energy Efficiency (NMEEE) aims to create a conducive regulatory and policy regime, aiming to save 19,598 MW and fuel savings of around 23 million tonnes each year once it is fully implemented. [24] The national LED lighting programme will replace 770 million incandescent bulbs with energy-efficient LED bulbs by March 2019. This will lead to savings of around 105 billion units annually once the programme is fully implemented. In another landmark programme, India will install 35 million street lights across cities.[25] By December 2015, EESL had replaced 440,000 street lights in 100 cities with estimated annual energy savings of 112 gigawatt-hours and peak load reduction of 18.6 megawatts,[26] representing approximately USD 11.7 million in cost savings for municipalities.

India has launched the Energy Conservation Building Code (ECBC) as an important step towards promoting energy efficiency. Eight states have already adopted and notified the Code and over 300 new commercial buildings have become compliant. Going forward, efforts will need to focus on Code enforcement and supporting additional states to adopt the Code.

India's market-based trading Perform, Achieve and Trade (PAT) scheme, aims to improve energy efficiency in the industry sector. The first cycle of PAT (2012-15) targeted a reduction in energy consumption on average by 4.1% in eight industry subsectors that made up 36% of total industrial energy consumption (2009-10 levels).[27] The majority of the estimated annual

24 GOI. INDC
25 International Energy Agency. Energy Efficiency Market Report. 2016.
https://www.iea.org/eemr16/files/medium-term-energy-efficiency-2016_WEB.PDF
26 Ibid
27 Ibid

savings were expected to come from power generation, followed by iron and steel and cement. The latest assessment of 427 industrial enterprises under the first cycle shows the original target was surpassed with energy consumption reduced by 5.3%, resulting in annual emissions reductions of 31 million tonnes of CO2.[28] PAT's second cycle (2016-19) will expand the programme across 900 to 950 industrial enterprises, representing a share of 50% of industrial energy consumption (2009-10 levels) by including sectors like refineries, railways and state distribution companies.[29]

The micro small and medium enterprises (MSME) sector will receive a boost from the Zero Effect, Zero Defect (ZED) initiative, under the Make in India programme. The focus on high quality manufacturing that is also green is designed to enhance the energy efficiency of this sector. More than one million enterprises are expected to benefit.

There is no doubt that the above policy measures will continue to be a key driver of efficiency interventions. However, much more is possible and much more is needed for India to unlock its energy efficiency potential. For one, financing and risk guarantee for dedicated energy efficiency products and services must expand. It is estimated that the energy savings potential in the country is about 180 billion kWh, which requires an investment of USD 9.5 billion. This could result in avoided installed capacity of about 10,000 MW. But the lack of finance and appropriate financing instruments are severe barriers to energy efficiency interventions. International public financing sources, such as the Green Climate Fund, will not be able to provide the large-scale investment needed on their own; hence, financing sources such as the private sector and increased provisioning in domestic fiscal budgets will be required.

Second, the NDCs strengthen the case for aggressive demand side management (DSM) interventions in India. DSM efforts are far cheaper than building new power plants and laying new transmission and distribution infrastructure. On a positive note, sixteen state regulators have already notified DSM regulations. This is because DSM has immense potential for

28 Ibid
29 Ibid

achieving efficiency across dominant end use applications like lighting, cooling, heating, refrigeration, motors, pumping etc.

Cities

We cannot curb the effects of climate change without building, managing and living in our cities differently. India is aware of this urban reality. Key policies such as The National Urban Transport Policy (NUTP), National Mission for Sustainable Habitat (NMSH) under the NAPCC, Energy Conservation Act etc. are already in place with the goal of guiding urban development on an energy efficient and low carbon pathway. In 2015, the Government of India recently launched two ambitious projects - Smart City and Atal Mission for Rejuvenation and Urban Transportation (AMRUT). The Smart Cities Mission is a multiyear effort to boost economic development, technological innovation, and sustainable growth across 100 cities. The Atal Mission for Rejuvenation and Urban Transformation (AMRUT) will cover 500 cities seeking to provide basic services (such as water supply, sewerage, urban transport) to improve the quality life for all, especially the poor and the disadvantaged.

Both projects hold plenty of promise. In particular, there has been much excitement around the Smart Cities Mission with 60 cities already selected for funding, through two competitive rounds of proposal evaluation. But several implementation challenges are expected. Smart cities need to develop Information and Communication Technology (ICT) platforms to bring about a convergence of investments in electricity, water, citizen connect, resilience and crisis management. While the Government has broadly defined the smart city concept and provided guidelines to define a smart city, each city will need to develop its own customized solutions and infrastructure that will determine the scale, content and pace of its urbanization. Urban planners must get used to an inclusive planning that will use ICT solutions and governance models, and also collaboration with private enterprises. For example, the Smart Cities Mission has placed significant emphasis on the Public Private Partnership (PPP) model encouraging the private sector to mobilize capital, technology and other resources required to finance Smart Cities. Such partnerships can support government funding and lead to a more sustainable and efficient stream of public goods and services. However, cities must make a conscious effort to use the PPP model to be able to close the financing gap required.

Transport

The transport sector (covering both passenger and freight services) is the second largest consumer of primary energy after the Industrial sector. It is also a leading contributor to air pollution. Private vehicle ownership has significantly increased and the share of public transport, and walking and cycling trips has been gradually declining. India is already the sixth largest producer of passenger vehicles in the world. This has led to congestion, pollution and a huge pressure on fuel sources. Already, India holds the dubious distinction of having 13 of the world's 20 most polluted cities several of which are state capitals. Another concern is that India's freight movement has been steadily shifting away from rail-based to road-based transport modes. In terms of the overall freight volume movement, the share of the railways has dropped from 65% to 30% over the last three decades. This is very energy inefficient and polluting.

There is an urgent need for policy actions to fast track the implementation of low carbon mobility interventions. The increased investment in public transport systems (such as city buses, Bus Rapid Transit systems (BRTS) and Metro systems), Non-Motorised Transport infrastructure and a focus on transit-oriented development (TOD) can make cities more energy efficient, better connected, and less polluted. Fuel-efficiency standards for all modes of transport is an important area to tap into. So far, passenger cars have established fuel efficiency standards and a labelling framework. There is significant potential in adopting and implementing progressive fuel efficiency and emission improvement measures for other vehicle types with commercial trucks and buses presenting the biggest potential savings. The accelerated timeline for introducing Bharat Stage (BS) VI (equivalent to Euro VI) fuel quality and vehicular emission standards will serve as an effective emission control means for new vehicle stock. However, the emission performance of in-use vehicles will need to be addressed through better inspection and maintenance norms and their enforcement.

Another key area of intervention is increasing the efficiency of railways to increase its modal share of both passenger and freight transport. Efforts are already being made to increase the share of rail freight via creation of dedicated freight corridors. And finally, one cannot discount Electric Vehicles (EVs), which offer significant fuel savings and urban air quality benefits. When powered by renewable energy, can strengthen India's energy and

economic security. More importantly, they can address the variable nature of renewable energy resources by acting as a balancing resource for the grid. But for these benefits to be realized, it is important to have the required policy and infrastructure interventions that will support the transition of public transport systems to electric vehicles in an optimal way. Both the National Electric Mobility Mission Plan 2020 and the Faster Adoption and Manufacturing of (Hybrid &) Electric Vehicles (FAME) scheme promote the adoption of electric vehicles.

CONCLUSION

The Paris Agreement provides the framework for global action to address climate change. As India plans to deliver on its NDCs, it must identify the key tasks and activities that are required to provide a well-defined pathway to implementation. Clean energy finance will be instrumental for powering renewable energy markets and meeting the NDCs. Some key opportunities that lie ahead for policy makers and other stakeholders have also been highlighted.

LIST OF ABBREVIATIONS

AD	Accelerated Depreciation
BAU	Business as Usual
ECBC	Energy Conservation Building Code
EESL	Energy Efficiency Services Limited
GBI	Generation-based Incentive
HFC	Hydrofluorocarbons
IEA	International Energy Agency
INDC	Intended Nationally Determined Contribution
ISA	International Solar Alliance
MSME	Micro Small and Medium Enterprises
MRV	Measuring, Reporting and Verification
NAPCC	National Action Plan on Climate Change
NDC	Nationally Determined Contributions
NMEEE	National Mission for Enhanced Energy Efficiency
PAT	Perform, Achieve and Trade (Scheme)
SAPCC	State Action Plan on Climate Change