



INDIAN  
INSTITUTE OF  
PUBLIC HEALTH  
GANDHINAGAR



NOVEMBER  
2021

## ISSUE BRIEF

# THE ROAD FROM PARIS: INDIA'S PROGRESS TOWARDS ITS CLIMATE PLEDGE

India is largely on track to meet, and even exceed, its Paris Climate Agreement targets: reduce emissions by 33 to 35 percent of its gross domestic product (GDP) by 2030 from 2005 levels and achieve 40 percent of installed power capacity from non-fossil fuels by 2030, with some more work to do on its goal of creating an additional carbon sink.<sup>1</sup> With solar and wind energy at the heart of India's climate goals, the country aims to install 175 gigawatts (GW) of renewable energy (excluding large hydro) by 2022 and an ambitious 450 GW by 2030, larger than India's current total grid capacity.<sup>2</sup> In August 2021, India passed a milestone of 100 GW of renewable energy (excluding large hydro), with renewables now making up a quarter of India's total installed capacity.<sup>3</sup> In response to the urgent need for newer, bolder action, India announced new climate goals at the United Nations Climate Change Conference in Glasgow in November 2021.<sup>4</sup>

## India Announces New Climate Actions

At the United Nations Climate Change Conference in Glasgow, Indian Prime Minister Modi announced five key actions on climate:<sup>5</sup>

- 1. India's non-fossil energy capacity to reach 500 GW by 2030.** Achieving the goal would make 60 percent of India's power capacity fossil-free by 2030, a significant increase from the 40 percent that India committed under the Paris Agreement. India's new announcement is a formalization of previously stated goals to reduce dependence on fossil fuels by installing an ambitious 450 GW of renewables by 2030.
- 2. India will meet 50 per cent of its energy requirements with renewable energy by 2030.** Meeting half the country's energy needs through renewable energy would be a significant jump for India. In 2021, less than 20 percent of India's energy requirement has been met through renewable energy, a number which constitutes a little over a fourth of the total power capacity.<sup>6</sup> Increasing the share of renewable energy would need strong investment in grid upgradation, energy storage, and would be good for greening India's industry and transportation sectors as well.
- 3. India will reduce its total projected carbon emissions by one billion tons between now to 2030.** This is a significant goal for a country with annual emissions of about 2.6 billion tons of carbon dioxide, expected to continue to grow in the coming years.<sup>7</sup> India's focus on energy-efficient buildings, appliances, and equipment can play a major role in reducing carbon emissions.
- 4. By 2030, India will reduce the carbon intensity of its economy to less than 45 percent.** This is a significant increase from India's previous Paris Climate Agreement target to decrease the intensity of its GDP by 33 to 35 percent from 2005 levels by 2030.<sup>8</sup>
- 5. By 2070, India will achieve the target of net zero emissions.** The world needs every major economy to move to a net zero emissions goal to avert the worst climate impacts and India has joined other major economies in committing to this pathway. With the enhanced near-term goals that India has announced, the country could potentially switch to a new carbon-free growth paradigm even earlier.

## National Overview

Despite very low per capita emissions, India is the world's third-largest greenhouse gas (GHG) emitter, with absolute emissions expected to rise in the near-term. India's 2021 total CO<sub>2</sub> emissions are set to be almost 200 metric tons (Mt) higher than 2020 levels (atypically low due to COVID-19) or 1.4 percent (30 Mt) above 2019 levels (equivalent to 132 Mt CO<sub>2</sub>).<sup>9</sup> CO<sub>2</sub> emissions in India are now at 2.35 gigatons, broadly equivalent with emissions in the European Union, though they remain 60 percent below the global average on a per capita basis.<sup>10</sup> India is also an economic powerhouse with an average GDP growth rate of 6.7 percent over the last decade.<sup>11</sup> With the COVID-19-induced economic slowdown, India's GDP contracted by 7.3 percent in 2020 but is expected to expand at least 9.5 percent in 2021, despite an unexpectedly severe second COVID-19 wave.<sup>12</sup>

Renewable energy –i.e., solar, wind, and biomass—have been on a fast growth trajectory, with the share of renewable energy capacity increasing to 26 percent (more than 100 GW out of 387 GW) in August 2021.<sup>13</sup> Though fossil fuels still account for the majority of India's power generation, the share of thermal capacity has decreased to 60.7 percent.<sup>14</sup> However, as part of the economic recovery in 2021, coal demand has rebounded and driven up emissions. In 2021,

coal-fired electricity generation is expected to be three times higher than generation from renewables.<sup>15</sup>



## Climate Updates – 2021

01

### Rapidly Growing Renewables

The share of installed capacity from renewable energy sources (not including large hydro) has increased to 26 percent (more than 100 GW out of 387 GW) in August 2021 while the share of thermal capacity is at about 60.7 percent.<sup>17</sup>



02

### Hydrogen Mission Gaining Steam

To support its clean energy transition, India has launched a new hydrogen mission, which explores how green hydrogen can be utilized by existing end users of hydrogen such as refineries and fertilizer plants, blended with natural gas for CNG users and piped natural gas, used as fuel for longer-range vehicles and heavy-duty trucks, and used in heavy industries like cement and steel.<sup>18</sup>

04

### Advancing Electric Mobility

Under Phase-II of the Faster Adoption and Manufacture of (Hybrid and) Electric Vehicles (FAME) Scheme, India allocated ₹10,000 crore (US \$1.4 billion) to advance electric mobility in public transportation fleets, four-wheelers, and three-wheelers, privately owned two-wheelers, as well as electric vehicle charging infrastructure.<sup>22</sup>

03

### Increasingly Competitive Solar Power

- Tariffs for solar energy projects reached record lows of 1.99 Indian rupees (₹) per kilowatt-hour (kWh) (US\$ 0.0269/kWh) at a December 2020 auction for solar projects in Gujarat.<sup>1</sup> Four companies quoted the low bid, and NTPC, India's largest power company, secured 200MW of solar capacity.<sup>19</sup> Solar power tariffs continually fell throughout 2020, showing investor confidence despite the pandemic.<sup>20</sup>
- India took encouraging steps towards Round-The-Clock (RTC) renewable power supply in August 2020 when ReNew Power signed a PPA with Solar Energy Corporation of India, a central government-owned entity, to supply RTC renewable electricity, the first of its kind in India.<sup>21</sup>



<sup>1</sup>USD numbers refer to 2021 exchange rates.

Factoring in large hydro and nuclear, India's fossil fuel-free power totaled 39.3 percent of the country's installed capacity, nearly equal to the 2030 goal. On its third key Paris Agreement goal of creating an "additional carbon sink of 2.5 to 3 billion tons of carbon dioxide equivalent (CO<sub>2</sub>e)," the Indian government recognizes the need to expand efforts as India's forest and tree cover has increased by only 5,188 km<sup>2</sup>, yielding a 42.6 Mt carbon sink increase.<sup>16</sup>

## 05

### Advancing Energy Efficient Buildings

As of July 2021, 18 states and two Union Territories have notified the Energy Conservation Building Code (ECBC). The Bureau of Energy Efficiency (BEE) also recently announced the National Energy Efficiency Roadmap for Movement towards Affordable and Natural habitat (NEERMAN) Awards for Energy Efficient Buildings in India, to highlight and acknowledge exemplary building designs that comply with the ECBC.<sup>23</sup>



## 06

### Ratifying Cooling Action Plans

In August 2021, India committed to ratifying the Kigali Amendment, the global pact to phase down super climate-polluting hydrofluorocarbons (HFCs) commonly used in cooling appliances and insulating foams.<sup>24</sup>



## 07

### Reducing Air Pollution



- As part of its goal to achieve a 20 to 30 percent air pollution reduction by 2024, India launched a national clean air program in 2019, and allocated funds to states for reducing air pollution under the 2020 and 2021 budgets.<sup>25</sup>
- The Indian government has issued directions to enable power distribution companies to exit power purchase contracts that are more than 25 years old. This will enable power distribution companies to purchase a greater share of electricity from renewable energy generators, which produce less air pollution than traditional sources.<sup>26</sup>

## 08

### Assessing the Impacts of Climate Change on India

Recent assessments, including the Intergovernmental Panel on Climate Change's Sixth Assessment report and the Ministry of Earth Sciences' Assessment of Climate Change over the Indian Region, have highlighted how the Indian region is likely to see disproportionate sea level rise, rising average temperatures, and increasing monsoon extremes. The already extreme heat and rainfall events will occur with greater frequency, resulting in both more flooding and more droughts.<sup>27</sup>

## 09

### Emerging Policy Developments

- The Ministry of Environment, Forest and Climate Change released a Draft Environmental Impact Assessment Notification, superseding the 2006 version and proposing new rules on industrial projects; the environmental merits of the draft policy are still being debated.<sup>28</sup>
- The Ministry of Power released the Draft Electricity (Amendment) Bill 2020 with provisions that can potentially bring more renewable energy players into the market.<sup>29</sup>
- The Ministry of New and Renewable Energy (MNRE) released a draft policy framework for developing and promoting Decentralized Renewable Energy (DRE) Livelihood Applications.<sup>30</sup> The objective of this framework is to develop an enabling market ecosystem to ensure widespread adoption of DRE for sustainable livelihood creation in the country, compliment grid electricity, and reduce reliance on diesel backup.

## India's Paris Agreement Targets

In 2015, 196 nations came together to approve the Paris Agreement during the 21<sup>st</sup> Conference of the Parties (COP21) to the United Nations Framework Convention on Climate Change (UNFCCC). The Paris Agreement aims to limit global temperature rise to well below 2°C and to make best efforts to hold warming to 1.5°C. As part of the Paris Agreement, all countries submitted Nationally Determined Contributions (NDCs) detailing plans to cut emissions to meet the global temperature goal.<sup>31</sup>

India ratified the Paris Agreement in 2016, and laid out a comprehensive approach to limit climate impacts while fostering economic growth. India's pledge includes the following commitments:

- To put forward and further propagate a healthy and sustainable way of living based on traditions and values of conservation and moderation.
- To adopt a path that is climate-friendly and cleaner than the one followed hitherto by others at a corresponding level of economic development.
- To reduce the emissions intensity of its GDP by 33 to 35 percent by 2030 from 2005 levels.
- To achieve 40 percent cumulative electric installed power capacity from non-fossil-fuel energy sources by 2030 with the help of technology transfer and low-cost international finance, including support from the Green Climate Fund (GCF).



**INDIA WILL CUT  
ITS EMISSIONS  
INTENSITY BY**

**33-35%**

**OF 2005 LEVELS  
BY 2030.**



- To create an additional carbon sink of 2.5 to 3 billion tons of CO<sub>2</sub>e through additional forest and tree cover by 2030.
- To better adapt to climate change by enhancing investments in development programs in sectors vulnerable to climate change, particularly agriculture, water resources, the Himalayan region, coastal regions, health, and disaster management.
- To mobilize domestic funds and new or additional funds from developed countries to implement the above mitigation and adaptation actions, given the resources required and the resource gap.
- To build capacities, create a domestic framework and international architecture for quick diffusion of cutting-edge climate technology in India and collaborative research and development for such future technologies.<sup>32</sup>

Before COVID-19, India's NDC was already one of the few rated by the Climate Action Tracker as compatible with limiting temperature rise to below 2°C.<sup>33</sup> In the most recent update, the Climate Action Tracker has reranked the countries on alignment to 1.5°C, and placed India with other developing countries that "need to update their targets and policies, but also show a pathway for how they could also reduce their emissions as fast as possible if they were supported financially - and to clearly indicate the support they need."<sup>34</sup>

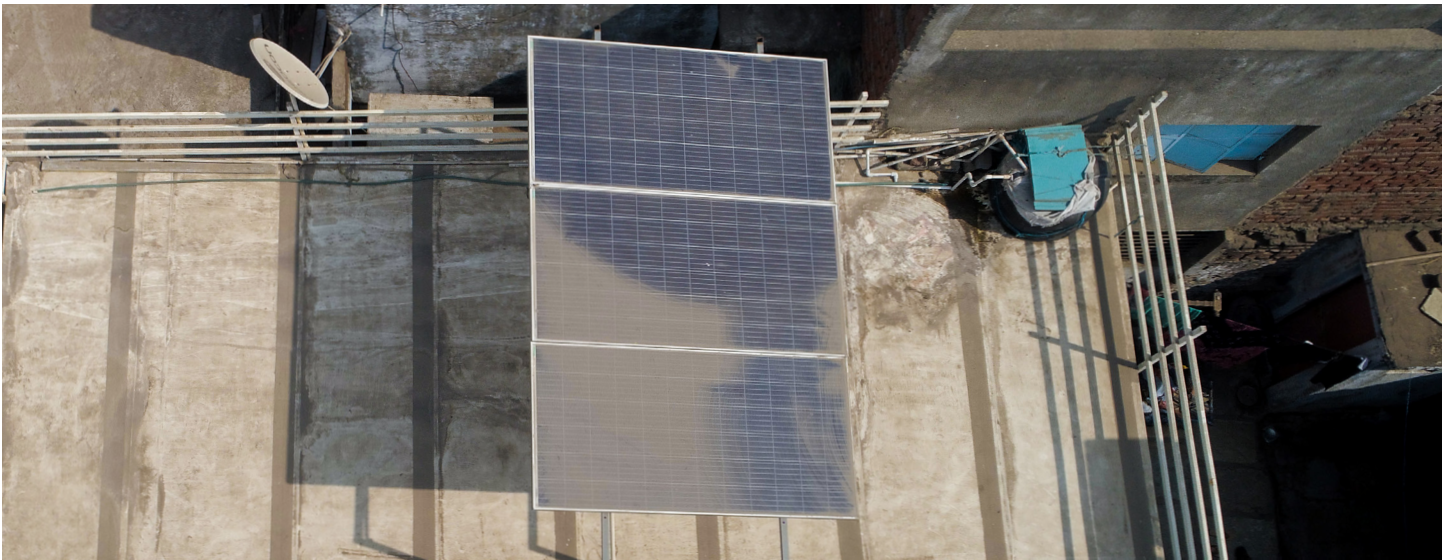
## National Action

Even before India signed the Paris Agreements, the country developed the National Action Plan on Climate Change (NAPCC) in 2008 to chart a low carbon development path.<sup>35</sup> The plan has eight missions focusing on solar, energy efficiency, sustainable habitat, water, ecosystems, forest cover, sustainable agriculture, and climate research. The NAPCC outlines India's strategic mission to promote sustainable economic development while encouraging private sector action on climate mitigation and adaptation.<sup>36</sup> This national plan lays a foundation for achieving India's climate action while simultaneously advancing other critical national priorities.

## Renewable Energy

India has committed to achieving 175 GW of renewable energy by 2022, including 100 GW of solar and 60 GW of wind, 10 GW from biomass, and 5 GW from small hydropower.<sup>37</sup> With power demand growing rapidly, in 2019, India increased its target to 450 GW renewable energy (excluding large hydro) by 2030, over five times India's then installed renewable capacity and more than India's current





Solar hybrid system installed by Mahila Housing Trust (MHT) at a house with mod roof technology to reduce the impact of heat waves and lower the electricity bills in Vishwasnagar slum, Ahmedabad. Source: MHT

total installed capacity (387 GW).<sup>38</sup> As of August 2021, India is more than halfway toward meeting its 175 GW by 2022 goal, with renewables (excluding large hydro) reaching the 100 GW milestone and a strong pipeline of projects to come online in the next twelve months.<sup>39</sup> While some analysts estimate India might need longer to reach 175 GW partly due to the impact of COVID-19, India's MNRE is confident of reaching the goal by 2022.<sup>40</sup>

## Green Hydrogen

India has launched a new hydrogen mission to further explore decarbonization of its energy needs. Green hydrogen is zero-carbon hydrogen production through the electrolysis of water (splitting of water into hydrogen and oxygen) using renewable electricity. It can be used as fuel for longer-range vehicles and heavy-duty trucks, in the power sector for longer-term energy storage, and in heavy industries like cement and steel.<sup>41</sup> A recent report estimated that the costs of hydrogen from renewables in India will fall by more than 50 percent by 2030 and will start to compete with hydrogen produced from fossil fuels.<sup>42</sup>

## Solar Energy

The National Solar Mission aims to install 100 GW of solar energy by 2022, and scale it to 280 GW by 2030.<sup>43</sup> While these goals are ambitious, India's solar energy potential is considerable - it is estimated to be 750 GW.<sup>44</sup> Because of this, India remains one of the most attractive global markets for renewable energy.<sup>45</sup> By sustaining a transparent and competitive market through its reverse auction system, India has been able to drive down the levelized cost of solar despite high borrowing costs and a limited number of available subsidies.<sup>46</sup>

India's solar energy capacity is 43.9 GW as of July 31, 2021.<sup>47</sup> Due to India's strong long-term policy goals and solar's rapidly declining costs, solar energy is expected to continue to grow quickly.<sup>48</sup> However, in order to capitalize on this opportunity as the country recovers from COVID-19, the solar market must respond to challenges such as intermittency, high cost of capital, and capacity constraints.<sup>49</sup> The solar industry is also experiencing headwinds with upcoming basic customs duties on solar modules, less competitive domestic manufacturing, land availability, the uncertainty of compliance with power purchase agreements, decreased subsidies and outstanding dues from distribution companies that have slowed solar capacity additions.<sup>50</sup>

Tariffs for solar energy projects reached record lows of ₹1.99/kWh (US \$0.0269/kWh) at a December 2020 auction for solar projects in Gujarat. Four companies quoted the low bid, and NTPC, India's largest power company, secured 200 MW of solar capacity.<sup>51</sup> Solar power tariffs have been continually falling throughout 2020, showing investor confidence despite the pandemic.<sup>52</sup> In comparison, the lowest thermal power tariff by a three-company bid was ₹3.26/kWh (US \$0.0436/kWh) in February 2020.<sup>53</sup> Solar tariffs, in some instances, have dropped to more than 30 percent below the cost of existing thermal power in India.<sup>54</sup> However, analysts warn that solar tariffs could again rise by about 20 percent when a 40 percent basic customs duty on solar modules and 25 percent duty on solar cells goes into effect in April 2022 as India continues to prioritize domestic manufacturing.<sup>55</sup>

In an encouraging step towards RTC renewable power supply, Renew Power announced in August 2020 that it had signed a PPA with Solar Energy Corporation of India, a

central government-owned entity, to supply RTC electricity, the first of its kind in India.<sup>56</sup> In the first year, supply will be at ₹2.90/kWh (US \$0.039/kWh).<sup>57</sup>

## Wind Energy

India aims to install 60 GW of wind energy by 2022 with 55 GW of onshore wind and 5 GW of offshore wind. India is currently the world's fourth-largest wind energy market, with nearly 40 GW of installed capacity, as of July 2021.<sup>58</sup> Wind energy amounts to over 10 percent of India's total installed power capacity. Installed wind capacity nearly doubled from 2015 to 2021, increasing by 15 GW.<sup>59</sup>

The year 2020 was forecasted to be a breakout year for the wind industry in India; however, that progress was delayed in part due to COVID-19. India only installed 1.1 GW of the projected 3.3 GW of wind power in 2020.<sup>60</sup> The remaining capacity was postponed until 2021. The sector is expected to rebound with more than 20 GW of additional capacity to be installed between 2021-2025.<sup>61</sup> To do so, the wind energy market in India must respond to challenges such as the question of viability around ultra-low tariffs in the reverse auctions regime, competition with low solar tariffs, resource variability as well as financial difficulties and land availability concerns.<sup>62</sup> India seems likely to miss its 2022 wind targets.<sup>63</sup> Yet, the opportunity for continued growth in wind power generation is promising, with an estimated 700-1500 GW of onshore wind energy potential and an estimated 70 GW of offshore wind potential.<sup>64</sup>

## Renewable Energy Job Growth

Achieving India's target of 175 GW of renewable energy by 2022 could employ over 300,000 workers and create 1 million job opportunities in the country.<sup>65</sup> With the new target of 450 GW of renewable energy by 2030, this figure is expected to grow tremendously.<sup>66</sup> To develop a skilled workforce and meet the renewable industry's needs, the Government of India established the Skills Council for Green Jobs (SCGJ) under the National Skill Development Mission in 2015. Since its inception, SCGJ has developed 51 Qualification Packs across renewable energy sectors (solar, wind, bioenergy, clean cookstoves) along with waste and wastewater management domain. It has cumulatively affiliated 423 training partners, 4879 certified trainers, 761 certified assessors along with 28 assessment agencies across India.<sup>67</sup> SCGJ has also trained approximately 5 lakhs (500,000) candidates including 1 lakh (100,000) in solar and other renewable energy domains and the remaining in waste/waste water management across the country.<sup>68</sup> A complementary initiative of SCGJ is the Suryamitra Skill Development Programme, instituted in 2017 and run by the National Institute of Solar Energy under the skill development initiative of the MNRE. The aim is for youth to develop skills related to employment opportunities in solar power project installation, operation, and maintenance in India and abroad. As per an impact assessment carried out by SCGJ on Suryamitra trainings, over 88 percent trained suryamitras have reported enhanced employability and better job opportunities along with over 80 percent reported increased income and improved livelihoods post trainings.<sup>69</sup>

## Recovery from COVID-19 and Clean Energy Opportunities

India has been battling multiple crises this year, including the deadly COVID-19 pandemic and the climate crisis. With devastating heat waves and power shortages in addition to increased health risks, the compounded impact of the crises has illuminated the need for reliable health systems and energy infrastructure for both long-term resilience and near-term support. While national lockdowns resulted in a short-term decline in the commercial and industrial energy load, India has been moving forward to realize its full renewable energy potential.<sup>70</sup> As India continues to recover from the COVID-19 crisis and rebuild after devastating climate disasters, there is an opportunity to continue to expand clean energy to help stimulate the economy, curb climate change, and improve air quality.<sup>71</sup> Policy decisions regarding tariffs, capacity expansion, asset retirement, and financial management made following COVID-19 will shape the direction of the energy market in India for years to come. The following policy actions would support clean energy expansion:

- **Air quality:** As cities are reopening, there is an opportunity to take actions such as mobility electrification and point-source pollution reduction, like from thermal plants, to ensure Indians can breathe clean air, have better health, and promote climate resilience in cities across the country.
- **Job opportunities:** Employment generation is a major priority as the economy recovers from the recession induced by COVID-19. Estimates suggest renewables can add 3 million new jobs in India by 2030.<sup>72</sup> Investing in skills needed for renewable energy jobs, upskilling and cross-skilling people employed in related traditional energy jobs is vitally important.
- **Renewable Energy Grid Integration:** The short-term decline in energy demand at the COVID-19 peak introduced opportunities for fossil fuel asset retirement and new tariff determinations, providing further opportunities for renewable energy sources to become a part of the grid mix.<sup>73</sup>
- **Equity and empowerment for the most vulnerable:** People who have suffered the most are often the poor living in India's many villages. This is an opportunity to build resilience and to invest in entrepreneurs, particularly women, who often act as catalysts for change and improve the livelihood of their families and communities as they grow, as demonstrated in several case studies.<sup>74</sup>



## Energy Access and the Power Sector

India prioritized household electricity access with the *Saubhagya Yojana* program, which provided ₹16,320 crore (US \$2.5 billion) for electrification expansion.<sup>75</sup> The program aimed to electrify every household by March 2018, and according to government estimates published in March 2019, India achieved nearly 100 percent household electrification with only a small portion of households in Chhattisgarh remaining.<sup>76</sup> While India has made tremendous progress in electrification, energy poverty remains.<sup>77</sup> An average Indian household receives 20.6 hours of power supply from the grid per day. The average daily supply in urban areas (22 hours) is longer by a couple of hours than in rural areas (20 hours). While there is a need to identify and electrify the remaining 2.4 percent households, we also need to review and consistently implement ultra-low tariffs for poor households with lifeline consumption. Sustaining electricity remains a challenge in villages with high reliance on diesel generators and solid fuels.<sup>78</sup>

In terms of agricultural electricity use, estimates suggest that expenses from the use of diesel for irrigation can amount to 30 to 50 percent of agriculture production costs.<sup>79</sup> India has 30 million irrigation pumps across the country – 70 percent electrical and 30 percent diesel.<sup>80</sup> To promote solar-based irrigation, India launched Pradhan Mantri Kisan Urja Suraksha evam Utthaan Mahabhiyan (PM-KUSUM) in 2019.<sup>81</sup> The scheme has three key objectives as stated in the February 2020 budget update – to establish 10 GW of ground-mounted grid-connected decentralized renewable energy plants by 2022, to install over 2 million standalone solar-powered agricultural pumps, and to install an additional 1.5 million grid-connected solar-powered agriculture pumps. To incorporate the learnings from the first year of implementation, MNRE expanded and amended the scope of the scheme in November 2020 to include installation of solar power plants on pastureland and marshy land in addition to barren, fallow and agricultural land, reduced the size of solar plants to enable participation of small farmers, allowed financial assistance for more beneficiaries for cluster-based irrigation systems and amended the tender and testing procedures.<sup>82</sup> The government has allocated ₹34,422 crore (around US \$5 billion) for the PM-KUSUM scheme. If the targets of the scheme are achieved, 30.8 GW of solar capacity can be added by 2022.<sup>83,i</sup> However, diverse regulatory, financial, operational, and technical challenges have affected the scheme's progress.<sup>84</sup> The scheme needs a renewed push to accelerate the installation of solar-powered pumps. This can be done by improving coordination between different state departments like agriculture, irrigation and power, providing

small and marginal farmers easy access to bank finance, and creating a level-playing field for distributed solar plants.<sup>85</sup>

In order to improve access to clean cooking energy in the country, the Government of India launched *Pradhan Mantri Ujjwala Yojana* (PMUY) in May 2016. Between 2016 and 2019, the government distributed more than 80 million liquified petroleum gas (LPG) connections under the PMUY at subsidized connection costs.<sup>86</sup> However, despite increased LPG access, 38 percent of Indian homes (mainly rural) stacked LPG with solid fuels, primarily due to high refill prices.<sup>87</sup> Under the FY 21-22 budget, provision for release of additional 10 million LPG connections under the second phase of the *Ujjwala* scheme has been made, with special focus on migrant families.<sup>88</sup> However, there is a need to provide targeted subsidies to poorer households to make LPG affordable. The government also needs to create an opportunity cost for biomass for those who procure and prepare biomass to meet their cooking energy needs.



Energy efficient appliances adopted by rural households in Gujarat as part of the green village plan implementation. Source: SEWA

Villages are a green economic opportunity. Empowering families living in India's villages with renewable energy and energy efficient appliances can help improve livelihoods, create jobs and enhance resilience to climate impacts. SEWA, NRDC and other partners are implementing green village plans in 10 villages in India. Led by women, green village plans bring together local communities, suppliers, financiers, and government officials to implement effective clean energy solutions for villages. If scaled up across India, green village plans have the potential to avoid 8,500 metric tons of CO<sub>2</sub> every year and act as an economic development model that is sustainable, rural-focused and gender-inclusive.<sup>89</sup>

PM KUSUM's initial targets were 1.75 million standalone pumps (component B) and 1 million grid-connected pumps (component C). This was increased in the February 2020 budget announcement to 2 million for component B and 1.5 million for component C.

## Energy Efficiency

With skyrocketing urbanization, the demand for buildings, appliances, and industry is rising. Buildings and industry already account for over 70 percent of India's annual energy usage.<sup>90</sup> With India's growing economy, advancing energy efficiency will be critical to saving energy, increasing energy access, and combating pollution.

### Buildings

Residential and commercial buildings in India account for nearly 30 percent of total electricity consumption, and this is expected to increase to 48 percent by 2042.<sup>91</sup> In 2017, the Bureau of Energy Efficiency (BEE) released an updated Energy Conservation Building Code (ECBC).<sup>92</sup> The ECBC sets minimum energy standards for commercial buildings and designates state agencies to certify and enforce ECBC by notifying the code. As of July 2021, 18 states and two Union Territories, including Andaman & Nicobar, Andhra Pradesh, Assam, Haryana, Karnataka, Kerala, Madhya Pradesh, Mizoram, Odisha, Puducherry, Punjab, Rajasthan, Telangana, Uttarakhand, Himachal Pradesh, Sikkim, Tripura, Uttar Pradesh, and West Bengal have notified ECBC. Five states have incorporated the ECBC into their by-laws: Andhra Pradesh, Haryana, Punjab, Telangana, and Uttar Pradesh. Four states—Andhra Pradesh, Karnataka, Telangana, and Uttar Pradesh—have taken additional steps to add transparent compliance processes and enforcement mechanisms.<sup>93</sup>

Over 225 commercial buildings have been certified under BEE's Star Rating Program.<sup>94</sup> India ranks third in the world for Leadership in Energy and Environmental Design (LEED) certification with more than 1,400 LEED-certified buildings, including schools, hospitals, offices, residential buildings, and more.<sup>95</sup> It has certified 3,369 LEED projects, totaling over 167 million gross square meters of certified space.<sup>96</sup> If states across India adopt energy-saving building codes and leading developers go beyond minimum code requirements for commercial buildings, an estimated 3,453 TeraWatt hours of electricity could be saved cumulatively by 2030, equivalent to powering 358 million Indian homes annually between 2014 and 2030.<sup>97</sup>

To further promote building energy efficiency, BEE announced a new initiative—the NEERMAN Awards in July 2021.<sup>98</sup> The awards will provide national-level recognition for exemplary building designs that comply with BEE's ECBC. BEE also released a revised and a complete version of residential building energy code—Eco Niwas Samhita 2021, which now includes all building systems in addition to the building envelope (from the earlier code).<sup>99</sup> This code

will help drive energy savings in India's residential buildings sector, also expected to grow rapidly in the coming decades.

### Green Appliances and Sustainable Cooling

India has made significant progress on energy-efficient appliances. Established in 2006, BEE's Standards and Labeling Program consists of both mandatory and voluntary schemes for 26 major appliances, including refrigerators, air conditioners, tube lights, color televisions, and electric geysers.<sup>100</sup> India has a specific program for addressing lighting and has successfully implemented one of the most extensive lightbulb replacement programs in the world. As of July 2021, the UJALA program distributed more than 367 million LED lights resulting in an annual emission reduction of 38.6 million tons of CO<sub>2</sub>e.<sup>101</sup> BEE claims that their STAR Labelling Program for room ACs saved up to 4.6 billion units of energy in FY 2017-2018 translating into 38 million tons of CO<sub>2</sub> emission reduction.<sup>102</sup> The UJALA program has been successful in transforming the lighting sector in India. Nearly two-thirds of the lighting stock in Indian homes now comprises LED bulbs and tube-lights.<sup>103</sup>

As of January 2020, India requires that all room air conditioners have a default temperature setpoint of 24°C (75.2°F), potentially resulting in significant energy savings.<sup>104</sup> BEE has also released an updated room air conditioner standard that requires an Indian Seasonal Energy Efficiency Ratio (ISEER) of 3.3-5.0 for split air conditioners and an ISEER of 2.7-3.5 for window air conditioners effective January 2022.<sup>105</sup>

India was one of the first countries to release a national plan on cooling—the India Cooling Action Plan (ICAP) in 2019. The ICAP is a comprehensive plan that prioritizes energy efficient, climate-friendly, and affordable cooling for all.<sup>106</sup> Working with civil society groups (including NRDC), the Government of India has now initiated the implementation of the plan and formed several thematic working groups to strategize implementation.

India's major inverter air conditioning market has been proactive in its efforts to reduce the high-global warming refrigerant HFCs that are used in air conditioning units while leapfrogging to the more climate-friendly R32 refrigerant. India's Energy Efficiency Services Limited (EESL) initiated a first of its kind Super-Efficient Air Conditioning Programme, under which consumers can buy the Super-Efficient Air Conditioners distributed by EESL at competitive prices. These super-efficient ACs provide 1.5 Tons of Refrigeration (TR) cooling capacity at high ambient temperature while also reducing the cost of cooling by 50 percent.<sup>107</sup> These ACs are more energy efficient than a 5-star labelled AC in the



market and use the low-global warming potential (GWP) refrigerant R-32.

Passive cooling techniques such as cool roofs, energy-efficient buildings, mobile air conditioning and cold-chain improvements are also part of the ICAP, which aims to reduce the demand for cooling.

In April 2021, with a view to expand sustainable cooling and enhance access to cooling, the National Disaster Management Authority (NDMA) working with partners NRDC and Indian Institute of Public Health-Gandhinagar (IIPH-G), released a “Heat Wave Season 2021: Cool Roofs Challenge.” 23 states and over 100 cities have developed Heat Action Plans (HAP) and several of them have included cool roofs targets as part of HAPs.<sup>108</sup>

## Industrial Energy Efficiency

The National Mission for Enhanced Energy Efficiency (NMEEE) aims to improve efficiency in industry and implement demand-side management programs. The main program, Perform Achieve Trade (PAT), establishes an energy trading program for high emitting industries – cement, aluminum, steel, iron, textiles, and paper and pulp. Under PAT Cycle I from 2012-2015, over 31 million tons of CO<sub>2</sub>e were avoided.<sup>109</sup> PAT Cycle II from 2016-2019, which included an expanded list of sectors, is believed to have avoided an additional 31 million tons of CO<sub>2</sub>e emissions. PAT Cycle III seeks to cover six energy-intensive sectors: thermal power plants, cement, aluminum, pulp and paper, iron and steel, and textile. Under PAT Cycle III energy consumption is projected to be lowered by 3 percent annually for regulated industries. PAT Cycle IV and V are notified and seek to expand the certified energy trading to more industry sectors.<sup>110</sup> India is a major industrial hub globally, and the decarbonization of industry will be critical for India to continue to chart a low-carbon future. India has taken steps to form international alliances to help curb emissions in hard-to-abate sectors such as steel and cement.<sup>111</sup>

## Transportation Sector

Even though walking remains the top mode of mobility in India, the transportation sector still accounts for upwards of 16 percent of total CO<sub>2</sub>e emissions and over 33 percent of particulate matter (PM) pollution.<sup>112</sup> In 2020, India was the fifth-largest global auto market, with approximately 3.49 million units sold in the passenger and commercial vehicles categories combined. COVID-19 has presented India's automotive sector with unprecedented challenges, as well as a liquidity crunch, higher acquisition costs, and weaker customer demand, which have all contributed substantially



Electric taxis getting charged in Delhi. Source: BluSmart

to the downturn the industry has been grappling with since the third quarter of fiscal year 2018.<sup>113</sup>

Despite the recent slowdown, domestic automobile production increased at a 2.36 percent compound annual growth rate (CAGR) between FY16-20. 26.36 million vehicles were manufactured in the country in FY20. Overall, domestic automobiles sales increased at 1.29 percent CAGR between FY16-FY20 with 21.55 million vehicles sold in FY20.<sup>114</sup>

## Vehicle Emissions Standards

India adopted the Bharat Stage VI (BS VI) vehicular and fuel emission standards as a part of its Auto Fuel Policy. Effective April 2020, India now has ultra-low sulfur fuel (10 parts per million or ppm) in use across the country. The BS VI emission norms for 2-wheelers are also among the most stringent in the world. The BS VI emissions standards will result in up to 40 percent reduction in particulate matter emissions and 43 percent reduction in NO<sub>x</sub> compared to BS IV emission standards.<sup>115</sup> Real Driving Emission testing will be implemented in 2023 to prevent the use of cheating devices and to regulate vehicle emissions. Additionally, India introduced a first phase of Corporate Average Fuel Efficiency (CAFE) standards in April 2017, aimed at increasing the efficiency of internal combustion engine vehicles, with a target to bring about an 18 percent improvement in fuel consumption of passenger vehicles by 2022, compared to 2012.<sup>116</sup> Recently the Government of India made its intention clear by rejecting automakers' plea to extend the deadline for CAFE norms tightening past 2022, citing that the industry

is meeting stringent anti-pollution standards in countries to which they are exporting vehicles, hence the same standards must be adhered to in India as well.<sup>117</sup>

In Phase I (2017-2022), CAFE norms require average corporate fleet CO<sub>2</sub> emissions to be less than 130 g/km by 2022. In Phase II (2022 onwards), these limits would be reduced to less than 113 g/km and could be further tightened to 108 or 104 g/km.<sup>118</sup>

## Electric Vehicles

India's electric vehicle journey started in 2013, with the Government putting out the National Electric Mobility Mission Plan 2020 with the aim to subsidize the cost and facilitate the sale of 6 to 7 million hybrid and electric vehicles by 2020.<sup>119</sup> With 236,802 electric vehicles (EV) sold during the financial year 2020-2021 (1.3 percent of total vehicles sold during this period), India ramped up its investment in electric mobility with FAME-II, which provides ₹10,000 crore (US \$1.4 billion) for demand incentives and charging infrastructure subsidies across market types including electric public buses, commercial vehicles, three-wheelers, and privately owned two-wheelers.<sup>120</sup> In 2021, the Government of India extended FAME-II until 2024 and also increased the demand incentives for electric two wheelers from 10,000 per kWh to 15,000 per kWh.<sup>121</sup>

However, for vehicles to be eligible for demand incentives under the FAME-II scheme, vehicle original equipment manufacturers need to meet the localization criteria as specified under the Phased Manufacturing Program. Specifically, the scheme requires half of the vehicle parts to be locally sourced in India.<sup>122</sup> To strengthen battery storage, the National Mission on Transformative Mobility and Battery Storage is designed to support battery and EV component manufacturing in India.<sup>123</sup> To promote the Make in India initiative, the Government of India also approved the Production Linked Incentive (PLI) scheme for manufacturing advanced chemistry cell battery with an estimated outlay of 18,100 crore (US \$16 billion).<sup>124</sup> The proposal aims to achieve manufacturing of 50 GW of battery storage, which is critical to India's renewable energy and EV mission. To raise India's stature as a manufacturing hub, the Government is planning to extend the PLI schemes under the Global Champion plan to 10 other key sectors, including automotive, with budgetary support of US \$26 billion.<sup>125</sup>

The Ministry of Power further amended the charging infrastructure guidelines, making them technology agnostic and encouraging both private and public sector entities to set up charging/swapping stations.<sup>126</sup> In early 2020, the Indian government approved the establishment of 2,636 publicly funded charging stations in 62 cities across 24

states and union territories.<sup>127</sup> The government also intends to set up charging stations at approximately 69,000 fuel pumps across India.<sup>128</sup> State and municipalities have also begun to lead the way on electric vehicle incentives and policies. Starting with the notification of the Karnataka Electric Vehicle and Energy Storage Policy in 2017, a total of 15 Indian states (Karnataka, Delhi, Kerala, Maharashtra, Uttarakhand, Tamil Nadu, Andhra Pradesh, Madhya Pradesh, Uttar Pradesh, Telangana, West Bengal, Bihar, Chandigarh, Punjab, Haryana, Gujarat, Assam and Himachal Pradesh) have notified or have draft EV policies as of July 2021.<sup>129</sup>

## Public Transit

India has a rail network of over 68,155 km, including a 660 km network of metro rail, which have proven to be an efficient means of transportation considering energy consumption, space occupancy, and numbers transported.<sup>130</sup> This railway network is the fourth largest in the world and is second in terms of rail passenger volume.<sup>131</sup> India is working to electrify its rail network, and in July 2020, Indian Railways announced that it would target net-zero carbon emissions by 2030.<sup>132</sup> Currently, 12 Indian cities have metro rail networks – Ahmedabad, Bengaluru, Chennai, Delhi, Gurgaon, Hyderabad, Jaipur, Kochi, Kolkata, Lucknow, Mumbai, and Nagpur. Public buses and private buses are also a growing form of transportation, and in 2017 there were 1.7 million privately owned and 1.5 million public buses.<sup>133</sup> Moreover, the central government has allocated ₹35.45 billion (US \$486 million) in incentives to support the adoption of 7,090 e-buses and to date, 5,595 e-buses have been sanctioned to 64 cities and State Transport Undertakings.<sup>134</sup> Major Indian states and cities, including Gujarat, Maharashtra, New Delhi, Telangana, Uttar Pradesh, Rajasthan, and Kerala, also have their own programs for the expansion of electric bus fleets.<sup>135</sup>

## Mobilizing Green Investment

While India has received more than US \$42 billion in green investment since 2014, US \$500 billion in investment is needed to achieve India's target of 450 GW of clean energy by 2030 target.<sup>136</sup> This includes investment in transmission and storage to support grid integration besides investments in RE generation. Investments needed in RE generation alone are approximately US \$200 billion.<sup>137</sup> In the near term, India needs over US \$35 billion in investments for renewable energy infrastructure (not including transmission lines) to meet its 175 GW by 2022 target.<sup>138</sup>

India is working to provide funding for clean energy through government programs, private investments, and international climate finance. However, public funds by

themselves will not produce the capital required; catalytic finance is needed to help expand the clean energy market. Catalytic finance leverages limited public funds to bring in greater private investment. Catalytic financial mechanisms and institutional facilities such as “green windows” can be effective in transforming the India clean energy market. India has two dedicated clean energy finance institutions, the Indian Renewable Energy Development Agency (IREDA) and Tata Cleantech Capital Limited (TCCL). IREDA is planning to pilot the first green window in India to develop and implement catalytic finance solutions.<sup>139</sup> India’s support for the green window could attract more concessional funding and open up the Indian clean energy market to new classes of international investors. TCCL is the world’s first private sector Green Bank. It is a member of the global Green Bank Network and the first private sector entity to partner GCF to mainstream rooftop solar financing in India.<sup>140</sup>

Green bonds are another beneficial investment instrument. IREDA and National Thermal Power Corporation (NTPC) have used masala bonds to increase the number of green bonds in the market. From 2014-2021, Indian developers raised over ₹78,200 crore (US \$11 billion) through green bonds issued in international markets.<sup>141</sup> According to a recent study by the Council on Energy, Environment and Water, that trajectory seems to be on an upswing. In the first half of 2021, a record-breaking US \$3.6 billion was raised—more than even previous 12-month periods. Apart from IREDA and NTPC, Greenko, ReNew Power, Azure Power, TCCL and Adani Green Energy have been integral to issuing green bonds.<sup>142</sup> Greenko and ReNew Power have accounted for nearly 70 percent of all issuances by value.<sup>143</sup>

Most power distribution companies (DISCOMs) have weak financial health. The DISCOMs debt has risen to ₹1.3 lakh crore (US \$18 billion).<sup>144</sup> Market reports suggest that debt could increase to ₹4.5 lakh crore (US \$66 billion) in FY 2021.<sup>145</sup> As a part of the economic stimulus measures, the national government has extended a ₹90,000 crore (US \$13 billion) liquidity line to DISCOMs. The loan will help DISCOMs pay outstanding dues owed to power generation companies through March 2020. Power Finance Corporation and Rural Electrification Corporation (both public sector institutions) have co-financed the loan.<sup>146</sup>

In the wake of the COVID-19 economic slowdown, capital investments will prioritize economic development and job creation. The economic recovery is an opportunity to increase public investment in clean energy. Historically low oil prices represent an opportunity to reduce fossil fuel subsidies, free up public capital and redefine future energy consumption trends.<sup>147</sup>

To help India meet its clean energy finance needs, the OECD’s Clean Energy Finance and Investment Mobilisation team and NRDC are jointly developing a roadmap for Clean Energy Finance Investment in India to put forward solutions for these clean energy segments that require investment support over the next five years.<sup>148</sup> The Roadmap will bring government and private sector stakeholders together to agree upon a clear action plan that identifies and addresses bottlenecks constraining financial institutions and investments, outline opportunities to tailor market and policy interventions to unlock further private finance, and focus on specific solutions for clean energy segments that require investment support.

## The Impacts of Climate Change on India

Recent assessments, including the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment report and the Ministry of Earth Sciences’ Assessment of Climate Change over the Indian Region, have provided dire new warnings about the impacts of climate change on the Indian subcontinent.<sup>149</sup> Sea levels are disproportionately increasing, average temperatures have risen, monsoon extremes are likely to increase, and the already extreme heat and rainfall events will occur with greater frequency, resulting in more flooding and droughts. The reports call for a greater emphasis on meeting growing energy needs with clean and renewable energy, as well as bold adaptation and mitigation responses, recommending increased monitoring, research, and investment in partnerships that promote community resilience.<sup>150</sup>

- According to the IPCC, the sea level around Asia has increased faster than the global average. Coastal area loss and shoreline retreats are already in progress and the regional mean sea level is expected to continue rising in the years to come.<sup>151</sup> Already, there was a high level of confidence that the rate of global mean sea level will rise by 26 centimeters by 2050, which would exacerbate the destructive potential of storm surges from cyclone storms.<sup>152</sup>
- India’s average temperature has increased by 0.43°C from 1986 to 2018, which is projected to increase the total duration of heatwaves to 40 days by the end of the twenty-first century under a business-as-usual high emission scenario.<sup>153</sup>
- The new IPCC report indicates that both annual and summer monsoon precipitation will increase during the 21st century, with a higher degree of year-to-year variation in monsoon precipitation. According to climate models, precipitation will increase over much of Asia, threatening increased flooding, including in cities such as Mumbai, Chennai, and Kolkata.<sup>154</sup>
- The rise in mean surface temperature over India increases the frequency and intensity of warm days and warm nights, which can trigger temperature-related illness and fatalities.<sup>155</sup>
- The Himalayan and Tibetan plateau have experienced substantial warming, which is significant as this region has the most extensive ice cover outside of the poles, and snowmelt accounts for a large portion of India’s freshwater supply.<sup>156</sup>



## Strengthening Resilience to Extreme Heat and Air Pollution

### Extreme Heat

The National Heat Guidelines developed by the NDMA, Indian Metrological Department and partners expand heat action plans to states and cities in India. The city of Ahmedabad implemented South Asia's first-ever heat action plan in 2013, providing an early warning and preparedness system to increase residents' resilience to extreme heat events. Since then, more than 23 states and over 100 cities in India have followed suit.<sup>157</sup>

Climate solutions, such as cool roofs, are critical for protecting communities from extreme heat, as included in heat action plans and the ICAP.<sup>158</sup> Cool roofs are shown to yield a 2-5°C (3-5°F) reduction in indoor air temperature; the cities of Ahmedabad and Hyderabad are developing city-wide cool roofs program pilots.<sup>159</sup> India also implemented the National Adaptation Fund for Climate Change, which was established in 2015 to help states become more resilient to the adverse effects of climate change. States can submit project proposals to the NAFCC program and will then receive subsequent program funding.<sup>160</sup>

NDMA, along with some sub-national disaster management authorities and local governments, have initiated the inclusion of medium- and long-term adaptive measures for building community level resilience to extreme heat. This includes incorporation of better thermal efficiency principles in model building codes, as well as the integration of other ongoing government projects, such as state action plans on climate change and smart city programs.

### Air Quality

India's National Clean Air Program (NCAP), released in 2019, aims to reduce particulate matter by 20 to 30 percent by 2024, compared to 2017 levels.<sup>161</sup> Under the program, 124 cities have prepared city-level action plans by the Central Pollution Control Board to meet the specified NCAP targets. The city-specific plans are primarily standalone measures without an airshed component, and the NCAP provides limited budgetary allocation.<sup>162</sup> Several cities, such as Ahmedabad, Pune, and New Delhi, have developed city clean air plans, including a focus air quality index and health risk communications. In addition, several states are expanding the New Delhi's Graded Response Action Plan to respond to air pollution emergencies, including odd and even license plate programs, shutting down thermal power plants, limiting construction and industrial activities, and other measures.<sup>163</sup> The NCAP is the first of its kind national level policy formulated to address air quality in Indian cities. It is a significant intervention to address air quality; however, state-level implementation and budgetary allocation are needed to achieve NCAP goals.

The Fifteenth Finance Commission report for 2020-2021 recommends a new grant program for ambient air quality improvements. The grant program targets cities with 1 million or more residents and Urban Agglomerations (UAs). The Finance Commission recommends ₹4,440 crore (US \$604 million) per grant used for air quality improvement measures, monitoring, and local body capacity building. In a subsequent Finance Commission Report for 2021-26 released in February 2021, this grant program has been deepened and renewed, with the total allocation of ₹12,139 crore (US \$1.65 billion) over a period of 5 years.<sup>164</sup> To date,



Brick kilns contributing to air pollution in National Capital Region. Source: NRDC



42 cities have received the grant, and these funds have been linked to the improvement of air quality indicators in the UAs, with better performing cities receiving greater funding.

Another major development is the establishment of an all-powerful California Air Resources Board-styled Air Quality Commission. Called the CAQM, it has major implications for setting a template for regional airshed level air quality management, and can potentially be replicated in other air quality hotspots across the country.<sup>165</sup>

The COVID-19 lockdown and decline in mobile and industrial activity had a temporary but dramatic effect on air quality in India. An official report by the Central Pollution Control Board found a striking 50 percent drop in fine particulate matter (PM<sub>2.5</sub>) and PM<sub>10</sub> levels in Delhi.<sup>166</sup> From April to May 2020, PM<sub>2.5</sub>, PM<sub>10</sub>, NO<sub>2</sub> (nitrous oxide), and CO dropped across India's metropolitan cities while ozone increased in some areas. The largest decline occurred in Ahmedabad (68 percent), Delhi (71 percent), Bangalore (87 percent), and Nagpur (63 percent) for PM<sub>2.5</sub>, PM<sub>10</sub>, NO<sub>2</sub>, and CO, respectively.<sup>167</sup>

## Global Engagement

Stepping up climate cooperation, India and France launched the International Solar Alliance (ISA) during COP21 in 2015. The ISA aims to mobilize more than \$100 billion by 2030 to promote solar power globally. As of July 2021, 89 countries have signed the framework agreement, and of those, 79 have also ratified.<sup>168</sup> The International Solar Alliance recently launched a plan “One Solar, One World, and One Grid” that aims to support greater renewables penetration through interconnected grid systems.

The Kigali Amendment to the Montreal Protocol, the global pact to phase down super-climate-pollutants called HFCs, is moving towards implementation. As of August 2021, 123 countries, including China, have ratified the agreement; with the United States' moving towards ratification, and India's recent announcement of intent to ratify, all major economies are now on board. India was central to the formation of the Kigali Amendment, and has for decades played a key role in bringing about the success of the Montreal Protocol, arguably the most successful international environmental treaty to date. The government's recent commitment through ratification is a strong signal of support and will also boost the Indian industry in transitioning away from HFC usage.<sup>169</sup>

To support the construction of climate-resilient infrastructure, India launched the international Coalition for Disaster Resilient Infrastructure at the September 2019 Climate Action Summit in New York.<sup>170</sup> India also co-created the Leadership Group for Industry Transition, a cooperative to promote innovation and technology exchange. The initiative will target steel, cement, and aviation to reach net-zero emissions from heavy industry by mid-century.<sup>171</sup> In March 2020, this collaborative was extended to support energy research and innovation, and India and Sweden established a co-funding mechanism to support the research and development of smart grid technologies.<sup>172</sup>

At the UNFCCC COP in November 2021, all countries are expected to submit progressively stronger NDCs and work to intensify efforts on finance and adaptation. Since the last COP in 2019, the United States has rejoined the Paris Agreement on President Biden's first day in office, providing a renewed vigor to the discussions. In April 2020, the United States submitted an enhanced NDC to reduce greenhouse gas emissions 50-52 percent by 2030 from 2005 levels – nearly double the Obama-era target, setting the stage for other large economies to follow suit. China has committed to carbon neutrality by 2060, and peak carbon emissions by 2030.<sup>173</sup> As one of the three major economies, India remains a critical international stakeholder when it comes to increasing ambition and charting a low carbon future.

India's commitments under the Paris Agreement are robust and achievable. Prime Minister Modi has announced even higher ambitions at the United Nations Climate Change Conference in Glasgow. This sets the right tone for other countries to raise their ambitions as well. Meeting India's and the world's climate goals would need a significantly large investment and wealthier countries need to step up their climate finance contributions. India has been an engaged stakeholder to the Paris Agreement, and India's commitment to be energy independent further signals that India is rising up to meet the climate challenge. Given the urgent need for all countries in the world to do more to combat the climate crisis, the time is right for India to accelerate its transition away from fossil fuels and ensure a green and sustainable future for all.

## ENDNOTES

1. Government of India, "India's Intended Nationally Determined Contribution: Working Towards Climate Justice", UNFCCC.int, 2015, Pg.29 <https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/India%20First/INDIA%20INDC%20TO%20UNFCCC.pdf> (August 14, 2020) ; Jocelyn Timperley, The Carbon Brief Profile: India, 14 March 2019, <https://www.carbonbrief.org/the-carbon-brief-profile-india> (August 16, 2020).
2. Central Electricity Authority, "All India Installed Power Capacity (in MW) of Power Stations (as on 30.09.2021)," [https://cea.nic.in/wp-content/uploads/installed/2021/09/installed\\_capacity.pdf](https://cea.nic.in/wp-content/uploads/installed/2021/09/installed_capacity.pdf) ; IEA, "India 2020 Energy Policy Review," [https://niti.gov.in/sites/default/files/2020-01/IEA-India%202020-In-depth-EnergyPolicy\\_0.pdf](https://niti.gov.in/sites/default/files/2020-01/IEA-India%202020-In-depth-EnergyPolicy_0.pdf) (August 28, 2020).
3. PIB Delhi, "India achieves 100 GW Milestone of Installed Renewable Energy Capacity", August 12, 2021, <https://pib.gov.in/PressReleaseDetail.aspx?PRID=1745254>; Livemint, "India's Installed Renewable Energy Capacity crosses 100 GW," August 12, 2021, <https://www.livemint.com/industry/energy/indias-installed-renewable-energy-capacity-crosses-100-gw-11628781563745.html>.
4. "Climate Action Tracker (as on September 22, 2020)," <https://climateactiontracker.org/countries/india/>; The Economic Times, "India Signals it is ready to do more to slow down climate change," August 26, 2020, <https://economictimes.indiatimes.com/news/politics-and-nation/india-says-it-will-do-more-to-slow-down-climate-change/articleshow/70813231.cms>. PM Narendra Modi surprises climate summit with 2070 net-zero vow for India," LiveMint, November 1, 2021, <https://www.livemint.com/news/pm-narendra-modi-surprises-climate-summit-with-2070-net-zero-vow-for-india-11635810434461.html> (November 1, 2021).
5. "PM Narendra Modi surprises climate summit with 2070 net-zero vow for India," LiveMint, November 1, 2021, <https://www.livemint.com/news/pm-narendra-modi-surprises-climate-summit-with-2070-net-zero-vow-for-india-11635810434461.html> (November 1, 2021); Somini Sengupta, "Narendra Modi says India will sharply increase renewable energy," NY Times, November 1, 2021, <https://www.nytimes.com/2021/11/01/world/asia/modi-india-cop26-renewable-energy.html> (November 1, 2021).
6. Sudarshan Varadhan, "India's coal-fired power output falls 1.5%, renewables jumps in Sept," Reuters, September 16, 2021, <https://www.reuters.com/world/india/indias-coal-fired-power-output-falls-15-renewables-jumps-sept-2021-09-16/> (November 1, 2021); Central Electricity Authority, "All India Installed Power Capacity (in MW) of Power Stations (as on 31.07.2021)," [https://cea.nic.in/wp-content/uploads/installed/2021/07/installed\\_capacity.pdf](https://cea.nic.in/wp-content/uploads/installed/2021/07/installed_capacity.pdf)(accessed August, 2021).
7. "Climate Action Tracker (as on September 15, 2021)," <https://climateactiontracker.org/countries/india/>.
8. Government of India, "India's Intended Nationally Determined Contribution: Working Towards Climate Justice", UNFCCC.int, 2015, Pg.29 <https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/India%20First/INDIA%20INDC%20TO%20UNFCCC.pdf> (August 14, 2021).
9. Global Energy Review 2021," April 2021, <https://www.iea.org/reports/global-energy-review-2021>; N. Jayashree, "India's CO2 emissions fell by 1% in 2019-20 financial year," Hindustan Times, May 13, 2020, <https://www.hindustantimes.com/india-news/india-s-co2-emissions-fell-by-1-in-2019-20-financial-year/story-kJ2Jus35sKtskGKz2yhXO.html> (August 28, 2020). Carbon Brief, "Analysis: India's CO2 emissions fall for first time in four Decades," May 2020, <https://www.carbonbrief.org/analysis-indias-co2-emissions-fall-for-first-time-in-four-decades-amid-coronavirus>.
10. Global Energy Review 2021," April 2021, <https://www.iea.org/reports/global-energy-review-2021>.
11. World Bank, "GDP Growth Annual Percent – India," <https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG?end=2010&locations=IN&start=2010&view=bar> (August 19, 2020) ; S. Yasir and J. Gettleman, "India's Economy Shrank Nearly 24% Last Quarter," New York Times, August 21, 2020, <https://www.nytimes.com/2020/08/31/world/asia/india-economy-gdp.html>.
12. International Monetary Fund, "World Economic Outlook: Fault Lines Widen in the Global Recovery," July 2021, <https://www.imf.org/en/Publications/WEO/Issues/2021/07/27/world-economic-outlook-update-july-2021>.
13. Central Electricity Authority, "All India Installed Power Capacity (in MW) of Power Stations (as on 31.07.2021)," [https://cea.nic.in/wp-content/uploads/installed/2021/07/installed\\_capacity.pdf](https://cea.nic.in/wp-content/uploads/installed/2021/07/installed_capacity.pdf) (accessed August, 2021); "India Has One Of The Fastest Rates Of Growth Of Renewable Energy Capacity In The World: Union Power Minister," Business Standard, July 16, 2021, [https://www.business-standard.com/article/news-cm/india-has-one-of-the-fastest-rates-of-growth-of-renewable-energy-capacity-in-the-world-union-power-minister-121071600225\\_1.html#:~:text=The%20Morning%20Show,-India%20Has%20One%20of%20The%20Fastest%20Rates%20of%20Growth%20of,The%20World%3A%20Union%20Power%20Minister&text=The%20Minister%20said%20that%20India,Renewable%20Energy%20capacity%20by%202030.](https://www.business-standard.com/article/news-cm/india-has-one-of-the-fastest-rates-of-growth-of-renewable-energy-capacity-in-the-world-union-power-minister-121071600225_1.html#:~:text=The%20Morning%20Show,-India%20Has%20One%20of%20The%20Fastest%20Rates%20of%20Growth%20of,The%20World%3A%20Union%20Power%20Minister&text=The%20Minister%20said%20that%20India,Renewable%20Energy%20capacity%20by%202030.;); PIB Delhi, "India achieves 100 GW Milestone of Installed Renewable Energy Capacity" August 12, 2021 <https://pib.gov.in/PressReleaseDetail.aspx?PRID=1745254>.
14. Central Electricity Authority, "All India Installed Power Capacity (in MW) of Power Stations (as on 31.07.2021)," [https://cea.nic.in/wp-content/uploads/installed/2021/07/installed\\_capacity.pdf](https://cea.nic.in/wp-content/uploads/installed/2021/07/installed_capacity.pdf) (accessed August 2021).
15. Global Energy Review 2021," April 2021, <https://www.iea.org/reports/global-energy-review-2021>.
16. Ministry of Environment, Forest and Climate Change, "Total Forest and Tree Cover rises to 24.56 percent of the total geographical area of the Country," December 2019, <https://pib.gov.in/PressReleaseDetail.aspx?PRID=1597987#:~:text=ISFR%202019%20is%20the%2016th,-forest%20cover%20is%20consistently%20increasing.&text=km%20followed%20by%20Andhra%20Pradesh,.%E2%80%9D%2C%20said%20the%20Minister> (August 28, 2020).
17. Ministry of New and Renewable Energy, "India achieves 100 GW Milestone of Installed Renewable Energy Capacity," Press Release, August 12, 2021. <https://pib.gov.in/PressReleaseDetail.aspx?PRID=1745254>; Livemint, "India's Installed Renewable Energy Capacity crosses 100 GW" August 12, 2021, <https://www.livemint.com/industry/energy/indias-installed-renewable-energy-capacity-crosses-100-gw-11628781563745.html>; Central Electricity Authority, "All India Installed Power Capacity (in MW) of Power Stations (as on 31.07.2021)," [https://cea.nic.in/wp-content/uploads/installed/2021/07/installed\\_capacity.pdf](https://cea.nic.in/wp-content/uploads/installed/2021/07/installed_capacity.pdf) (accessed August 2021).
18. Ministry of Petroleum and Natural Gas, "India is looking towards kick-starting the hydrogen ecosystem development, says Shri Dharmendra Pradhan," April 2021, <https://pib.gov.in/PressReleasePage.aspx?PRID=1712018>.
19. J. Scully, "Solar tariffs in India hit record low after Gujarat's 500MW auction," PV Tech, December 2020, <https://www.pv-tech.org/solar-tariffs-in-india-hit-record-low-after-gujarats-500mw-auction/> (accessed on July 20, 2021).
20. J. Gulia, and V. Garb, "IEEFA: India's new record-low solar power tariff demonstrates investor confidence despite the pandemic," IEEFA, December 2020, <https://ieefa.org/ieefa-indias-new-record-low-solar-power-tariff-demonstrates-investor-confidence-despite-the-pandemic/> (Accessed July 15, 2021).
21. Renew Power Limited, "ReNew Power Signs India's First Round-The-Clock Renewable Energy PPA," August 2021, <https://www.prnewswire.com/news-releases/renew-power-signs-indias-first-round-the-clock-renewable-energy-ppa-301350330.html> (accessed august 2021); S. Sai-Roche, "ReNew Power signs PPA for 'India's first' round-the-clock renewable energy project," <https://www.pv-tech.org/renew-power-signs-ppa-for-indias-first-round-the-clock-renewable-energy-project/>.
22. Ministry of Heavy Vehicles Industries and Public Enterprises, Government of India, "Publication of notification in Gazette of India (Extraordinary) regarding Phase-II of FAME India Scheme," 2019, <https://dhi.nic.in/writer-addata/UploadFile/publicationNotificationFAME%20II%20March2019.pdf> (August 10, 2020).

23. Ministry of Power, "BEE's Neerman Awards Could Be A Game Changer For Indian Energy Efficient Buildings," August 27, 2021, <https://www.beepindia.org/bees-neerman-awards-could-be-a-game-changer-for-indian-energy-efficient-buildings/>.
24. A. Sinha, "India decides to ratify Kigali Amendment to Montreal Protocol," The Indian Express, August 19, 2021, <https://indianexpress.com/article/india/india-decides-to-ratify-kigali-amendment-to-montreal-protocol-7460521/>; S. Kwatra, A. Hilbrand and P. Madam, "India to Ratify the Kigali Amendment, Develop HFC Strategy," NRDC, August 18, 2021, <https://www.nrdc.org/experts/sameer-kwatra/india-ratify-kigali-amendment-develop-hfc-strategy>.
25. Ministry of Housing & Urban Affairs, "Long-Term, Time-Bound, National Level Strategy to Tackle Air Pollution-National Clean Air Programme (NCAP) To Achieve 20% to 30% Reduction in Particulate Matter Concentrations by 2024," September 16, 2020, <https://pib.gov.in/PressReleasePage.aspx?PRID=1655203>.
26. Government of India, Ministry of Power, "No. 23/23/2020-R&R," July 5, 2021, [https://powermin.gov.in/sites/default/files/webform/notices/Enabling\\_the\\_Discoms\\_to\\_either\\_continue\\_or\\_exit\\_from\\_the\\_PPA\\_after\\_completion.pdf](https://powermin.gov.in/sites/default/files/webform/notices/Enabling_the_Discoms_to_either_continue_or_exit_from_the_PPA_after_completion.pdf).
27. IPCC, 2021: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Masson-Delmotte, V., P. Zhai, A. Pirani, S. L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M. I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J. B. R. Matthews, T. K. Maycock, T. Waterfield, O. Yelekçi, R. Yu and B. Zhou (eds.)]. Cambridge University Press. In Press. <https://www.ipcc.ch/report/ar6/wg1/>; R. Krishnan, et al, Assessment of Climate Change over the Indian Region: A Report of the Ministry of Earth Sciences (MoES), Government of India, (Singapore: Springer, 2020).
28. A. Mishra, N. Mohanbabu, K. Anujan, "Draft EIA 2020 undercuts India's biodiversity and climate goals," September 3 2020, <https://www.downtoearth.org.in/blog/environment/draft-eia-2020-undercuts-india-s-biodiversity-and-climate-goals-73201>.
29. Ministry of Environment, Forest and Climate Change, "Notification of Draft Environment Impact Assessment," [http://environmentclearance.nic.in/writereaddata/Draft\\_EIA\\_2020.pdf](http://environmentclearance.nic.in/writereaddata/Draft_EIA_2020.pdf) (August 20, 2020).
30. Ministry of New & Renewable Energy, "Draft Policy Framework for developing and promoting Decentralized Renewable Energy (DRE) Livelihood Applications – for comments and stakeholders," March 8, 2021, [https://mnre.gov.in/img/documents/uploads/file\\_f1615276189186.pdf](https://mnre.gov.in/img/documents/uploads/file_f1615276189186.pdf).
31. UNFCC, "The Paris Agreement," <https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement> (August 28, 2020).
32. Government of India, India's Intended Nationally Determined Contribution: Working Towards Climate Justice, UNFCCC.int, 2015, Pg.29 <https://www4.unfccc.int/sites/submissions/INDC/Published%20Documents/India/1/INDIA%20INDC%20TO%20UNFCCC.pdf> (August 14, 2020).
33. Climate Action Tracker, "Country Summary – India," December 2019, <https://climateactiontracker.org/countries/india/> (August 06, 2020).
34. Climate Action Tracker, "Global Update: Climate target updates slow as science demands action," September 2021, <https://climateactiontracker.org/publications/global-update-september-2021/> (September 17, 2021).
35. P. Ghosh, "National Action Plan on Climate Change," Prime Minister's Council on Climate Change, October 2009, [http://moef.gov.in/wp-content/uploads/2018/07/CC\\_ghosh.pdf](http://moef.gov.in/wp-content/uploads/2018/07/CC_ghosh.pdf).
36. Ministry of Science and Technology, "Climate Change Programme," <https://dst.gov.in/climate-change-programme>; S. Anwar, "National Action Plan on Climate Change (NAPCC)," May 2018 <https://www.jagranjosh.com/general-knowledge/national-action-plan-on-climate-change-1441620255-1> (August 20, 2020).
37. Ministry of New and Renewable Energy, "Renewable Energy Sector Made rapid Strides in 2019," <https://pib.gov.in/PressReleaseDetail.aspx?PRID=1598948> (August 28, 2020).
38. IEA, "India 2020 Energy Policy Review," [https://niti.gov.in/sites/default/files/2020-01/IEA-India%202020-In-depth-EnergyPolicy\\_0.pdf](https://niti.gov.in/sites/default/files/2020-01/IEA-India%202020-In-depth-EnergyPolicy_0.pdf) (August 28, 2020); Central Electricity Authority, "All India Installed Power Capacity (in MW) of Power Stations (as on 31.03.2020)," [http://www.cea.nic.in/reports/monthly/installedcapacity/2020/installed\\_capacity-03.pdf](http://www.cea.nic.in/reports/monthly/installedcapacity/2020/installed_capacity-03.pdf) (August 08, 2020).
39. PIB Delhi, "India achieves 100 GW Milestone of Installed Renewable Energy Capacity," August 12, 2021, <https://pib.gov.in/PressReleaseDetail.aspx?PRID=1745254>; Livemint, "India's Installed Renewable Energy Capacity crosses 100 GW," August 12, 2021, <https://www.livemint.com/industry/energy/indias-installed-renewable-energy-capacity-crosses-100-gw-11628781563745.html>.
40. N. Jhalani, "India looks likely to miss the 2022 renewable energy targets," June 3, 2021, <https://india.mongabay.com/2021/06/india-looks-likely-to-miss-the-2022-renewable-energy-targets/>.
41. U. Gupta, "Indian Railways tenders hydrogen fuel cell technology for trains," August 9, 2021. <https://www.pv-magazine-india.com/2021/08/09/indian-railways-tenders-hydrogen-fuel-cell-technology-for-trains/>.
42. W. Hall, T. Spencer, G. Renjith, S. Dayal, "The Potential Role of Hydrogen in India," TERI, 2020, <https://www.teriin.org/sites/default/files/2020-12/Report%20on%20The%20Potential%20Role%20of%20Hydrogen%20in%20India%20%E2%80%93%2027Harnessing%20the%20Hype%27.pdf>.
43. Ministry of Power Central Electricity Authority, "Report on Optimal Generation Capacity Mix for 2029-30," January 2020, [https://cea.nic.in/old/reports/others/planning/irp/Optimal\\_mix\\_report\\_2029-30\\_FINAL.pdf](https://cea.nic.in/old/reports/others/planning/irp/Optimal_mix_report_2029-30_FINAL.pdf).
44. India Environment Portal, State Wise Estimated Solar Power Potential in the Country, 2014, <http://www.indiaenvironmentportal.org.in/content/403483/state-wise-estimated-solar-power-potential-in-the-country/>; CleanTechnica, India's Solar Power Potential Estimated at 750 GW, 2014, <https://cleantechnica.com/2014/11/29/indias-solar-power-potential-estimated-750-gw/> (August 14, 2020); Ministry of New and Renewable Energy, "Solar Energy Overview," <https://mnre.gov.in/solar/current-status/#:~:text=National%20Institute%20of%20Solar%20Energy,one%20of%20the%20key%20Missions> (August 14, 2020).
45. Bloomberg New Energy Finance, Emerging Markets Outlook 2019, November 2020, <https://globalclimatescope.org/assets/data/reports/climate-scope-2019-report-en.pdf> (August 14, 2020).
46. R. Gadre et al, India's Clean Power Revolution: A Success story with global implications, Bloomberg NEF, June 26, 2020, [https://data.bloomberglp.com/professional/sites/24/2020-06-26-Indias-Clean-Power-Revolution\\_Final.pdf](https://data.bloomberglp.com/professional/sites/24/2020-06-26-Indias-Clean-Power-Revolution_Final.pdf).
47. CEA, "All India Installed Capacity (In MW) Of Power Stations," 2021, [https://cea.nic.in/wp-content/uploads/installed/2021/04/installed\\_capacity.pdf](https://cea.nic.in/wp-content/uploads/installed/2021/04/installed_capacity.pdf) (July 2021).
48. IEA, "India Energy Outlook 2021," IEA, February 2021, <https://www.iea.org/reports/india-energy-outlook-2021>.
49. "India set to achieve 450 GW renewable energy installed capacity by 2030: MNRE," October 12, 2021, <https://www.indiatoday.in/india/story/india-450-gw-renewable-energy-installed-capacity-2030-mnre-1863724-2021-10-12>; P. Sanjay, "COVID-19 Disrupts India's Solar Growth, Installations Decline to 1.1 GW in Q1 2020," Mercom, May 2020, <https://mercomindia.com/covid-19-disrupts-india-solar-installations-q1-2020/> (August 22, 2020).
50. M. Aggarwal and K. Panday, "Policy flip-flop over solar contracts could eclipse India's sunshine sector," June 11, 2021, <https://india.mongabay.com/2021/06/flip-flop-in-policy-can-derail-indias-long-term-renewable-journey/>; T. Spencer, et al., "Execution challenges may limit renewable energy growth at 8GW in 2020: Icra," Live Mint, July 29, 2020, <https://www.livemint.com/industry/energy/execution-challenges-may-limit-renewable-energy-growth-at-8gw-this-year-icra-11596023739242.html> (accessed on August 21, 2020).
51. J. Scully, "Solar tariffs in India hit record low after Gujarat's 500MW auction," PV Tech, December 2020, <https://www.pv-tech.org/solar-tariffs-in-india-hit-record-low-after-gujarats-500mw-auction/> (accessed on July 20, 2020).



52. J Gulia, and V Garb, "IEEFA: India's new record-low solar power tariff demonstrates investor confidence despite the pandemic," IEEFA, December 2020, <https://ieefa.org/ieefa-indias-new-record-low-solar-power-tariff-demonstrates-investor-confidence-despite-the-pandemic/> (Accessed July 15, 2020).
53. S. Singh, "Adani Power, Essar Power place lowest tariffs in years," The Economic Times, February 2020, <https://economictimes.indiatimes.com/industry/energy/power/adani-power-essar-power-place-lowest-coal-based-tariffs-in-years/articleshow/74009321.cms?from=mdr> (August 28, 2020).
54. IEEFA, "Developers and Global Investors Snap Up India's Solar Power Tenders Decoding Tariffs vs. Returns for Solar Projects in India," May 2020, [https://ieefa.org/wp-content/uploads/2020/05/Developers\\_Investors-Snap-Up-Indias-Solar-Power-Tenders\\_22-May-2020-2.pdf](https://ieefa.org/wp-content/uploads/2020/05/Developers_Investors-Snap-Up-Indias-Solar-Power-Tenders_22-May-2020-2.pdf) (August 28, 2020).
55. U. Gupta, "Solar tariffs could rise about 20% due to customs duty," March 2021, <https://www.pv-magazine-india.com/2021/03/16/solar-tariffs-could-rise-about-20-due-to-customs-duty/>.
56. Renew Power Limited, "ReNew Power Signs India's First Round-The-Clock Renewable Energy PPA," August 2021, <https://www.prnewswire.com/news-releases/renew-power-signs-indias-first-round-the-clock-renewable-energy-ppa-301350330.html>; S. Sai-Roche, "ReNew Power signs PPA for 'India's first' round-the-clock renewable energy project," <https://www.pv-tech.org/renew-power-signs-ppa-for-indias-first-round-the-clock-renewable-energy-project/>.
57. Renew Power Limited, "ReNew Power Signs India's First Round-The-Clock Renewable Energy PPA," August 2021, <https://www.prnewswire.com/news-releases/renew-power-signs-indias-first-round-the-clock-renewable-energy-ppa-301350330.html>; S. Sai-Roche, "ReNew Power signs PPA for 'India's first' round-the-clock renewable energy project," <https://www.pv-tech.org/renew-power-signs-ppa-for-indias-first-round-the-clock-renewable-energy-project/>.
58. Central Electricity Authority, "All India Installed Power Capacity (in MW) of Power Stations (as on 31.07.2021)," [https://cea.nic.in/wp-content/uploads/installed/2021/07/installed\\_capacity.pdf](https://cea.nic.in/wp-content/uploads/installed/2021/07/installed_capacity.pdf) (accessed August 2021); EV Wind, "India has emerged the fourth-largest wind power producer in the world," <https://www.ewind.es/2016/12/19/india-has-emerged-the-fourth-largest-wind-power-producer-in-the-world/58322> (August 14, 2020).
59. Central Electricity Authority, "Break up of RES all India as on 30.04.2021," [https://cea.nic.in/wp-content/uploads/installed/2021/04/installed\\_capacity.pdf](https://cea.nic.in/wp-content/uploads/installed/2021/04/installed_capacity.pdf) (August 4, 2021); Central Electricity Authority, "All India Installed Power Capacity (in MW) of Power Stations (as on 31.07.2021)," [https://cea.nic.in/wp-content/uploads/installed/2021/07/installed\\_capacity.pdf](https://cea.nic.in/wp-content/uploads/installed/2021/07/installed_capacity.pdf) (August 2021), All India Installed Power Capacity (in MW) of Power Stations (as on 31.07.2015)," [http://www.cea.nic.in/reports/monthly/executivesummary/2015/exe\\_summary-07.pdf](http://www.cea.nic.in/reports/monthly/executivesummary/2015/exe_summary-07.pdf) (August 14, 2020).
60. R. Nair, "India to Add 20.2 GW of Wind Capacity Between 2021-2025, Wind Market to Grow by 50%," June 18, 2021, <https://mercomindia.com/india-to-add-20-2-gw-wind/>.
61. Ibid.
62. Institute for Energy Economics and Financial Analysis, "India's Renewable Energy Policy Headwinds," February 2020, [https://ieefa.org/wp-content/uploads/2020/02/Indias-Renewable-Energy-Policy-Headwinds\\_February-2020.pdf](https://ieefa.org/wp-content/uploads/2020/02/Indias-Renewable-Energy-Policy-Headwinds_February-2020.pdf) (August 29, 2020); M. Aggarwal "India's struggling wind power sector needs fresh air to regain growth," August 5 2021, <https://india.mongabay.com/2021/08/indias-struggling-wind-power-sector-needs-fresh-air-to-regain-growth/>; J. Ambrose, "Britain's last coal power stations to be paid huge sums to keep lights on," September 2021, <https://www.theguardian.com/business/2021/sep/13/britain-last-coal-power-stations-to-be-paid-huge-sums-to-keep-lights-on-record-energy-prices>.
63. J. Lee and F. Zhao, "Global Wind Report 2021," GWEC, March 2021, <https://gwec.net/wp-content/uploads/2021/03/GWEC-Global-Wind-Report-2021.pdf>; A. Lee, "India to miss 2022 offshore wind target, says top official," November 2019, <https://www.rechargenews.com/wind/india-to-miss-2022-offshore-wind-target-says-top-official/> (August 20, 2020).
64. T.A Phadke, "Reassessing Wind Potential Estimates for India: Economic and Policy Implications," Lawrence Berkeley National Laboratory, [https://ies.lbl.gov/sites/all/files/lbnl-5077e\\_1.1.pdf](https://ies.lbl.gov/sites/all/files/lbnl-5077e_1.1.pdf) (August 20, 2020).
65. NRDC, CEEW, and SCGJ, Powering Jobs Growth With Green Energy, 2019, <https://www.nrdc.org/sites/default/files/jobs-growth-green-energy.pdf> (August 28, 2020).
66. Business Standard, "India to have 60% renewable energy by 2030: Power minister R K Singh," July 2020, [https://www.business-standard.com/article/current-affairs/india-to-have-60-renewable-energy-by-2030-power-minister-r-k-singh-120072101815\\_1.html](https://www.business-standard.com/article/current-affairs/india-to-have-60-renewable-energy-by-2030-power-minister-r-k-singh-120072101815_1.html) (August 5, 2021).
67. Discussion with Skills Council for Green Jobs on August 4, 2021.
68. Ibid.
69. SCGJ, NSDC, Skills India, "Green Jobs Newsletter Issue 15," July 2021, <https://sscgi.in/wp-content/uploads/2021/07/SCGJNewsletterIssue15.pdf> (August 5, 2021).
70. World Bank, "India's Solar Learning Curve Inspires Action Across the World," July 2021, <https://www.worldbank.org/en/news/feature/2021/07/09/india-s-solar-learning-curve-inspires-action-across-the-world>.
71. T. Spencer, et al., Bending The Curve: 2025 Forecasts for Electricity Demand by sector and state in the light of the COVID-19 epidemic, TERI, July 2020, [https://www.teriin.org/sites/default/files/2020-07/Bending-the-Curve\\_Report.pdf](https://www.teriin.org/sites/default/files/2020-07/Bending-the-Curve_Report.pdf).
72. B. Tripathi "India's shift to green economy could add 3 million jobs by 2030: Report" July 12, 2018, [https://www.business-standard.com/article/economy-policy/india-s-shift-to-green-economy-could-add-3-million-jobs-by-2030-report-118071200103\\_1.html](https://www.business-standard.com/article/economy-policy/india-s-shift-to-green-economy-could-add-3-million-jobs-by-2030-report-118071200103_1.html).
73. T. Spencer, et al., Bending The Curve: Renewable Power Pathways: Modelling the Integration of Wind and Solar by 2030, TERI, July 2020. Ibid.
74. NRDC, "It Take a Village: Advancing Hariyali Clean Energy Solutions in Rural India," January 2021, <https://www.nrdc.org/sites/default/files/takes-a-village-clean-energy-solutions-202101.pdf>.
75. U. Bhaskar, "26.02 million households get electricity connections under Saubhagya scheme," March 31 2019, <https://www.livemint.com/politics/policy/26-02-million-households-get-electricity-connections-under-saubhagya-scheme-1554018490695.html>.
76. S. Agrawal, S. Mani, A. Jain, and K. Ganesan, State of Electricity Access in India: Insights from the India Residential Energy consumption Survey (IRES), 2020, New Delhi: Council on Energy, Environment and Water, <https://www.ceew.in/publications/state-electricity-access-india>; Government of India, "PM Launches Pradhan Mantri Saubhagya Yojana; Dedicates Deendayal Urja Bhavan to the Nation," [http://www.pmindia.gov.in/en/news\\_updates/pm-launches-pradhan-mantri-saubhagya-yojana-dedicates-deendayal-urja-bhawan-to-the-nation/](http://www.pmindia.gov.in/en/news_updates/pm-launches-pradhan-mantri-saubhagya-yojana-dedicates-deendayal-urja-bhawan-to-the-nation/) (August 25, 2020); Ministry of Power and Rural Energy Cooperation, "About Saubhagya: Pradhan Mantri Sahaj Bijli Har Ghar Yojana – Saubhagya," <http://saubhagya.gov.in> (August 24, 2020).; Rural Electrification Corporation and MoP, Saubhagya Dashboard, <http://saubhagya.gov.in> (October 24, 2019).
77. S. Agrawal, S. Mani, A. Jain, and K. Ganesan. State of Electricity Access in India: Insights from the India Residential Energy consumption Survey (IRES) 2020, New Delhi: Council on Energy, Environment and Water. <https://www.ceew.in/publications/state-electricity-access-india>.
78. Ibid.
79. Nikhil Goveas, "Exploring the Potential, Scope and Demand for Micro Solar Water Pumps in India: A Case Study of Vaishali, Bihar," March 2019, New Delhi: Koan-GIZ, <https://www.koanadvisory.com/wp-content/uploads/2019/06/Micro-SWP-Koan-Advisory-Final-Report.pdf>
80. IEEFA, "Vast potential in India for solar-powered irrigation," August 2018, <https://ieefa.org/wp-content/uploads/2018/08/Indias-Vast-Potential-in-Solar-Powered-Irrigation-.pdf> (August 28, 2020).
81. Cabinet Committee on Economic Affairs, Press Information Bureau, "Cabinet approves launch Kisan Urja Suraksha evam Utthaan Mahabhi-



- yan," February 2019, <http://pib.nic.in/PressReleaseFramePage.aspx?PRID=1565274> (August 19, 2020); NRDC, SEWA, "It Takes a Village: Advancing Hariyali Clean Energy Solutions in Rural India," January 2021, <https://www.nrdc.org/sites/default/files/takes-a-village-clean-energy-solutions-202101.pdf> (August 4, 2021).
82. PIB India, Ministry of New and Renewable Energy, "MNRE expands scope of PM-KUSUM Scheme to enable greater solar energy generation in farm sector," November 2020, <https://pib.gov.in/PressReleaseFramePage.aspx?PRID=1672580> (August 4, 2021).
  83. Uma Gupta, PV Magazine, "Upscaling solar-powered irrigation in India," June 2021, <https://www.pv-magazine-india.com/2021/06/11/upscaling-solar-powered-irrigation-in-india/> (August 4, 2021); Prasanna Singh, Saur Energy International, "With New Target Of 30.8 GW by 2022, Changes In KUSUM Scheme Follow," November 2020, <https://www.sauenergy.com/solar-energy-news/with-new-target-of-30-8-gw-by-2022-changes-in-kusum-scheme-follow> (August 4, 2021); Sudheer Singh, "Budget 2020: Major Focus on PM KUSUM Scheme to Help Farmers Generate Income from Solar Power," Economic Times, 01 February 2020, <https://energy.economictimes.indiatimes.com/news/renewable/budget-2020-major-focus-on-pm-kusum-scheme-to-help-farmers-generate-income-from-solar-power/73832492> (May 26, 2020).
  84. Council on Energy, Environment and Water, "Unleashing the Potential of PM-KUSUM," Aug 26 2021, <https://www.ceew.in/events/unleashing-potential-pm-kusum>.
  85. K. Shah, Institute for Energy Economics and Financial Analysis, "Powering up solar irrigation effort will support India's renewable energy targets," June 2021, <https://ieefa.org/ieefa-powering-up-solar-irrigation-effort-will-support-indias-renewable-energy-targets/> (August 4, 2021); A. Rahman, Shalu Agrawal, and Abhishek Jain. "Powering Agriculture in India: Strategies to Boost Components A & C Under PM-KUSUM Scheme." New Delhi: Council on Energy, Environment and Water. August 2021. <https://www.ceew.in/publications/powering-irrigation-system-with-solar-powered-plants-and-grid-pumps-in-india>.
  86. Ministry of Petroleum and Natural Gas, "Pradhan Mantri Ujjwala Yojana," <https://www.pmuy.gov.in/> (August 5, 2021).
  87. S. Mani, Shalu Agrawal, Abhishek Jain and Karthik Ganesan. "State of Clean Cooking Energy Access in India: Insights from the India Residential Energy Survey (IRES) 2020." New Delhi: "Council on Energy, Environment and Water" September 2021. <https://www.ceew.in/publications/state-of-clean-cooking-energy-access-in-india-ires-2020-report>.
  88. Ministry of Petroleum and Natural Gas, "Pradhan Mantri Ujjwala Yojana," <https://www.pmuy.gov.in/> (August 5, 2021).
  89. "It Takes A Village," NRDC and SEWA, January 2021, <https://www.nrdc.org/sites/default/files/takes-a-village-clean-energy-solutions-202101.pdf>.
  90. National Statistical Office Statistics and Programme Implementation Government of India, "Energy Statistics 2020," [www.mospi.gov.in/sites/default/files/publication\\_reports/ES\\_2020\\_240420m.pdf](http://www.mospi.gov.in/sites/default/files/publication_reports/ES_2020_240420m.pdf) (August 20, 2020).
  91. NITI Aayog, "India Energy Security Scenarios 2047," <http://iess2047.gov.in/%20pathways//electricity> (August 20, 2020).
  92. Ministry of Power, "Energy Efficiency," <https://powermin.nic.in/en/content/energy-efficiency> (August 20, 2020).
  93. ANGAN: Augmenting Nature by Green Affordable New-habitat, A Courtyard for Revolutionary Change in Building Energy Efficiency, An International Conference & Exhibition on Building Energy Efficiency Presentation, September 2019.
  94. Bureau of Energy Efficiency, "ECBC Commercial," <https://beeindia.gov.in/content/ecbc-commercial> (August 26, 2020).
  95. S. Trierweiler, "Annual Top 10 States for LEED In India announced by GBCI India," <https://gbc.org/annual-top-10-states-leed-india-announced-gbc-india> (August 26, 2020).
  96. GBCI, 2020 Global Town Hall Series: India, July 2020, <https://www.gbc.org/sites/default/files/India-Town-Hall-Report.pdf>.
  97. ASCI and NRDC, Building Efficient Cities: Strengthening the Indian Real Estate Market Through Codes and Incentives, 2017, <http://www.nrdc.org/international/india/files/real-estate-efficiency-codes-IB.pdf> (August 20, 2020).
  98. Ministry of Power, "National Energy Efficiency Roadmap for Movement towards Affordable and Natural habitat," <https://bee-neerman.com/index.html#register>.
  99. Bureau of Energy Efficiency, "Eco Niwas Samhita 2021," July 2021 <https://beeindia.gov.in/sites/default/files/ENS%202021.pdf>.
  100. BEE Bureau of Energy Efficiency, Mandatory Scheme, <https://www.bees-tarlabel.com/Home/EquipmentSchemes?type=M> (August 20, 2020).
  101. Ministry of Power, "National Ujala Dashboard," <http://www.ujala.gov.in/> (August 13, 2020).
  102. Ministry of Power, "BEE notifies new energy performance standards for air conditioners," November 5 2019, <https://beeindia.gov.in/sites/default/files/Press%20release-%20Amendment%20in%20Energy%20Conservation%20Act%202001.pdf>.
  103. S. Agrawal, Sunil Mani, Dhruvak Aggarwal, Abhishek Jain, Chetna Hareesh Kumar and Karthik Ganesan. October 2020. "Awareness and Adoption of Energy Efficiency in Indian Homes: Insights from the India Residential Energy consumption Survey (IRES) 2020." New Delhi: Council on Energy, Environment and Water. <https://www.ceew.in/publications/awareness-and-adoption-energy-efficiency-indian-homes>.
  104. Ministry of Power, "BEE Notifies New Energy Performance Standards for Air Conditioners," <https://pib.gov.in/PressReleasePage.aspx?PRID=1598508> (August 13, 2020).
  105. Ibid.
  106. K. Shanmuganathan, et al., "Analyzing the barriers to promote energy-efficient air conditioners in India," August 04, 2020, [teriin.org/policy-brief/analysing-barriers-promote-energy-efficient-air-conditioners-india](http://teriin.org/policy-brief/analysing-barriers-promote-energy-efficient-air-conditioners-india) (August 13, 2020).
  107. Ministry of Power, "National Energy Efficiency Roadmap for Movement towards Affordable and Natural habitat," <https://eesindia.org/en/super-efficient-ac/>.
  108. NRDC Expanding Heat Resilience across India: Highlights from Heat Action Plans," May 2021, [https://www.nrdc.org/sites/default/files/expanding-heat-resilience-india-fs-20210514\\_0.pdf](https://www.nrdc.org/sites/default/files/expanding-heat-resilience-india-fs-20210514_0.pdf).
  109. The Ministry of Power, "PAT-Read more," <https://beeindia.gov.in/content/pat-read-more> (August 20, 2020).
  110. Ibid.
  111. W. Hall, "Decarbonization of India industry: Transitioning to a cleaner economy," October 2019, <https://www.teriin.org/policy-brief/decarbonisation-indian-industry-transitioning-cleaner-economy>.
  112. A Soman, H Kaur and K Ganesan, "How Urban India Moves: Sustainable Mobility and Citizen Preferences," July 2019, [https://www.ceew.in/sites/default/files/CEEW%20-%20How%20Urban%20India%20Moves%20Report%20PDF%2022Oct19\\_compressed.pdf](https://www.ceew.in/sites/default/files/CEEW%20-%20How%20Urban%20India%20Moves%20Report%20PDF%2022Oct19_compressed.pdf); Asian Development Bank, "Reducing Carbon Emissions from Transport Projects," July 2020, <https://www.oecd.org/derec/adb/47170274.pdf>; The Hindu, "India walks to work: Census," <https://www.thehindu.com/data/india-walks-to-work-census/article7874521.ece#:~:text=For%20commutes%20up%20to%2010,taking%20buses%20> (August 20, 2020).
  113. Mckinsey Center for Future Mobility, "The unexpected trip: The future of mobility in India beyond COVID-19," July 2020, <https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/the-unexpected-trip-the-future-of-mobility-in-india-beyond-covid-19>.
  114. India Brand Equity Foundation, "Automobile Industry in India," August 2021, <https://www.ibef.org/industry/india-automobiles.aspx>; Society of Indian Automobile Manufacturers, Automobile Domestic Sale Trends, <http://www.siamindia.com/statistics.aspx?mpgid=8&pgidtrail=14> (August 25, 2020); ET Auto, "India Auto Industry Status Report," <https://auto.economictimes.indiatimes.com/e/report2020#:~:text=In%202018%2C%20the%20Indian%20automobile,in%20the%20country%20has%20doubled> (August 18, 2020).

115. S. Sharma, "Fleet Modernization: solution to achieve better air quality," Teriin, [https://www.teriin.org/sites/default/files/2019-12/Policy\\_India\\_Light-Duty Emission,-Brief.pdf](https://www.teriin.org/sites/default/files/2019-12/Policy_India_Light-Duty Emission,-Brief.pdf) (August 20, 2020).
116. Government of India, Ministry of Heavy Industries & Public Enterprises, "National Auto Policy (Draft)" February 2018. [https://dhi.nic.in/writereaddata/UploadFile/DHI-NAB-Auto%20Policy%20Draft%20Document\\_vDRAFT.pdf](https://dhi.nic.in/writereaddata/UploadFile/DHI-NAB-Auto%20Policy%20Draft%20Document_vDRAFT.pdf).
117. Autocar Pro News Desk, "Nitin Gadkari discusses postponing CAFE Phase 2 norms with SIAM delegation," 02 Mar 2021, <https://www.autocarpro.in/news-national/nitin-gadkari-discusses-postponing-cafe-phase-2-norms-with-siam-delegation-78634>; ICCT, "Fuel consumption standards for heavy-duty vehicles in India," 2017, <https://theicct.org/publications/fuel-consumption-201712#:~:text=Indian%20HDVs%20greater%20than%202012,effective%20beginning%20April%201%2C> (August 30, 2020).
118. A. Ahmed and A. Shah, "India will not extend 2022 deadline for tighter fuel efficiency rules: Report," March 26, 2021, <https://www.livemint.com/companies/news/india-will-not-extend-2022-deadline-for-tighter-fuel-efficiency-rules-report-11616771219210.html>; "Nitin Gadkari discusses postponing CAFE Phase 2 norms with SIAM delegation," March 2, 2021, <https://www.autocarpro.in/news-national/nitin-gadkari-discusses-postponing-cafe-phase-2-norms-with-siam-delegation-78634>.
119. Government of India, Ministry of Heavy Industries & Public Enterprises, "National Electric Mobility Mission Plan 2020" <https://dhi.nic.in/writereaddata/content/nemmp2020.pdf>.
120. B. Singh "EVs Covers 1.3% of Vehicle Sales in India in FY 20-21," May 5, 2021, [https://www.saurenergy.com/ev-storage/evs-covers-1-3-percent-of-vehicle-sales-in-india-in-fy-20-21#:~:text=According%20to%20the%20numbers%20given,of%20the%20total%20EV%20sales.](https://www.saurenergy.com/ev-storage/evs-covers-1-3-percent-of-vehicle-sales-in-india-in-fy-20-21#:~:text=According%20to%20the%20numbers%20given,of%20the%20total%20EV%20sales.;); National Mission on Transformative Mobility and Storage, "Mobility Solutions get a boost," March 2019, <https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1567807> (August 20, 2020).
121. Livemint, "Govt extends Fame scheme till 2024," June 26, 2021, <https://www.livemint.com/news/india/govt-extends-fame-scheme-to-promote-electric-mobility-till-2024-11624688932461.html>.
122. Ministry of Heavy Industries and Public Enterprise, "Publication of notification in Gazette of India (Extraordinary) regarding Phase-II of FAME India Scheme," 2019, <https://dhi.nic.in/writereaddata/UploadFile/publication-NotificationFAME%20II%20March2019.pdf> (August 25, 2020); NRDC, Scaling Up Electric Charing Vehicle Infrastructure, July 2020, <https://www.nrdc.org/sites/default/files/charging-infrastructure-best-parctices-202007.pdf> (August 25, 2020).
123. India Government, "National Mission On Tranformative Mobility and Battery Storage Approved by Cabinet," <https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1567807>.
124. PTI Agency, "Govt approves Rs 18,100 cr PLI scheme for promoting ACC battery manufacturing," May 12, 2021, <https://auto.economicstimes.indiatimes.com/news/policy/govt-approves-rs-18100-cr-pli-scheme-for-promoting-acc-battery-manufacturing/82575976>.
125. N. Khan, "ET Auto Exclusive: PLI scheme draft offers benefit to big auto manufacturers only; here is why," July 2, 2021, <https://auto.economicstimes.indiatimes.com/news/industry/etauto-exclusive-pli-scheme-draft-offers-benefit-to-big-auto-manufacturers-only-here-is-why/79751658>.
126. Government of India, Ministry of Power, "Amendment in Revised Guidelines," June 2020, [https://powermin.gov.in/sites/default/files/uploads/Amendment\\_in\\_Revised\\_Guidelines.pdf](https://powermin.gov.in/sites/default/files/uploads/Amendment_in_Revised_Guidelines.pdf).
127. NRDC, Scaling Up Electric Charing Vehicle Infrastructure, July 2020, <https://www.nrdc.org/sites/default/files/charging-infrastructure-best-parctices-202007.pdf> (August 25, 2020).
128. PTI, Govt plans to set up charging infrastructure across 69,000 petrol pumps" November 2020, <https://www.thehindu.com/news/national/govt-plans-to-set-up-charging-infrastructure-across-69000-petrol-pumps/article33162526.ece>.
129. AEEE, "Dissecting India's Electricity Tariff Landscape for EV," <https://www.aeee.in/wp-content/uploads/2020/01/thought-leadership.pdf> (August 20, 2020); India Smart Grid Forum, "Electric Vehicle Policies and Electricity Tariff for EV Charging in India," July 2019, [http://www.indiasmartgrid.org/reports/ISGF-Study-Report-EVCharging-India\\_July2019.pdf](http://www.indiasmartgrid.org/reports/ISGF-Study-Report-EVCharging-India_July2019.pdf), (August 20, 2020).
130. M. Reddy, "ArcStory Maps: Indian Metro," March 4, 2020, <https://storymaps.arcgis.com/stories/4ba848e1cad54d9c95d4661802ae13a8> (August 25, 2020).); Indian Railways, "Directorate," [https://www.indian-railways.gov.in/railwayboard/uploads/directorate/stat\\_econ/Year\\_Book/Year%20Book%202018-19-English.pdf](https://www.indian-railways.gov.in/railwayboard/uploads/directorate/stat_econ/Year_Book/Year%20Book%202018-19-English.pdf) (August 25, 2020).
131. Carbon Brief, "The Carbon Brief Profile: India," March 2019, <https://www.carbonbrief.org/the-carbon-brief-profile-india> (August 25, 2020).
132. UN Environment Programme, "It's full steam ahead to green India's railway network," September 03, 2020, <https://www.unenvironment.org/news-and-stories/story/its-full-steam-ahead-green-indias-railway-network> (September 8, 2020).
133. Statista, "Number of private sector buses across India from financial year 2001-2017," <https://www.statista.com/statistics/667417/busccces-owned-in-the-private-sector-india/#:~:text=Private%20sector%20buses%20in%20India%20FY%202001-2017&text=In%20fiscal%20year%202017%2C%20around,the%20private%20sector%20across%20India.> (August 25, 2020); Statista, "Number of private sector buses across India from financial year 2001-2017," <https://www.statista.com/statistics/667417/busccces-owned-in-the-private-sector-india/#:~:text=Private%20sector%20buses%20in%20India%20FY%2020012017&text=In%20fiscal%20year%202017%2C%20around,the%20private%20sector%20across%20India.> (August 25, 2020); Association of State Road Transport Undertakings, "ASRTU Vender Development Registration Scheme," <https://www.asrtu.org/about-asrtu/> (September 10, 2020).
134. R. Laemel, "Preparing India for 5,500 Electric Buses," RMI, January 25, 2021, <https://rmi.org/preparing-india-for-5500-electric-buses/>.
135. UITP "FAME II Allocated 5595 Electric Buses for 64 Cities- a Thirst for Public transport," <https://india.uitp.org/fame-ii-allocates-5595-electric-buses-64-cities-thrust-public-transport>".
136. T. Buckley, S. Trivedi, "Capital Flows Underpinning India's Energy Transformation Global: Capital Is Primed and Ready," February 2021, [http://ieefa.org/wp-content/uploads/2021/02/Capital-Flows-Underpinning-Indias-Energy-Transformation\\_February-2021.pdf](http://ieefa.org/wp-content/uploads/2021/02/Capital-Flows-Underpinning-Indias-Energy-Transformation_February-2021.pdf); Ministry of Finance, "Enabling Inclusive Growth Through Affordable, Reliable, and Sustainable Energy," Economic Survey 2018-19, Ch. 9, [https://www.indiabudget.gov.in/economicsurvey/doc/vol1chapter/echap09\\_vol1.pdf](https://www.indiabudget.gov.in/economicsurvey/doc/vol1chapter/echap09_vol1.pdf) (August 20, 2020).
137. V. Singh, A. Dutt, and G. Sidhu. "RE-Financing India's Energy Transition Limited Period Subsidised Credit Enhancement for Domestic RE Bond Issuances." New Delhi: Council on Energy, Environment and Water. July 2020, <https://cef.ceew.in/solutions-factory/publications/re-financing-india-energy-transition.pdf>.
138. M. Aggarwal, "India's renewable energy industry is up against financial challenges," August 6, 2021, <https://india.mongabay.com/2021/08/indias-renewable-energy-industry-is-up-against-financial-challenges/>.
139. NRDC, IREDA, CEEW, "IREDA: Pioneering a Catalytic Green Window in India," <https://www.orfonline.org/research/moving-from-growth-to-development-financing-green-investment-in-india-49420/> (August 25, 2020).
140. A. Bercarra Cid, P Bodnar, T Grbusic, D. Sims, etc. "State of Green Banks 2020," Natural Resources Defense Council, 2020, <https://www.nrdc.org/sites/default/files/state-green-banks-2020-report.pdf>.
141. S. Garg, R. Jain, G. Sidhu, "Financing India's Energy Transition Through International Bond Markets," CEEW- CEF, August 2021, <https://cef.ceew.in/solutions-factory/publications/financing-india-energy-transition-through-international-bond-markets>.
142. N. Kumar, et al., "Moving from Growth to Development: Financing Green Investment in India," ORF Special Report No. 85, April 2019, Observer Research Foundation, <https://www.orfonline.org/research/moving-from-growth-to-development-financing-green-investment-in-india-49420/> (August 25, 2020).

143. S. Garg, R. Jain, G. Sidhu, "Financing India's Energy Transition Through International Bond Markets," CEEW- CEF, August 2021, <https://cef.ceew.in/solutions-factory/publications/financing-india-energy-transition-through-international-bond-markets>.
144. PRAAPTI, "Ease of Making Payments By Discom," July 2020, [https://praapti.in/\(August, 20, 2020\)](https://praapti.in/(August, 20, 2020)).
145. CRISIL, "Discom Debt to Hit All-Time High of Rs 4.5 Lakh Crore This Fiscal," June 2020, <https://www.crisil.com/en/home/newsroom/press-releases/2020/06/discom-debt-to-hit-all-time-high-of-rs-4point5-lakh-crore-this-fiscal.html> (August 26, 2020).
146. C. Kumar, "Loans Worth Rs. 68,000 Crore Sanctioned Under Discoms Stimulus Package," Business Today, August 9, 2020, <https://www.businesstoday.in/sectors/energy/rs-68000-crore-loan-sanctioned-under-discoms-stimulus-package/story/412470.html> (August 26, 2020).
147. IEA, "Low fuel prices provide a historic opportunity to phase out fossil fuel consumption subsidies," June 2020, <https://www.iea.org/articles/low-fuel-prices-provide-a-historic-opportunity-to-phase-out-fossil-fuel-consumption-subsidies>; IISD, Global Subsidies Initiative, CEEW, "Mapping India's Energy Subsidies 2020: Fossil fuels, renewables and electric vehicles, April 2020, <https://www.iisd.org/sites/default/files/publications/india-energy-transition-2020.pdf> (August 29, 2020).
148. OECD, "Clean Energy Finance and Investment Mobilisation: India," <https://www.oecd.org/cefim/india/>.
149. IPCC, 2021: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change, <https://www.ipcc.ch/report/ar6/wg1/>; R. Krishnan, et al, Assessment of Climate Change over the Indian Region: A Report of the Ministry of Earth Sciences (MoES), Government of India, (Singapore: Springer, 2020).
150. Ibid.
151. IPCC, 2021: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press. In Press. <https://www.ipcc.ch/report/ar6/wg1/>;
152. R. Krishnan, et al., Assessment of Climate Change over the Indian Region: A Report of the Ministry of Earth Sciences (MOES), Government of India, (Singapore: Springer, 2020) Ibid.).
153. Ibid.
154. IPCC, Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change, 2021, <https://www.ipcc.ch/report/ar6/wg1/>; R. Krishnan, et al., Assessment of Climate Change over the Indian Region: A Report of the Ministry of Earth Sciences (MOES), Government of India, (Singapore: Springer, 2020) Ibid.).
155. Ibid.
156. Ibid.
157. NRDC, "Expanding Heat Resilience Across India: Heat action Plan Highlights," May 2020, <https://www.nrdc.org/sites/default/files/india-heat-resilient-cities-ib.pdf> (August 25, 2020).
158. NRDC, ASCI, IIPHG, and Mahila Housing SEWA Trust, Cool Roofs – Protecting Local Communities and Saving energy, 2018, [https://www.nrdc.org/sites/default/files/ib\\_-\\_cool\\_roofs\\_-\\_hyd\\_workshop.pdf](https://www.nrdc.org/sites/default/files/ib_-_cool_roofs_-_hyd_workshop.pdf) (August 19, 2020).
159. NRDC, Keeping it cool: Cool Roofs Programs Protect People, Save Energy and Fight Climate change, July, 2019, <https://www.nrdc.org/sites/default/files/keeping-it-cool-roofs-india-fs.pdf> (August, 20, 2020).
160. R. Prasad, "Implementing climate change adaptation: lessons from India's national adaptation fund on climate change." August 2018, <https://www.tandfonline.com/doi/abs/10.1080/14693062.2018.1515061?journalCode=tcpo20>.
161. Ministry of Environment, Forests and Climate Change, "Government Launches National Clean Air Programme (NCAP)," Press Information Bureau, January 10, 2019, <https://pib.gov.in/newsite/PrintRelease.aspx?relid=187400> (August 19, 2020).
162. NCAP Tracker, "National Clean Air Program," [https://ncap.carboncopy.info/\(August 25, 2020\)](https://ncap.carboncopy.info/(August 25, 2020)).
163. IAS Parliament, "Graded Response Act – New Delhi," October 2019, [s://www.iasparliament.com/current-affairs/graded-response-action-plan-delhi](https://www.iasparliament.com/current-affairs/graded-response-action-plan-delhi) (August 25, 2020).
164. Finance Commission of India, "15th FC Report for 2021-26," <https://fincomindia.nic.in/ShowContent.aspx?uid1=3&uid2=0&uid3=0&uid4=0&uid5=0&uid6=0&uid7=0>.
165. E. Roy, "Explained: What the commission for air quality management in NCR aims to achieve and why are some opposing it?" August 8, 2021. <https://indianexpress.com/article/explained/delhi-air-quality-commission-explained-7444052/>.
166. CPCB, "Continuous Stations Dashboard," <https://app.cpcbcr.com/ccr/#/caaqm-dashboard-all/caaqm-landing> (August 25, 2020); S. Mahato, et al, Effect of lockdown amid COVID-19 pandemic on air quality of the megacity Delhi, India, Science of the Total Environment volume 740, August 2020.
167. Central Control room for Air Quality Management, "Continuous Stations Status," <https://aaqr.org/articles/aaqr-20-05-covid-0256> (August 25, 2020); The Hindu, "Lockdown cuts PM2.5, PM10 levels by half in Delhi: CPCB," <https://www.thehindu.com/news/cities/Delhi/lockdown-cuts-pm25-pm10-levels-by-half-in-delhi-cpcb/article31415389.ece>.
168. International Solar Alliance, "Working towards making solar energy available 24X7 at affordable cost to all," [https://isolaralliance.org/\(August 25, 2020\)](https://isolaralliance.org/(August 25, 2020)).
169. NRDC and TERI, India and the Kigali Amendment to the Montreal Protocol, July 2021, <https://www.nrdc.org/sites/default/files/india-kigali-amendment-fs.pdf>.
170. NRDC and TERI, India and the Kigali Amendment to the Montreal Protocol, July 2021, IISD, "India Launches Global Coalition for Disaster Resilient Infrastructure," October 2019, <https://sdg.iisd.org/news/india-launches-global-coalition-for-disaster-resilient-infrastructure/>.
171. Government of Sweden Ministry of Energy, "Sweden launches global leadership group to reduce industry emissions," September 2019, [https://www.government.se/press-releases/2019/09/sweden-launches-global-leadership-group-to-reduce-industry-emissions/\(August, 20, 2020\)](https://www.government.se/press-releases/2019/09/sweden-launches-global-leadership-group-to-reduce-industry-emissions/(August, 20, 2020)).
172. Press Information Bureau, "Sweden and India announce co-funding for multimillion-dollar program on Smart Grids," March 2020, [https://pib.gov.in/PressReleaseDetail.aspx?PRID=1605428\(August, 28, 2020\)](https://pib.gov.in/PressReleaseDetail.aspx?PRID=1605428(August, 28, 2020)).
173. "Statement by H.E. Xi Jinping President of the People's Republic of China At the General Debate of the 75th Session of The United Nations General Assembly," Ministry of Foreign Affairs of the People's Republic of China, September 2020, [https://www.fmprc.gov.cn/mfa\\_eng/zxxx\\_662805/t1817098.shtml](https://www.fmprc.gov.cn/mfa_eng/zxxx_662805/t1817098.shtml).

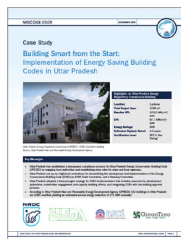
# Highlighted Reports



India and the Kigali Amendment to the Montreal Protocol



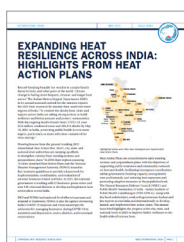
Transitioning to Electric Mobility in Gujarat Impacts and Benefits



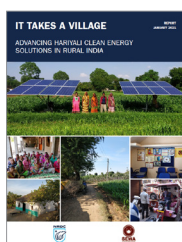
Building Smart from the Start: Implementation of Energy Saving Building Codes in Uttar Pradesh



Protecting People from the Health Risks of Climate Change: Local Experts Team Up in Ahmedabad



Expanding Heat Resilience Across India: Highlights From Heat Action Plans



It Takes a Village Advancing Hariyali Clean Energy Solutions in Rural India



Creating Jobs and Income: How Solar Mini-Grids Are Making a Difference in Rural India



Investing in a Green Future India's Initiatives in Clean Energy Finance

Copyright © 2021 Natural Resources Defense Council

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without prior permission.

