

# India's Energy Sector Companies: Riding on a New Wave of Growth

## *Key Trends Observed With Companies Across the Value Chain*

### Executive Summary

The United Nations climate science body, the Intergovernmental Panel on Climate Change (IPCC), recently released its Working Group III report with a grave warning for the world. Unless there are immediate and deep emissions reductions across all sectors, 1.5°C is beyond reach.<sup>1</sup> A major part to be played here is by the energy sector where massive transitions are required to limit global warming, including reduction in fossil fuel use, widespread electrification, improved energy efficiency, electric vehicles, large scale deployments of renewable energy infrastructure supported by grid modernisation and use of alternative fuels such as green hydrogen.

India, as one of the fastest growing large economies, will play an important role in helping put the world on track to meet climate goals. The country's energy needs will grow exponentially in the coming decades, to feed the burgeoning economy. With rampant imported fossil fuel inflation, energy security is a key national priority. In managing these challenges, India is leading from the front in tackling climate change through ambitious domestic clean energy targets and bold policies and reforms to support them. With a doubling of annual new capacity adds in FY2022 to a record 15.5 gigawatts (GW)<sup>2</sup>, domestic and international financial institutions are rapidly scaling up Indian renewable infrastructure capacities and are preparing for the next wave of sectoral reforms.

The next step required is massive, predicated on new renewable energy capacity adds required to double again, and India's government plans to roll out several big bang policies and reforms to accelerate the transition to a more resilient and sustainable energy economy while also harnessing the investment, employment and import replacement opportunities involved.

**India is leading from the front in tackling climate change through ambitious domestic clean energy targets and bold policies.**

Some major themes observed among larger industry players include commitments to diversify across the value chain, leapfrog the competition in adopting still-evolving new zero emission technologies, and increase the range of value-added

<sup>1</sup> IPCC. *Climate Change 2022: Impacts, Adaptation and Vulnerability*.

<sup>2</sup> CEA, MNRE, IEEFA calculations.

products and services. Below is a list of some government reforms enabling the clean energy wave and pertinent business plans.

**Figure 1: Government Efforts and Companies Having Plans**

Government Efforts	Companies
Green Hydrogen Policy	Acme Solar, Adani Group, Greenko, JSW Energy, NTPC, Renew Power, Reliance
Solar Module Manufacturing (Production-Linked Incentive Scheme)	Acme Solar, Adani Group, Avaada, Azure Power, Renew Power, Tata Power
Energy Storage (Production Linked Incentive Scheme)	Greenko, JSW Energy, NTPC, Renew Power, Tata Power
General Network Access (GNA) and Market Based Economic Dispatch (MBED)	Amp Energy, Avaada, Azure Power, JSW Energy, NTPC, Renew Power, Tata Power
Green Energy Corridor (GEC) & National Monetization Pipeline (NMP)	Adani Group, Indigrid, Torrent Power
Discom Privatisation	Adani Group, Tata Power, Torrent Power

Source: IEEFA analysis.

On the green hydrogen front, a growing number of energy companies are betting on the rapid decline in production costs to exploit its use in energy storage, mobility, fertilisers, refining and industry while also foraying in manufacturing of electrolysers, used to produce green hydrogen from renewable energy (RE). In energy storage, numerous industry players have been betting on the emergence of technologies being aggressively pursued in leading global markets (but yet to be commercially deployed domestically) such as pumped hydro, virtual power plants, demand response management and battery storage, to provide dispatchable and controllable RE and grid reliability. In a bid to diversify upstream in the solar value chain and build India's domestic supply chain security, players have participated wholeheartedly in the government's solar module PLI scheme while also acquiring stakes in state discom businesses, integrating the last link of the power sector value chain. In transmission, operators have been vying for both greenfield and brownfield regulated assets as government agencies plan to evacuate the large RE generation capacity planned to be set up in the country. As the power markets become more democratised and nationally integrated, companies see opportunities in power trading through exchanges and contracting with customers through open access and merchant capacities.

For India to accelerate its transition path, it is imperative to build the momentum in clean energy investments through policies and corporate actions listed above. This in turn depends on clarity and integrity on the policy front and the availability of cost-effective, long-term financing to fuel the ambitious long-dated infrastructure plans of industry players. Domestic and global capital providers, for both debt and equity, have provided the latter. Over the years, RE financing has transformed significantly, with the entry of varied sources of funding such as banks, bond market

(domestic and global), international lenders and development finance institutions (DFIs) vying to participate in the growing sector.<sup>3</sup> Accompanying this, companies have improved their environmental, social and governance (ESG) disclosure profiles to attract the massive pool of global capital aligned to ESG investing.

The coming decade will be among the most transformational periods for global energy markets. In this paradigm change, new leaders will emerge, and current corporate giants stand to become obsolete if they do not engage in the transition to the new energy economy. Developing economies such as India have an enormous opportunity to both build energy independence and grow in a climate resilient manner and in the process create a thriving corporate sector that best leverages these increasingly prominent global financial capital market priorities, and funding capacities.

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<sup>3</sup>IEEFA. [Renewable Energy Financing Landscape in India](#). February 2022.

## Table of Contents

Executive Summary .....	1
Tailwinds From Government Policies and Reforms .....	5
Key Trends Observed Among Energy Sector Companies .....	8
About the Author .....	23

## Table of Figures

Figure 1: Government Efforts and Companies Having Plans .....	2
Figure 2: India Total Energy Storage Capacity Forecast (GW).....	9
Figure 3: Green Hydrogen Use Cases .....	11
Figure 4: Power Sector Value Chain .....	14
Figure 5: New PV Manufacturing Coming From India's Subsidy Scheme .....	15
Figure 6: Indian Power Exchange Depth Vis-à-vis Developed World Economies.....	17
Figure 7: Solar Open Access Installations in India (MW) .....	18
Figure 8: ReNew Power's Presence Across Market Segments .....	19
Figure 9: ESG Frameworks and Standards Followed by Indian Energy Companies.....	21

## Tailwinds From Government Policies and Reforms

From pledging to becoming a net-zero carbon emitter by 2070 and to achieving 500GW renewable energy capacity by 2030, India is leading from the front in tackling climate change. The Climate Change Performance Index (CCPI) 2022 ranked India at 10th, among the top performing countries in greenhouse gas (GHG) emissions, energy use and climate policy.<sup>4</sup> India's renewable energy targets may seem ambitious, but IEEFA believes with the right factors where policy and finance meet, the country has the potential to achieve them. In the past decade, India's firm commitment to decarbonise its economy has spawned several new business models, ranging from renewable energy generation to electric vehicles and energy storage. The biggest investors, domestic and offshore, have lined up to capitalise on the various government policies and reforms. Fiscal year 2021/22 (FY2022) saw renewable energy and hydro represent 92% of net new capacity adds, a record high renewable energy installation rate of 15.5GW, and a record low net addition of just 1.4GW of thermal power capacity.<sup>5</sup>

In its next massive step, the government plans to roll out several big bang policies and reforms to accelerate India's transition to a more resilient and sustainable energy economy. Several of the country's biggest business houses and institutional investors have showed their commitment to this new wave of reforms.

**India's firm  
commitment to  
decarbonise its economy  
has spawned several  
new business models.**

### *Green Hydrogen Policy*

India's recently announced green hydrogen policy puts it among the few nations globally supporting a nascent technology with the potential to decarbonise numerous industries. As per a rather bullish scenario presented by Goldman Sachs, green hydrogen could supply up to 25% of the world's energy needs by 2050 and become a US\$10 trillion addressable market by 2050.<sup>6</sup> Green hydrogen is produced through electrolysis by using renewable energy, hence the green credentials. Domestic production of green hydrogen will boost the demand for renewable energy massively. According to ICRA, even in a scenario of 30% of hydrogen demand to be met through green hydrogen in the country, incremental RE capacity required will be 60GW.<sup>7</sup>

### *Adoption of Electric Vehicles (EVs)*

India is betting huge on electric vehicles to decarbonise its transport sector, leveraging this growing global technology pivot that is likely to see the near

<sup>4</sup> CCPI. [India](#).

<sup>5</sup> CEA, MNRE, IEEFA Analysis.

<sup>6</sup> Goldman Sachs. [Green Hydrogen The next transformational driver of the Utilities industry](#). September 2020.

<sup>7</sup> ET Energy World. [Green hydrogen production cost estimated to be \\$5.5 per kg to \\$6 per kg](#): ICRA. March 2022.

terminal decline in new internal combustion engines for passenger vehicles within the next two decades or so. At COP26 in November 2021, India set an ambitious goal to achieve EV sales accounting for 30% of private cars, 70% of commercial vehicles and 80% of two- and three-wheelers by 2030. The recent budget's battery-swapping policy will benefit EV makers. Further, the FAME II policy by Ministry of Heavy Industries (MHI) allocated Rs10 billion (~US\$133m) to set up EV charging infrastructure in India, complementing leading private company initiatives by the likes of NTPC and Tata Power. State polices in Delhi, Karnataka and Andhra Pradesh are also providing growth impetus to the industry. As per Bloomberg New Energy Finance (BNEF), India-based EV firms raised US\$636 million from venture capital and private equity investors as well as commercial banks in 2021 – a sharp rise from US\$100 million in 2020.<sup>8</sup> With Global EV sales growing 103% year-on-year in CY2021<sup>9</sup>, the electrification of global transport trend is accelerating rapidly.

Higher EV adoption would dramatically improve India's energy security, given the country imports more than 80% of its crude oil requirements.<sup>10</sup> For the power sector appropriate regulatory and infrastructure investment programs would see EVs strengthen the grid and help accommodate higher RE penetration while maintaining secure and stable grid operation.

**Higher EV adoption would dramatically improve India's energy security.**

### *Market Based Economic Dispatch (MBED)*

The Central Electricity Regulatory Commission (CERC) in December 2018 published a discussion paper to implement MBED In India. The paper proposed a day-ahead market in which power producers and customers bid on supply and demand based on variable costs to a centralised platform mediated by a power exchange. In place of the current system of "self-scheduling" by discoms, the biggest customers for power producers, scheduling would be via national power exchanges that match customers with lowest-cost producers. MBED aims to reduce power procurement costs by Rs12,000 crore (US\$1.6bn) annually.<sup>11</sup> The first phase of MBED, planned from April 2022, will give a fillip to RE producers by reducing power curtailment and help shut down inefficient high marginal cost power generation plants consistent with strengthening India's merit order dispatch grid model.

### *General Network Access (GNA)*

In December 2022, CERC released the draft GNA proposal, which set the stage for providing open access to the inter-state transmission system for all power producers and consumers, unravelling the current system so that a generator

<sup>8</sup> Bloomberg. Funding to Indian EV Firms Surged in 2021 as Demand Grows. March 2022.

<sup>9</sup> BNEF. EV Sales. March 2022.

<sup>10</sup>MyGov.in. [India's electric vehicle push will lead to brighter, greener future](#). December 2021.

<sup>11</sup> Power Ministry. [Discussion Paper on Market Based Economic Dispatch](#). July 2021.

focuses only on producing power and the consumer on buying it. Transmission will no longer be a challenge. The rules will help streamline the process of planning, development and recovery of investment in the transmission system and will invite much needed investment in the grid sector helping in evacuation of RE from merchant capacities (where electricity generation is not committed to a buyer through a long-term power purchase agreement) and enhancing national grid reliability. Adani Transmission believes India's target of 500GW installed RE capacity by 2030, along with the GNA proposal, will push capital investment needed in the transmission system far beyond what was stated earlier. IndiGrid believes implementing GNA will require tremendous investment in transmission and that is the only way GNA can succeed.<sup>12</sup>

### *Green Energy Corridors*

The Green Energy Corridor scheme, which involves building new electricity transmission facilities across the country, was launched by the Ministry of Power in 2015-16, initially for the large-scale evacuation of RE from renewable rich states and synchronise RE with conventional power stations in the grid. The first phase is set to facilitate supply of ~24 GW of renewable energy by 2022 while the recently notified Phase 2 of the scheme will support evacuation of 20GW of RE capacity. On a combined basis, the phases combined will add 20,450 circuit kilometres (ckms) of transmission capacity to India.

### *National Monetisation Pipeline (NMP)*

India's finance minister announced in Budget 2021-22 the launch of NMP to unlock value in state-owned assets and help them realise management and operational efficiencies which private ownership brings. Of the total Rs6 trillion of assets earmarked for sale, 14% are from the power sector including transmission assets totalling 28,608ckm and generation assets totalling 6GW.

### *Production Linked Incentive (PLI) Scheme & Basic Customs Duty (BCD) on Solar Cells and Modules*

The National Programme on High Efficiency Solar PV Modules – PLI scheme is the Indian government's ambitious plan for incentives to ramp up domestic solar module manufacturing capabilities and reduce its import dependence. The PLI scheme, topped up in the recent budget by Rs19,000 crores, now has a total outlay of ~Rs24,000 crores to boost development of more than 50GW of module manufacturing capacity. The government has also announced a BCD on solar cells (25%) and modules (40%), effective from April 1, 2022, to further discourage import of solar modules and cells and boost local demand. BCD will progressively push the solar tariffs up by up to 25%<sup>13</sup>, especially for some of the smaller players, but for larger generators, the imposition might not be a major investment hurdle. Adani Green Energy Limited expects limited impact from the imposition of BCD as

<sup>12</sup> IndiGrid analyst call transcript Q3 2022.

<sup>13</sup> CEEW. [Customs duty for solar manufacturing is good, but are we prepared for the potential fallouts?](#). March 2021.

the projects won before the announcement have a “cost pass through clause”, while auction bids after the BCD announcement accounted for any potential price increase.<sup>14</sup>

PLI also applies to ACC battery storage manufacturing, to create demand for electric vehicles and stationary storage in India. Approved in May 2021 with a total outlay of Rs18,100 crore (US\$2.5 billion), the scheme aims to establish local manufacturing capacity of 50 gigawatt hours (GWh) of ACC and 5GWh of Niche ACC capacity. In the recent budget, India also gave infrastructure status to energy storage systems.

### *Distribution Company (Discom) Privatisation*

India's distribution sector, which is still majority owned by individual states, is the weakest link in the energy sector. A significant strain on the Indian power system due to poor financial performance, discoms owed generators Rs1 trillion (US\$13.9 billion) in overdue payments at the end of January 2022.<sup>15</sup> A key reform to discom woes is higher private sector participation. Several privatised discoms in areas such as Delhi, Mumbai, Ahmedabad, Kolkata and Odisha recorded rapid improvements in metering, billing, and collection, and progressively declining AT&C loss rates.<sup>16,17</sup> In May 2020, the Government of India proposed to privatise discoms in nine union territories to try to give a new lease of life to the sector.

**A key reform to discom woes is higher private sector participation.**

## **Key Trends Observed Among Energy Sector Companies**

India has a vibrant and growing energy sector, with a growing number of participants across the value chain. Domestic and international institutions, having already launched Indian renewable infrastructure sector capacities, are now gearing up for the next wave of sectoral reforms. Experience from nations such as Denmark, Italy, France, the UK and the U.S. has shown that supportive policies and government impetus can go a long way in transforming conventional utilities to

<sup>14</sup> Adani Green. Adani Green analyst call transcript Q3 2022.

<sup>15</sup> Mercom India. [Discom dues to renewable energy generators slide](#). February 2022.

<sup>16</sup> Mercom India. [Discom Privatization](#). January 2022.

<sup>17</sup> The Indian Express. [RK Singh: 'Opening up competition in discom key to efficiency, nearly all states on board'](#). October 2021.



clean energy juggernauts, e.g., Orsted,<sup>18</sup> Enel, ENGIE, Octopus Energy and Nextera Energy.

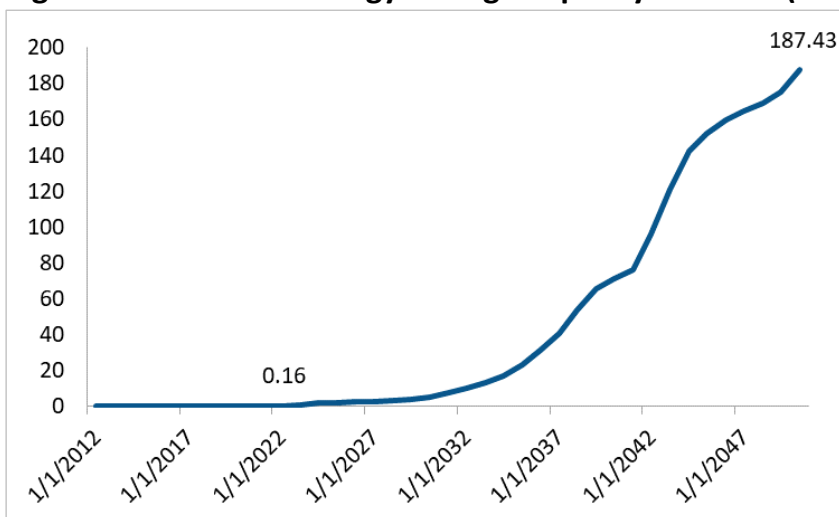
Among major themes observed in the larger industry players is the commitment to diversify across the value chain, jump ahead of competition in adopting still-evolving technologies and rolling out more and more value-added product and services. The next section will discuss some of the major trends observed through the lens of public announcements made by industry players, capital commitments and management discussions during analyst calls.

**Supportive policies  
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## Energy Storage

In energy storage, industry players are aiming to transform RE from exceptionally low cost but intermittent sources to dispatchable and controllable energy through use of storage solutions. As India moves towards a policy focussed on “reliable electricity” from “providing electricity” and given its ambitious plans to supply 50% of electricity generation through renewable sources by 2030, the next leg of growth for the RE industry will come from energy storage, complementing the enhanced national grid T&D infrastructure. Several RTC and Hybrid tenders being rolled out around the country require energy storage capabilities. Further, the setting up of merchant capacities and corporate decarbonisation solutions (see subsequent sections) require RE players to deliver firm power.

**Figure 2: India Total Energy Storage Capacity Forecast (GW)**



Source: Bloomberg.

<sup>18</sup> IEEFA. IEEFA: Orsted's transition provides key insights for India's public utilities and renewable energy companies. September 2021.

Despite the long history of disruptions in PHS in India, JSW Energy is betting big on pumped hydro storage with two project developments in the pipeline (like Snowy Hydro in Australia), one in Maharashtra for 1.5GW and another in Rajasthan for 1GW, while looking towards projects totalling up to 10GW in other states. It also envisages providing on demand round the clock (RTC) green energy solutions for corporate customers.<sup>19</sup>

ReNew Power's joint venture (JV) with Fluence Energy to provide energy storage solutions will help it move ahead in the battery energy storage system (BESS). It views battery pack assembly and building battery asset management capabilities as key growth areas in this segment.

Tata Power believes the general direction of growth in RE would be in the form of hybrid/RTC solutions. Leveraging on its experience of operating India's first utility scale BESS, the company sees opportunities ranging from small scale storage with rooftop solutions to utility scale application for peaking shifting and ancillary services required for frequency regulation. The utility's distribution business in Delhi has also installed India's first grid connected community energy storage (CES) solution – this involves storage at the periphery of the distribution system, near end-users. The project is in a densely populated area in which electrical load growth is rising quickly, leading to concerns over stability and adequacy of electricity supply.<sup>20</sup>

Another player active on the storage front is Greenko. The company won 900MW in Solar Energy Corporation of India's (SECI) first peak power supply tender of 1.2GW. It is developing a hybrid project in Rajasthan with 2.5GW pumped hydro storage.<sup>21</sup> The company is installing a total of 40GWh of pumped hydro capacity across India<sup>22</sup> which will be used to compete in RTC and Hybrid power auctions as well as providing standalone storage solutions. Greenko has entered into agreements with NTPC<sup>23</sup> and Ayana<sup>24</sup> to offer RTC power jointly and with Adani group to provide energy storage solutions at the latter's facilities.

## Green Hydrogen

Green hydrogen, a still-nascent technology, has multiple uses in the clean energy ecosystem. Today, imported fossil fuel derived hydrogen's dominant use is in industries such as oil refining and production of ammonia for fertilisers, plus methanol and steel. So, there is significant potential for both emissions reductions and improved energy security for India from clean hydrogen use. Further

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<sup>19</sup> JSW Energy. JSW Energy analyst call transcript Q3 2022.

<sup>20</sup> Energy Storage News. [India's 'first grid-connected community energy storage system' inaugurated in Delhi](#). March 2021.

<sup>21</sup> ET Energy World. [Greenko to set up Rs 30,000-crore hybrid project in Rajasthan](#). March 2021.

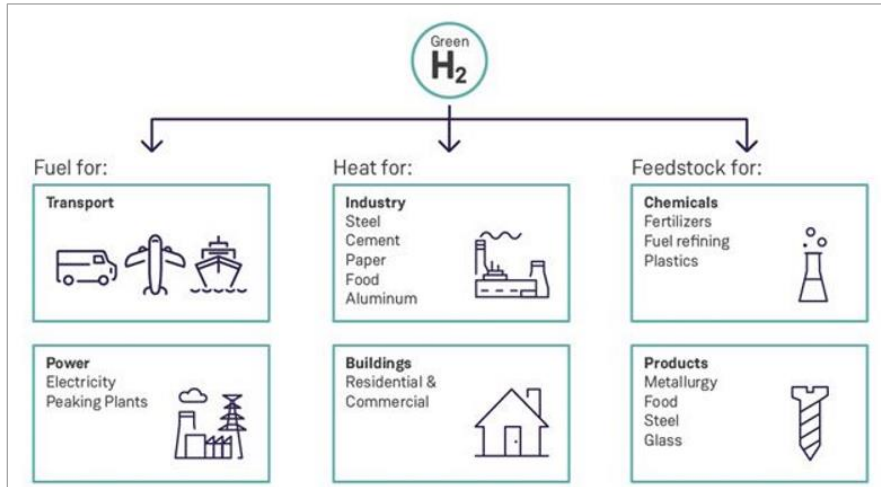
<sup>22</sup> The Hindu Business Line. [Greenko, NTPC partner for energy storage, flexible, despatchable RE power supply solutions](#). August 2020.

<sup>23</sup> The Hindu Business Line. [Greenko, NTPC partner for energy storage, flexible, despatchable RE power supply solutions](#). August 2020.

<sup>24</sup> Hydro Review. [Ayana Renewable, Greenko storage agreement includes pumped hydro](#). February 2022.

employment in transport, energy storage and blending with gas widens the commercial use of the fuel.

**Figure 3: Green Hydrogen Use Cases**



Source: BNEF.

RE companies will play an important role in the green hydrogen economy as the production of green hydrogen through electrolysis, the leading green hydrogen production pathway, is an 'opex' heavy business model where renewable power used is 50-70% of the total cost.<sup>25</sup> Thus, the per unit cost of green hydrogen is majorly dependent on the cost of RE used in its production, so India has a global competitive advantage with its large scale deployment of wind and solar at progressively lower cost. Further, the fuels' major appeal is a partial solution to intermittency of renewable power and the flexibility to turn on and off green hydrogen producing electrolyzers almost instantaneously allowing them to be used as virtual batteries, providing a viable source of energy storage, which reinforces its importance for the RE sector.

Betting on the rapid decline in green hydrogen production costs, several energy companies are leading efforts through internal research & development (R&D), forming strategic partnerships and taking up demonstration and pilot projects to explore possibilities to commercially exploit this technology. The dominant route to diversify into this business has been through partnering with global companies with expertise in green hydrogen technology and where RE companies focus on large scale renewable power generation. Several projects and partnerships in storage, mobility, industrial supply and blending with natural gas among others are being taken up by industry players to capitalise on the technology's promises and opportunities.

At the forefront of green hydrogen efforts, the state-owned NTPC is exploring various options using hydrogen ranging from fuel in transport sector to blending with natural gas, green ammonia and methanol. In July 2021, it invited tenders for

<sup>25</sup> Financial Express. [Making green hydrogen cost competitive](#). February 2022.

deploying hydrogen fuel cell buses in Delhi and Leh<sup>26</sup> and another tender to set up India's first green hydrogen fuelling station in Leh. In August 2021 it issued an expression of interest (EoI) for a pilot project on green hydrogen-natural gas blending as key learning-by-doing in the domestic context with these pilot studies.<sup>27</sup> In December 2021 it awarded India's first green hydrogen-based energy storage project at one of its plants<sup>28</sup>. NTPC is also running several R&D works for development of high temperature steam electrolyzers, static hydrogen compression system, and development of sea water electrolyser.<sup>29</sup>

**State-owned NTPC  
is at the forefront of  
green hydrogen efforts.**

Adani Group, among the biggest business houses in the country and having operations in RE generation and energy transmission, last year pledged a combined investment of US\$70 billion in the green energy value chain. It has ambitions to produce the world's least expensive green hydrogen. The group collaborated with Snam,<sup>30</sup> Europe's leading gas infrastructure company, in November 2020 to explore opportunities in low emissions hydrogen production. In March 2021, it partnered with Italian conglomerate Maire Tecnimont to produce chemicals, ammonia and hydrogen from renewable feedstock.<sup>31</sup> In another recent announcement, the group signed an MoU with South Korea's steel maker POSCO to establish a green integrated steel mill,<sup>32</sup> demonstrating the constructive role for green hydrogen in decarbonising hard-to-abate industries.

Another conglomerate betting big on the green hydrogen economy and needing a special mention even as it doesn't have operations in the power sector, is Reliance Industries (RIL). The company has a target of bringing down the cost of green hydrogen to under \$2 per kg by 2030 in the country. RIL teamed up with US hydrogen equipment manufacturer Chart Industries last year to commercialise hydrogen technology and develop a supply chain within the country.<sup>33</sup> The company has plans to invest a cumulative US\$10bn in building four gigafactories across the entire spectrum of renewable energy, two of which include an electrolyser factory

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<sup>26</sup> NTPC. [NVVN Invites Bid Hydrogen Buses Delhi Leh](#).

<sup>27</sup> Mercom India. [NTPC Invites EoI for Pilot Project on Green Hydrogen-Natural Gas Blending](#). September 2021.

<sup>28</sup> NTPC. [NTPC Awards India's first Green Hydrogen Microgrid Project](#). December 2021.

<sup>29</sup> NTPC. [NTPC annual report 2021](#).

<sup>30</sup> Adani Gas. [Adani Group announces strategic collaboration with Snam](#). November 2020.

<sup>31</sup> Saur Energy. [Adani to Develop Green Hydrogen Projects in India, Partners With Maire Tecnimont](#). March 2021.

<sup>32</sup> Outlook. [Adani Group Partners With POSCO](#). January 2022.

<sup>33</sup> IHS Markit. [Chart Industries, Reliance Industries to build hydrogen supply chain in India](#). April 2021.

for the production of green hydrogen and a fuel cell factory for converting hydrogen into motive and stationary power.<sup>34</sup>

Also prominent in RE, Acme Solar has proposed one of the world's largest green ammonia projects in Oman and has plans to have capacities of ~10 million tonnes per annum by 2030.<sup>35</sup> The company also has plans to jointly produce green hydrogen in India and Europe with Lhyfe Labs SAS of France.<sup>36</sup>

**Reliance's target is to bring down the price of green hydrogen to under \$2/kg by 2030.**

Other efforts include ReNew Power's partnership with Larsen & Toubro (L&T) to jointly develop, own, execute and operate green hydrogen projects, with L&T having recently signing an MoU with HydrogenPro for manufacturing hydrogen electrolyzers in India.<sup>37</sup> Renew, L&T and Indian Oil Corporation (IOC) have formed another joint venture recently for development of green hydrogen business in India.<sup>38</sup> JSW Energy partnered with Fortescue Future Industries (FFI) of Australia in July 2021<sup>39</sup> and has completed scoping exercises for green hydrogen. It recently shared plans to approach its board for approval on setting up its first green hydrogen plant.<sup>40</sup> Greenko and Italy's Snam will collaborate on green hydrogen production methods, design of hydrogen-ready infrastructure and potential final applications in both industry and transport, including fuel cell mobility<sup>41</sup>. Greenko also collaborated with John Cockerill, manufacturer of alkaline electrolyzers in Belgium, to jointly develop market initiatives for green hydrogen electrolyzers in India<sup>42</sup>. Other prominent partnerships include Hero Future Energies with green hydrogen firm Ohmium International to build 1GW of green hydrogen production capacity in India, Europe and the UK<sup>43</sup> and an MoU between Ayana and Greenstat Hydrogen to accelerate hydrogen technology development in India.<sup>44</sup>

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<sup>34</sup> Business Insider. Mukesh Ambani reiterates Reliance's ₹75,000 crore push, reveals development of Giga Complex under way. September 2021.

<sup>35</sup> EQ International. [Acme eyes 10 million tonnes green hydrogen, ammonia capacity by 2030](#). August 2021.

<sup>36</sup> Mint. [Acme Solar Lhyfe Labs Plan Green Hydrogen Ops In India](#). February 2021.

<sup>37</sup> Larsen & Toubro. [L&T signs MoU with HydrogenPro](#). January 2022.

<sup>38</sup> The Economic Times. [Indian Oil, L&T and ReNew to form JV for development of Green Hydrogen business](#). April 2022.

<sup>39</sup> Financial Express. [Green hydrogen: JSW Energy partners Fortescue Future Industries](#). July 2021.

<sup>40</sup> The Hindu Business Line. [JSW Energy to seek its board nod for green hydrogen plant](#). January 2022.

<sup>41</sup> The Hindu. [Greenko, Italy's Snam to collaborate on Green Hydrogen](#). November 2020.

<sup>42</sup> Saur Energy. [Greenko, John Cockerill Partner on Green H2 Initiatives in India](#). December 2021.

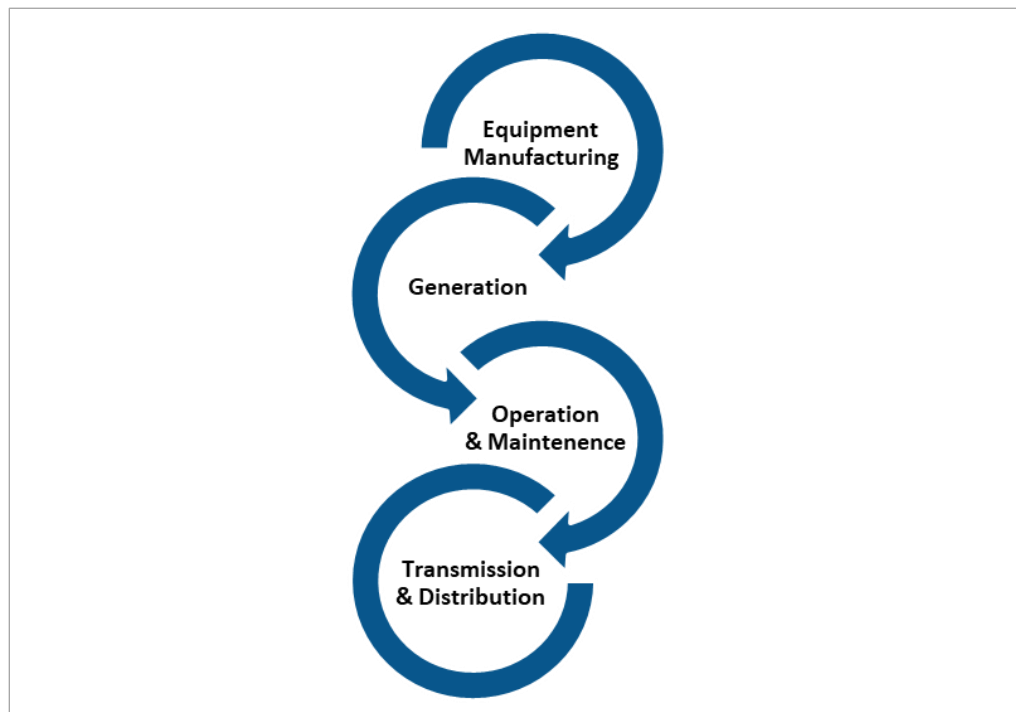
<sup>43</sup> Power Technology. [Hero Future Energies and Ohmium to develop green hydrogen facilities](#). January 2022.

<sup>44</sup> Solar Quarter. [Ayana and Greenstat Hydrogen Enter into MOU](#). September 2021.

## Vertical and Horizontal Integration

The power sector's competitive strength lies in its cost structure. From capital expenditure (more importantly for RE companies where costs are front-loaded) to operation and maintenance (O&M) and finance costs, a company that can achieve cost efficiencies will be more competitive.

**Figure 4: Power Sector Value Chain**



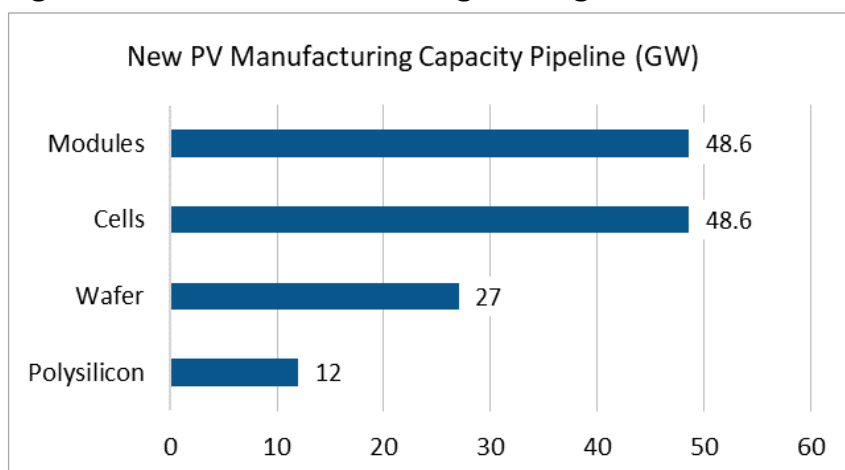
Source: IEEFA analysis.

Several Indian RE companies participated in – and oversubscribed – the government's PLI scheme for solar module manufacturing rolled out last year, in a bid to diversify upstream in the solar value chain. The tender saw bids for 54.8GW as against the requirement for 10GW with participation from Adani Infrastructure (affiliated to Adani Green Energy), Renew Solar, Tata Power Solar, Avaada Ventures and Acme Eco Clean Energies.<sup>45</sup> As most solar modules and other equipment is imported presently, cost control is currently limited to having long term supply relations with foreign importers. Borosil Renewables, India's leading solar glass manufacturer, expects 37GW of new solar module manufacturing capacity to be added by new and existing players in the next few years.<sup>46</sup>

<sup>45</sup> Mercom India. [Bidders Announced for IREDA's Solar Module Manufacturing PLI Auction](#). October 2021.

<sup>46</sup> Borosil Renewables. Borosil Renewables analyst call transcript Q3 2022.

**Figure 5: New PV Manufacturing Coming From India's Subsidy Scheme**



Source: BNEF.

On the O&M side, most of the biggest players have in-house expertise for solar projects. Those with wind portfolios such as ReNew Power have also started to build in-house O&M capabilities. On the transmission side, IndiGrid (InvIT) has transitioned into inhouse project and asset management, which was earlier outsourced.

An important aspect of cost rationalisation is achieving economies of scale. Backward integration into module manufacturing, in-house O&M teams and engineering, procurement and construction (EPC) capabilities will give a competitive advantage only when significant scale of operations have been achieved. ReNew Power and Azure Power, both pure play RE operators, have in the recent past sold-off their smaller rooftop solar portfolios to focus on projects with scale.

Another aspect of achieving scale is through integrating horizontally. As the RE market matures and consolidates and as financial investors seek capital recycling, several opportunities exist for larger players to grow inorganically and capitalise on their inhouse expertise to deliver efficiencies in acquired projects. Adani Green expects to reduce O&M costs significantly on its acquired SB Energy portfolio.<sup>47</sup> ReNew Power acquired 260MW of solar projects in Telangana in August 2021, providing opportunities to increase productivity and reduce O&M costs.<sup>48</sup> Financial investors such as Macquarie<sup>49</sup> and Global Infrastructure Partners (GIP),<sup>50</sup> holding portfolios of RE assets, plan to sell to investors including such strategic entities as RE developers. Another private equity investor, Actis, plans to sell Sprng Energy, its RE platform in India, eliciting interest from Adani Group and Greenko.<sup>51</sup> On the

<sup>47</sup> Adani Green Energy. Adani Green Energy analyst call transcript Q3 2022.

<sup>48</sup>Mercom India. [ReNew Power Acquires 260 MW of Operational Solar Projects in Telangana](#). August 2021.

<sup>49</sup> Mint. [Macquarie looks to sell 450MW solar assets for \\$300mn](#). April 2021.

<sup>50</sup> The Economic Times. [US'GIP looks to sell Indian clean energy unit](#). October 2021.

<sup>51</sup> Bloomberg Quint. [Shell Vies With Adani, Greenko for Actis's Sprng Energy](#). March 2022.

transmission side, the rapidly expanding Indigrid InvIT is vying for the monetisation of PowerGrid Corporation of India's assets and other intra-state transmission assets which will be up for grabs.<sup>52</sup>

Several utilities such as Tata Power, Adani Transmission and Torrent Power have previously acquired discoms, primarily owned by states, integrating the last link of the power sector value chain. Recently, Torrent Power<sup>53</sup> acquired discom business of Daman and Diu and Dadar and Nagar Haveli. Adani Transmission's Mumbai distribution business recorded lower distribution losses and better collections after acquisition in 2018.<sup>54</sup> Tata Power has achieved impressive results in its Delhi discom over the past decade, where aggregate technical and commercial (AT&C) losses have come down drastically, and expects similar results from its recently acquired Odisha discom.<sup>55</sup> Torrent Power's Bhiwandi discom business saw a turnaround in both AT&C losses and financial performance after the utility took over its operations.<sup>56</sup> Further, the government in the past has mulled the idea of opening up the state discom business to private competition, ending the current state government-owned, but largely capital starved monopoly regime.<sup>57</sup> Such a move should invite much interest from private players, which see enormous potential for efficiency gains in the distribution business.

## Capital Recycling

A recurrent theme in global RE infrastructure assets has been to recycle capital from operational assets and redeploy it to fund pipeline projects. The majority of value creation in RE assets takes place during the pre-operation stage so generators are able to realise upfront gains by selling stakes in operational assets. Adani Green Energy has a JV with Total SE for its operational solar assets, Sterlite Power and PowerGrid Corporation of India have floated InvITs housing their transmission assets.<sup>58</sup> Acme has sold several of its operational assets to financial and strategic investors to redeploy capital to pipeline assets, Edelweiss Infrastructure Yield Plus (EIYP), an alternate investment fund (AIF) has been buying operational assets from IPPs within the country.<sup>59</sup> Another yield vehicle, Virescent Renewable Energy Trust, India's first RE focussed InvIT, acquires mature solar assets to provide steady cash flows to its unit holders. It recently acquired Godavari Green Energy,<sup>60</sup> a solar IPP and operational assets of Focal Energy.<sup>61</sup> Once derisked, renewable energy

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<sup>52</sup> IndiGrid. IndiGrid analyst call transcript Q3 2022.

<sup>53</sup> Mint. [Torrent Power buys 51% stake in Dadar and Naar Haveli and Daman & Diu discom](#). March 2022.

<sup>54</sup> Adani Transmission. Adani Transmission annual report 2021.

<sup>55</sup> Tata Power. Tata Power annual report 2021.

<sup>56</sup> Business Standard. [Rajasthan to emulate famous 'Bhiwandi' power reforms model](#). February 2016.

<sup>57</sup> Financial Express. [Discom privatisation: Lessons from Chandigarh and Dadra & Nagar Haveli](#). March 2021.

<sup>58</sup> IEEFA. [From Dong to Orsted: A Leading Utility's Green Energy Transition](#). September 2021.

<sup>59</sup> Business Standard. [Edelweiss Infra Yield Plus acquires Indian solar assets of France's Engie](#). March 2021.

<sup>60</sup> Mercom India. [Virescent Renewable Energy Trust Acquires Godawari Green Energy for 6.65 billion](#). February 2022.

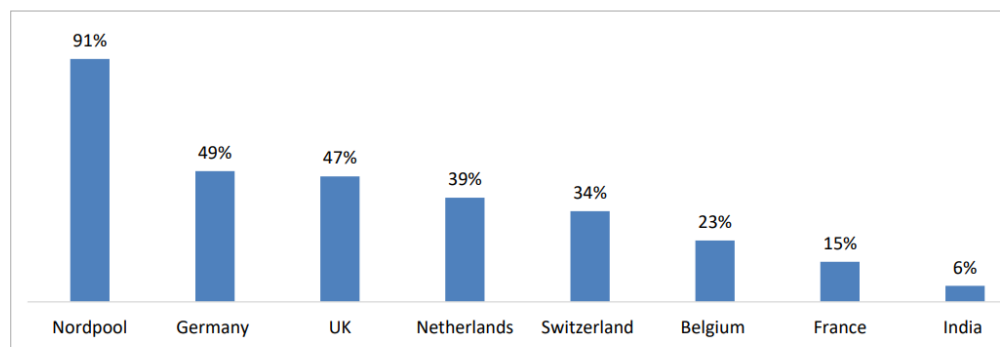
<sup>61</sup> Mercom India. [Virescent Acquires 49 MW of Operating Solar Projects](#). December 2021.



infrastructure and grid T&D assets can be near perfect fits for global pension, infrastructure and sovereign wealth asset managers – given the long dated, largely government guaranteed revenue streams.

## Short Term Markets and Merchant Capacities

**Figure 6: Indian Power Exchange Depth Vis-à-vis Developed World Economies**



Source: IEX investor presentation Q3 2022.

Indian Energy Exchange (IEX), India's largest power exchange, has been witnessing increasing volumes along with high prices for green energy traded through green term-ahead and day-ahead markets (GTAM and GDAM). The draft National Electricity Policy 2021 envisions 25% share of the power exchanges by the year 2024, implying a fourfold growth from the present 6% share of energy markets.<sup>62</sup> This may also lead to companies keeping merchant or un-tied RE capacities to trade through the exchanges. Further, generators can now sell power in case of RE curtailment by state discoms through the GDAM market. The draft GNA regulations will provide more tailwinds to the market, when implemented. Another gamechanger for energy markets will be the introduction of financial derivative contracts, which will help deepen the electricity markets in India and aid power users in hedging their power procurement costs. A judgement by the country's apex court in November last year, on jurisdiction of derivative contracts in India, has paved the way for the introduction of such contracts in the country's power bourses.<sup>63</sup>

Several companies such as JSW Energy, Tata Power and NTPC already sell through power exchange, using either untied capacity or Un-Requisitioned Surplus (URS). JSW Energy, which has ~16% capacity untied to any PPAs, had a major boost to its Q3 2022 results from higher short term trading margins and volumes. Power trading is currently limited but, as clarity around government policies improves and price and volume indicators on the exchange improve further, several new players

<sup>62</sup> Saur Energy. "This fiscal we aspire to achieve 100 billion units in terms of volume", says Rohit Bajaj, IEX. February 2022.

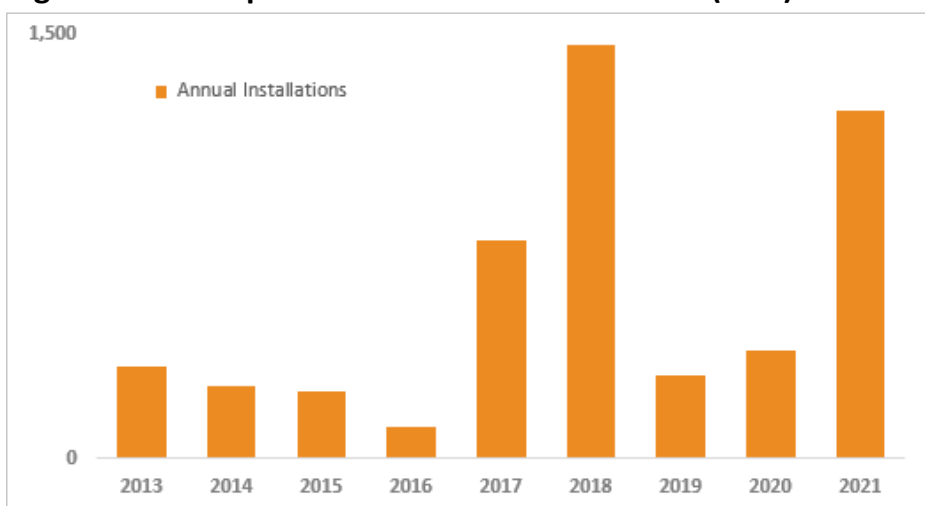
<sup>63</sup> ET Energy World. *Forwards & derivatives in the power sector: A new beginning*. November 2021.

should find selling power through the exchanges a lucrative proposition.

### Corporate Decarbonisation

Another trend is offtake of green energy by commercial and industrial (C&I) customers on an open access basis. According to Mercom research, cumulative solar open access installations surpassed 5GW as of Q4 2021<sup>64</sup> in the country, reflecting the significant cost saving potential but also the need for Indian firms to meet the growing global Net Zero Emissions pledges of global corporates, including their supply chains, as well as the now US\$130 trillion of collective capital pledged to net zero emissions and 1.5 degrees C investment alignment of the Mark Carney led Global Financial Alliance. Several renewable IPPs have contracted with companies to supply power directly.

**Figure 7: Solar Open Access Installations in India (MW)**



Source: Mercom India Research.

The majority of IPPs have done this through a captive capex model, selling to offtaking companies stakes (minimum 26%) in special purpose vehicles (SPVs) holding such open access capacities and legally converting these SPVs as captive power plants (CPPs) and preventing cross-subsidy and additional surcharges for the consumer. Indian multinational pharmaceutical company Cipla Limited entered into a PPA, along with agreement to acquire a 32.5% stake in one of Amp Energy's SPVs.<sup>65</sup> Another pharmaceutical company, Bharat Serums recently acquired stake in another of Amp Energy's SPVs to source green power.<sup>66</sup> DFM Foods acquired stake in Fourth Partner Energy's SPV in May 2021.<sup>67</sup> Airtel has partnered with IPPs such

<sup>64</sup> Mercom India. [Mercom India Solar Open Access Market Report 04 and Annual 2021](#).

<sup>65</sup> Mercom India. [Cipla to Procure Power from AMP Energy's 16 MW Open Access Solar Project](#). February 2022.

<sup>66</sup> ET Energy World. [Bharat Serums acquires 26 per cent stake in solar power firm](#). March 2022.

<sup>67</sup> Mercom India. [DFM Foods to Buy Solar Via Open Access Under Group Captive Mode from Fourth Partner Energy](#). May 2021.

as Avaada<sup>68</sup> and Amp Energy<sup>69</sup> to secure green energy for its data centres across the country, Grasim industries contracted with ReNew Power to procure energy from its wind-solar hybrid open access project as a captive customer.<sup>70</sup>

### Value Added Product Offerings

Several conventional utilities and renewable IPPs are diversifying their product offerings from commoditised electricity generation, distribution and transmission to providing value added product offerings, which fetch higher margins and offer growth prospects in a fast-evolving energy economy. Tata Power leads on this front with a dedicated Energy Service Company (ESCO) business that helps commercial and industrial clients to embrace digitalisation and monitor energy savings. The company has also been fortifying its presence in electric vehicle charging infrastructure with partnerships with Tata Motors, Morris Garage India, Jaguar Land Rover, Apollo Tyres and an MoU with TVS Motor for developing EV charging infrastructure for customers and dealers. Further Tata also provides internet of things (IoT) home automation solutions and introduced home automation products as a part of its Smart Energy Management Tool.<sup>71</sup>

ReNew Power, which currently provides energy management services for public utilities, commercial and industrial customers, anticipates 5-7GW of projects to be auctioned in providing intelligent energy solutions such as peak power supply, round-the-clock supply and storage services.<sup>72</sup>

**Several conventional utilities and renewable IPPs are diversifying.**

**Figure 8: ReNew Power's Presence Across Market Segments**

	Plain Vanilla Renewable Energy (RE)	Intelligent Energy Solutions	M&A	Corporate PPAs
GWs Currently For Auction	5 - 6 GW	5 - 7 GW <sup>(1)</sup>	6 - 8 GW	NA
No. Of Competitors	~15 - 20 (Large scale 8 - 10)	3 - 4	5 - 6	5 - 6
Indicative Range Of IRRs	Lower end of targeted range	Higher than plain vanilla RE	Higher than plain vanilla RE	Higher than plain vanilla RE

Source: Renew Power analyst presentation Q3 2022.

<sup>68</sup> Airtel. Airtel strengthens its green energy footprint with the commissioning of 21 MW Solar Power Unit in Maharashtra. January 2022.

<sup>69</sup> Business Standard. Airtel commissions captive solar power plant for data centres in UP. April 2021.

<sup>70</sup> Mercom India. Grasim to Procure Additional Power from ReNew's Captive Wind-Solar Hybrid Project. October 2021.

<sup>71</sup> Tata Power. Tata Power annual report 2021; Tata Power analyst presentation Q3 2022.

<sup>72</sup> Renew Power. Renew Power investor presentation Q3 2022.

Azure Power has also structured a new business unit focused on delivering similar solutions such as RTC power, peak and dispatchable power based on storage and green steam and green hydrogen for large energy consumers.<sup>73</sup>

JSW Energy says that it is migrating from a power company to a services and product company supplying power for desired time blocks and supplying products such as hydrogen, ammonia or other chemical derivatives to industries.<sup>74</sup>

Adani Transmission's distribution arm in Mumbai rolled out green power and tariff option to consumers for reduction in their carbon footprint.<sup>75</sup>

### *Improving ESG Profile*

Sustainability is fast taking centre stage in corporate boardrooms globally, and this trend is inevitably working its way into Indian boardrooms as well, as the shift from shareholder wealth creation to stakeholder "value creation" accelerates. The pressure to address ESG issues is increasingly an existential question for energy companies. Adding to rising pressure from institutional investors such as pension funds, insurance companies and sovereign wealth funds, which have heavily invested in India RE companies, the regulatory regime in the country is transforming to mandate ESG disclosures by companies, with the roll-out of the business responsibility and sustainability reporting (BRSR) standards from April 2022. Globally, institutional investors are rapidly aligning their investment decision making process to also include ESG metrics. The United Nations Principles of Responsible Investing (UNPRI), the world's leading proponent of responsible investing, has more than 4,000 signatories, which includes the world's biggest asset owners and managers, having cumulative assets under management upwards of US\$120 trillion.<sup>76</sup>

For companies too there are several benefits from having a favourable ESG profile. First, for a capex heavy business, access to cheaper sources of financing is paramount. Globally, issuance of sustainable loans and bonds exceeded US\$1.5tn in 2021,<sup>77</sup> where yields have been often found to be lower than conventional debt instruments. Several customers for energy companies are planning to tackle their supply chain emissions and will prefer to do business with partners who make efforts towards disclosing their carbon footprint and making credible efforts towards reducing them. Then there are reputational benefits for companies in a sector which has been under constant scrutiny due to its carbon-heavy image.

Companies in the sector have been disclosing their ESG footprint in line with the most widely used ESG standards and frameworks.

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<sup>73</sup> Azure Power. Azure Power analyst call transcript Q3 2022.

<sup>74</sup> JSW Energy. JSW Energy analyst call transcript Q3 2022.

<sup>75</sup> Adani Transmission. Adani Transmission analyst presentation Q2 2022.

<sup>76</sup> UNPRI. [UNPRI annual report 2021](#).

<sup>77</sup> Refinitiv Database.

**Figure 9: ESG Frameworks and Standards Followed by Indian Energy Companies<sup>78</sup>**

	CDP	BRSR	TCFD	UN Global Compact	UN SDG's	GRI	IIRC	SASB
Adani Transmission								
Adani Green Energy								
Azure Power		NA						
Borosil Renewables								
Coal India Limited								
NTPC								
PowerGrid								
Tata Power								
ReNew Power		NA						
JSW Energy								

Source: IEEFA analysis.

In terms of disclosure, Tata Power and JSW Energy map their ESG information to the greatest number of internationally recognised standards and frameworks while Coal India and Power Grid Corporation have the least alignment to such standards. Alignment to a greater number of frameworks and standards may attract more investor interest as many investors find material relevance in multiple frameworks/standards.

### Changing Debt Profile

India's renewable energy financing landscape has transformed in the past decade as the sector went mainstream.<sup>79</sup> In early years, when RE technologies were evolving and there wasn't enough demonstrable history of operations, financing avenues were scarce. Today there are several funding avenues available for RE players. Industry players have capitalised on these avenues and have been refinancing debt at lower rates and for longer tenures. ReNew Power has refinanced debt in excess of US\$1.5bn over the past 12 months while Azure Power has refinanced 1GW of its operating projects so far, saving 200 basis points in interest costs in the process.<sup>80</sup> Bond market issuances have become an important refinancing instrument for operational projects. Among them green bonds are being increasingly issued by RE players. BNEF data show Indian utility and renewable IPPs have raised US\$11.5bn in green bonds since 2010.

<sup>78</sup> CDP: Carbon Disclosure Project, TCFD: Task Force for Climate Related Financial Disclosures, UN SDG: United Nations Sustainable Development Goals. GRI: Global Reporting Initiative, IIRC: Integrated Reporting Framework, SASB: Sustainability Reporting Standards Board.

<sup>79</sup> IEEFA. [Renewable Energy Financing Landscape in India](#). February 2022.

<sup>80</sup> Renew Power & Azure Power analyst call transcript Q3 2022

Companies have been diversifying their leverage profile on multiple fronts: by including a mix of bank and non-bank loans and bonds; through having fixed and variable interest rate loans; through raising debt from both Indian and global financing sources; and having a mix of short and long-term loans, depending on business needs. For Adani Group companies, debt profile has moved from being dominated by public sector banks to bonds. Azure Power and Renew Power, both listed on offshore stock exchanges, have most of the debt in foreign currency. Further, a large part of their debt is long-term in nature.

## About IEEFA

The Institute for Energy Economics and Financial Analysis (IEEFA) examines issues related to energy markets, trends and policies. The Institute's mission is to accelerate the transition to a diverse, sustainable and profitable energy economy. [www.ieefa.org](http://www.ieefa.org)

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