Confederation of Indian Industry

Insights into Renewable Energy Adoption in India

The Corporate Story

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Message

Corporate renewable energy focus has been enhanced lately due to the formation of Low Carbon Technology Partnerships Initiatives (LCTPI) by the World Business Council for Sustainable Development (WBCSD) which aims to catalyse actions to accelerate low-carbon technology development, and scale up the deployment of business solutions such that global warming is limited to below 2 degrees C. Global companies such as IKEA, Swiss Re, BT, Formula E, H&M, KPN, Mars, Nestlé and Philips are taking bold steps to create transformative change needed to drive a clean energy revolution.

The Government of India has also released an ambitious plan for enhancing RE use in India. Several top corporates in India too have deployed several renewable energy projects in the last 10 years. However, only two Indian company figures in the RE100 a global platform for committing to 100% renewable power. In spite of lofty goals and aims, achieving 100% renewable energy is still a dream for corporates in India.

Managers who are required to create a business case for renewable energy projects are ill-equipped to handle challenges such as cost effectiveness, policy issues, funding and financial viability of renewable energy systems, multiplicity of government agencies and institutional structures, grid stability and availability, variation in state level wheeling criteria. In addition, corporates that previously invested in clean development projects feel that there must be a mechanism to incentivise corporate renewable energy projects.

This paper investigates the corporate scenario for undertaking renewable energy projects, explores roadblocks and challenges, and benchmarks leaders who have adopted renewable energy business solutions in India. It highlights companies that are adopting RE, the challenges in adoption of renewable energy in India, and how some companies have overcome the hurdles associated, as well as the vendors in RE sector are, and innovations happening in this space.

On behalf of the CII WR Environment Sustainability in Business Sub-Committee, I'd like to thank all the Industry members and stakeholders for their valuable inputs and support.

I sincerely hope this report will stimulate further thought and dialogue, spurring a rich exchange of ideas.

Piyush Shah
Chairman, CII WR Environment Sustainability in Business Sub-Committee 2016-17 & Executive Vice Chairman
Hitachi Hi-Rel Power Electronics Pvt Ltd.

Report Objectives

The global environmental status is scientifically proven to be increasingly threatened by climate destabilization, and renewable energy plays a pivotal role in helping bring balance to the ecosystem as well as human economies. This study occurs at a crucial juncture of climate policy, as Indian Government and leaders made aggressive commitment in adopting Renewable Energy at the meet at Paris for COP21. In the recent past, the Ministry of Environment, Forests, and Climate Change, Government of India, has taken several policy initiatives to facilitate the role of renewables and simultaneously empower "the billions at the bottom."

Notwithstanding the action or inaction of governments, it is necessary for corporate entities to take up the task of empowering society through their initiative and ingenuity. A majority of existing literature explores RE adoption challenges from the perspective of a government or a utility. With the increasing interest in adoption of RE by corporates, there is a necessity to delineate the challenges and opportunities, considering the corporate perspective.

We have examined the challenges and opportunities for corporate and non-corporate entities to participate effectively in constructing a 100% renewable energy society. As part of this study, we had devised a survey to elicit the insights and insecurities of professionals and experts who are exploring renewable energy investment and adoption. We had also developed a realistic picture of the existing policy and technology developments to help corporations assess the gap between their present state and a potential RE100 scenario. On behalf of the CII WR Environment Sustainability in Business Sub-Committee, I'd like to thank all the Industry members and stakeholders for their support and inputs.

I sincerely hope that you find this report informative and resourceful.

Anirban Ghosh
Head, Core Team- Energy,
CII WR Environment Sustainability in Business Sub Committee 2016-17
& Chief Sustainability Officer, Mahindra & Mahindra Ltd

Executive Summary

Context

Post COP21, India's commitment to a low carbon economy has been demonstrated via several changes at policy level which have paved a path for quickening the pace of RE adoption in India. India's INDC[1] outlines a **40%** nonfossil fuel based power **by 2030** including **175** GW of RE by 2022, of which solar is expected to contribute 100 GW, and wind 60 GW. The policy thrust to renewables has been significant, and specific targets have been announced to accelerate the deployment of renewable energy. The National Action Plan on Climate Change (NAPCC, 2008) envisages a dynamic Renewable Purchase Obligation (RPO) target of 10% at the national level for 2015 with an annual increase of 1% in order to reach around 15% by 2020. The new electricity tariff policy is a step in the right direction for increased RE adoption.

The Need for The Study and Study Methodology

In spite of lofty goals and aims, achieving 100% renewable energy is still a major challenge for corporates in India. A majority of existing literature explores RE adoption challenges from the perspective of a government or a utility. With the increasing interest in adoption of RE by corporates, there is a necessity to delineate the challenges and opportunities, considering the corporate perspective. The objective of this RE Policy Paper is to inform key stakeholders about the existing perspectives on the current and potential initiatives in the pursuit of renewable energy (RE) consumption, benchmark leaders who have adopted renewable energy business solutions and to assess the main internal and external challenges on the path of achieving 100% RE use by corporate sector in India.

The approach adopted for this work is based on primary data (through a survey) and secondary research. It also helps corporates to understand about the innovations happening in this space and vendors associated with it. The scope of the study is limited to policies of various states from the perspective of the Western Region comprised of Maharashtra, Goa, Madhya Pradesh, and Gujarat.

Key Hurdles in Rapid Adoption

The key hurdles perceived by stakeholders interviewed via the survey method cover 5 areas:

1. Anticipation of new RE technology, lack of awareness: This has an impact in form of deferred investment as corporates are still waiting for prices to lower further.

2. Gaps in technical evaluation and feasibility have been identified as the main technical constraints the implementation of RE, such as:

(a) Variability of resource availability,
(b) Storage of excess power generated by RE, and
(c) Feeding of power to the grid

3. Policy implementation & Government clearances: Single window clearances and ease of navigating through maze of disparate policies is definitely a turnoff. Unlike states like Rajasthan, Karnataka, Telangana, and Tamil Nadu where the timeline for the approval and clearance has been specified, the renewable energy policy of Maharashtra does not specify any time line or turn around period for the application, approval and clearance. Though open access has been allowed in Maharashtra, no exemption is provided in wheeling and transmission charges of renewable energy power. This is slated for change with the open access policy.

4. Net metering: Government of Maharashtra has approved the net-metering policy in 2015, whereas, Tamil Nadu has approved and started promoting its net-metering policy from 2012. Due to late initiation of the net metering in Maharashtra, Solar rooftop PV system in Maharashtra has encountered set-backs. Moreover, Open Access permission will not be granted to the consumers availing single point supply and sub distributing it further to multiple consumers. E.g. Commercial Malls, IT parks, commercial complexes, software technology parks etc. Such consumers are required to apply for Distribution Franchisee through MoU route or take separate individual connections as per relevant Regulations & Orders of MERC. (Refer Procedure for grant of open access permission, MAH govt. order)[2]

5. High initial project financing costs: Upfront project costs scares several investors, and leads them to believe that open access of RE through grid-procured power purchase agreements would be the most viable option

6. Project Implementation related issues: Implementation phase of RE generation encounters hurdles in:

- Land acquisition and space availability;
- Identification of vendor & EPC(Engineering & Procurement Service Provider) service provider;
- Lack of awareness of the related policies at the ground level
- Discouraging attitude of utility companies towards commercial consumers,
- No incentives for project developers

Conclusion

Falling cost of renewables, new progressive policies have set the tone for larger RE adoption. This will be hastened if the key asks are well received and addressed by the government. Key asks by Corporates from Government in context of RE are as follows:

- Strict monitoring of RPOs and RGOs for a robust REC market
- Implementation of the tariff policy on the ground through a clear guidance at all levels. Seamless facilitation of access to Renewable Energy via grid through PPA
- Simplification and standardisation of policies across states.
- Single window clearances.
- Availability and awareness of various viable financial models for off grid and grid based RE.

The two key outcomes of this work are:

1. Results of the Survey on Renewable Energy Perspectives from corporate India indicated that variety of hurdles exist, however overall adoption is expected to increase.
2. Analysis of current RE policy scenario in India revealed that the government of India has taken several steps which will boost RE adoption. However, there is a concern regarding weak governance, and on ground implementation support. Strengthening these will be key to RE adoption.

The Western Region comprising of states of Maharashtra and Gujarat has the largest concentration of business houses. Textiles, pharma, petroleum, IT, chemicals, electronics, heavy chemicals, automobiles, food, and plastics are some of the major industries in the region. Infosys and Tata Motors are the two Indian companies that figure in the global list of over 55 companies[3] which have signed up for RE 100 program, it is in the interest of all to see more companies declare their commitment in a similar fashion. This will help India transition to a low carbon economy.

Contents

Reason for This Study

The global environmental status is scientifically proven to be increasingly threatened by climate destabilization, and renewable energy (RE) plays a pivotal role in helping bring balance to the ecosystem as well as human economies. This study was conceptualised at a crucial juncture of climate policy, as international leaders met at Paris for COP21, where in a historic Paris agreement on 12th December 2015, 195 nations set path to keep temperature rise well below 2 degrees Celsius.

In the recent past, the Ministry of Environment, Forests, and Climate Change, Government of India, has taken several policy initiatives to facilitate the role of renewables and simultaneously empower "the billions at the bottom." Notwithstanding the action or inaction of governments, it is necessary for corporate entities to take up the task of empowering society through their initiative and ingenuity. A majority of existing literature explores RE adoption challenges from the perspective of a government or a utility. With increasing interest in corporate RE projects, there is a necessity to delineate the challenges and opportunities, considering the corporate perspective.

Corporate renewable energy focus has been enhanced lately due to the formation of Low Carbon Technology Partnerships Initiatives (LCTPI)[4] by the World Business Council for Sustainable Development (WBCSD), which aims to catalyse actions to accelerate low-carbon technology development, and scale up the deployment of business solutions such that global warming is limited to below 2°C. Pertinent to adoption of Renewable Energy is the RE 100 initiative[5] which is a collaborative, global initiative of influential businesses committed to 100% renewable electricity, working to massively increase corporate demand for renewable energy. The top corporates in India have deployed number of renewable energy projects in the last 10 years. Global companies such as IKEA, Swiss Re, BT, Formula E, H&M, KPN, Mars, Nestlé, Philips, among others, are taking bold steps to create transformative change needed to drive a clean energy revolution. They are all members of RE100 – a global, collaborative initiative of influential businesses committed to 100% renewable electricity. RE100 is led by The Climate Group in partnership with CDP, as part of the We Mean Business[6] coalition. Infosys and Tata Motors, headquartered in India, are part of the global list of around 60 companies[7].

A survey was devised to elicit the insights and insecurities of professionals and experts who are exploring investment and adoption of RE. This report analyses the realistic scenario of the existing policy and technology developments with an aim to help corporations assess the gap between their present state and a potential 100% RE scenario.

Methodology and Scope

The core approach adopted in developing this work is based on primary data obtained through surveys, interviews, as well as desk-based research. Primary data was collected via survey and interviews with companies based in Maharashtra, and secondary data on RE status, policies, and obstacles is obtained for other states in the Western Region and India. The national status on renewable energy progress, in terms of policy and technology is first drawn out by assessing the history of RE growth and penetration in India, as well as current goals for growth as set in the context of the COP21 Paris meetings and the Intended Nationally Determined Contributions (INDCs) stated by the Government of India. Projections for RE based on current data and anticipated growth are then made to identify the gap and potential for reaching the INDC goals. A thorough and detailed state-wise analysis of supportive policy statements is also presented here to quickly and easily inform readers about the scenario for RE progress in leading states.

The hurdles to RE penetration identified via the survey and interviews are vetted via an independent evaluation of the present and potential challenges and opportunities for corporate adoption and investment in RE. Learnings from India from past success stories, as well as other countries are showcased to identify policy actions that strongly encourage RE progress. Insights from CDP report data and interview comments are also included to give more nuanced understanding of the obstacles for RE. This paper scope of the paper is centred on Solar and Wind as a major chunk of INDC commitment will be fulfilled via this route. It does not dive into Biomass and Waste-toEnergy adoption hurdles as that is a topic that needs to be discussed in detail separately.

Scope of the interactions is limited to companies and vendors with operations in the Western region with special focus on Maharashtra. Corporate adoption challenges of both on-site off grid and grid based solutions have been touched upon in this paper.

Background

A. India's Renewable Energy Journey

The World Economic Forum has identified climate change as one of the top global risks in their 2015 risk assessment[8], where climate change is directly related to energy consumption and the ways by which required energy is produced. Just 90 companies across the world produce enough greenhouse gas emissions every year to account for 67% of the global emissions leading to climate change.[9] Electricity generated from RE is considered to be carbon neutral and thus, have a significant contribution towards climate change mitigation actions. It has been projected by World Energy Outlook that "Over 50% of new generation capacity to 2040 comes from renewables and nuclear"[10]. Electricity generation accounted for about 38% of India's total greenhouse gas emissions in 2007.[11] Installed capacity of grid-connected renewable energy projects in India has been steadily increasing since 2010, and has spiked in 2015. The installed capacity of RE systems in India has been moderate until 2014, with the cumulative total installed capacity of grid-connected RE systems in India rising from 31.70 GW to 33.79 GW between March 2013 and December 2014. However, there has been steep increase in RE in the year 2014-15, where it rose from 33.79 GW to 42.75 GW by March 2016.

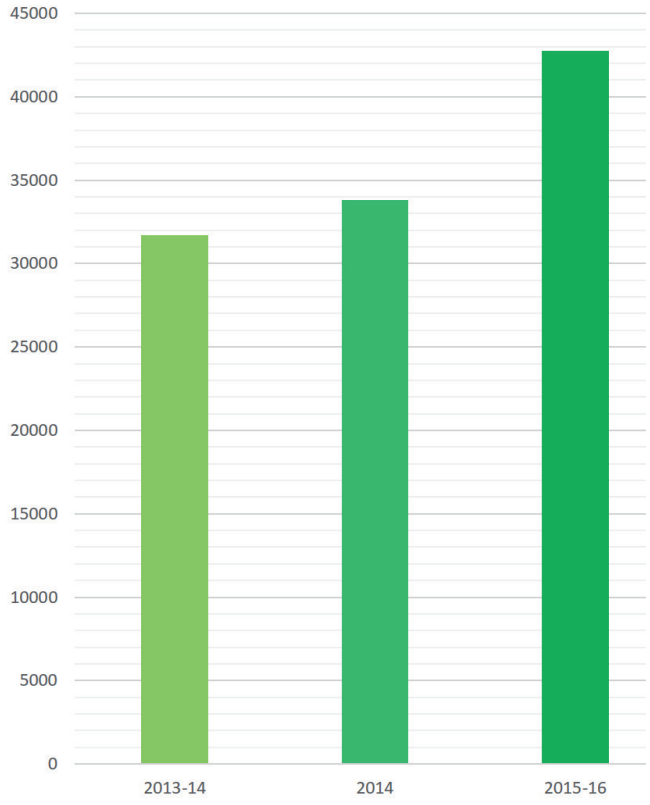


Figure 1: Cumulative Installed Capacity of Grid-connected Renewable Energy Systems in India, MW

At current levels of growth, the electricity demand in India is projected to reach 2241 TWh by 2030. Owing to trends such as increased urbanisation, need for infrastructure development, and the "Make in India" initiative that summons an increase in local manufacturing. India has declared an Intended Nationally Determined Contribution (INDC) to reduce carbon emissions by 33-35% below 2005 levels by 2030. To achieve this goal, India will have to avoid 3.59 billion tonnes of CO_2 equivalent emissions over the current 'business-as-usual' status. The country also aims for around 40% of the installed power capacity from non-fossil fuel-based energy sources by 2030. To achieve the RE contribution to the total power capacity mix, 175 GW of renewable power capacity has to be installed by 2022 and 300 – 350 GW by 2030. The development of RE technology in India officially began in 1981 with the

formation of Commission for Additional Sources of Energy (CASE) in the Department of Science and Technology (DST).

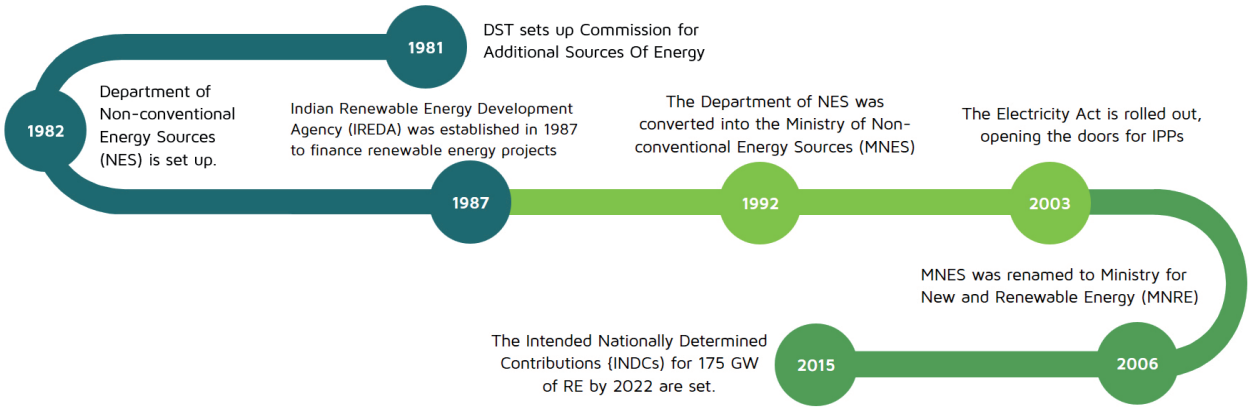


Figure 2: Timeline of the development of RE in India.

B. Penetration of RE in India

The RE sector has shown a CAGR of 15.42% from 2010 to 2015. The table and graph shows the total RE capacity and growth in the RE installing -till March 2015 respectively.

Units, GW	Solar Power	Wind Power	Biomass Power	Small Hydro Power
Installed Capacity (March 2015)	3.38	22.65	4.18	4.03
2022 RE Goal as per INDCs	100.00	60.00	10.00	5.00
Total Potential Sources	748.99	102.77	25.09	19.75

Table 1: RE installed capacity as of March 2015[12]

A survey that received 32 responses from Indian companies shows that grid-connected solar PV systems, wind power, and waste-to-energy systems appear to be the top choices for investment in RE technology by organizations, with 50% of the respondents choosing each option.

The CDP India Report 2015 states that "[Indian] Organizations are getting more aware of opportunities and are investing significantly in upstream renewable energy options."[13] Captive solar power, biomass-power, and solar water heating are also popular and seem to attract investment.

From the corporate perceptive, climate change, emissions reduction, and environmental pollution concerns are the prime reasons for the organizations who responded to this survey to invest in renewable energy.

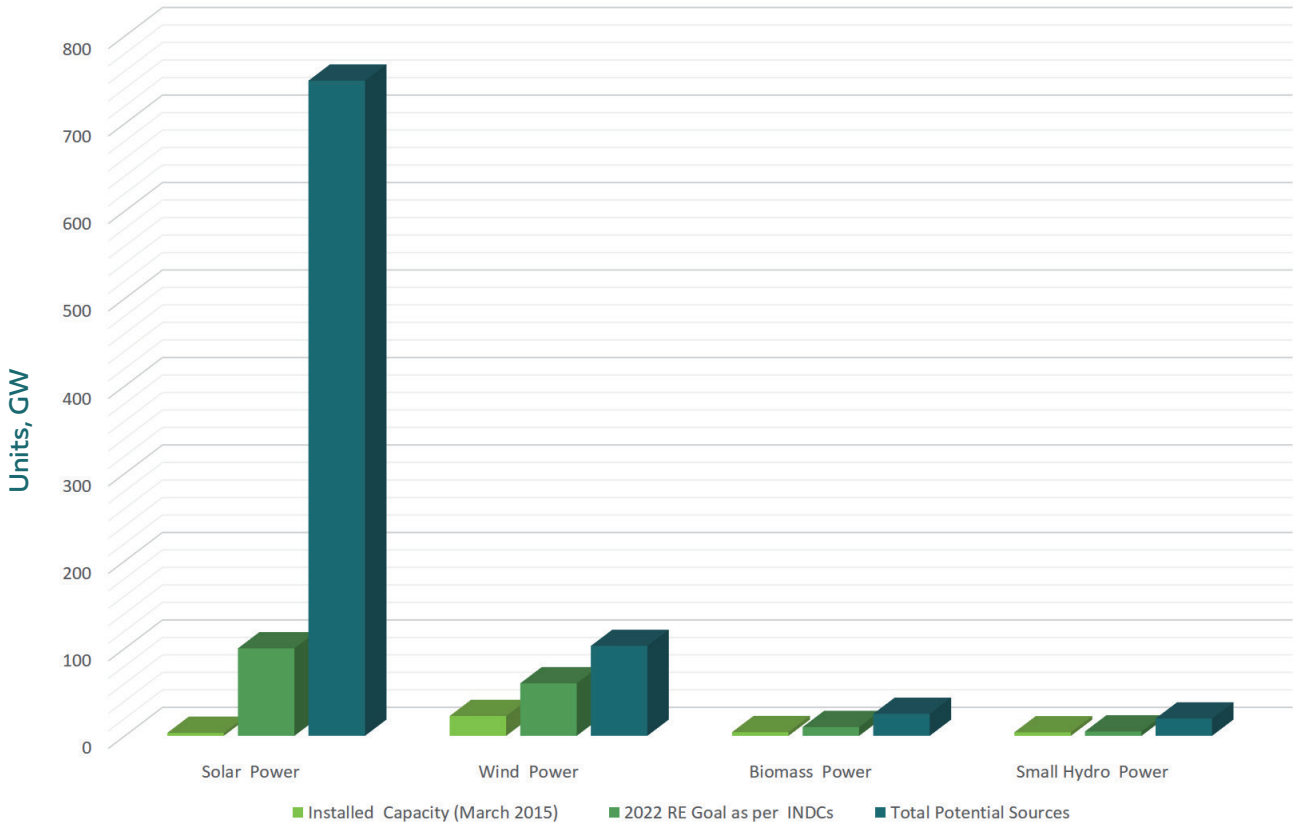


Figure 3 Gap Assessment of renewable energy current installed capacity and total potential

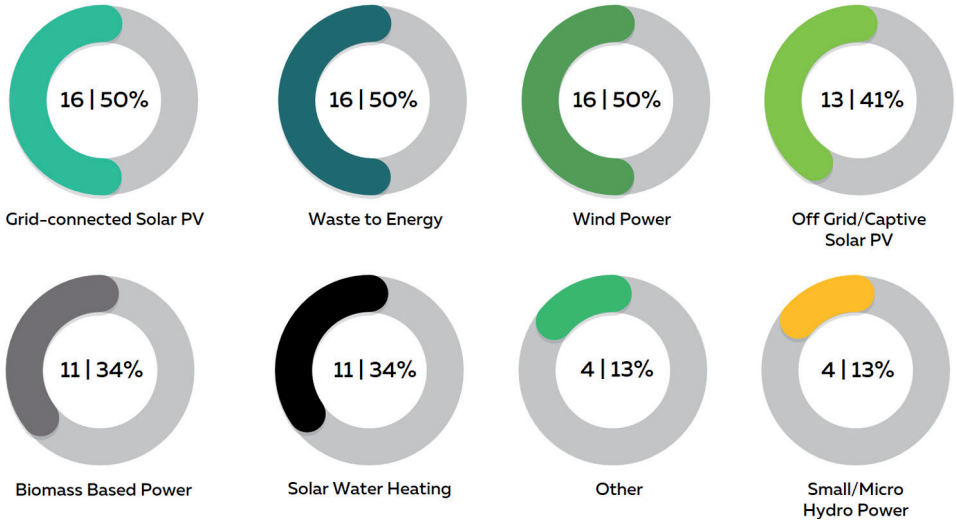


Figure 4: Top Choices of renewable energy Technology for Adoption

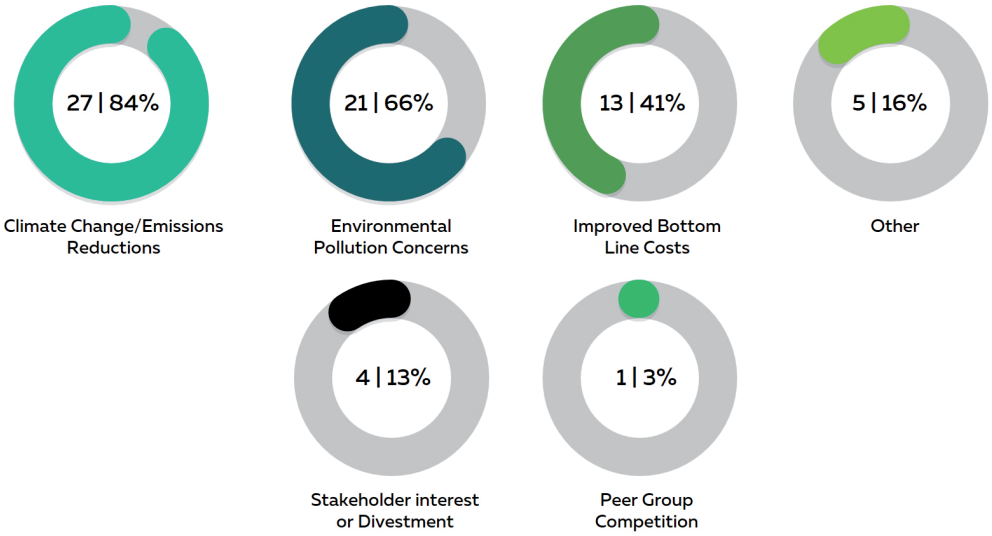


Figure 5: Reasons for renewable energy Adoption and Investment

C. Current Renewable Energy Goals

The renewable energy target for 2022 has been set as 175 GW, with a target of 100 GW from solar power, 60 GW from wind, 10 GW from biomass and 5GW from small hydro power plants (less 25 MW installed capacity).

The new amended electricity tariff policy was published on 20 January 2016[15] . Following are the major amendments made, in particular, to encourage development of renewable energy in India.

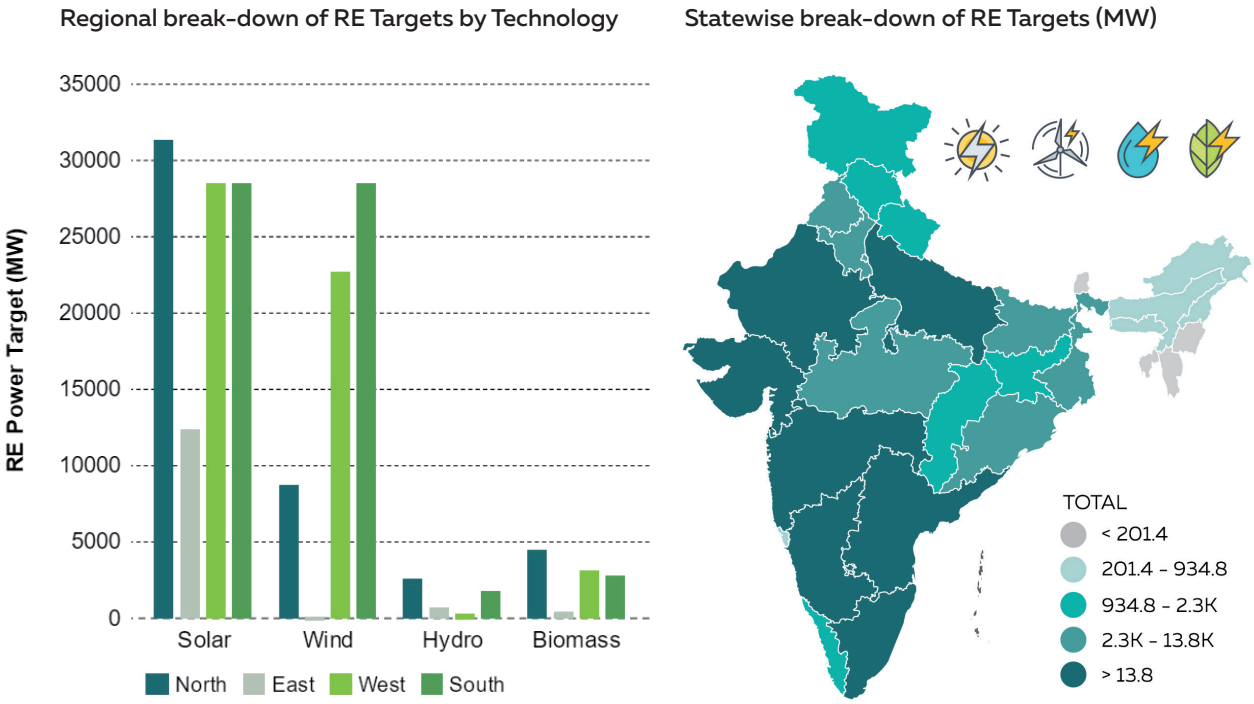


Figure 5: Reasons for renewable energy Adoption and Investment[14]

- RPO has been increased from 3% by 2022 to 8% by 2019, excluding hydro power. This shall be mainly from solar power, thus increase in solar installed capacity to 69 GW by 2019.
- Solar and wind power are exempted from the inter-state transmission charges and losses. This can potentially boost the investment in solar and wind energy resource rich states. Green energy corridors for evacuating renewable energy shall have a significant impact on the renewable energy transmission between states. In December 2015, ADB has approved a loan of USD 1 billion for the "Green energy corridor" project by Power Grid Corporation of India Limited[16] .
- The new coal based thermal power plants have to generate or procure at-least 10% of its installed capacity from RE, after a specific date. The thermal power plants, due to their existing energy evacuation infrastructure and scale, shall have advantage over the independent power producer of renewable energy.
- The power generated from waste to energy plant shall be procured. 100% procurement of power from waste to energy technology shall boost bio-energy generation.

The amendments in the tariff policy also allow the bundling of renewable power with the conventional coal power for which the PPA has been expired or the useful lifetime of the conventional coal power plant is over. This will help in improving the affordability of renewable energy. The amendments in the tariff policy have been made in view of the renewable target of 175 GW by 2022; however, the policy is observed to be highly ambitious and without proper strategy and action plan, the changes on the ground will be difficult to implement. The survey of 32 corporates shows that 63% of the respondents are satisfied with this policy change, and 38% are not satisfied.

D. Projections for 2022 At The Current Rate of Increase in Renewable Energy

The CAGR, as assessed for the year 2010-11 to 2014-15, of 6.58%, the renewable energy target of 175 GW is projected be achieved in the 2033 as opposed to 2022 as targeted. Overall, these projections predict that renewable energy target of 175 GWh by 2022 is not achievable at current CAGR. To meet the renewable energy target of 175 GW by 2022, the renewable energy in India needs to grow at the rate of 31% CAGR.

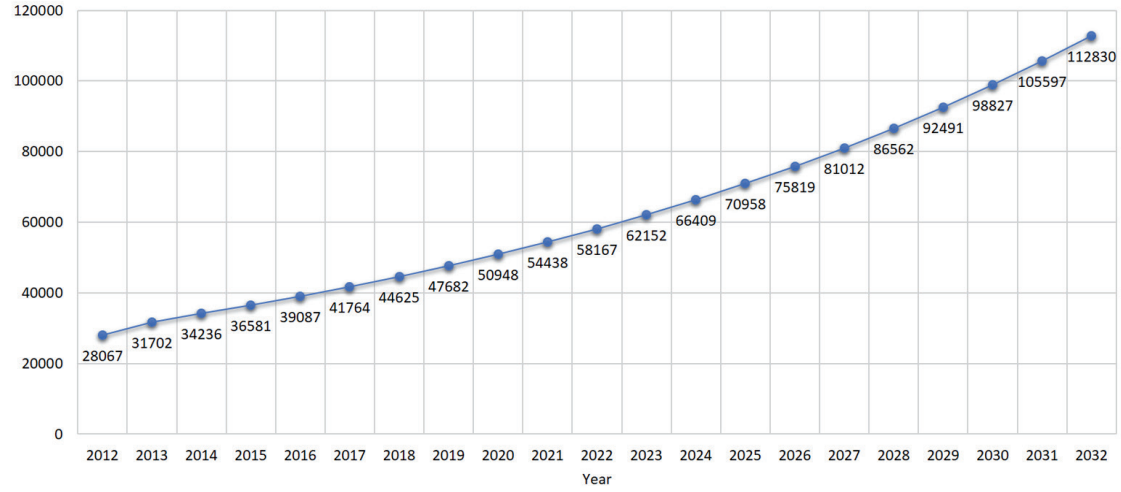


Figure 7 At Current CAGR of 6.85%, INDC goals will be reached in 2031

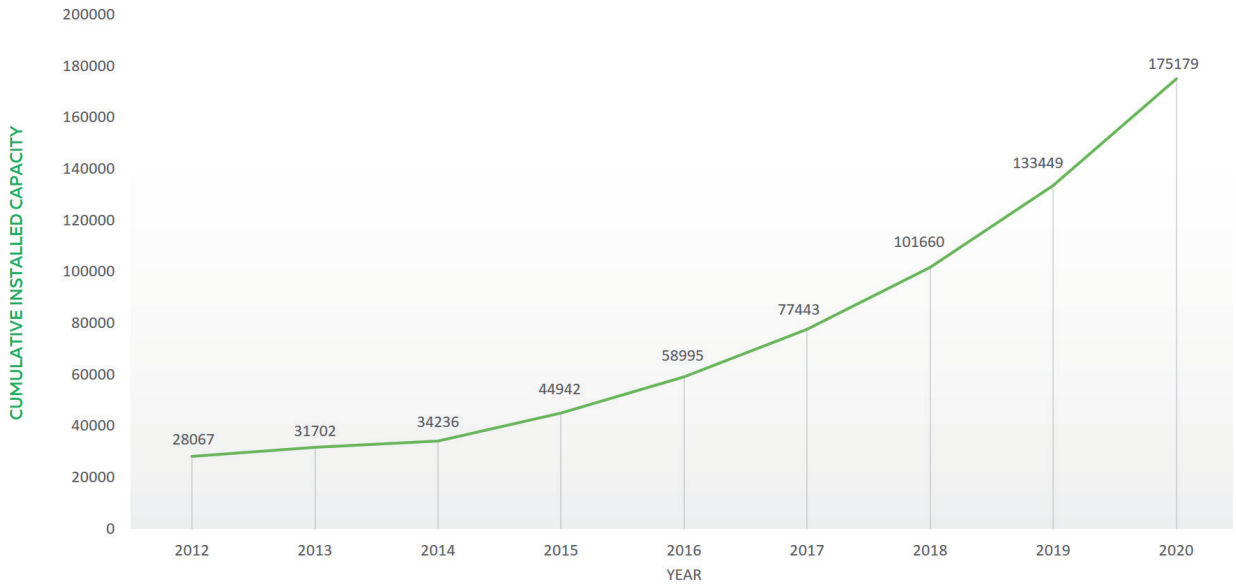


Figure 8: To achieve INDC goals by 2022, CAGR should increase to 31% or more

In terms of technology solutions, the main observation is that a majority of the survey respondents (84%) choose Waste-to-Energy as the primary technology option where infrastructure should be created for the realization of renewable energy targets by 2022. However, it is to be noted that the largest fraction of the renewable energy targets is the 100 GW goal for solar power, and 66% of the respondents agree that development of solar parks is necessary for reaching this goal.

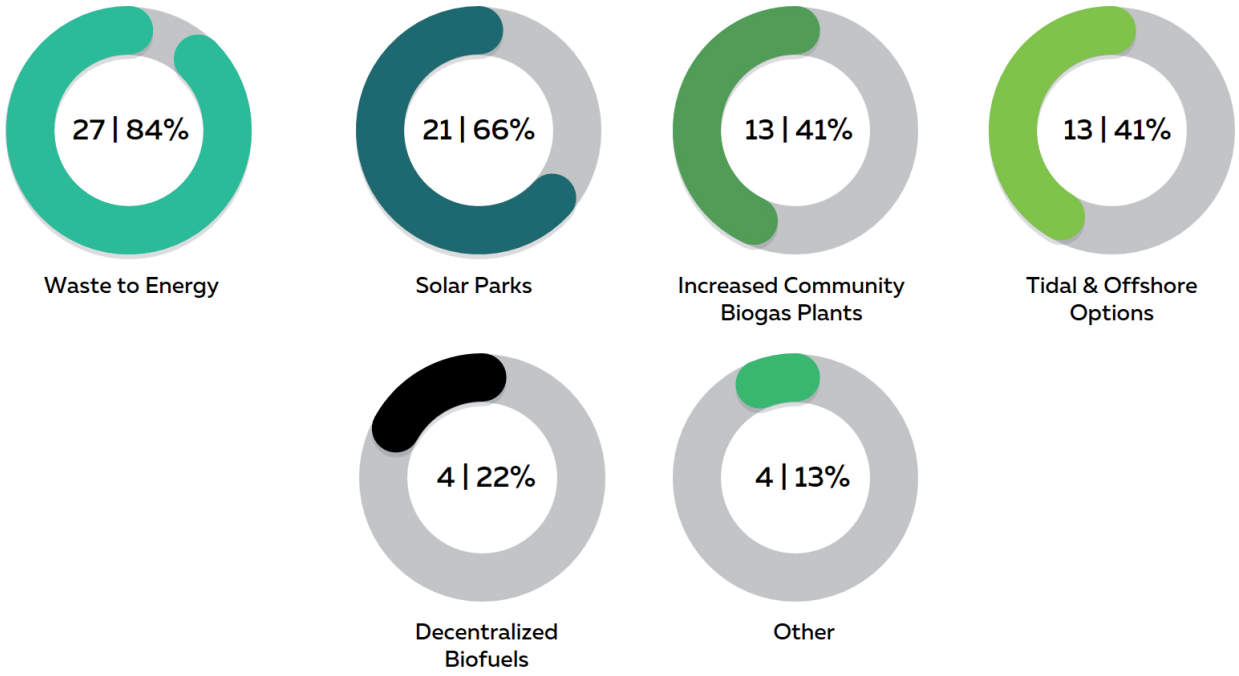


Figure 9 Developments required to reach the renewable energy goals by 2022

"In terms of renewable energy technology, we are mainly exploring solar because it matches with our load curve and has good ROI. We are also exploring other renewable sources for our future requirement. With renewable energy installations, one has to make sure that the installed plant is performing at the anticipated level, since down time or un-used assets are not profitable". -Infosys

"The installation of 100-GW solar PV systems by 2022 is vital to the success of India's INDC statement the COP21, Paris. India's INDC have been correctly made keeping in mind both, our need for growth and care for the environment. Royal DSM is a RE100 signatory and all our decisions are driven by this commitment. In India, DSM has operations at 6 sites, of which one already gets more than 50% power from renewable energy sources. (Pune – 1 MW technology demonstration PV plant also serves to meet that sites renewable energy goal). More sites are considering solar power over next 12-18 months. These initiatives are driven by sustainability goals and it gets better when they become commercially viable too. We are still in early days for solar in India. Most policies and procedures are going through a transformation, targeted at accelerating adoption of solar in India." – DSM, India

"While there is progress and excitement around COP21, it may not help achieve 100% renewable energy target, since that is very difficult to implement on the ground. The facilitation in regulatory environment is not yet created to enable a shift towards 100% renewable energy. Ecosystem has to be modified to facilitate it. There are no internal challenges, since there is common agreement on renewable energy initiatives, but external factors such as cost and regulatory framework around renewable energy has is the main obstacle.RE should become at-par with grid tariff in order for companies to take it up more aggressively. SERCs sometimes stop companies from using power from their own captive plants. Long term strategy of renewable energy procurement is set, with the goal of achieving 50% reduction in per capita emissions by 2020 using 2008 as baseline year. Science based goals are way ahead for us. However, renewable energy is on the radar and there is common agreement for pursuit based on our own maturity cycle."
– Prominent IT Major.

Solar Power Projections

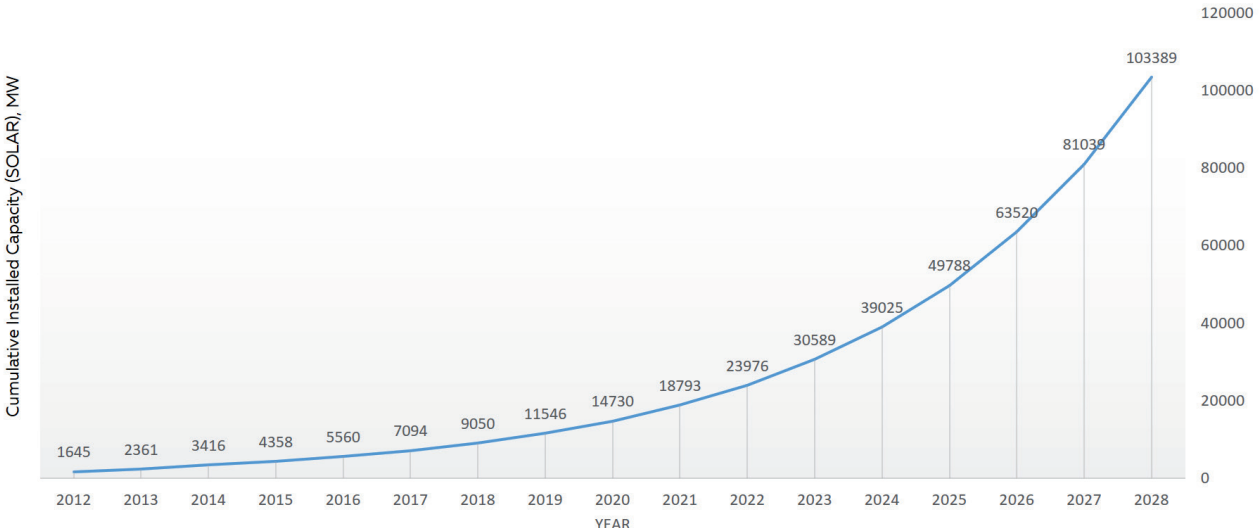


Figure 10 At current CAGR (27.58%), 100 GW solar targets can be reached in 2028

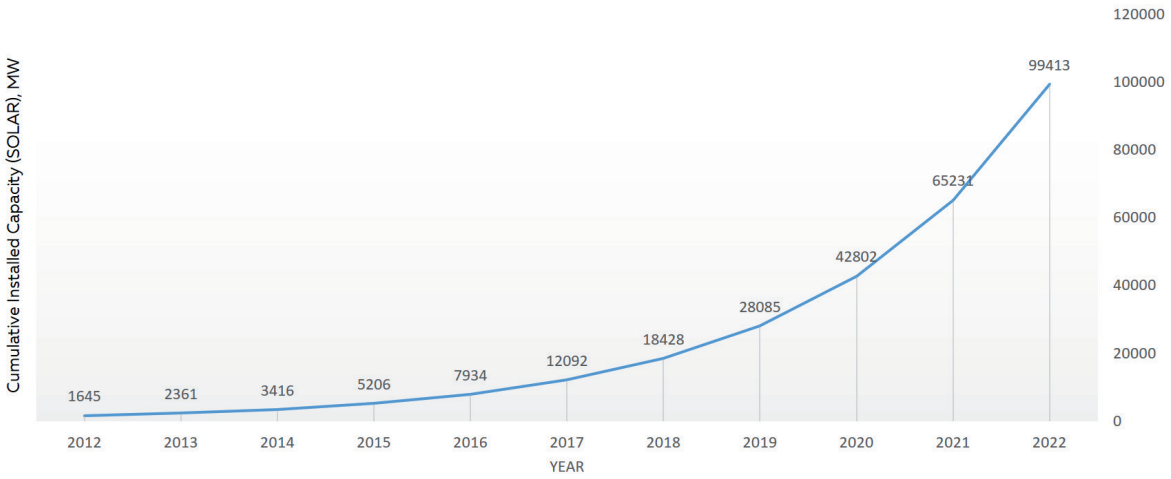


Figure 11 To achieve the 100 GW solar goal by 2022, we need a 90% increase in CAGR

Wind Power Projections

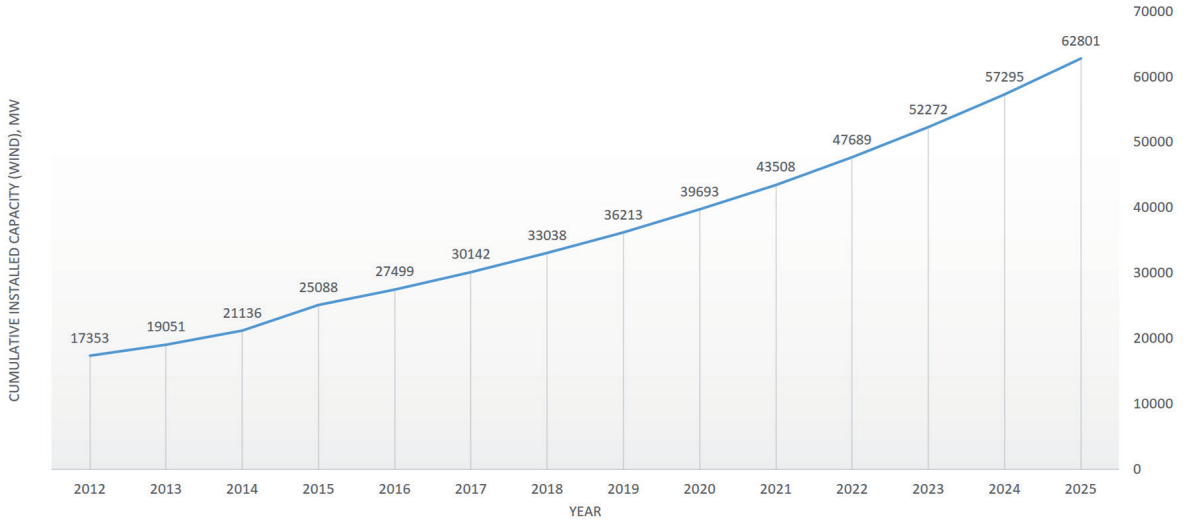


Figure 12 At Current CAGR (9.61%), INDC goal for Wind power can be reached in 2025

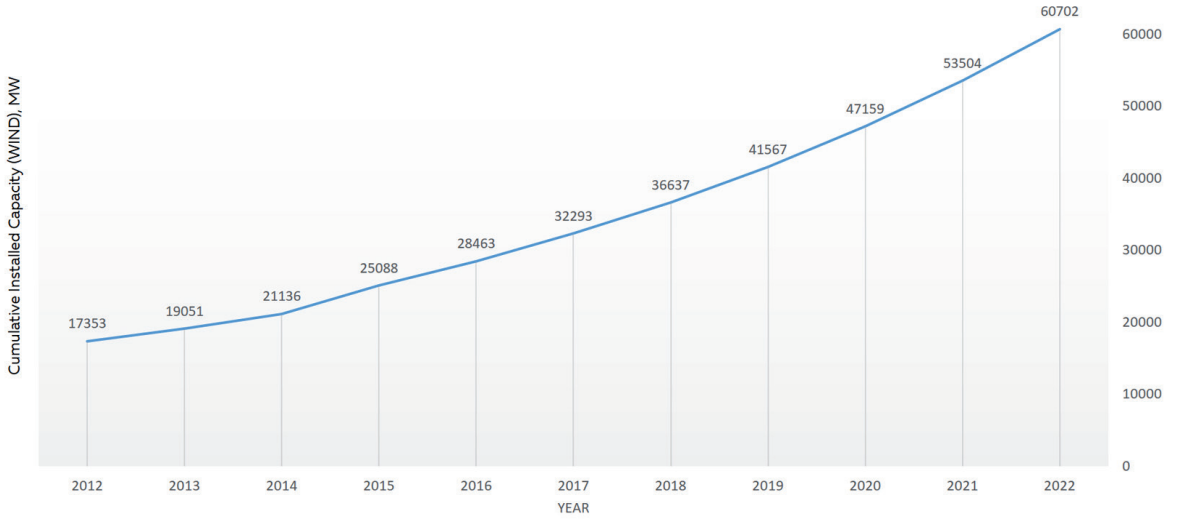


Figure 13 To achieve INDC goals by 2022, CAGR should increase by 40% to 13.45%

Bio Power Projections

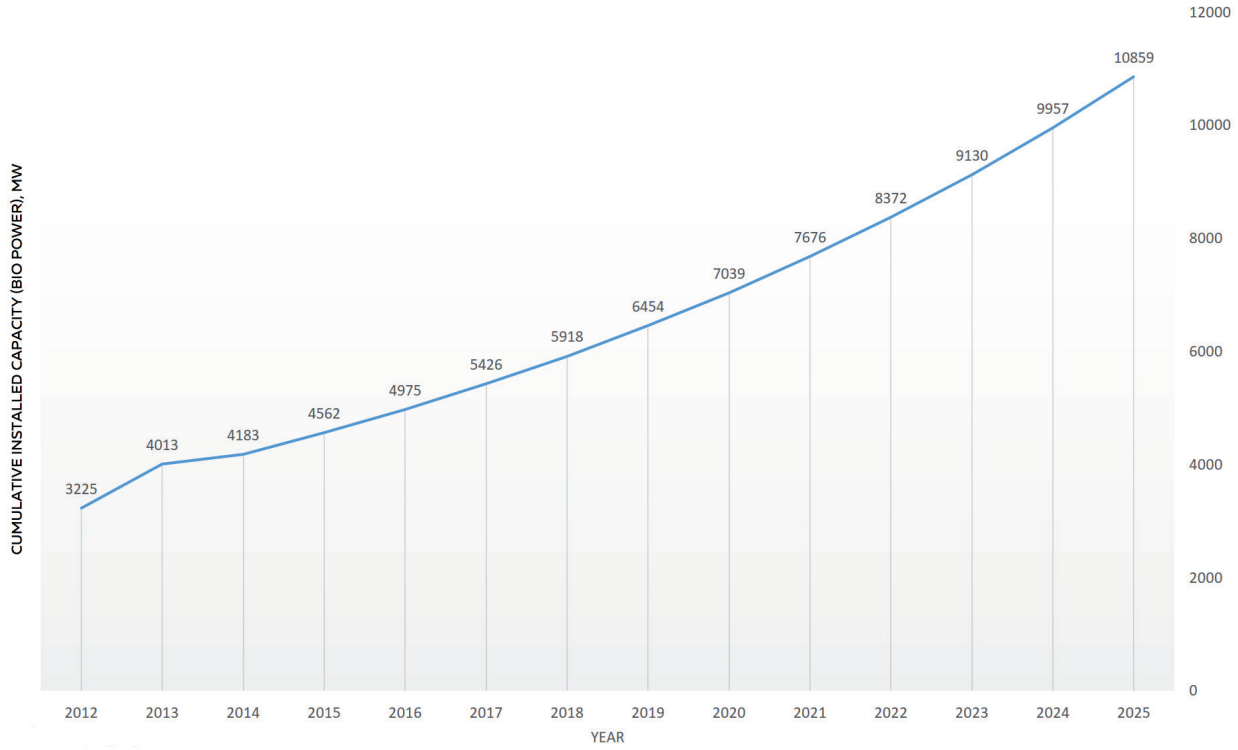


Figure 14 At current CAGR (9.6%), INDC goal for Bio power can be reached by 2025

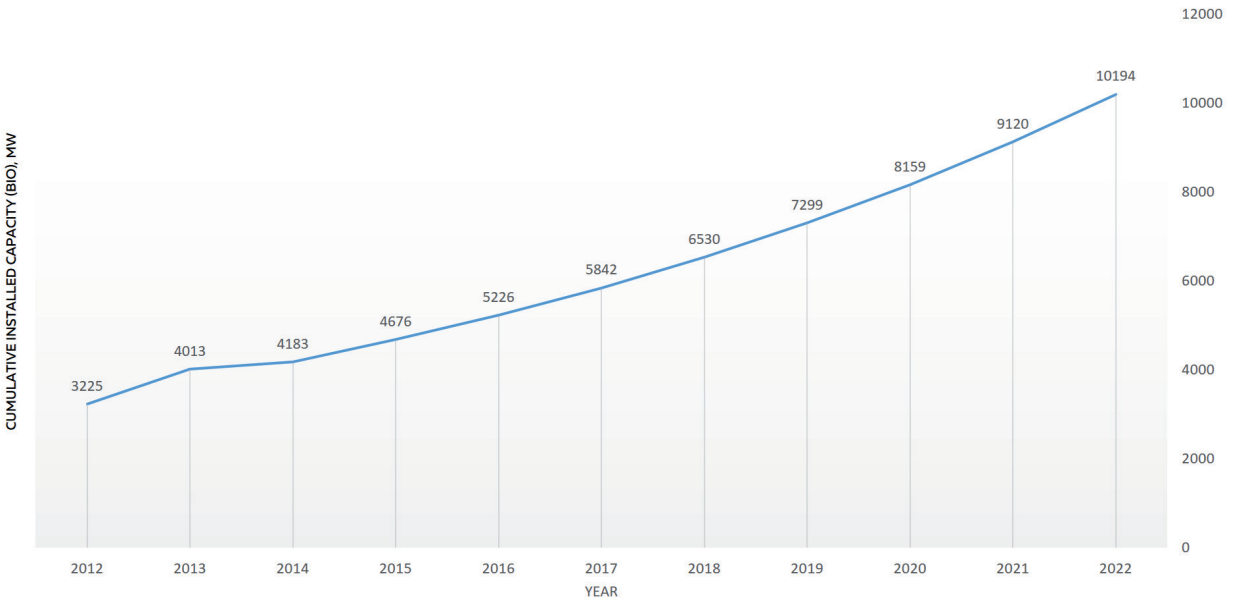


Figure 15 To achieve INDC goal of 10 GW Bio power by 2022, CAGR needs to be 11.78%.

Insights from Surveys And Interviews

Current Hurdles in Renewable Energy Penetration In Corporate India

Based on our interaction with various top corporates such as Infosys, DSM, Yes Bank, Mahinda and Mahindra, Tata Motors, Tech Mahindra, Dr. Reddy's, TCS, ACC etc in India, and key vendors in this space via surveys and one-on-interviews the key hurdles can be bundled into 5 major sections.

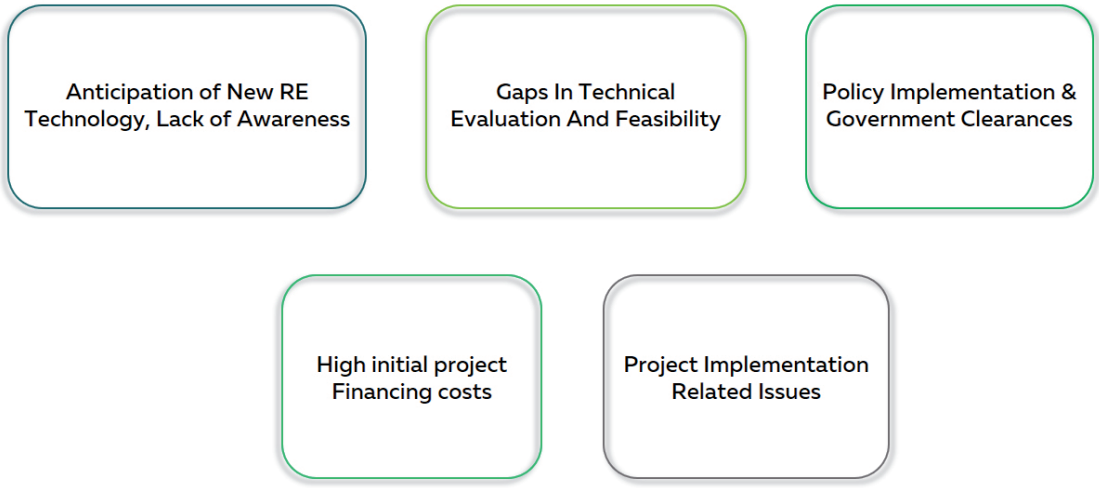


Figure 16: Major Hurdles in renewable energy Adoption

"The process of reverse tendering has resulted in investor bidding for tariff which is below the project financial feasibility. This acts as constraint in encouraging investment. It has been suggested that Feed-In Tariff is a better option as the investor is aware of the tariff. Implementation of FIT for all renewable energy supplying power to grid shall improve investment in renewable energy. The now-prevalent reverse tendering process is not beneficial since it gives little time for careful planning. Investors should plan properly first."

"Currently, there is no policy in relation to the quality of the product used in solar rooftop and SPV large projects. The policy needs to be supported by strong legislation. Moreover, there is deferred investment thinking, since solar prices are crashing. In reality, several solar professionals need to understand the technology well enough to make it succeed."

"There needs a proper understanding of the relationship between continuously falling tariffs which bounds developers to invest into comparatively lower quality product specifically PV Modules to meet the ROIs. Strict guidelines with respect to PV Modules and inverters for country like India with diversified climate is essentially required to make sure that our multi-billion dollars (Almost 6,00,000 Crores INR) of investment is profitable."
The above comments are attributed to Infosys Ltd.

"In addition, Infrastructure for power evacuation and transmission is considered as the major bottleneck

or hurdle. State utilities are not financially healthy enough to take care of the power evacuation and transmission infrastructure. Writing-off the loans of SEBs can be way for improving financial health of SEBs. Laid-back attitude of state utilities also acts as constraint in the development of renewable energy. Coal India and NTPC are involved in infrastructure investment." – Independent Consultant 1 (RK Mandoli)

"One of the biggest drivers needed to achieve the 100-GW goal would be to attract adequate investment and funding. Another key challenge we foresee could be compromise on quality of the panels used. If we use sub-standard panels to reach this ambitious goal, it will impact the long term feasibility of solar and derail the entire thrust and optimism towards it." – Prominent Indian Power Company

"The first and foremost challenge is the need for a positive mind-set and willingness to adopt renewable energy. The JNURM had defined a national solar mission at a part of NAPCC (National action plan on climate change). Currently the PM is pushing for an aggressive solar adoption. However, this is not percolating down at grass root level and increasing adoption.

There is a marked gap in what the Centre and State say and do, in terms of renewable energy. Centre wants renewable energy adoption in all states; however, at state level, there is no provision to make adoption happen on the ground. Power is a state subject. Oil and Coal is a central subject. If renewable energy adoption has to increase then renewable energy power should be a central subject and the states must make provisions for higher adoption of renewable energy. From countries energy security point of view the – India is heavily dependent on oil imports.

Wind energy adoption in India has been successful, Biomass there is an issue of storage and assured availability, solar has potential in this country. Solar is DC – lots of devices like LED, laptops, chargers can accept DC current. If 2 types of wiring systems are available then adoption could be influenced In India very few biomass plants have come up. 5000 MW of wind set up in India.

Capacity utilization factor of wind and solar power plants is another issue. The capacity utilisation of solar is 20-25%. Tracking panels may increase cap utilisation but that increases the cost. Wind has a higher cap utilisation factor. If wind and solar both are combined in the same area the cap utilisation factor can be raised yielding higher power."
All above comments attributed to Independent Consultant 2 (Atul Shah)

Major Hurdles to RE Adoption

1.Awareness and anticipation of new renewable energy technology.

Description

It has been observed from the survey outcome that 50% of the corporates consider deferred investment due to the technical maturity, continuous development and anticipation of new renewable energy technology and more cost-effective technologies.

It has also been indicated by the corporate, during interviews, that there is gap in the implementation of central policies at state level. The lack of awareness on renewable energy policies in State Electricity Boards and SERCs acts as a hurdle in the process of renewable energy implementation. The need for capacity building, i.e., to develop awareness among non-technical professional who do not fully understand renewable energy and Climate Change, has been identified. Mostly companies whose top management is convinced and committed to RE, work with power and renewable energy consultants to help them in choosing the right technology. Some companies mentioned that the top management would like to see the business case for various options and then choose the most suitable one and hence easy to use tools, where ROI of projects can be worked out by the companies themselves would be wonderful.

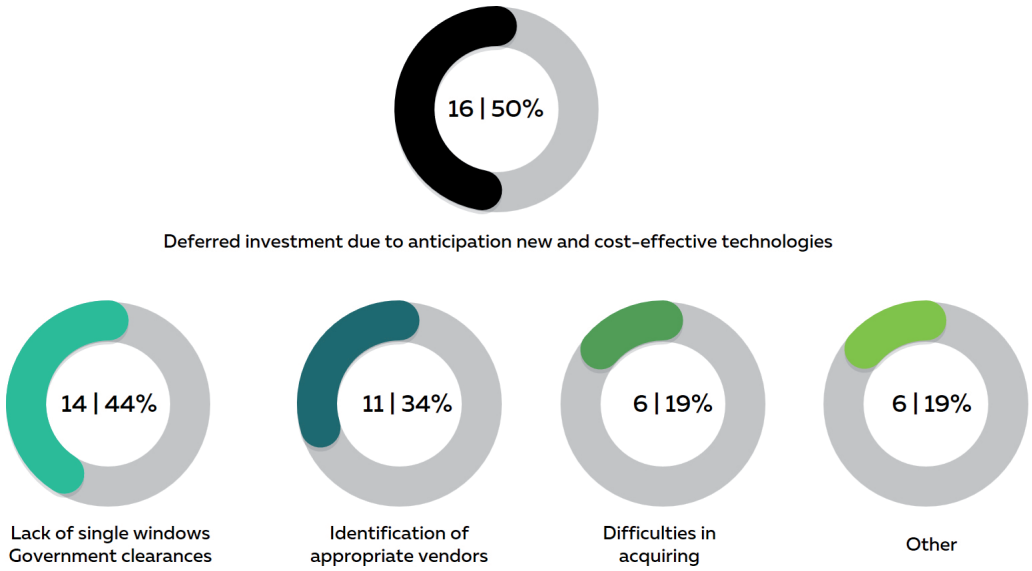


Figure 17 Main external reasons for inertia in renewable energy adoption

2. Technical evaluation and feasibility.

Description

Issues such as (a) variability of resource availability, (b) storage of excess power generated by renewable energy and (c) feeding of power to the grid have been identified as the main technical constraints in the implementation of renewable energy.

Solar roof-top installations encounter constraints in terms of old building structure. Since the GHG emissions from buildings accounts to over 35% of total emissions, new buildings must be designed to handle solar installations.

The existing power transmission and distribution infrastructure needs technological transformation to eliminate power loss, including transmission & distribution (T&D) loss and power theft. The survey shows that 63% of the respondents consider development of smart grids as the most important infrastructure that can encourage organizations to invest in RE, followed by research and development infrastructure and local manufacturing facilities.

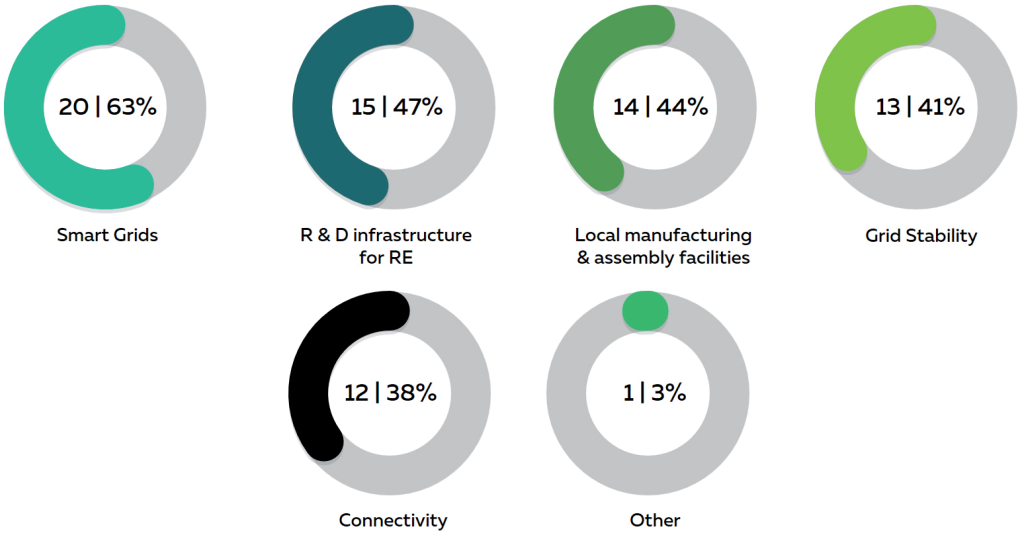


Figure 18 Most important infrastructure development for renewable energy progress

Technical evaluation of large-scale deployment of solar PV systems in India encounters barriers due to lack of testing facilities and qualified experts who can test and certify solar products, as well as the capability to qualify and demonstrate viability of solar modules based on local conditions. Nearly 60% of the respondents are interested in new renewable energy technologies that enable extraction of energy from landfills, sewage, and municipal solid waste.

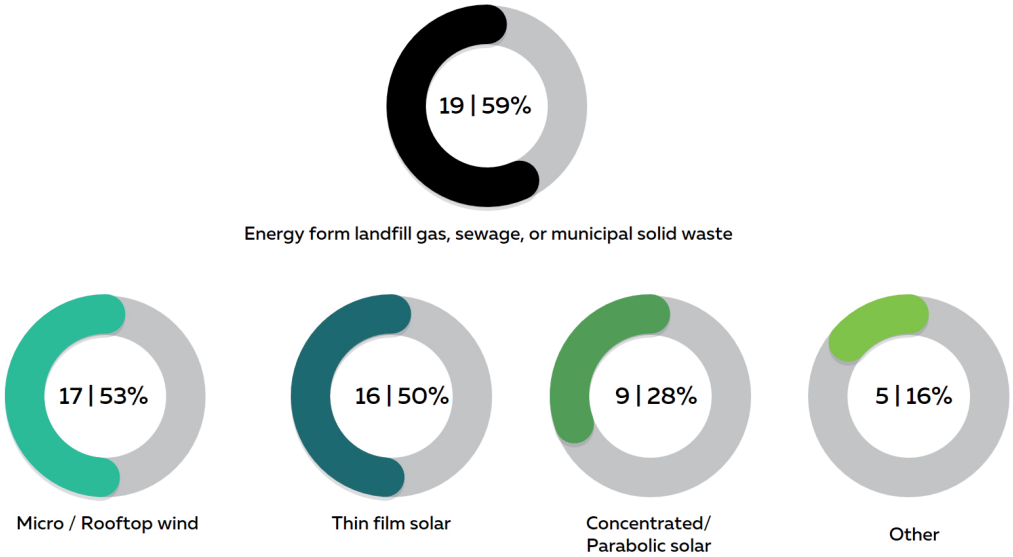


Figure 19 Most Interesting New renewable energy Technology Options

Concerning the ecosystem of infrastructure and technology around RE, a large majority of the respondents (63%) clearly indicate that improvements in the power output per unit installed capacity can largely influence organizations' decision to invest in renewable energy.

It has been a general observation that solar power technology is constantly upgrading and is in the path to be a business case for profitable investment. However, solar is yet to mature as technology

to invest and other mature technologies such as micro-hydro, wind, should be further encouraged. Wind is most developed in terms of policy, process, and awareness and is a mature technology.

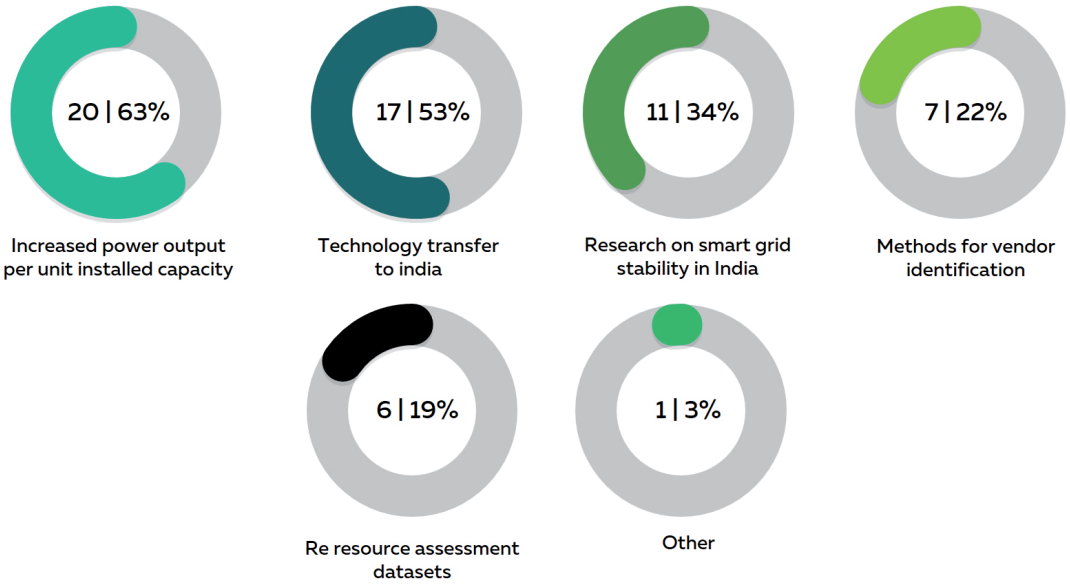


Figure 20 Main improvements required to ecosystem surrounding RE

3. Implementation.

Description

Implementation phase of renewable energy generation encounters hurdles in

A) land acquisition and space availability,
B) identification of vendor and EPC service provider,
C) lack of awareness of the related policies.

Solar and wind renewable energy systems demand large space per unit of power generation. Furthermore, investors find it difficult to identify the appropriate vendor and EPC service provider in the current vendor environment.

34% of the survey respondents indicate that identification of vendors is an issue and 19% of the respondents identified land acquisition as a constraint.

Implementation of solar power, specifically in urban areas, encounters acute space constraints. Currently, states do not have any system or policy to lease out land from the land banks to offer to renewable energy investors and incentivize land owners, to overcome space constraints.

Implementation hurdle for waste to energy projects are collection of wastes and waste volumes.

Wind adoption has been successful so far. Going forward, implementation hurdle for wind are state-wise policy constraints.

For both solar and wind implementation hurdles are around lack of alignment of central and state governments. Some states are more pro renewable energy as compared to Maharashtra.., namely Karnataka and Telangana Implementation can be streamlined for vendors if at least for public.

sectors renewable energy investors common guidelines for installation are drafted by NTPC, PGCIL, CEA. This would reduce the long wound process of project implementation.

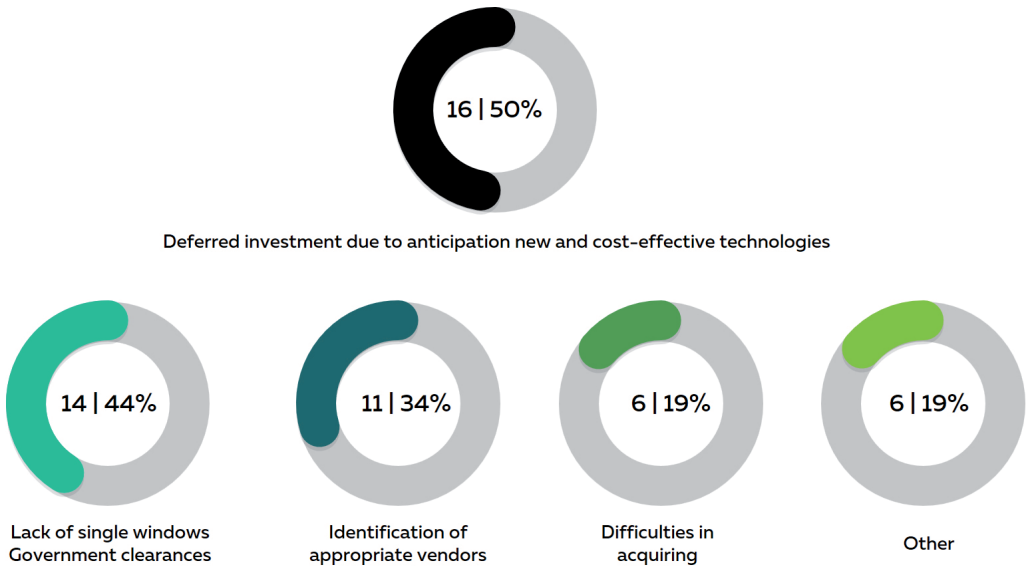


Figure 21 Main constraints to renewable energy project implementation

Practical implementation challenges for organisations that work out of leased facilities(such as banks with remote sites), shared sites(such as BTS), project based operations at sites(such as construction and heavy engineering infra firms) which are temporary make adoption and implementing renewable energy instead of diesel a distance dream.

4.Finance.

Description

High capital cost and low cost effectiveness of RE, particularly solar power technology, acts as a major hurdle in investment. Investment in renewable energy is yet to become a profitable business case that is economically sustainable for corporates.

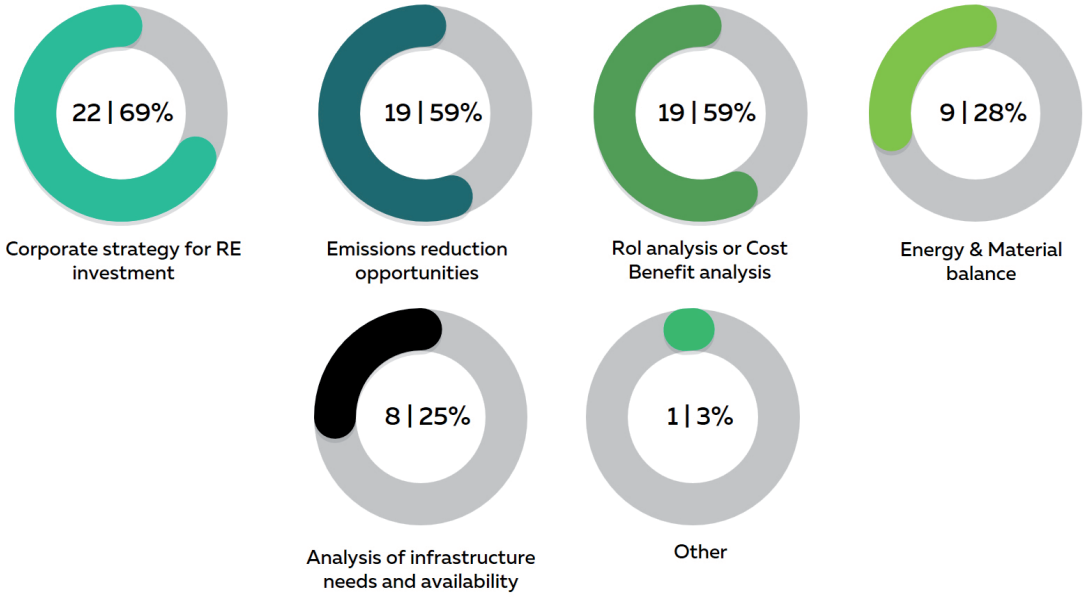


Figure 22 Main reasons for corporates to invest in RE

Therefore, there is absence of corporate strategy and budget allocation in renewable energy investment at present.

The survey results indicate that corporate strategy statements are the vital mechanism (69%) that influences renewable energy investment decisions at organizations that responded to this survey, followed by ROI or Cost Benefit Analysis and the processes for identifying emissions reduction opportunities.

Concerns about high ROI and low payback period are the key main internal obstacles to adoption of (and investment in) renewable energy at 63% of the organizations responding to this survey. Allocation of budget for renewable energy projects is another difficult obstacle on this path.

"Foreign exchange fluctuations are also a concern: for instance, projects that were financially closed when the dollar was at $63, are suffering from a percentage hit since then at present rates, affecting their business model and IRR. Since solar is an infirm power, investments in grid balancing is also required. Adding to this, there are frequent challenges of acquiring land in a short time. Lastly, majority of the 100 GW projects will be handled predominantly by private sector solar companies as well as few Government entities. Accordingly health and intent of state distribution companies will also play a pivotal role in long term perspective. If the system of reverse bidding continues with possibilities of lowered unfeasible prices, thereby making these projects unviable in case of any untoward change in input cost, and hence developer can opt out."
– Prominent Indian Power Company.

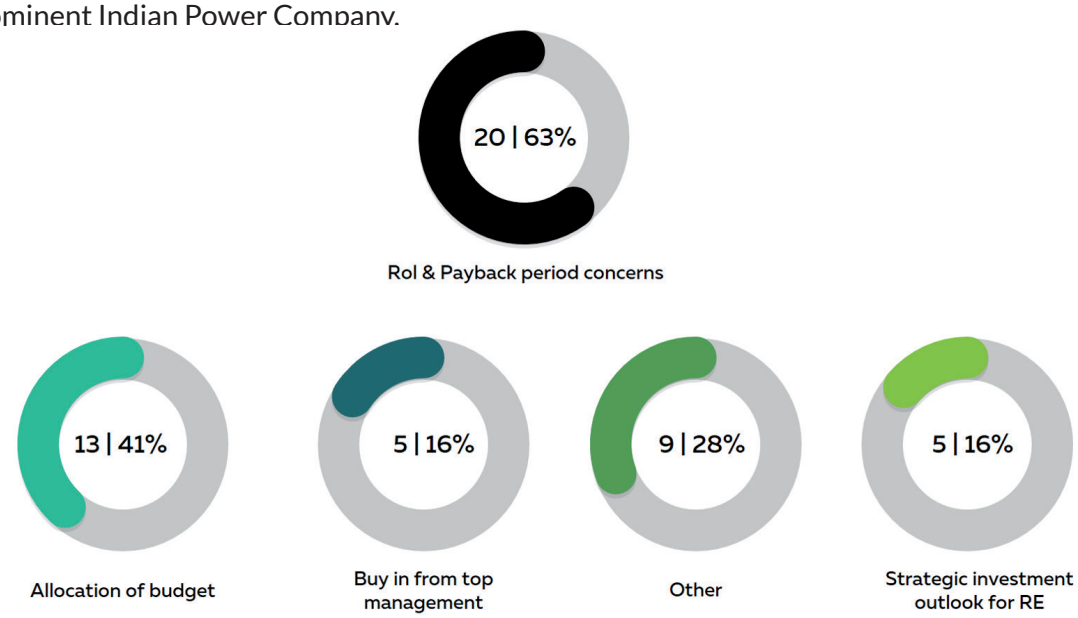


Figure 23 Main Internal Obstacles to renewable energy Adoption

It has been a general indication during the survey interviews that investment in renewable energy is also done to avoid high HT or commercial tariff. 47 % of the respondents agree that lower interest rates for renewable energy loan can spur investment, while 31% agree that streamlining paperwork pertaining to loans from banks or the government as the most vital external action that can encourage organizations. Project financing is tough for small projects.

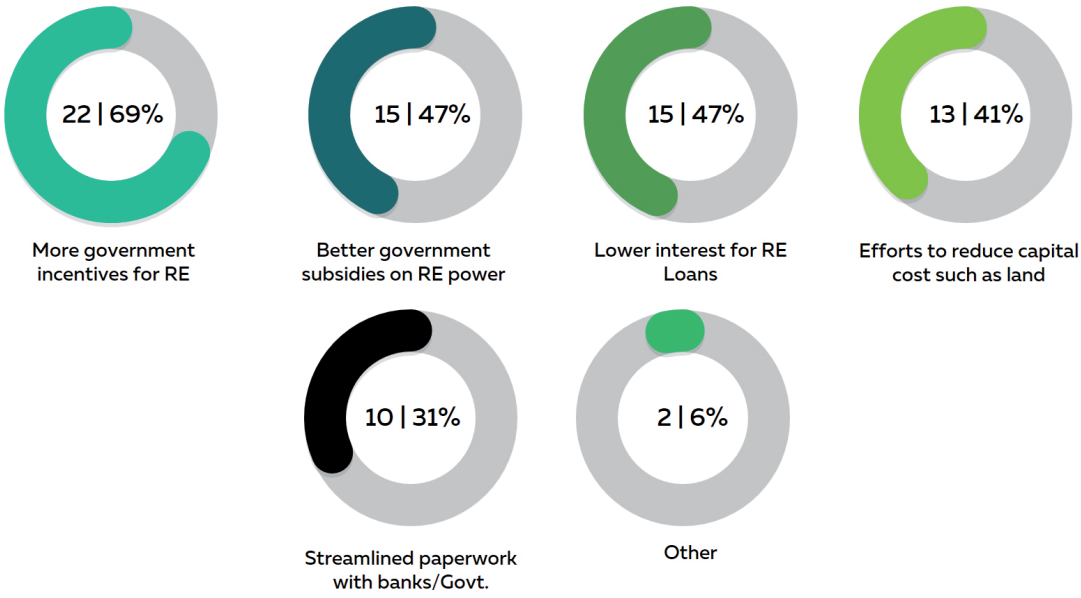


Figure 24 Main external actions that can boost renewable energy Investments

"The bottom-line for renewable energy progress is the financial aspects of investment and installation of renewable energy. Subsidies matter! Organizations should be given financial support. In addition, there is need for capacity building, to develop awareness among non-technical professional who do not fully understand renewable energy and Climate Change. This awareness should increase even among top-level decision makers and management so that they get a good idea of the benefits of RE, combined with ease of adoption. SEBI has made BRR mandatory for Top 200 companies. Similar specific guidelines for renewable energy adoption could be offered by SEBI to Top companies in the market, and the regulatory authority could conduct audits on progress of renewable energy installation and investments, showing not just commitments, but also clear action plans." – Dr Reddy's labs

5. Policy implementation and government clearance

Description

Implementation of policy at state level has been identified as one of major hurdles in renewable energy development in India. The issues related to policy implementation are:

Implementation of RPO: Lack of strong compliance implementation of RPO has resulted to the failure of REC market. Since, the actual adaptation of RPO is poor and there are no actions taken against non-compliance with RPO, the demand and the market for Renewable Energy Certificates (REC) has not developed. Currently, the price of REC is lower than that for generating renewable energy or buying renewable energy power from grid.

"Companies buy solar power to meet the RPO. Due to the low implementation of RPO and RGO, REC market has not developed. Strong RPO compliance implementation is required for the renewable energy market to develop. REC is cheaper than buying renewable energy power. However, strong implementation of these regulations will ensure renewable energy growth even if renewable energy captive generation does not make business case. Also, investment in renewable energy is mostly done to avoid the high commercial

power tariff. (This is particularly true for service sector like BPO, IT etc. which have huge infrastructure)." – ACC Limited

Government clearances: Ease of doing business and obtaining government clearances act as barriers in development of renewable energy. There is also lack of awareness on renewable energy regulations and policies at the state level agencies.

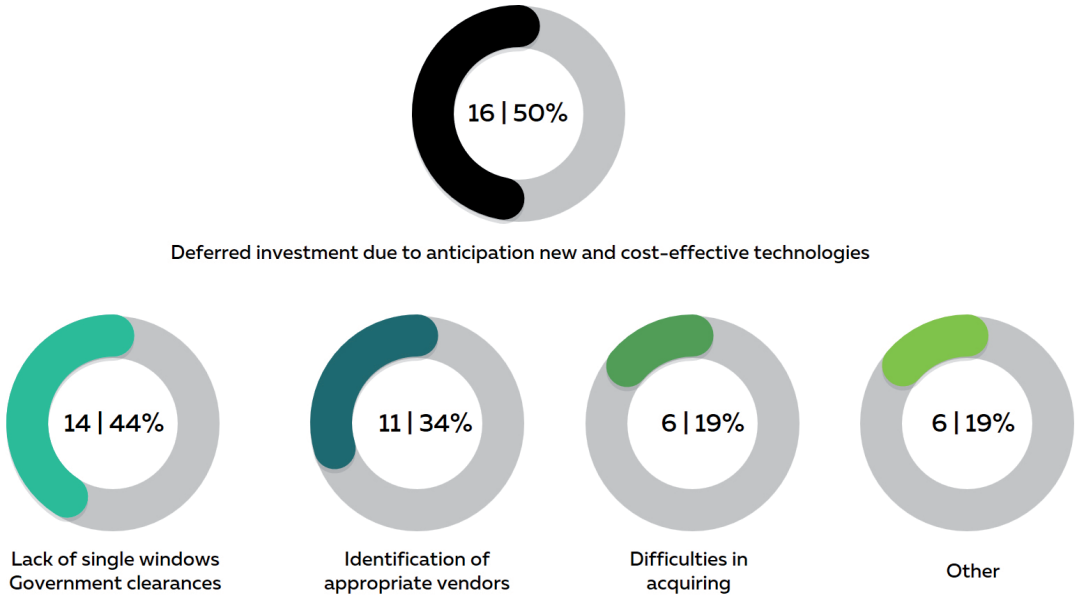


Figure 25 Lack of single window clearances is an obstacle

44% of survey respondents identified lack of single window government clearances ass a major external hurdle encountered by corporates.

Policy adoption: The onus for implementation of national policies lies with the state government, but the adoption of national policies on renewable energy by states is low in India. Even though Open Access and Net Metering have been introduced in the national renewable policy, in states like Maharashtra, there is a lack in the implementation. No energy banking was allowed in open access in Maharashtra as per Distribution open access policy 2014. The lack of these policies implementation in Maharashtra has resulted in reduced cost effectiveness of renewable energy and increased cost of captive generation of renewable energy at the demand side.

Policy around coal usage: Due to the reduction in the price of coal, the cost of conventional coal power is lower than power generated from renewable energy.

Lack of incentive structure: In the current scenario, there is no incentive structure for procuring green power or investing in renewable energy.
At least 66% of the respondents opine that offering encouraging incentives for innovation in renewable energy is the main policy change that can enable organizations to invest in renewable energy. 59% of the respondents also call for reduced renewable energy power tariffs for buyers as a

means for inciting greater purchase of renewable energy. 69% of the respondents call for supportive government incentives for investment in renewable energy and for generation, and 47% favour better government subsidies as the most vital external action that can encourage organizations.

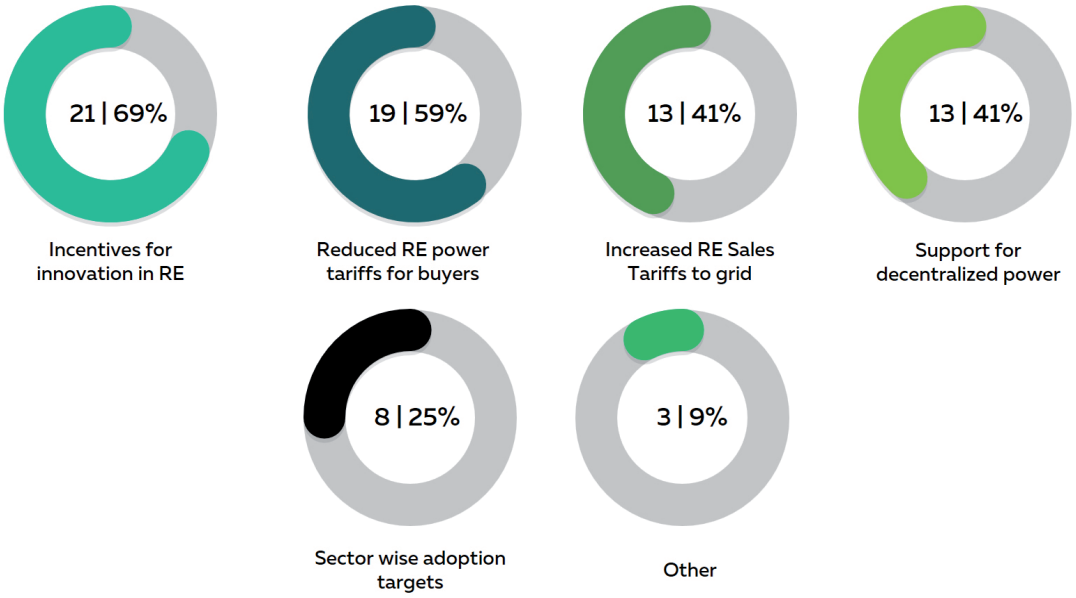


Figure 26 Policy changes that can spur renewable energy adoption and investment

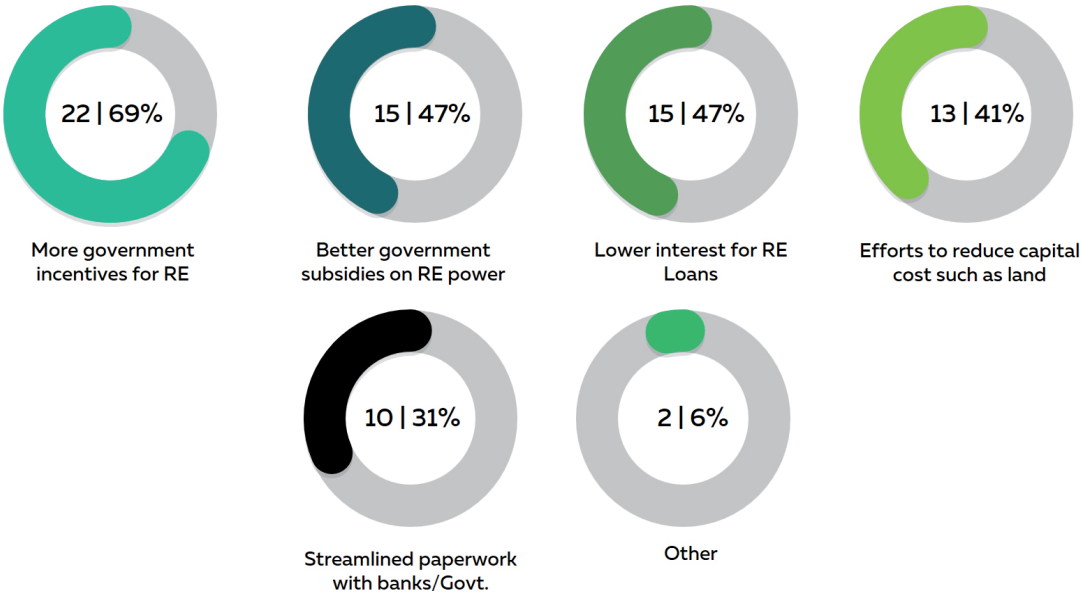


Figure 27 External financial environment for renewable energy progress

It is a general observation that strong implementation of regulations will ensure renewable energy growth even if renewable energy captive generation does not make an immediately profitable business case.

Good Policy Gives Good Results

It has been observed from the "Tentative State-wise break-up of Renewable Power target to be achieved by the year 2022" by MNRE that of the total renewable energy target of 175 GW, 99.53GW is from solar, with 60GW from solar project and 40GW from solar rooftop, and 60GW is from wind energy. In view of this, the policy conditions are analysed for the states mentioned in Table 3 and detailed the policy highlights are provided in relation to solar and wind energy for mentioned states in Appendix 4.

The top states of India with highest renewable energy installation for wind and solar power are Tamil Nadu, Gujarat, Rajasthan, Maharashtra, Karnataka and Andhra Pradesh.

It is observed from Table 3, as of 1 March 2016 Tamil Nadu, Telangana, Rajasthan, Andhra Pradesh and Madhya Pradesh are the top states in terms of solar capacity addition. Furthermore, Rajasthan, Madhya Pradesh, Karnataka, Gujarat and Maharashtra are the top five states showing wind power capacity addition.

It is observed that Maharashtra has the lowest capacity addition in solar power, among below mentioned states, followed by Gujarat and Karnataka. In terms of wind capacity addition, Tamil Nadu showed the lowest capacity addition, followed by Andhra Pradesh and Gujarat. Only Rajasthan and Madhya Pradesh are the two states who are among the top 5 states in capacity addition for both wind and solar. Variations across India in open access costs/tariffs, wheeling /banking charges and other open access charges make it difficult for companies to adopt renewable energy in reality.

State/UT	Installed capacity				Potential	
	Solar in MW		Wind in MW		Solar	Wind
	As on March 2015	As on 1st March 2016	As on March 2015	As on 1st March 2016	In MW	In MW
Andhra Pradesh	247.46	475.74	*912.5	*1155	38440	*14497
Goa	--	--	--	--	880	--
Gujarat	1000.05	1024.15	3581.3	3876	35770	35071
Karnataka	78.22	104.22	2548.7	2886	24700	13593
Madhya Pradesh	563.58	678.58	567.3	1200	61660	2931
Maharashtra	363.7	378.7	4369.8	4638	64320	5961
Rajasthan	1047.1	1264.35	3052.7	3877	142310	5050

* Andhra Pradesh numbers include current Telangana State

Though progressive companies are trying best at all levels, it is very difficult for companies to meet renewable energy 175 MW Goal in absence of clear policies and even different policies in different states. For example in state of Maharashtra and Tamil Nadu there are plenty of different kinds of OA charges that makes the state not very investment friendly.

The western states, namely, Maharashtra, Goa, Madhya Pradesh and Gujarat have been considered for the analysing the policy enablers, policy related hurdles and plausible solutions.

State/UT	Installed capacity				Potential	
	Solar in MW		Wind in MW		Solar	Wind
	As on March 2015	As on 1st March 2016	As on March 2015	As on 1st March 2016	In MW	In MW
Tamil Nadu	147.98	635.87	7394.0	7515	17670	14152
Telangana	62.75	392.39	*	*	20410	*

Table 3 State-wise Current Installed Capacity and Potential for Solar and Wind Energy[17]

Enablers, hurdles, and possible solutions for Western Region states

States : Maharashtra | Topic : Land

Enablers	Hurdles	Possible solutions
Land acquired will be granted deemed status of Non-agricultural land. Government land, if available, for solar parks and manufacturing of solar modules/panels/etc. shall be given 50 % discount on lease/rental charges.	Availability, identification and acquisition of land for implementation.	Identification and availability of state's land bank for the implementation and easy approval of land. Implementation of solar parks by Govt. Incentive, such as reduction on the stamp duty.

Topic : Policy

Enablers	Hurdles	Possible solutions
Inter-state and intra-state open access is allowed. Exemption of electricity duty for solar for 10 years. Re-powering of old WTG. Solar rooftop, with net metering: Energy banking for 1 year. Supervision charges levied by the TRANSCO/ DISCOMS for renewable energy power evacuation lines are exempted.	No power banking allowed for solar and wind power plants. Sourcing of power from multiple renewable energy generator through open access is not allowed. No "must run" status for solar. "Merit order dispatch" principle applicable. No exemption in wheeling, CSS, T&D charges and power scheduling. Minimum 1MW capacity for wheeling power. No exemption in registration cost for small scale installation in private space.	Allowing power banking for 1 year and removal of power scheduling as per draft Distribution Open Access regulation, 2015. Regulation should allow multiple sourcing of renewable energy (wind, solar) through open access. Exemption of wheeling, T&D, CSS for renewable energy energy. Providing "Must run" status for solar plants, thus removing "Merit order dispatch" principle. Reduction in the minimum capacity. Removal of registration cost for small scale rooftop solar or wind (less than 100 kW) installation in private space. Exemption of demand cut for solar rooftop, as provided in Gujarat.

Topic : Ease of business

Enablers	Hurdles	Possible solutions
Exempted from NOC/PCB clearance.	No single window clearance – there are about 6 numbers of permits/ clearances required for solar and wind project installation. (List of clearance in Appendix 5) No time-line for the approval, thus affecting project implementation time. Ease of availability of information in single source is lacking.	Introduction of single window clearance facility. Specifying time-line and turn-around time for the application. Allow start of project implementation immediately upon submission of application and fee. Providing all requisite information regarding policy, regulations, list of permits, clearances and approvals in a single source for ease of use.

Solar and wind Installed capacity [18]

378.7 MW solar installed capacity. 4638 MW wind installed. 52MW solar rooftop installation. [19]

States : Goa | Topic : Land

Enablers	Hurdles	Possible solutions
Identifying large land for solar park development though private- public partnership. Lease rooftop or private land for solar rooftop installation with net metering.	No concession in demand cut for wind and solar captive use. No concession in the land acquisition requirements for renewable energy.	Land acquired for renewable energy power can be deemed as non-agricultural land. Provide incentive, rebate in govt. land, and concession in stamp duty. Development of state land bank.

Topic : Policy

Enablers	Hurdles	Possible solutions
Solar projects exempted from wheeling, banking, cross subsidy and T&D losses charges. Grid connected solar projects, selling power to grid, considered as "must-run" Solar rooftop, with net metering, allowed power banking for 1 year. Open access – within Goa and other union territories.	State renewable energy policy is still in draft stage. Open access is limited to union territories. Power banking is limited to 30% of the annual generation capacity for solar rooftop. No power banking is allowed for ground mounted solar, installed for selling power. No exemption of energy scheduling and demand cut.	Implementation of state renewable energy policy. Removing limitation of open access within union territories. Removing ceiling of power banking for rooftop solar. Allow power banking for ground mounted solar plants. Exemption of demand cut and power scheduling shall encourage investment.

Topic : Ease of business

Enablers	Hurdles	Possible solutions
Payment is made within 30 days from the bill submission by generator. Electricity duty is exempted for power generation from solar projects.	Single window clearance in draft stage. No special clearance exemption for solar projects. No timeline on the approval and turn-around time for applications. Lack of ease in finding requisite information.	Implementation of single window clearance. Exemption of NOC/PCB clearance. Introduction of specific time-bound turn-around time for approvals and clearances. Provide all requisite information regarding policy, regulations, list of permits, clearances and approvals in a single source for ease of use.

Solar and wind Installed capacity [18]

As of Jan 2016, there was no installed capacity of solar.

States : Madhya Pradesh | Topic : Land

Enablers	Hurdles	Possible solutions
No land limit for solar projects in private land. Private land purchased has 50% concession in stamp duty. Govt. land allotment to bidder is based on the maximum free energy/MW offered by bidder.	Private land purchased for renewable energy projects is not deemed as non-agricultural. No policy on identification and development of state land bank for availability of land.	Land acquired for renewable energy power can be deemed as non-agricultural land. Provide incentive, rebate in govt. land. Development of state land bank and implementation of solar park.

Topic : Policy

Enablers	Hurdles	Possible solutions
Intra and inter-state third party power sale is allowed For third party sale of wind power within state, Government of MP provides grant of 4% in terms of energy injected. For solar power, Govt. of MP provides grant of 4% in terms of energy injected. Power banking allowed for 1 year. Electricity duty and cess not applicable for 10 years. Contract demand reduction is allowed for buying wind and solar power.	Banking charge of 2% energy banked is charged. No "must run" status for solar. "Merit order dispatch" principle applicable. Solar rooftop policy is in draft stage and yet to be implemented. (Highlights of draft policy in annexure). No exemption of demand cut and energy scheduling.	Providing "Must run" status for solar plants, thus removing "Merit order dispatch" principle. Removing wheeling, banking and T&D charges for renewable energy power. More than 100 km power evacuation line can be erected by state TRANSCO. Approval and implementation of solar rooftop policy as the soonest. Exemption of demand cut and energy scheduling shall encourage investment.

Topic : Ease of business

Enablers	Hurdles	Possible solutions
No registration cost is applicable for installing small scale WTG or Wind Solar hybrid plant (up to 100 kW) at a private rooftop or land. Industry status for solar and wind projects. No licence for solar project, generating and distributing power in rural area.	No single window clearance. No special clearance exemption for solar projects. No timeline on the approval and turn-around time for applications. Lack of ease in finding requisite information.	Implementation of single window clearance. Exemption of NOC/PCB clearance. Introduction of specific time-bound turn-around time for approvals and clearances. Provide all requisite information regarding policy, regulations, list of permits, clearances and approvals in a single source for ease of use.

Solar and wind Installed capacity [18]

678.58 MW solar installed capacity.

1200 MW wind installed capacity.

9MW solar rooftop installed.

States : Gujarat | Topic : Land

Enablers	Hurdles	Possible solutions
Allotment of waste land, based on availability.	Availability and identification of land for implementation. Private land purchased for renewable energy projects is not deemed as non-agricultural.	Development of state land bank. Implementation of solar parks by Govt. Incentive, such as reduction on the stamp duty. Land acquired for renewable energy power can be deemed as non-agricultural land.

Topic : Policy

Enablers	Hurdles	Possible solutions
Inter-state and intra-state open access is allowed. Beyond 100 km, the evacuation line from wind farm, is implemented by GETCO. No wheeling charge for solar rooftop with net metering. 50% of normal wheeling and T&D charges for captive solar plant under REC. Power banking is allowed for 1 billing cycle for solar rooftop with net metering, non REC solar project – captive and third party sale and captive wind projects. Solar rooftop exempted from 100% demand cut for residential and 50% demand cut exemption for industrial and other consumers. Captive wind and solar are exempted from demand cut up-to 30% and 50% respectively. Electricity duty exempted for all types of solar power projects and for wind projects, except in case of third party sales. CSS exempted for solar rooftop. 50% surcharge for non REC solar project.	No complete exemption of wheeling charges for wind and solar power. No power banking facility for wind power for third party sale. No "must run" status for solar. "Merit order dispatch" principle applicable. No concession in wheeling charge for third party wind power and captive consumption at 66kV. Policy does not address any exemption on the cost of registration of small solar rooftop. Solar rooftop capacity is limited to 50% of contract demand and load. Unlike wind project, no policy mentioned implementation of power evacuation line by GETCO from solar plants, beyond 100 km. No exemption of energy scheduling.	Removing wheeling, banking and T&D charges for renewable energy power. Allow power banking for wind project – third party sale. Providing "Must run" status for solar plants, thus removing "Merit order dispatch" principle. Re-powering of old WTG can allowed. Removal of registration cost for small scale rooftop solar or wind (less than 100 kW) installation in private space. Solar rooftop capacity limit is suggested to be increased. Policy to specify and implement that the power evacuation line, beyond 100 km from solar farm to be erected by GETCO. 100% demand cut exemption for industrial consumers can encourage solar rooftop installation. Exemption of power scheduling for renewable energy

Topic : Ease of business

Enablers	Hurdles	Possible solutions
Solar power and wind are exempted from NOC/PCB clearance.	No single window clearance facility No specific time line of the approval or erection of the power evacuation facility, beyond 100 km from wind farm. No timeline on the approval and turn-around time for applications. Lack of ease in finding requisite information	Implementation of single window clearance. Specify timeline for erection of power evacuation facility, beyond 100 km from wind farm. Introduction of specific time-bound turn-around time for approvals and clearances. Provide all requisite information regarding policy, regulations, list of permits, clearances and approvals in a single source for ease of use.

Solar and wind Installed capacity [18]

1024.15 MW solar installed capacity. 3876 MW wind installed. 44MW solar rooftop installed capacity.

It is observed that issue and its possible solutions, as mentioned below, will build a conducive renewable energy environment:

- Development of land bank by states, streamlined and quick procedure of land acquisition and providing deemed status of non-agricultural land upon acquisition of private land for RE.
- Provide single window clearance, time-bound turn-around time for approvals and clearances and specific timeline for facilities that are to be provided by state utility like TRANSCO/ DISCOMs.
- Allow open access, with multiple power sourcing, and power banking facility
- Providing "must-run" status for renewable energy projects.
- Demand cut exemption for residential as well as industrial and commercial consumers.

In addition, allowing re-power of old WTGs, availability of information is systemic manner, better incentive structure will increase ease of doing business and encourage investments. The details on issues and possible solutions of each state are provided in the above table.

Although the availability of potential is the key criteria for the magnitude of renewable energy development, it is understood that the relevant state policies around renewable energy plays a significant role in the development of renewable energy in the state. Below are the policy analysis and ease of business in Telangana, Andhra Pradesh, Tamil Nadu, Rajasthan and Karnataka.

Enablers, hurdles, and potential solutions for other select states

States : Telangana

Enablers	Hurdles related to policy	Possible solutions
Solar parks implementation is done by the state. Deemed conversion to Non-agricultural land status. Exemption of land ceiling act.	Energy banking for 100% of energy during all 12 months of the year. "Must-run" status. 100% refund of VAT/SGST and 100% refund of Stamp Duty for land purchase. Exemption of CSS for 5 years, wheeling for captive use, electricity duty.	Single window clearance PCB clearance within 7 days and NOC from Grampanchayat with 14 days. Grid connection approval within 21 days. Closure of technical feasibility with 30 days.

Land:

Solar parks implementation is done by the state. Deemed conversion to Non-agricultural land status. Exemption of land ceiling act.

Solar & wind installation , as on 1 March 2016

Solar rooftop, as of Oct 2015

392.39MW installed capacity of solar power (Appendix 6). 28MW solar rooftop installation.

States : Andhra Pradesh

Enablers	Hurdles	Possible solutions
Exemption of supervision charge by TRANSCO/DISCOM. Power banking for 1 financial year. Exemption of T&D and wheeling charge-captive or third party sale on 33kV line. Exemption of T&D charges within state. Exemption of Electricity Duty in case of sale of power to AP Discom by wind projects. Exemption of electricity duty Solar Power Projects setup within the State. Exemption of CSS third party sale for solar power projects setup within the State for 5 years from the date of commissioning. Intra-state and inter-state open access for third party sale.Intra-state open access for captive generation.	No deem non-agricultural land status. No "must-run" status for solar power, as given in Telangana. No exemption of banking charges. No inter-state open access for captive generation. No exemption of demand cut. No exemption in energy scheduling.	Wind energy projects: All approvals and clearances within 30 days from the date of registration. Solar Rooftop projects: All approvals and clearances within 14 days from the date of application. Technical feasibility for evacuation within 14 days from the date of receipt of application. All wind and solar power projects are exempted from obtaining PCB clearance. Open access turn around within 21 days, else deemed permitted.

Land

Allotment of revenue land as per availability. Private land to be procured by developer.

Solar & wind installation , as on 1 March 2016

Solar rooftop, as of Oct 2015

Installed capacity as of 1 March 2016 - 475.74 MW. 1155MW wind, which includes data of

32MW solar rooftop installation.

States : Karnataka

Enablers	Hurdles	Ease of business
Exemption of solar power banking charge for 10 years Exemption of wheeling and CSS for 10 years for solar projects commissioned between 1st April 2013 and 31st March 2018. Captive solar project can opt for REC, paying normal charges as per KERC. Re-powering old wind generator is allowed. Urban buildings are likely to be exempted from floor-area-ratio with respect to the floor area created for solar rooftop. Solar rooftop tariff of 9.56 INR/kWh for unsubsidised systems and 7.20 INR/kWh for systems availing a 30% central subsidy. "Surya Raitha System" to encourage farm land owner to install 1MW to 3MW solar PV system. Power can be sold to grid.	No timeline on processing of application for evacuation line. No exemption in open access and wheeling charges for wind projects. No "must run" status for solar power, as given in Telangana and union territories. No exemption of demand cut No exemption in energy scheduling.	The wind energy project installation can start immediately upon submission of application and requisite fee. Single window clearance - Karnataka Renewable Energy Development Ltd acts. Departmental clearance within 90 days. Forest clearance within 120 days.

Land:

Deemed status of non-agriculture land. Land bank for respective renewable energy technology shall be generated by the concern government department. The government lands, such as barren land and forest land will be developed by Karnataka renewable energy Development Limited. Change or shifting of location is not permitted under the policy.

Solar & wind installation , as on 1 March 2016

Solar rooftop, as of Oct 2015

104.22 MW –solar power of installed capacity. Wind installed capacity of 2886 MW. 34 MW solar rooftop installation.

States : Rajasthan

Enablers	Hurdles	Possible solutions
Inter-state and intra-state open access allowed. Power banking allowed for captive generation for billing cycle. Exemption of banking and wheeling charges and cross subsidy surcharge for solar rooftop. Solar rooftop energy banking allowed for a month and credit will be carried forward to next period to the extent of 50 units.	No exemption in transmission and wheeling charges for captive and third party sale.	Exemption from State Pollution Board clearance. Exemption from grampanchayat NOC for wind farms in govt. land.

Enablers	Hurdles	Possible solutions
Solar rooftop power plant can be used by DISCOM for meeting its solar RPO. Captive consumption exempted from electricity duty. No energy scheduling for solar power generator for intra-state ABT. 50% rebate in transmission charges for solar projects commissioned between April 2015 to March 2018. Net metering energy accounting in 12 months – August to July.	No power banking for third party. No exemption of banking charge. No exemption of demand cut and power scheduling for re-newable energy.	Solar power projects' comprehensive consent to establish and consent to operate within 15 days from the date of application submission.

Land

Procure of private land for renewable energy projects allowed. The conversion of private land to industrial land done at the charge of 10% of the charge levied for industrial purpose. Govt. land for wind farm at 10% of District Level Committee (DLC) rates on first cum first served basis, with a maximum land allotment of 5 hectare/MW. The sub-lease of land for wind farm development is allowed. Govt. land allotment solar parks and solar Power Projects as per the provisions of Rajasthan Land Revenue, Rules 2007. (details in appendix 4) No land conversion is required for setting up solar projects. Farmers are allowed to install or sub-let solar projects in their land without land conversion. Land allotment for solar power projects done on the refundable payment of 5lac INR/ MW to RREC.

Solar & wind installation , as on 1 March 2016

Solar rooftop, as of Oct 2015

1264.35MW solar installation. 3877MW wind project installation. 32MW solar rooftop installation.

States : Tamil Nadu

Enablers	Hurdles	Possible solutions
Intra-state and inter-state open access and wheeling of power is allowed. Wind - wheeling, transmission and scheduling and system operation charges to be 40% of conventional power. Solar - wheeling, transmission and scheduling and system operation charges to be 30% of conventional power. Wind power banking is allowed for one financial year. Solar power banking for 1 billing cycle. 100% exemption from demand cut for the solar power plants. CSS 50% for wind and solar for third party open access consumers.	No specific time line is given for the clearance with respect to wind power projects. No separate policy for wind. No removal of power scheduling. No deemed status of non-agricultural land.	Single window clearance for solar. Clearances within 30 days.

Land:

Land acquisition is the responsibility of the investor. Subjected to availability, industrial estates shall be allocated for erection of solar power plants.

Solar & wind installation , as on 1 March 2016

Solar rooftop, as of Oct 2015

635.87 MW capacity solar and 7515 MW wind.

Key Takeaways for Western Region

Maharashtra and Gujarat has the highest concentration of business houses, textiles, pharma, petroleum, IT, chemicals, electronics, heavy chemicals, automobiles, food processing, and plastics. Gujrat and Madhya Pradesh have adopted single window clearance, progressive policies for adoption of RE in comparison to Maharashtra. Goa is clearly lagging in RE adoption.

In view of the fact that most of the corporates are concentrated in Maharashtra, it has high potential of investment in renewable energy. Maharashtra needs a favourable renewable energy policy and vibrant eco-system for the development of renewable energy in the state.

Based on the study of other states policies on renewable energy- wind and solar, following can be considered as key takeaway especially for the state of Maharashtra are:

- **Land:** Land acquisition has been perceived as one of major hurdles in the renewable energy implementation. Identification of sites, availability of state's land bank for the implementation and easy approval of land for projects can act as major boost for renewable energy in Maharashtra. In Telangana, the Government of Telangana shall be developing land for solar parks. In Karnataka, installation of wind project can be started immediately upon submission of application and fee, thereby, removing the time required for application processing from the project implementation phase.
- **Status of renewable energy power:** Telangana and union territories has given the status of "Must –run" for solar power plants, thus removing the principle of "merit order dispatch" for the power from solar projects. Declaration of solar power under "must-run" can encourage investors as it will remove the ambiguity, if any, in the selling power price.
- **Clearance and approvals:** Unlike states like Rajasthan, Karnataka, Telangana and Tamil Nadu where the timeline for the approval and clearance has been specified, the renewable energy policy of Maharashtra does not specify any time line or turn-around period for the application, approval and clearance. Furthermore, there is no single window clearance system in Maharashtra. Providing single window clearance system and specifying turn-around time for the applications shall improve the interaction between government and project developer and thereby, increasing the investment and implementation of solar and wind energy in Maharashtra. Currently, there are approximately 6 different permits and clearances are required for solar and wind project installation. List of clearances are provided in appendix 5.
- **Open access:** Though open access has been allowed in Maharashtra, sourcing of power from multiple renewable energy generator through open access is not allowed. No exemption is provided in wheeling and transmission charges of renewable energy power. Furthermore, in the current open access policy 2014, energy accounting is done in 15 minutes time-slot, thus no power banking facility is available for the renewable energy generation for captive consumption facilities. This has acted as hurdle in implementation of wind and solar power plants in Maharashtra. All other aforementioned states, apart from Gujarat, allow power banking for billing cycle or yearly basis.

The Draft Open Access policy, 2015[20] , can bring in following favourable changes, which shall boost the renewable energy in Maharashtra, provided the policies are implemented:

1. The minimum eligibility has been reduced to 500 kW, i.e., a consumer having contract demand of 500kW can be sourced power from a single source or multiple sources. The power can also be evacuated from multiple sources and power exchange.
2. The draft Distribution Open Access regulation, 2015, allows power banking for 1 year for renewable energy.
3. CSS for renewable energy is 25% of the charges stipulated by commission for open access, as per draft open access regulation 2015
4. No power scheduling is required, as per draft open access regulation 2015.

It is important that implementation of the draft open access policy is expedite for boosting renewable energy in Maharashtra.

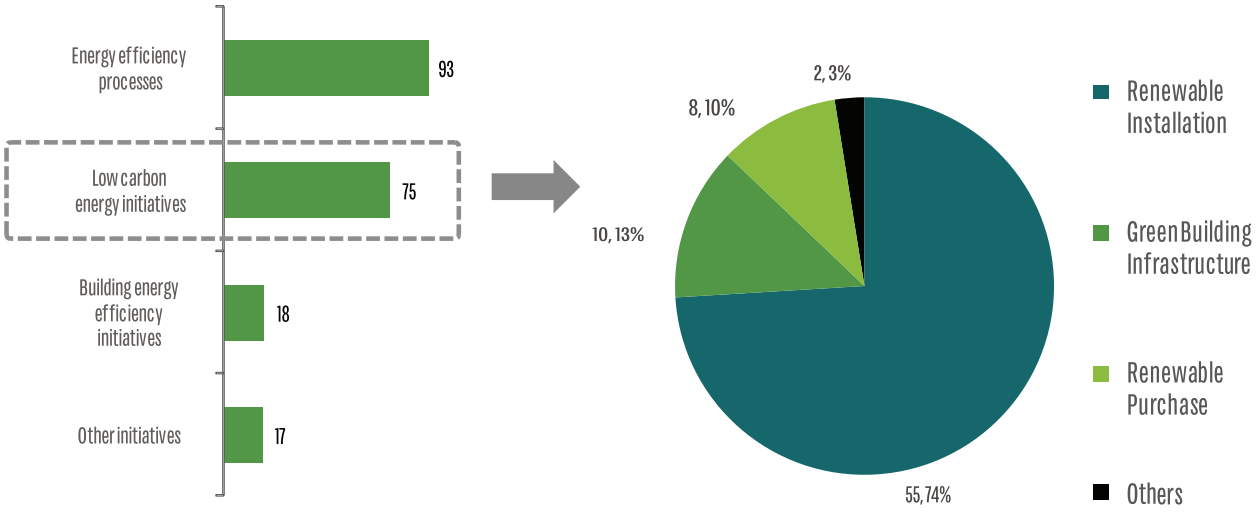
- **Net metering:** Government of Maharashtra has approved the net-metering policy in 2015, whereas, state like Tamil Nadu has approved and started promoting its net-metering policy from 2012. Due to late initiation of the net-metering in Maharashtra, Solar rooftop PV system in Maharashtra has encountered set-back.
- **Incentives:** For states like Gujarat, Rajasthan, Telangana, cross-subsidy surcharges exemption, exemption from demand cut and energy scheduling and exemption from electricity duty are provided for solar power projects, whereas, Maharashtra renewable energy policy does not indicate such incentive for the project developers. Attractive tariff structure has also been adopted by state like Karnataka for solar-rooftop PV system to encourage investment in the respective area. In view of the fact where financial cost and initial investment as well as variability of wind or solar availability, right kind of incentive structure which supports variable renewable energy generation and financial feasibility shall play a crucial role in boosting renewable energy in Maharashtra.

Comment by Tata Motors Limited on current open access hurdle: *"One challenge which we will be facing is regarding the Open Access Regulation of 2014. Due to this regulation, Maharashtra State Electricity Distribution Company Limited did not permit purchase of wind energy through Open Access and hence captive wind energy was the only source of renewable power in FY 2014-15. We hope to secure renewable energy through Open Access on the grid in future."* –Tata Motors Limited.

Re Adoption by Corporations In India

Climate leadership and adoption of clean energy go hand-in-hand. The CDP India report 2015 shows interesting trends in terms of the following key points.

1. Companies are moving to a more long-term approach, as opposed to tactical and short-term measures.



Notes: Renewable Installation includes Wind power, Solar plant, Biomass based CPP plant, Distributed small captive systems like solar panels,solar heating systems, captive biomass CHP, Solar PV Pump, etc. Renewable Purchase includes buying renewable energy by getting into tripartite agreement with Distribution companies and RE supplier, buying RECs Green Building Infrastructure includes addition of LEED guidelines based green building space to existing infrastructure Others include low carbon LED and efficient lighting arrangements, setup to switch to cleaner fuel and Energy Recovery.

Figure 28 Investment in Low Carbon Energy Initiatives (USD million) during 2015[21]

2. Companies are showing increasing interest and action in deploying renewable energy.
Despite the fact that not even a single Indian company features in the Climate A List 2015 published by CDP in the CDP India Report 2015[22] , several Indian companies are reporting to CDP and making progress in renewable energy adoption. Four Indian companies got a full 100 Disclosure score for the Climate Change Report 2015, and nearly 30 companies have a score of 90 or more. The Top 15 companies from India in the CDP India Report 2015,18 their Disclosure Scores and information on their renewable energy adoption are given in the Table 6 below.

Company	Disclosure Score	RE % in Energy Mix	Possible solutions
ITC Limited	100	43 %	ITC has been constantly working at increasing its share of renewable energy, and set a goal to achieve 50% of its total energy consumption through renewable energy sources by 2020.
Tata Steel	100	As per RPO, 1% solar and 3% non-solar.	At present TSI purchases solar REC to meet mandate additionally it is pursuing strategies to reduce power consumption.
Tech Mahindra	100	2.8% as per Sustainability Report	Increasing renewable energy mix in our operations through installation of solar plants & windmill at our facilities. There has also been an increase in renewable energy shares to the company operations with additions of solar plants at Chennai & Pune Locations. Strong pipeline for renewable energy projects implementation at Hyderabad with total capacity of 1200 KWh.
Wipro	100	20%	Entered a Tripartite Power Purchase agreement signed between Wipro (Purchaser), Renewable energy (mainly Solar and Wind) generator and distribution company. They were able to meet only half of their renewable procurement target (65 Million units Vs a target of 130 Million units) largely due to regulatory constraints and economics, which were not anticipated when the goals were set in 2010.

Company	Disclosure Score	RE % in Energy Mix	Possible solutions
IndusInd Bank	99	Not mentioned in CDP report or sustainability report 2014-15	IndusInd Bank has invested in Renewable Energy solutions through our investment in on-site solar energy at our ATMs and offices. This has also led to an increase in the number of transactions at our solar-powered ATMs. The energy generated from the fleet of solar ATMs in FY 2014-15 is approximately 1,20,000 kWh and the cost saved by the Bank is approximately INR 1 million.
Infosys	99	30%	Infosys is the first Indian company to join RE100 in order to move towards meeting 100% of electricity requirements from renewable sources. In 2015-16, Infosys planned to install 15 MW of solar plants to meet 40% of its electricity requirements from renewable sources. Installed capacity is 12.4 MW solar. Poised to invest in 170 MW solar energy (nearly 145 million USD) by 2018.
Tata Chemicals	99	Not explicitly mentioned in sustainability report or CDP report.	At present, Tata Power Renewable Energy Limited has commissioned a 25 MW solar power plant at Mithapur as mentioned in their sustainability report 2014-15
Tata Consultancy Services	99	2.5%	In FY 2014-15, approximately 2.5% of the total power consumption was from renewable sources. 132 MWh of electricity were generated from installed solar capacity.
Tata Global Beverages	99	Not explicitly mentioned in sustainability report or CDP report.	TGB targets to source 5% of its energy needs through renewable sources by 2016.
Associated Cement Companies	98	Not explicitly mentioned in CDP report or Sustainability report.	Purchased RECs equivalent to 97.51 Million INR in 2014 (RPO); Investing in wind (19 MW installed) and solar energy projects towards CDM
Gas Authority of India Limited	98	Not explicitly mentioned in CDP report or sustainability report.	On renewable energy front, they plan to set up 500 MW wind power capacity in the next 3-4 years and over 300 MW solar based power generation capacity in a phased manner. GAIL engaged in trading renewable energy certificates (RECs) for Tamil Nadu WEG projects where they successfully sold 10646 RECs with net revenue generation of INR 1.57 crores. These certificates have been utilised to purchase renewable power obligations (RPO) for 5 of its locations
Larsen & Toubro	98	8%	Entered in to tripartite agreements with the electricity board and the operator of wind farms for consumption of green energy (wind) within their Powai, Hazira and Chennai Campuses. In 2013-14, renewable power contributed to 8 % of the indirect energy mix, thereby avoiding Scope 2 emissions.
Mahindra & Mahindra	98	5.6%	Implementation of Renewable energy projects (Solar/ Solar Thermal/Solar PV) at all manufacturing sites. Procurement of RECs from power exchange thus promoting renewable energy deployment. They have installed solar PV panels to harness solar energy. M&M is the first Indian company to sign up for the EP 100 program. By signing up for EP100 , M&M is making a significant commitment to doubling its energy productivity by 2030 on a baseline of 2005, and hope to make a strong contribution towards achieving the climate goals agreed upon at COP21.

Company	Disclosure Score	RE % in Energy Mix	Possible solutions
Tata Communications	98	For Bangalore operations, the contribution of wind power as the energy source is about 80% and 62% for Chennai operations.	Investment in 16 MW wind turbines in Karnataka for wind power for Data Centres in Bangalore. This shall provide a minimum of 27 MW units every year, which constitute 80% of their power requirement at Bangalore. TCL has also invested as a group captive user in Tamil Nadu, India to harness and use 20 MW units of power at their Chennai data centre. TCL is part of captive users in Delhi to promote solar farm to harness day time power to run their data centres. 5 MW of solar power plants is deployed across India operations till date.
Tata Motors Limited	98	8.3%, calculated from Renewable and Total energy consumption given in CDP report 2015	21.95MW Wind Power Project has been registered with NLDC under REC scheme until 2017. TML has set the target to achieve 50% of the total electricity demand from renewable energy sources by 2020.

Table 6 Renewable Energy Initiatives listed for companies with very high CDP Disclosure Score

The leaders in CDP disclosure have a wide variety of active initiatives and goals for moving towards renewable energy. Some of the companies have set specific and time-bound goals for increasing renewable energy in their total energy mix, and some others have stated intention of moving towards renewable energy adoption, as described in Table 6. Overall, several companies are achieving substantial progress and demonstrating intention and ability to move towards a fully renewable energy scenario. In particular, ITC Limited, with 43% and Infosys, with 30% of their energy being sourced from renewables currently, are raising the bar for all corporations. Infosys has joined the RE100 of The Climate Group, with the intention of using 100% renewable energy.

In addition to the leaders, several other companies are also investing in renewable energy and have disclosed some of this information in their CDP Report. Table 16: CDP Scores and renewable energy initiatives listed for a select cohort of companies in the Appendices lists out the renewable energy initiatives undertaken by companies who we have reached out to in context of this paper. Out of the 53 companies, 47% of companies achieved a CDP disclosure score above 90, and 49% have been not listed, not scored, or not responded. Few companies are planning to respond next year. However, it is heartening to see that almost all companies are working towards initiatives to increase renewable energy in energy mix. Since the CDP data base was referred to for this information, we did not pull out renewable energy initiatives companies with "no response". Real-time interactions across various industry sectors revealed that almost all companies are exploring renewable energy options.

"YES BANK believes that the 175 GW target is achievable and is committed to provide funding through innovating financing models. The Bank has one of the largest portfolios in renewable energy in the private banking space. During the year, the Bank made commitments to further enhance its lending in this space at key global platforms, such as the UN Climate Summit. YES BANK was the knowledge partner for the first ever Renewable Energy Investors Summit organized by the Ministry of New and Renewable Energy, GOI. At the COP 21 the Bank committed to mobilize USD 5 billion towards climate finance in India by 2020."
– Yes Bank

Cop 21 And Implications On Renewable Energy Adoption

The COP21 has set aside certain targets for each country which includes India. As a nation, India consists of the government, the citizens, and the corporates. So, each target will ultimately trickle down to these three verticals, and corporates will be bearing a big share of it. They have the resources and internally face lesser hurdles to get things done. The government can accelerate this by doing changes at policy level as well. A mandatory share of CSR spending can be reserved for climate change initiatives. Tax exemption schemes for these activities will also go a long way in encouraging the corporatesto actively support these initiatives.

"COP 21 and subsequent conversations enable governments of countries to accelerate actions required to adapt to and mitigate climate change. This in turn has a positive effect on corporations who are alive to risks of climate change. However, today the biggest reason for adoption of renewable energy and green tech rise squarely in space of economic wisdom."
– Mr.Anirban Ghosh, Chief Sustainability Officer, Mahindra & Mahindra Group

"COP21 is a crucial outcome for renewable energy proliferation. Context has been set for RE, linking with global context, environmental challenges. Certain challenges are still there; to realize 100%RE, emphasis is on technology such as grid stability, appropriate technology options are required. For developing countries, renewable energy must be competitive and affordable for deeper penetration. India is now part of international consortium for renewable energy tech development. Awareness should be developed about OVERALL COST per unit of electricity, for example, fossil fuel electricity has human health impacts, pollution impacts etc. which are not currently accounted in market price."
– Mr. Basant Jain, CEO, Mahindra Susten

Throughout the paper we have maintained that the private sector plays a critical role in the renewable energy revolution. The RE100 India briefing report[24] has indicated an upward trend in renewables in India, highlights the business case for investing in Renewables.

Two case studies of RE100 member companies in India:
Tata Motors Limited has recently become the 1st manufacturing company in India and first company to join RE100 after COP21 in Paris. Tata Motors is the 54th company and the second Indian company - to join RE100.
"Unless policies, rules and regulations are aligned to the international and national goal of scaled up use of renewable energy, a company cannot go forward with the aspiration of using 100% renewable energy in its manufacturing operations."
Chief Sustainability Officer, Tata Motors

Infosys, the first Indian company to join the RE100, has demonstrated clear leadership and commitment ever since it first stated its carbon neutrality goal early in this decade. Infosys is pioneering investment in renewables in India, and has significantly reduced energy use over the last six years. By doing so, they reduced their operational costs and attained the lowest per capita electricity consumption in the IT industry. The company strongly believes that responsible energy

management is one of the factors that helps attract and retain clients – especially those with strong sustainability goals.
As part of their strong commitment to improve energy use and reduce costs, Infosys has committed to sourcing 100% of their energy from renewable sources by 2018[25] .
In the absence of clear guidelines, Infosys has developed its own due diligence strategies and policies to ensure best technologies to invest.

EP 100 is another program which is an Initiative of The Climate Group. It will work with the world's most influential businesses in setting commitments to double their energy productivity and maximize the economic output from each unit of energy used. In light of achieving low carbon growth along with renewable energy adoption, energy productivity is critical.

Dr. Pawan Goenka, Executive Director, Mahindra & Mahindra Ltd., said,
"Sustainability is an integral part of Mahindra's approach to business. At Mahindra, it has always been our endeavour to drive positive change by making every aspect of our business sustainable. This is our philosophy behind "Rise for Good".
"By signing up for EP100, we are making a significant commitment to doubling our energy productivity by 2030 on a baseline of 2005, and hope to make a strong contribution towards achieving the climate goals agreed upon at COP21. We hope many other corporations will become a part of this campaign."

CDP's concern with Corporate Climate Action has been around how corporate goals aren't serving the purpose. "Though companies are setting targets they are neither enough nor sufficiently long term", CDP India report, 2015

Many companies in India were waiting for the outcome of the Paris agreement. Now it's time to commit to long term targets. The best way to set targets is to embrace the "The Science Based Targets initiative which uses the 2°C scenario developed by the International Energy Agency". The two Indian companies which have committed to science based targets are Aditya Birla Chemicals and Tech Mahindra.

The Climate Group, under RE100 has estimated that an entire private sector switch to renewables would cut CO^2 emissions by nearly 15%. Globally, the world's leading companies are re-creating a thriving renewable energy market that will aim at keeping the global temperature rise below two degrees. India's private sector, which accounts for more than half of national energy consumption, stands to gain from this experience. This is not just the government's responsibility, but ultimately the corporates' as well; therefore, it is not about mere top-down enforcement but about enthusiastic adherence from the corporates.

"India has to be clear of the role of renewable energy in the energy scenario following the COP21 INDC statements. We are primarily speaking of renewable energy as replacement energy, i.e., additional energy requirement. Our primary energy source remains coal. India's per capita energy consumption is still low (~900 units per capita) Vis – a –Vis countries like China (~2500 units). In India 33% of people still do not have access to reliable electricity. India's imports of coal and fossil fuels comprises of 80 to 85 % of our

This is not good from point of view of economy and energy security... The goal of 175 MW from renewable energy by 2022, out of which 100 GW is from Solar, 60 W, remaining from biomass – the governance of this policy and clearly chalked out roles and responsibilities of the state government, utilities, vendors, enterprises, and the central government will help in creating clarity and clear path for goal realization."
–Wind Power Generator company.

Intriguing Insights

Future Thoughts in Renewable Energy – Climate Parliamentarian

The Climate Parliamentarian is an international cross-party network of legislators, dedicated to preventing climate change and promoting renewable energy. This group of forward-thinking legislators have begun to brainstorm a unique possibility for sustaining the entire worlds' energy needs using solar installations located in deserts such as Sahara, Thar, Gobi and Atacama. Desert areas have a very high insolation, and very low population of species as well as human inhabitants.

"A total area of solar panels and power stations 600 km x 600 km would provide enough power to give 500 million people the average American's total energy consumption, which is the equivalent of 250 kWh per day," reads a section of the Climate Parliament Strategy to go 100% Renewables[26]. This intriguing possibility, without going deep in the technical feasibility, is one that pushes the envelope on renewable energy installations across the globe and would call for inter-governmental cooperation and resource sharing, since long-distance infrastructure would be required to move power from desert-based installations to human habitats, where power is consumed.

Re Ecosystem in India

During our conversations with renewable energy industry professionals, and through research, we have understood that a majority of the renewable energy technology and products manufactured in India are considered to be of lower quality than those made elsewhere. Consequently, renewable energy installations in India contain only a small fraction of indian-made solar panels and other components. To enhance the quality of indian-made components and technology solutions, we need to improve the two following aspects:

1. Renewable energy manufacturing ecosystem in India: Organizing and enhancing the ability of Indian manufacturers to deliver high quality products at affordable prices is vital to encourage this. This could translate to ease of doing business, more comfortable taxation as well as bridging the gap between markets to make sure products are economically viable for the manufacturers while delivering excellent power output and durability. The Government of India, as of now, allows up to 100% Foreign Direct Investment (FDI) under the automatic route for renewable energy generation and distribution projects subject to provisions of The Electricity Act, 2003.

To enhance the renewable energy ecosystem, the government is playing an active role in promoting the adoption of renewable energy resources by offering various incentives, such as generation-based incentives (GBIs), capital and interest subsidies, viability gap funding, concessional finance,

fiscal incentives etc. The Make In India program of the Government of India has a focus on the renewable energy sector. Moreover, the mandate of the Solar Energy Corporation of India (SECI) allows wide-ranging activities to be undertaken with an overall view to facilitate the implementation of the National Solar Mission and the achievement of set targets.

2. RE Technology Research & Development in India: Vital breakthroughs in renewable energy technology can enhance power output per unit installed capacity. There is also possibility for varied and innovative solutions arising from research and development of renewable energy technologies in India. Coalitions, such as SERIIUS (Solar Energy Research Institute for India and the United States) between Indian Institute of Sciences, Bangalore and the NREL (National Renewable Energy Laboratory), Golden, Colorado (USA) have to be facilitated further.

Comments relevant to this aspect from Director Business Excellence, Quality & Sustainability, SKF India Ltd. are quoted below:

"Improvements in the power output per unit installed capacity can largely influence organizations' decision to invest in renewable energy , and so also this will help in making Solar a business case in a very prominent way . In some states, the gap between Grid power rate and solar power tariff in a PPA model is already thin and hence it is difficult to create a sizeable margin; nevertheless, the green aspects clearly support use of solar energy. However, solar energy technology is constantly upgrading and is in the path to be a business case for profitable investment. Added to this, if we use other technological innovations such as solar tracking and solar hub developed by SKF, will add to the efficiency of generation and will help to make the systems more profitable. As regards implementation, Opex based PPE model is best suited for SME's as well companies which do not want to invest big capital and there are a lot of players now available in this area."

Learning from The World – Good and Bad

Here we have identified countries across the world where renewable energy contributes to 100% of the energy demand. This list helps us understand how small countries with abundant natural resources have switched to renewable energy sources.

In order to understand the learnings from outside of India we have looked at the following:
1. Countries across the world where renewable energy contributes to 100% of the energy demand (Refer Appendix 7, table a)
2. Countries that are amongst the top in Renewable Energy Consumption.
(Refer Appendix 7, table b)
Noteworthy amongst countries leading in renewable energy use is Iceland which switched to geothermal in a big way from fossil fuel in the 1990s. It has shown the world that given resources "what a nation can achieve when it sets it mind to it!". Norway generates 98% of power from

renewable energy. Norway sells its renewable energy to neighbouring countries in form of clean energy guarantees of origin. In spite of its oil reserves, the country has opted to use oil money to sustain its traditional business. Key learnings are from Uruguay where clear government decision-making and supportive regulatory environment and strong public /private partnership have paved a path for 100% renewable energy. India is a large country, and one can argue that the countries listed here are small and are not as complex as India.

The second list comprises of countries that are amongst the top in Renewable Energy Consumption are shown in the figure below [27]

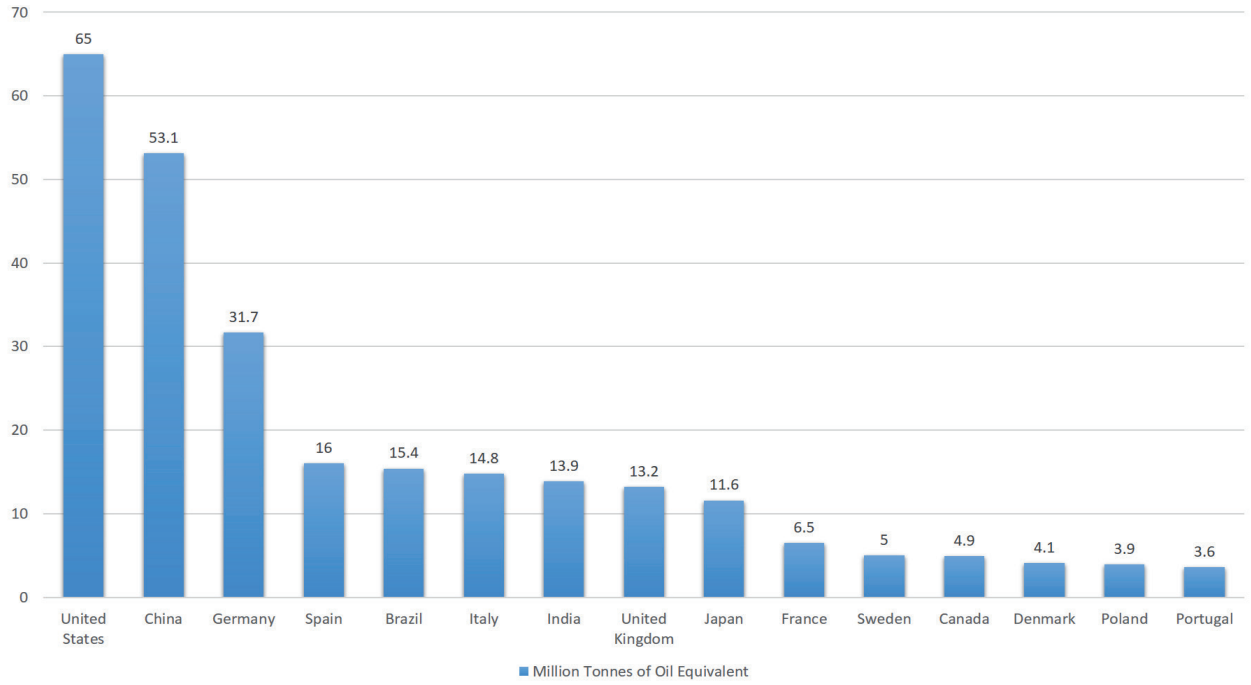


Figure 29 Global renewable energy usage by portion of total demand supplied by renewable energy sources.

The above figure shows the top countries in renewable energy consumption. India is 7th in this list. This list comprises of big countries. What India has achieved in wind energy sector can be achieved in solar and waste to energy areas as well. The government of India is running several collaborative research projects in indigenous technologies in Renewable[28].

Key learnings from USA, it is looking at renewable energy as a means to revive its economy though American Recovery and Reinvestment Act 2009. India must look at the energy policy as a means to revive green jobs in this sector. China is an innovator in solar and wind, leading to reduction in cost of installations. India must learn from China and establish a way to encourage innovation and R&D in renewable energy technology.

Germany is a curious case of political will combined with aggressive targets allowing rapid transition to renewable energy helping Germany to move away from fossil fuel and nuclear at the same time. It is a combination of political will and public support to pass the right regulations that lead to the path of dominance. It is facing challenges from China and cheaper costs, but the Germans are not the ones to throw in the towel. The growth rate in Germany has nearly tripled in the last 10 years. In Spain, the government dishonouring of solar tariffs ruined lives of several individual citizen

investors. Spain was leading in renewable energy in 2008 till a changed government led to abandoning of its solar growth. India needs to be wary of making similar mistakes. Still some companies survived the economic downturn by selling power outside Spain.

It is very interesting to see Brazil's rise in renewable energy consumption. What India needs to learn from Brazil is how clearly researched well-articulated policy and clarity in thought lead to growth in renewable energy. Focus on biodiesel and a clearly working mechanism on the ground for reduction of transportation emissions.

From Italy we learn that grid operators are obliged to give priority access to renewable energy plants in the operation of their grids. In Italy, training programmes on renewable energy are developed at regional level. Certification of installed plants is obligatory. All new or refurbished buildings must integrate RES, with an additional 10 % to the obligation level for public buildings.

From all the above examples cited here there are great learnings and lessons. By integrating these in our policy and actions, India will be able to surpass all the above examples within a short time span.

Conclusion

The objective of this paper is to identify the major hurdles in the process of development of renewable energy in India. India has set the target of 175 GW of renewable energy by 2022, with 100 GW from solar and 60GW from wind energy. With the current CAGR, as assessed for the year 2010-11 to 2014-15, of 6.58%, the renewable energy target of 175 GW is projected be achieved in 2033 as opposed to 2022 as targeted. It has been assessed that India needs to increase the renewable energy growth CAGR by 31% to achieve the set target by 2022.

Although Rajasthan has the highest total potential for renewable energy, Maharashtra is potentially more viable for renewable energy projects, owing to the presence of a large number of corporates that can invest and propagate renewable energy projects in Maharashtra. A survey has been conducted for 32 corporates in India and the major perceived hurdles identified are:

a) Anticipation for new technology;
b) Technical evaluation and feasibility of RE
c) Policy implementation at ground level
d) Initial cost and financing
e) Project implementation.

The renewable energy policies, for wind and solar, of 8 states of India have been analysed. Though all the states have their individual renewable energy policy, following are observed:

It has been observed that uniformity of the renewable energy policy for solar rooftop, solar power plant and wind power plant across all states is lacking. The uniformity of the taxation policy is also lacking. It is required to have uniform renewable energy friendly policy for overall growth of renewable energy in India.

For state like Tamil Nadu, there is no existing formal wind energy policy. A clearly researched and well-articulated policy shall bring in more confidence in the investors and project developers.

More pro-active involvement by State Government in site identification, land allotment, turn-around time for approval and single window clearance are required by all states for ensuring ease of doing business. Implementation of policy at ground level is one of major setback in India. For

example, lack of implementation on the penalty structure of RPO has been the main hurdle in the development of REC market.

(Refer Appendix 7, table b)
Noteworthy amongst countries leading in renewable energy use is Iceland which switched to geothermal in a big way from fossil fuel in the 1990s. It has shown the world that given resources "what a nation can achieve when it sets it mind to it!". Norway generates 98% of power which is Some additional aspects are highlighted below:

- The existing built structures are not constructed considering the possibility for installation of rooftop solar panel systems. Due to this, some solar rooftop projects encounter hurdle in implementation. Therefore, to facilitate the expansion of rooftop solar systems, it is necessary to enable building codes to incorporate the possibility for rooftop installations.
- It has been observed that some projects are noted to be stalled due to inefficiency and delay on the part of state boards responsible for processing applications or providing required clearances and permits. Due to lack of clarity of the turn-around time for these processes, projects face delays and inefficiency.
- Another intriguing obstacle that we discovered in the course of developing this whitepaper is that all the information about relevant renewable energy regulation and policies are not in one place, most of the time. This is a hassle for the corporates and other personnel who have to obtain and use such information. To facilitate the proper progress of renewable energy projects, it is suggested to have a systematic repository where all the relevant policy and methodology information can be placed. In addition, the simplified and direct structure of policy can ease the application and project implementation. As an illustration of a good example of such policy, we have included the Renewable Energy Policy Brief of Brazil, June 2015, in Appendix 6.
- As per MNRE circular dated, 19 November 2015, central financial assistance of 30% of benchmark cost for general category States/UT and 70% of benchmark cost for special category states is provided, which is currently released through different state nodal agencies. The change of this to online approval and disbursement of CFA can reduce the time consumed in the application process and encourage investment in renewable energy sector.
- India needs improvement in technology innovation and facilitates R&D to reduce the cost of renewable energy installation, especially solar power sector. The solar sector, as a result of budget 2016-17, shall have boost due to implementation of double cess levied on coal production thereby increasing the cost of thermal power generation. This can have a positive impact in development of renewable energy sector by making the renewable power price competitive with coal-fired power plant. Furthermore, solar rooftop sector may have boost in 2016-17 before the accelerated depreciation is reduced from 80% to 40%.

To move towards a 100% renewable energy scenario, it is also necessary that corporations utilize a sustainability lens to assess all their undertakings. Without a holistic understanding on how renewable energy helps companies reach sustainability goals, one-off attempts remain inadequate to address the core problems of energy security, environmental pollution, and global climate change. Companies who intend to lead the transition to a clean energy world must make renewable energy

inseparable from their modus operandi. Companies must evaluate and identify opportunities for pushing the envelope on RE, whether through purchase, or through installation, in all facets of the company where renewable energy has a role everywhere, including hiring, materials procurement, supply-economics, transportation, and logistics.

"All projects are looked at from environmental and social angles, considering environmental impact, clearances, and social inclusion. Top management is committed to the principles of sustainability. It is integrated with the business organisation structure with member of executive management commitment (EMC) responsible for driving sustainability initiative across organisation. The EMC is very proactive and has provided a direction to adopt carbon neutrality approach for key campuses of L&T where renewable energy plays a key role" – L&T. Corporate action in renewable energy adoption is led by progressive companies which can be further enhanced by removal of hurdles.

Key Asks by Corporates from Government in context of RE:

- Strict monitoring of RPOs and RGOs for a robust REC market
- Implementation of the tariff policy on the ground through a clear guidance at all levels
- Seamless facilitation of access to Renewable Energy via grid through PPA
- Simplification and standardisation of policies across states
- Single window clearances
- Availability and awareness of various viable financial models for off grid and grid based renewable energy solutions.

In addition, a welcome boost to the renewable energy scenario in India would be an assertive stance from the government in the form of a Renewable Energy Mandate on TOP 100 financially well-performing companies In a manner similar to how SEBI mandates the BRR for top 200 companies in India. The goal is for them to invest in renewable energy to meet 100% of their energy demands, as suggested by Mr. Swapan Kumar of Dr. Reddy's Labs. This is feasible because top 100 corporate leaders don't have financial hindrances that are often a common obstacle for other companies to invest in renewable energy to a larger extent.

Therefore, the government or its appointed regulatory authority (perhaps, the MNRE) could oversee, as with the implementation of SEBI's BRR, that the top 100 companies in India commit to 100% renewable energy to meet their needs by a stipulated plan. Leading corporations can then comfortably setup their roadmaps towards 100% renewable energy for all their facilities and operations, and submit annual progress reports to the concerned government bodies, who can conduct timely audits to ensure that commitments are matched with clear action plans and deliverable results on the ground.

Falling cost of renewables, new progressive policies have set the tone for larger renewable energy adoption. This will be hastened if the key asks are well received and addressed by the government. Integration of global and regional learnings into Western Region policy, action on ground and governance will drive drastic adoption and thereby help in a low carbon transition.

Recently released report of the Expert Group on 175 GW RE by 2022 investigated the financing aspects of the 175 GW RE target . The report states that "India lacks a comprehensive national

policy and legislative framework for renewable energy, Existing policies and programmes are technology specific and vary across states restricting strategic intent. Placing renewables at the heart of India's power system will require a paradigm shift in planning and governance practices". Corporate world needs this paradigm shift for the Indian economy to flourish. Ironing out the hurdles, innovations and strategic direction, planning and governance at centre and state level is required for this.

Appendices

Appendix 1: Abbreviations and Definitions

List of Definitions of Terms and Abbreviations

TERM	DEFINTION
Bio Mass	Wastes produced during agricultural and forestry operation energy plantation e.g. Husks, shells.
CAGR	Compounded Annual Growth Rate
CDM	Clean Development Mechanism
Date of Commissioning	Date on which supply of energy is commercially commenced by the generating plant
Developer	Entity which develops the projects
DISCOM	Distribution Company
Energy Consumption	Useful energy input that is supplied by the fuel (normally bagasse or other such biomass fuel)
EPC	Engineering, Procurement and Construction service, contract
GHG	Green House Gas
Grid	The high voltage backbone system of interconnecting transmission lines, substations and generating plants
Group Captive Power Scheme	A group captive scheme is where someone develops a power plant for collective usage of many commercial consumers. The developer should have at least 26% of the equity and has to consume at least 51% of the power produced. The term "captive power scheme" was introduced in the Electricity Rule, 1995. For example. Imagine Company A along with company B and company C decide to bring down their electricity costs. Collectively they make a power plant with 26% equity and decide to use about 51% of energy produced. Then they decide to sell the remaining 49% power to Company X, Y and Z. This makes the whole group part of the group captive power scheme. Suppose the developer decides to make a Solar power plant for using the group captive scheme. Now, he not only gets the group captive scheme benefits but also gets to sell the REC (Renewable Energy Certificates) in open market or the IEX (Indian Energy Exchange).

TERM	DEFINTION
GW	Giga Watts
HT	High Tension
Investor	A body interested in investing in a project
KWh	Kilo Watt-hour
Low Voltage	Voltage at 415 Volts and below
MNRE	Ministry of New and Renewable Energy
MSW	Municipal Solid Waste
MU	Million Unit
MW	Mega Watt
O&M	Operation and Maintenance
OA	Open Access, which is Non-discriminatory provision for use of transmission lines/ distribution system / associated facilities with such lines or system by any licensee /consumer/ person engaged in generation in accordance with the regulations specified by the appropriate commission
Power Banking	It is the process under which a generating plant supply power to the grid not with the intention of selling it to either a third party or to a licensee but with the intention of exercising his eligibility to draw back this power from the grid.
PPA/PSA	Power Purchase Agreement/ Power Supply Agreement
Project	Means a Generating Station or the Evacuation System up to Inter-Connection Point.

TERM	DEFINTION
RE	Renewable Energy
R&D	Research & Development
SERC	State Electricity Regulation Commission
Small Hydro Power Plant	(Electricity Generating Station) Single Window System facilitated by Nodal Agency to expedite process of receiving clearances from multiple agencies and fulfil all inception-related requirements of a renewable energy project.
Solar Plant/Solar Power Plant	A power plant or system utilizing solar energy through solar photo-voltaic or concentrated solar thermal devices including its integration into conventional fossil fuel for generating of electricity.
Solar PV Power	The solar photo voltaic (PV) power project that uses sunlight for direct conversion into electricity through photo voltaic technology. Solar PV Power Plant Solar Photo Voltaic (SPV) Power Plant that uses sunlight for direct conversion into electricity through Photo Voltaic technology.
Solar Thermal Power	The solar thermal power project that uses sunlight for direct conversion into electricity through concentrated solar power technology based on either line focus or pointy focus principle. The direct sun light is concentrated several times to reach higher energy densities and thus higher temperatures whereby the heat generated is used to operate a conventional cycle to generated electricity.
SPO Solar Purchase Obligation	A state/govt. mandated requirement for minimum amount of solar power in total power consumed.
Substation	Facility equipment that switches, changes, or regulates electric voltage.
Tariff	Schedule of charges for generation, transmission, wheeling and supply of
Transmission Charges	The charges payable by renewable energy sources for the use of transmission system
Wind Farm	Cluster of wind energy generators erected by a single developer and generating electricity from wind
Merit order dispatch	Way of ranking the dispatch of available electricity generally based on price.
Must Run status	Power generated are not subjected to competitive bidding and purchased by DISCOMS as and when produced.

Appendix 2: List of Tables

Appendix 3: List Of Figures

Figure 26 Policy changes that can spur renewable energy adoption and investment
Figure 27 External financial environment for renewable energy progress
Figure 28 Global renewable energy usage by portion of total demand supplied by renewable energy sources.

Appendix 4: State-Wise Policy Highlights

Goa

Minimum capacity of solar thermal project is 500 kW of installed capacity and 1 kW to less than 500 kW for rooftop solar power projects. Central incentives are eligible if the collective capacity of solar roof top installed capacity is a minimum of 100 kW. The allotted solar projects need to be implemented within the span of 12 months for projects of capacity below 500 kW and within 18 months for capacity of 500 KW or more. Policy highlights [30]:

Category	Description of Provided Incentives
Land availability and Land acquisition	Land acquisition is to be performed by the developer. The land owner or rooftop owner are eligible to lease space for solar roof top installation. Development of solar parks is encouraged through private investment or through public-private partnership.
Power evacuation	Cost of power evacuation to the grid interconnection point shall be borne by the project developer.
Open access and wheeling	Open access is allowed within Goa or with other union territories. No wheeling charge is applicable for solar rooftop system.
Power banking	Rooftop solar system, with net metering, can bank a maximum of thirty (30) % of the annual generation capacity of electricity for a maximum of 12 months. Settlement will be performed every 6 months. Ground mounted solar systems, installed for sale of power, are not allowed for power banking
Clearances	Single window clearance policy is in draft stage and yet to be implemented.
Other incentives	Electricity duty is exempted for power generation from solar projects. Solar system, self-owned or third-party owned are exempted from wheeling charges, banking, cross subsidy and T&D losses charges. CSS is exempted for ground mounted solar system set-up for Sale of power. Power generation from solar rooftop can be accounted towards RPO. Rooftop solar system is not eligible for REC. Payment shall be made by the state distribution within 30 days from date of bill submission by the solar power generator. All grid connected solar power plants are considered as “Must Run” and thus are not subjected to merit order dispatch principle.

Madhya Pradesh

MP has the wind and solar power policy. Net metering policy for solar rooftop is in draft phase and shall be applicable from the date of its notification in the Madhya Pradesh State Gazette. Policy highlights[31] :

Category	Description of Provided Incentives
Land availability and Land acquisition	Solar power - No capacity limit for the solar projects in private land. The project in government land has the minimum capacity of 0.25 MW to a maximum of 100 MW. Govt. land if available shall be 3.0 Hectares per MW. Govt. land shall be allotted to bidder, if available, basis of maximum free energy per MW offered by eligible and qualified bidders and they would be eligible for incentives under this policy. Private land purchased by project develop shall have 50% exemption in stamp duty. Forest land and land owned by schedule tribes can be used with necessary permission from concern departments. Wind power – Govt. land shall allotted based on availability. Permission for use of Govt. Revenue land to be provided by New & Renewable Energy Department Developer is eligible for 50% exemption on stamp duty on purchase of Pvt. land for the project. A maximum of 100MW installed capacity is eligible in govt. land. Forest land and land owned by schedule tribes can be used with necessary permission from concern departments.
Power evacuation	Power evacuation facility from the project site to grid intersection shall be done by the project developer.
Open access and wheeling	Intra-state and inter-state open access is allowed as per the MPERC open access regulation, 2005. The revised open access regulation is in the draft phase. Wheeling charge is as per the rate prescribed by MPERC. Captive power generation are charged 2% of energy injected towards wheeling charge. Solar power - Government of MP shall provide grant of 4% in terms of energy injected and the balance, if any, to be borne by the project developer for the above wheeling charge. Wind power – For third party sale within state, Government of MP shall provide grant of 4% in terms of energy injected.
Power banking	Solar and wind power - Power banking is allowed for a financial year, with 2% of banked energy as banking charge
Clearances	No single window clearance facility is available. No licence is required for solar project, generating and distributing power in rural area.
Other incentives	Electricity duty is exempted for solar and wind for a period of 10 years. No cess is applicable for wind power. Energy cess is exempted for 10 years for solar power. No registration cost is applicable for installing small scale WTG or Wind Solar hybrid plant (up to 100kW) at a private rooftop or land. Projects implemented under the solar and wind policy shall receive status of industry and shall be eligible for all the incentives provided under “Industrial Promotion Policy of State Govt.” Contract demand can be reduced by the consumer buying wind and solar power, on permanent basis.
Net metering	Solar rooftop net metering policy is in the draft stage. The minimum capacity of installation is 0.5 kW and maximum capacity of 250 kW. Technical feasibility application shall be processed within 30 days of receiving the application. Power banking is allowed for a year time. Installation of SRPs under the policy shall be exempted from banking, wheeling, cross-subsidy surcharges and electricity duty. Solar rooftops are exempted from property tax and equipment are exempted from VAT and entry tax.

Telangana

Telangana, being a newly formed state, has intense energy demand and supply gap. To mitigate this problem, Telangana State Electricity Regulatory Commission has drafted the solar policy to encourage solar power development in the state through providing incentives and ease of doing business. The policy is applicable for all solar power projects and solar parks. The power generation needs to be within the time limit stipulated in the PPA or within a maximum period of 2 years from the date of application whichever is earlier, failing which the provisions under the policy will be cancelled. The highlights on ease of business and other incentives in the Telangana solar policy, 2015[32] are as:

Incentive Category	Description of Provided Incentives
Land availability and Land acquisition	Solar parks implementation is done by the state. The land acquired by the solar power project developer shall be deemed to be converted to non-agriculture land. No land ceiling, as per land ceiling act, is applicable for land acquisition for solar projects.
Open access and wheeling	Intra-state open access for the tenure of the project is granted. Intra-state transmission and wheeling charges are exempted for captive use of solar power.
Power evacuation	The project developer shall bear the infrastructure cost of power evacuation facility to the grid. The developers shall be supported by the transmission and distribution company for Supervision charges levied by the TSTRANSCO/DISCOMS shall be exempted; b) TSTRANSCO/DISCOMS shall process and close the proposals for technical feasibility within thirty (30) days of receipt of application from the developer.
Power banking	Banking of 100% of energy shall be permitted for all captive and Open Access/ Scheduled consumers during all 12 months, from April to March, of the year.
Clearances	The Solar Policy Cell (SPC) will undertake single window clearance for all solar power projects. PCB clearance for the solar projects shall be provided within 7 days from the date of application. Applications for grid connected solar projects shall be processed within 21 days from the date of application.
Other incentives	Electricity duty is exempted for all solar projects. Electricity duty is waived for new manufacturing facilities and ancillaries of the Solar Power Projects. 100% exemption of cross subsidy surcharge (CSS) for solar power generated and sold with Telangana for 5 years from the date of commissioning. Gram Panchayat will give permission within 14 working days from the date of making payment of INR 25,000 for development charges, failing which permission will be deemed to have been accorded. 100% refund of VAT/SGST for all the inputs required for solar power projects for a period of 5 years. 100% refund on stamp duty for the land purchased. Provision for grid connected solar power shall be made within a week time. Facility of gross and net metering, as chosen by the developer, shall be extended to SRPs for a period of 25 years All solar power plants are given the status of “Must Run”.

Maharashtra

Maharashtra has an overall target of 14.4 GW of energy generation from renewable energy. Of the total, 5 GW and 7.5 GW are to be generated from wind and solar respectively. Of the total of 5 GW of wind energy target, 1.5 GW will be used to fulfil RPO of distribution companies and the rest 3.5 GW capacity of wind project can be utilized open access for interstate/ intrastate open access/ captive consumption/REC etc.

Similarly, for solar power, out to the total 7.5 GW, 2.5 GW will be used to fulfil RPO through public-private partnership in association with MahaGenco. 5 GW shall be developed by private investors. The minimum installed capacity of solar project applicable under renewable energy policy, 2015 is 1 MW. The highlights on renewable energy policy, 2015 are as follows:

Incentive Category	Description of Provided Incentives
Power evacuation	The project developer shall bear the infrastructure cost of power evacuation facility to the grid. The developers shall be supported by the transmission and distribution company for Supervision charges levied by the TSTRANSCO/DISCOMS shall be exempted; b) TSTRANSCO/DISCOMS shall process and close the proposals for technical feasibility within thirty (30) days of receipt of application from the developer.
Power banking	Banking of 100% of energy shall be permitted for all captive and Open Access/ Scheduled consumers during all 12 months, from April to March, of the year.
Clearances	The Solar Policy Cell (SPC) will undertake single window clearance for all solar power projects. PCB clearance for the solar projects shall be provided within 7 days from the date of application. Applications for grid connected solar projects shall be processed within 21 days from the date of application.
Other incentives	Electricity duty is exempted for all solar projects. Electricity duty is waived for new manufacturing facilities and ancillaries of the Solar Power Projects. 100% exemption of cross subsidy surcharge (CSS) for solar power generated and sold with Telangana for 5 years from the date of commissioning. Gram Panchayat will give permission within 14 working days from the date of making payment of INR 25,000 for development charges, failing which permission will be deemed to have been accorded. 100% refund of VAT/SGST for all the inputs required for solar power projects for a period of 5 years. 100% refund on stamp duty for the land purchased. Provision for grid connected solar power shall be made within a week time. Facility of gross and net metering, as chosen by the developer, shall be extended to SRPs for a period of 25 years All solar power plants are given the status of “Must Run”.

Incentive Category	Description of Provided Incentives
Land availability and Land acquisition	Wind energy: The land acquired by developers shall be deemed to be converted to non-agriculture land as per as per Maharashtra land acquisition act. Solar power: Land acquired by the developer for solar projects will be granted deemed status of Non-agricultural land. The solar project can be developed on the land available with the Water Department, area near water canal and above canal. Solar parks: Solar projects having capacity up to 2 MW can be given land 4 hectors as per availability and 50 % discount shall be given on rental/ lease charges. All such transactions will be governed as per Maharashtra land acquisition act. The project developer can lease or rent land for solar project from private land owner.
Power evacuation	In line with MERC, the power evacuation facility to the grid shall be developed by project developer. Supervision charges levied by the TRANSCO/DISCOMS shall be exempted. MSELDC/MSETDC shall provide grid connectivity for the solar project of minimum 1 MW in solar park. The policy does not provide any comment on the time of processing the application for evacuation.
Open access and wheeling	Open access is allowed for wind energy and solar power as per MERC regulation. Inter-state and intra-state open access is allowed. There is no exemption in provided for renewable energy for the wheeling and transmission and distribution losses. As per Distribution Open Access regulation, 2014, the minimum eligible installed capacity is 1 MW.
Power banking	In Distribution Open Access regulation, 2014, the banking of renewable energy power has not been specifically addressed. The excess power feed to the grid under open access shall be purchased by DISCOM in 15 minutes. This acts a serious set-back for the renewable energy generator and consumer under open access.
Clearances	Solar power and wind are exempted from NOC/PCB clearance. No single window application clearance facility for the ease of business.
Other incentives	• Government land if available requires for manufacturing of solar modules/ panels/etc. shall also be given 50 % discount on lease/rental charges. • Solar power has exemption from E-duty for captive power plants for 10 years from the date of commissioning. • Solar project developers can sell electricity generated from solar projects to distribution companies /captive use/third-party sale/ REC. • Existing wind electric generators are permitted for re-powering with appropriate micro-siting and use of updated technology. This will help in re-powering the old wind facilities or non-operable wind facilities.
Solar rooftop – net metering[34]	MERC has approved the net metering policy for solar rooftop project, 2015. The capacity of the rooftop solar should not exceed 40% of the rated capacity of the distribution transformer. The maximum limit of solar rooftop PV system is 1000 kVA (~800kW), i.e., less than 1 MW. The power generated from solar rooftop PV system can be used for meeting RPO. The net meter for consumers within the scope of "Time of Day" tariff shall record the time of generation and consumption and compensated accordingly. Any unadjusted net credit of power injected to the grid shall be purchased by DISCOMS at the end of the financial year at the average cost, thus allowing a power banking of one year and ensured buying by the DISCOMS of the un-used power.

Karnataka

Karnataka has separate policies for solar and other renewable energy. In 2014, Karnataka Renewable Energy Development Ltd. published solar policy for 2014-2021[35] and renewable energy policy for 2010-2021 is under progress. The total renewable energy target installation, by 2021, is 5.6 GW of which 2 GW is from solar power and remaining 3.6 GW is from other renewable energy sources. Karnataka has not defined on the RPO percentage from solar power. The major renewable energy sources are wind, with a target of 2.6 GW by 2021 followed by solar with 2 GW target by 2021. Key highlights of the policies[37] [38] are: Karnataka also approaches its energy situation by managing energy demand through energy efficiency programs. Karnataka has the energy conservation and efficiency policy 2015-19 with a vision to harness potential energy saving from energy efficiency.

Incentive Category	Description of Provided Incentives
Land availability and Land acquisition	The land acquired by the developer shall be deemed to be converted to non-agriculture land as per as per Karnataka land acquisition act. The wind energy project installation can start immediately upon submission of application and requisite fee. The renewable energy policy indicates that the land bank for respective renewable energy technology shall be generated by the concern government department. The government lands, such as barren land and forest land will be developed by Karnataka renewable energy Development Limited to facilitate setting up of various renewable energy projects. Land for waste to energy projects shall be identified and reserved by the Municipality Bodies. Change or shifting of location is not permitted under the policy.
Power evacuation	The power evacuation facility to the grid shall be developed by project developer. The policy does not provide any comment on the time of processing the application for evacuation.
Open access and wheeling	Open access and wheeling of power within state is allowed as per KERC norms at the rate of 5% as wheeling charge. All solar power generators in the State achieving commercial operation between 1st April 2013 and 31st March 2018 are exempted from payment of wheeling and banking charges and cross subsidy surcharge for a period of ten years from the date of commissioning. Captive solar power plants opting for Renewable Energy Certificates shall pay the normal wheeling, banking and other charges as specified in the Commission's Order
Power banking	Power banking of for the renewable energy is allowed by KERC. Charge for power banking is exempted for solar power plants for 10 years.
Clearances	All solar PV projects are exempted from obtaining PCB clearances. Karnataka Renewable Energy Development Ltd acts as a single window for the clearances and shall be responsible for pursing the concern departments within 90 days and 120 days all departmental and forest clearances respectively. As per the draft renewable energy policy, response time for the departments is stipulated to be within 45 days from the date of application.
Other incentives	Existing wind electric generators are permitted for re-powering with use of updated technology. This will help in re-powering the old wind facilities or non-operable wind facilities. 10 % of "Green Energy Cess" fund shall be used as contribution to Energy Conservation Fund for Energy Conservation activities. The balance will be set apart for renewable energy project financing.

Incentive Category	Description of Provided Incentives
Other incentives	Solar parks are promoted. A financial assistance of INR 1 Cr shall be provided by Government of Karnataka for solar park of area 100 acres or more. "Plug and play" solar park development by private parties are also encouraged. Farm land owners are encouraged to implement solar plant from 1MW to 3 MW capacities. Urban buildings are likely to be exempted from floor-area-ratio with respect to the floor area created for solar rooftop. "Surya Raitha System" has been launched to encourage famers to install solar panels for their irrigation pumps. Farmers can sell excess electricity produced back to the grid.
Solar rooftop – net metering	KERC has approved the net metering policy for solar rooftop project. The maximum limit of solar rooftop PV system is 1 MW. An attractive solar rooftop tariff of 9.56 INR/kWh for unsubsidised systems and 7.20 INR/kWh for systems availing a 30% central subsidy has been offered to boost solar rooftop PV system.

Andhra Pradesh

Andhra Pradesh has a large potential for Solar (58.8 GW) and Wind (14.5 GW) installations. The Andhra Pradesh Government has released its new policy for the development of solar power projects in the state in 2015. The main objective of the solar power policy[39] now is to ensure installations of 5 GW of solar power within the next 5 years, through development of solar parks and promoting manufacture of solar equipment. The state also placed a Wind power policy[40] and a Net metering policy[41] .

Incentive Category	Description of Provided Incentives
Land availability and Land acquisition	For Wind projects, based on the availability the allotment of revenue land shall be considered. For Solar projects, the project developer should acquire the land required for the project. The land owned by Revenue Department, the land allotment shall be done as per the prevailing government policy.
Power evacuation	For Wind Projects: The project developer shall bear the entire cost of power evacuation facilities for interconnecting the wind farm with the grid. For Solar projects, the Nodal Agency and/or designated offices by the Nodal Agency will facilitate in getting power evacuation. For solar parks, the state government will facilitate power evacuation. Supervision charges levied by the TRANSCO/DISCOMS shall be exempted for wind and solar power projects.
Open access and wheeling	Intra-state Open Access for wind and solar projects are allowed as per the APERC Regulations. In absence of any response to the application for open access or intimation from the Nodal Agency to the generator within 21 days, application shall be considered to be deemed open access. Transmission and Distribution charges are exempted for wheeling of power within the state, generated from Solar and wind power projects. No wheeling and transmission charges for wheeling to the desired location/s for captive use/third party sale within the state through 33KV system subject to industries maintaining their demand within its contracted demand.

Incentive Category	Description of Provided Incentives
Power banking	100% power banking is allowed during all 12 months of the year, from April to March.
Clearances	Wind energy projects: All approvals and clearances will be provided within 30 days from the date of registration. Solar Rooftop projects: All approvals and clearances will be provided within 14 days from the date of application" Technical feasibility for evacuation will be disposed within 14 days from the date of receipt of application. All wind and solar power projects are exempted from obtaining PCB clearance.
Other incentives	All wind power projects are exempted from paying Electricity Duty in case of sale of power to AP DISCOM. Electricity duty shall be exempted for captive consumption, sale to DISCOM(s) and third party sale provided the source of power is from Solar Power Projects setup within the State. Cross subsidy surcharges are exempted for third party sale for solar power projects setup within the State for a period of five (5) years from the date of commissioning.

Gujarat

Gujarat has significant potential of wind and solar power along with significant amount of barren and uncultivated land and long coastal area. Gujarat has the tentative renewable energy target of 17.133GW by 2022 of which 8.02GW is from solar power and 8.8 GW is from wind energy[42] . Gujarat came up with its new solar power policy on 13th August 2015, which would be operative up to March 31, 2020[43] . As per the current solar policy, solar PV (under net metering) and solar power plants for captive consumptions are eligible to have the installed capacity not more than 50% of the contract demand or load. GERC has published its recent wind energy policy in July 2013[44] . The key highlights of the policies are as follows:

Incentive Category	Description of Provided Incentives
Land availability and Land acquisition	The project developers are responsible for acquiring land. Based on the availability, revenue waste land or Gujarat Energy Development Agency (GEDA) land can be allotted for wind power plant installation.
Power evacuation	Wind power: The power evacuation facility from wind farm substation to GETCO substation, up to 100 km, needs to be erected by the project developer. Beyond 100 km, the evacuation line shall be erected by GETCO Solar power: The power evacuation facility from solar farm to GETCO substation shall be erected by project developer. The policy does not comment on the time line of the approval or erection of the power evacuation facility.
Open access and wheeling	Inter-state and intra-state open access is allowed in Gujarat. Wheeling of wind power for third party sale and captive consumption at 66kV voltage, normal open access and wheeling charge is applied. For captive consumption below 66kV, 10% and 7% of the energy fed by multiple WTGs and single WTG respectively are charged for wheeling. The wind power generator, wheeling power

Incentive Category	Description of Provided Incentives
	to more than two sites, shall pay INR 0.05/unit of energy fed to the grid.
Open access and wheeling	Solar power: No wheeling charges are applicable for solar PV under net metering. Captive solar projects which are registered under REC, 50% of the normal wheeling charge and losses as applicable to normal open access consumers. For the REC solar projects, wheeling charges are as applicable to normal open access consumers.
Power banking	Wind power: No power banking facility is available for third party sale. Energy accounting is done on 15 minutes time block. WTGs which are used for captive consumption can bank power for one month time during the same calendar month. Solar power: The solar power projects under REC mechanism, selling power outside the state and solar projects which are selling power to DISCOMS are not allowed for power banking and the energy accounting for such projects are done on 15 minutes time block. The non-REC solar power, either captive usage or third party sale, are eligible for power banking for consumer's one billing cycle wherein set-off can be done in any of the billing cycle.
Clearances	Solar power and wind are exempted from NOC/PCB clearance. The policies do not comment of single window clearance or timeline of the clearances.
Other incentives	Electricity duty shall be exempted for all types of solar power projects. For wind projects, except in case of third party sales, the electricity generated from the WTGs is exempted from electricity duty. Wind Turbine Generator (WTG) power: WTGs for captive use are exempted from demand cut to the extent of 30% of the installed capacity. Solar power: Rooftop solar PV for residential and government consumers, solar projects for selling power to DISCOMS and solar project under NSM are exempted from demand cut. For solar project for captive usage, third party sale, rooftop solar PV for industrial consumers under REC are exempted from demand cut up to 50% of the installed capacity. Cross subsidy surcharge in solar power projects are exempted for: Rooftop solar PV projects in residential, industrial, commercial and government consumers under net metering For captive consumption For sale of power to DISCOMs or the power is sold outside state. This surcharge is 100% for REC projects and 50% for non-REC projects for sale of power to third party under Open Access within the state for solar projects.
Solar roof top- Net metering	The installed capacity of roof-top solar PV is limited to 50% of the contract demand and load. The existing consumer tariff is applied for not metering roof top solar PV power. Any unadjusted net credit of power injected to the grid shall be purchased by DISCOMS at the end of the consumer's billing cycle at the average cost, thus ensured buying by the DISCOMS of the un-used power.

Rajasthan

Rajasthan has the tentative total renewable energy target of 14.362GW of which 5.762GW is from solar power and 8.6GW is from wind energy[45] . The Rajasthan Electricity Regulatory Commission (RERC) has even set a fixed RPO for the year 2016-17 at 2.5% solar power. RERC has come up with policies for wind[46] and solar[47] power generation. The key highlights of the policies are.

Incentive Category	Description of Provided Incentives
Land availability and Land acquisition	Wind power developers are allowed to procure private land. The conversion of private land to industrial land shall be done at the charge of 10% of the charge levied for industrial purpose. Rajasthan government land will provide land for wind farm at 10% of District Level Committee (DLC) rates on first cum first served basis, with a maximum land allotment of 5 hectare/MW. The sub-lease of land for wind farm development is also allowed under the policy. Government land is allotted for solar parks and solar Power Projects as per the provisions of Rajasthan Land Revenue (Allotment of land for setting up of Power Plant based on renewable energy Sources), Rules 2007. The maximum land allotment for different technologies of solar power plants are as, described: 1. Solar PV Crystalline Technology: 2.5 Ha/MW 2. Solar PV Crystalline Technology with tracker 3.5 Ha/MW 3. Solar PV on Thin film / Amorphous Technology 3.5 Ha/MW 4. Solar Thermal (CSP) Tower / Trough or other technology: Up to PLF of 21% 3.5 Ha/MW For every 1% increase in PLF 0.15 Ha/MW additional land will be allotted The land allotment for solar power projects shall be done only on the refundable payment of 5 lac INR/MW to RREC. The solar project developers are allowed to procure private land. No land conversion is required for setting up solar projects. Farmers are allowed to install or sub-let solar projects in their land without requirement of land conversion.
Power evacuation	The power evacuation facility shall be erected and maintained by the power producer.
Open access and wheeling	Inter-state and intra-state open access and wheeling of power is allowed for wind and solar power projects. Transmission & wheeling charges for third party sale or captive use within or outside the state the wheeling and transmission charges will be recovered in cash as per orders of the commission[48] .
Power banking	As per "Terms and Conditions for Determination of Tariff for renewable energy Sources - Wind and Solar power Regulations, 2014" [49] by RERC, the power banking of solar and wind energy is allowed at consumer end for only captive consumption within the state. The period of banking will be monthly basis and banking charges at 2% of banked energy would be payable.
Clearances	Wind power projects are exempted from State Pollution Board clearance. Further, no N.O.C is required from Gram Panchayat for installation of wind farm in the government allotted land Solar power projects are notified under "Green Category" and a comprehensive consent to establish and consent to operate shall be issued for solar project by PCB within 15 days from the date of application submission.
Other incentives	Incentives available under Rajasthan Investment Promotion Scheme (RIPS) shall be available to the solar and wind power projects. The Cross-subsidy surcharge shall not be applicable in case of open access transactions based on wind and solar power[50] . Wind energy used for captive consumption is exempted from electricity duty. The transmission charge for solar power projects, commissioned from April 2015 to march 2018 shall be charged 50% of the normal transmission charge[51] . No energy scheduling is applicable for solar power generator for intra-state ABT. Based on the availability, Water Resource Department shall allocate water from IGNP canal or nearest source of water for solar thermal power plant.
Solar rooftop – net metering[52]	The installed capacity of the solar rooftop PV system is limited to 1MW installed capacity and not be more than 80% of the consumer's connected load or contracted demand. The total installed capacity of the solar-rooftop PV system is not be more than 30% of the distribution transformer capacity. Energy generated by solar rooftop is exempted from banking and wheeling charges and cross subsidy surcharge. The energy banking allowed for a month and credit will be carried forward to next period to the extent of 50 units. DISCOMS can use the energy generated by solar rooftop power plant for meeting its solar RPO through entire generation from a net-metering plant, when the consumer is not an obligated entity.

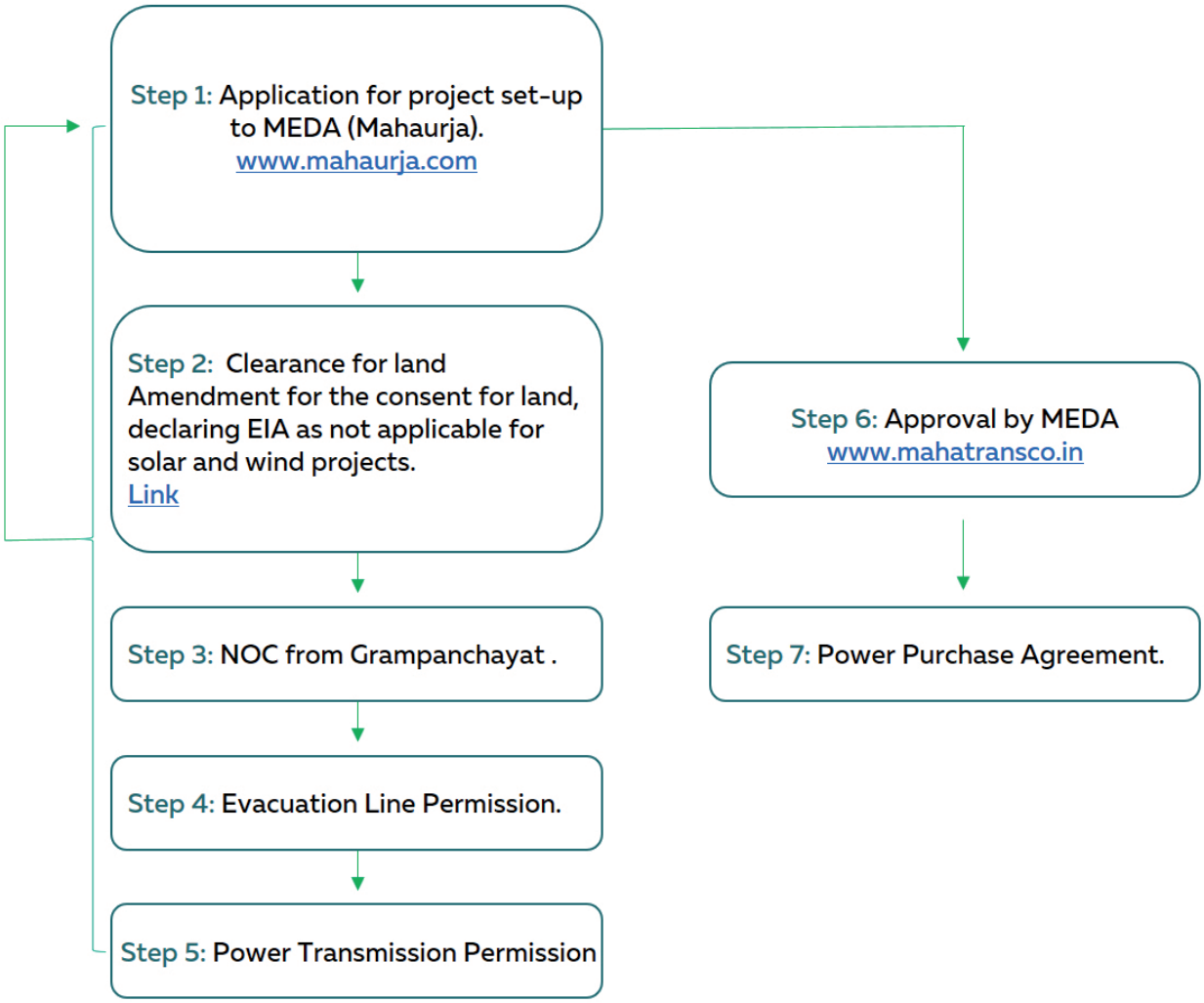
Tamil Nadu

Tamil Nadu is among the states with highest insolation of 5/5 – 6 kWh/sq. m./day has been proactive about encouraging wind and solar power installations. The renewable energy target for Tamil Nadu, by 2022, is 21.508 GW of which 8.88GW is from solar power and 11.9 GW is projected to be from wind energy[53]. The state laid down a progressive solar policy in 2012[54] , with ambitious goals, such as to generate an additional 3,000 megawatts (MW) of solar power by end-2015.

The state also had plans to levy a 6% Solar Power Obligation (SPO) upon power consumers. However, the state electricity tribunal has set aside these directives and the renewable energy sector had suffered due to this legal setback. Tamil Nadu is yet to have any formal wind energy policy for the state.

Incentive Category	Description of Provided Incentives
Land availability and Land acquisition	Land acquisition is the responsibility of the investor. Subjected to availability, industrial estates shall be allocated for erection of solar power plants.
Power evacuation	The power evacuation facility is to be erected and maintained by the project developer in line with requirement of TNERC.
Open access and wheeling	Intra-state and inter-state open access and wheeling of power is allowed. For wind power projects and solar power projects, wheeling, transmission and scheduling and system operation charges to be 40%[55] and 30%[56] respectively of the charges as applicable to conventional power plants. The projects which are opting for REC, 100% of the charges are applied.
Power banking	Wind power banking is allowed for one year, from 1 April to 31 March[57] . Banking of solar power is allowed for the billing cycle[58] .
Clearances	For solar power projects single window clearance will be provided through TEDA in 30 days from date of application. No specific time line is given for the clearance with respect to wind power projects.
Other incentives	100% of electricity generated from solar power used for self- consumption/sale to utility, allowed for 5 years Tax concessions will be given as per Tamil Nadu Industrial Policy The cross subsidy charges for the third party open access consumers as proposed to be 50% for both wind and solar power. 100% exemption from demand cut for the solar power plants. Government shall identify the land for solar manufacturing parks.
Solar rooftop – net metering[52]	Net metering has been allowed in the solar policy 2012 to promote solar rooftop PV system installation in commercial and individual buildings. The capacity of net metering installation is not to be more than 90% of the connected load. The energy accounting shall be done on 12 month basis from August – July with no further carry forward.[59]

Appendix 5: Clearances & Permits for Solar and Wind Projects in Maharashtra



Specific to renewable energy projects, the EIA rules are defined as:

- Biomass Projects up to 15 MW are exempted from EIA.
- Solar Photo Voltaic (SPV) all capacity is exempted up to a plant size of 50 hectares.
- Small Hydro Projects (SHPs) are exempted up to a capacity of 25 MW - But the project proponents have to approach State Pollution Control Board (SPCB) for clearance under Air and Water Act.
- No EIA for wind projects of any capacity is required.

Wind and Solar and hydel <25 MW have been moved from Red category to Green as per the CPCB clarification of amendment in the categorisation of industries based on pollution potential. (http://mpcb.gov.in/consentmgt/pdf/Clarificatory%20amendment%20in%20thecategorisatio%20industries%20RedOrangeGreen_grantconsent.pdf\)

For wind and solar projects need CTE and CTO from the state pollution control authority.
For solar projects, keeping in view the extent of land required, the state pollution control board before providing the consent to establish, must ensure that the proposed area does not involve

1. Wet land,
2. Any agricultural land
3. Eco sensitive area
4. Large habitation
5. Areas rich in biodiversity.

http://mnre.gov.in/file-manager/UserFiles/environmental_clearance_grid_connect_stp_jnnsm.pdf

For forest land, clearance from forest department must be taken. Projects of national importance like wind and solar farms can be granted forest land on lease through a detailed two stage process by the MoEF.

In Stage-I, the developer provides the necessary documents to the Divisional Forest Officer (DFO), who assesses the Net Present Value (NPV) of the current forested area to make recommendations for forest land diversion and determine areas for compensatory afforestation.

In Stage-II, MoEF or its regional office reviews the document and gives a go ahead for the project. Forest areas are identified using forest atlas and GIS maps and alternatives have to be considered to minimize forest land use during this process.
No renewable energy project may be undertaken in coastal region.
Listed below are the clearance s and permits required for wind power projects in Maharashtra
1. Type test certificate
2. Grid connectivity permission
3. Land ownership documentation/ Forest land clearance
4. Wind assessment document from NIWE or verified by NIWE
5. No-objection certificate from local body
6. Notarised undertakings prescribed by MEDA

Listed below are the clearance s and permits required for solar power projects in Maharashtra
1. Grid connectivity permission
2. Land ownership documentation
3. Solvency certificate of up to 30% of project cost from any nationalized/scheduled bank
4. Mandatory to inform SLDC about the electricity generation through real time visibility.
5. Permission required from MEDA for installations on government waste land
6. Notarised undertakings prescribed by MEDA

List of Clearances and Permits for Renewable Energy Projects in India.

Sr. No.		Details
		Approvals to be obtained by the Developer
Pre Bidding Approvals		Pre bidding approvals
	1	Registration under PAN, TAN, IEC, Service tax, Entry Tax, VAT law and Central Excise and Customs Acts.
	2	Identification of nearby substation
	3	Load flow analysis/connectivity letter from the Utility, with estimate for bay extension received from Transco
	4	Identify the location, where the numbers of farmers are less preferably: At least 30-40 acres per farmer or an aggregator who as a GPA for his name Local intelligence on who is having how much land:
Post Award Pre PPA approvals		**Post Award Pre PPA process**
	1	Creation of SPV for the project
	2	Project registration certificate and documents.
	3	Power purchase agreement/approvals with the relevant distribution licensee in AP.
	4	Power Evacuation Agreement with State Utility
		Private Land Acquisition
	1	Collect all the documents
	2	Verified by the advocate for the due diligence
	3	Public notice for acquiring the land, needed for legal due diligence
	4	If cleared legally, you can buy from the aggregator, see the land is contiguous,
	5	There is an system if AP, Karnataka, Telangana, , you can buy a land only up to 54 acres then you can apply for NA conversion The entire land acquisition needs to be done stage wise. Deemed NA conversion. Solar policy document available on NREDCAP. After submitting fees deemed conversion is received takes about 45 days. After submission you can easily start construction. The land has to be purchased in blocks and applied for in stages with limit of 54 acres.
		Revenue Land
	1	After identification of land. Apply NREDCAP, approval at CM, revenue minister office, the nodal agency will send it to energy secretary, from energy secretary it will go to district collector. Collector – Joint collector – Revenue divisional officer – Mandal/Tehsildar – Government surveyor.

Sr. No.		Details
Post Award Pre PPA approvals	2	Based on the market they submit prepare a proposal and it will go to higher authorities. RDO will give approval and submit his report. JC will inspect the land and submit the reports and recommend the price. Collector will send it to CCLA (Chief Commissioner land administrator at the rank of CS).
	3	A committee called APLNA – meets one in a month which is attended by all secretaries and the proposal will be presented to the authority to review it. After getting cleared in APLNA it will be forwarded to state government.
	4	Process: It has to be cleared to revenue, finance, Chief Secretary of state, revenue minister and then it goes to CM. Once it is cleared by CM it will be cleared by cabinet meeting. GO will be issued in the name of company, defining the land and purpose. (In wind the GO will be issued in the name of NEDCAP and developer, after commissioning NREDCAP will be go back from GO)
	5	ALIENATION or lease. Based on GO 571 AP is not doing alienation, will give only for special cases, but by default by lease, 25-30 years based on plant life. Prepare the project feasibility/DPR for application to NEDCAP.
	6	Process time required is 4-6 months: after expenditure
Post PPA Pre Construction		**Post PPA - Pre Construction**
	1	Construction of Plant No required from gram panchayat, required for both government and private land:
	2	Factory license is required before commencement. Submission of layout, Directory factory . Registration under the Factories Act, 1948, Approval of building plans under factories act
	3	Commercial taxation/state tax with local authority once again at the local level for the plant Municipal registration: Business establishment certificate: Company registration document, Project NoC, in the name of the SPV.\
	4	Separate approval for control room buildings required director-town and country planning - 2 weeks
	5	Pollution control board No-objection certificate (CTE) from pollution control board, if required.: Telangana state industry policy IPASS – Single window clearance system: Apply online, upload some documents viz. plant layout, building plan all these documents to the concerned department. Also single point contact for factory license and town and country planning: Consultant to Establish and Consultant to Operate
	6	Approval from competent Authorities of AP state government for the procurement of good and material while execution of Work at concessional custom duties and "nil excise duties" as currently for grid connected solar power plants.
	7	Approval for ground water extraction from competent authorities (if required).
	8	In case of bidding: evacuation related feasibility and approval is not required: The makes and models, the SLDs, submit it to the Transco, equipment layout and they approve. Submission of letters, and pay supervision charges. But for open access : Load flow analysis, from the nodal transmission authority, Identification of the substation as a spare capacity confirmation is the first requirement.

Sr. No.		Details
Post Award Pre PPA approvals	9	Right of access and permits for Transmission Lines and interconnection of the same from plant Battery Limits to the nearest TRANSCO/DISCOM receiving sub-station. Transmission Agreement, Section 68 approval, PTCC clearance.
	10	Employer obtains registration as Principal Employer from the Department of Labour. Registration and licenses under Contract Labour (Regulation and Abolition) Act, 1970
		MNRE
	1	Submission of any bond / undertaking / declaration to customs / central excise / any other tax authorities / MNRE / Designated government body required in connection with the procurement of material (both imported and indigenous).
	2	Declaration of Project Site for the purposes of IHS code for the purposes of material procurement (both imported and indigenous)
	3	Approval for MNRE for concessional customs and nil excise duty
	4	Approval from Local Body / Panchayat / Tehsildar
Pre Commissioning Approvals		**Pre Commissioning**
		CTO from pollution control board
		ELECTRICAL
		Load flow approval
		Bay allotment approval
		Transco Approval
		Scheme approval
		All drawing approvals
		All inspections including stage , onsite and offsite and final inspection and getting NOC
		All required liasoning for the above works
		CEIG
		CEIG- drawing approval
		CEIG- site visit
		WCC-Discom(work completion certificate)
		WCC by TRANSCO
		WCC by OPS and maintenance
		WCC by MRT

Sr. No.	Details
	WCC by SLDC
	Synchronization
	Transmission utility
	Distribution utility
	Transmission utility
	TSSPDCL
Pre Commissioning Approvals	(TL & Metering)
	TSTRANSCO
	TSSPDCL
	NEDCAP (Nodal agency)
	DPE (vigilance)
	Synchronisation Committee formation by discom

Appendix 6: Renewable Energy Policy Brief, Brazil

Brazil's Renewable Energy Policy is exemplary. The policy can be accessed at http://www.irena.org/DocumentDownloads/Publications/IRENA_RE_Latin_America_Policies_2015_Country_Brazil.pdf

Appendix 7: Learnings from The World

Countries across the world where renewable energy contributes to 100% of the energy demand.

Name	Energy Mix	Specific Remarks	What India can learn and watch out for
Iceland	Primarily Geothermal 85% and 15% hydropower	Iceland is on volcano and this makes it possible to tap the earth's warmth In talks with Britain to build an interconnector to the UK grid (tapping its geothermal capacity for neighbouring countries)	Iceland switched to geothermal in a big way from fossil fuel in the 1990s. It has shown the world that given resources "what a nation can achieve when it sets it mind to it!"
Lesotho	Hydropower 100%	Lesotho Highlands Water Project powers this tiny African nation. Project is riddled with controversies and serious corruption.	Lesotho project was based on breaking the sanction which was then imposed on South Africa. Riddled by corruption at the highest level project was implemented with serious adverse impact on people and environment.
Norway	Hydropower, geothermal, wind	98% of power generated is Renewable, but only 24% is consumed in Norway – remaining from fossil fuel. Norway sells its Renewable power to neighbouring countries in form of Clean Energy Guarantees of origin.	Norway has oil reserves and has prudently used the oil money to create a fund which is invested outside. It focussed on using funds to create and sustain traditional industries such as fishing and develop its renewable energy portfolio.
Costa Rica	Hydro, Geothermal, wind, biomass and solar 99% - 1% fossil fuel.	Recently made headlines for operating on 100% renewable energy for 285 days.	Small country with big ambitions in renewable energy – it understands that hydro power will suffer in course of drought, back-up plan is to invest in a large geothermal project.
Bhutan	Hydro 100%	Exports 85% of its power generated to India.	Impact on stranded assets with withdrawal of glaciers is something to watch out for In dry season Bhutan needs to import power from India.
Uruguay	Biomass, Solar, hydro	Uruguay is another country that is generating 95% of its electricity from renewable energy.	Clear decision-making, A supportive regulatory environment Strong partnership between the public and private sector. Importance of cross party support which emerged after a rancorous debate on its energy policy in 2008.

Countries that are amongst the top in Renewable Energy Consumption:

Country	Portion	What India can learn from
USA	22% of the global consumption of RE.	USA is looking at renewable energy as a means to revive its economy though American Recovery and Reinvestment Act 2009 India must look at the energy policy as a means to revive green jobs in this sector USA has complained to the WTO about India's minimum requirement for procuring locally produced solar panels.
China	RE as a means of energy security above fossil fuels.	Technological innovator in solar and wind, leading to reduction in cost of installations India must learn from China and establish a way to encourage innovation and R&D in renewable energy technology.
Germany	27% of its power is from renewable. Germany, the world's fourth largest economy, has promised some of the most aggressive emission cuts—by 2020, a 40 percent cut from 1990 levels, and by 2050, at least 80 percent.	Accelerated adoption after govt. shutting down nuclear after the Fukushima nuclear disaster Aggressive targets and rapid transition to renewable energy moving away from fossil fuel and nuclear at the same time Grass root level movement involving citizens - Individual citizens and local citizen associations have made half the investment and there are 1.5 million citizens selling power to the grid Utilities are resisting as they are still based on coal Fraunhofer Institute is a world leader in solar research – focus on research has helped Germany transition to Renewables Protection of its forests due to acid rain – death of forests made them think harder about fossil fuel emissions
Spain	The country is still the fifth largest producer in the world of wind power and the third biggest exporter Spain is committed to meeting 20 percent of its energy needs through renewables by 2020, compared to the current 15 %	Government dishonouring of solar tariffs ruined lives of several individual citizen investors Spain was leading in renewable energy in 2008 till a changed government led to abandoning of its solar growth Spain wants to make up the ground it lost during the economic crisis when it reversed its policy slashing subsidies and decimating the sector Some strong companies survived the economic downturn by doing business outside of Spain
Brazil	Brazil entered a bilateral agreement with the US to obtain up to 20% of their electricity from renewable power by 2030.	Clearly researched well-articulated policy Clarity in thought in evolution of a holistic energy policy Focus on biodiesel and a clearly working mechanism on the ground for reduction of transportation emissions.
Italy	28.5% of the total energy is from renewable energy sources; Just Solar PV provides 7.8% of the nations' demand.	In Italy, grid operators are obliged to give priority access to renewable energy plants in the operation of their grids. In Italy, training programmes on renewable energy are developed at regional level. Certification of installed plants is obligatory. All new or refurbished buildings must integrate RES, with an additional 10 % to the obligation level for public buildings. A guarantee fund is in place for supporting district heating network development. In addition, a loan can also be used for supporting investment in district heating infrastructure. Further, Italy is subsidizing electric cars since transport accounts for their large emissions footprint. Italy is also giving Income Tax credits (50% deductions) for captive and residential solar PV plants less than 20kW.

Appendix 8: Cdp Scores And Renewable Energy Initiatives Of Selected Enterprises

CDP Scores and renewable energy Initiatives listed for a select cohort of companies.

Name of Company	CDP 2015 Disclosure Score	Initiatives related to Renewable Energy listed in CDP Report
AB Management Corp.	No response	
Ambuja Cements	97	They have installed a330 KV Solar energy plant at Bhatapara, Chhattisgarh and a 7.5 MW Wind energy plant at Kutch, Gujarat.
Bharti Infratel	Not scored	No response towards CDP Reporting
Cairn India	65	Solar lights installed in 2014 generated 42,860 kWh of electricity
Chambal Fertilisers	Not scored	No response towards CDP Reporting
Coal India	Not scored	No response towards CDP Reporting
DLF	Not scored	No response towards CDP Reporting
Dr Reddy's Laboratories	97	Signed PPAs of 15 MW with solar power producers (DRL will pay 26% equity of projects); established biomass based steam production plant in Pydibhimavaram.
DSM India	Not listed	DSM has solarised their Pune office with a 1 MW plant, as a technological demonstration of anti-reflective coating for improving solar panel efficiency. Three more sites will be solarised in 12-18 months.
Godrej Consumer Products Limited	94	Purchased 2764 MWh of renewable energy during the current reporting year. Investing roughly INR 200 million in renewable energy and low carbon technology
HCC	Not listed	Not explored renewable energy due to the project based type of work in construction sector
Hero Motorcorp	Not listed	Not listed in the CDP report
Hindalco	No response	
Hindustan Petroleum Corporation Limited	Forthcoming	Latest initiatives to be updated in the 2015 report
Idea AB	No response	
Indian Oil Corporation	94	Existing installations: 63 MW wind, 5 MW solar, and 4.4 MW off-grid solar
Jubilant Life Sciences	Not scored	In FY 2014-15, 4.54 % of total energy consumed was sourced from renewables
Kansai Nerolac Paints	Not Available	No response towards CDP Reporting
Mahindra EPC	Not listed	
Mahindra Sanyo	Not scored	
Maruti Suzuki	Forthcoming	No previous response available for public viewing
NTPC	Declined	Declined

Name of Company	CDP 2015 Disclosure Score	Initiatives related to Renewable Energy listed in CDP Report
Reliance ADA	No response	
Reliance Industries	No response	No response towards CDP Reporting
Shree Cements	90	Setting up 50 MW solar thermal; installed Waste Heat Recovery Systems of capacity 81 MW
Suzlon	Not scored	
Tata Group	Not listed	
Tata Housing	Not scored	
Tata Power	92	Installed capacity: 59 MW solar, 468 MW wind, 573 hydro, and 120 MW waste heat recovery
Tata Power Solar	Not listed	
Tata Refractories	Not listed	
Titan	No response	No response towards CDP Reporting
UltraTech Cement ADB	95	Poised to invest INR 49 crore in purchasing RECs due to being mandated to meet RPO
Welspun Renewables	77	NO initiatives mentioned clearly in CDP report.
Yes Bank	98	NO initiatives for direct installation or purchase of RE, BUT, will be providing loans as "Green Energy Finance" to assist with renewable energy installations. Made commitments to fund 500 MW renewable energy in this FY.

Appendix 9: References

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[3] Members include: Adobe, Alstria, Autodesk, Aviva, Biogen, BMW Group, BROAD Group, BT Group, Coca-Cola Enterprises, Commerzbank, DSM, Elion Resources Group, Elopak, Formula E, Givaudan, Goldman Sachs, Google, H&M, IKEA Group, Infosys, ING, International Flavours & Fragrances Inc.(IFF), J. Safra Sarasin, Johnson & Johnson, Kingspan, KPN, La Poste, Land Securities, Marks & Spencer, Mars Incorporated, Microsoft, Nestlé, Nike, Inc., Nordea Bank AB, Novo Nordisk, Pearson PLC, Philips, Procter & Gamble, Proximus, RELX Group, Salesforce, SAP, SGS, Starbucks, Steelcase, Swiss Post, Swiss Re, UBS, Unilever, Vaisala, Voya Financial, Walmart and YOOX Group.

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[5] http://there100.org/re100 RE100 is brought to you by The Climate Group in partnership with CDP, as part of the We Mean Business coalition.

[6] We Mean Business is a coalition of organizations working with thousands of the world's most influential businesses and investors. These businesses recognize that the transition to a low carbon economy is the only way to secure sustainable economic growth and prosperity for all. To accelerate this transition, this common platform helps to amplify the business voice, catalyze bold climate action by all, and promote smart policy frameworks.

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About Mahindra

The Mahindra Group focuses on enabling people to rise through solutions that power mobility, drive rural prosperity, enhance urban lifestyles and increase business efficiency.

A USD 17.8 billion multinational group based in Mumbai, India, Mahindra provides employment opportunities to over 200,000 people in over 100 countries. Mahindra operates in the key industries that drive economic growth, enjoying a leadership position in tractors, utility vehicles, information technology, financial services and vacation ownership. In addition, Mahindra enjoys a strong presence in the agribusiness, aerospace, components, consulting services, defence, energy, industrial equipment, logistics, real estate, retail, steel, commercial vehicles and two wheeler industries.

In 2015, Mahindra & Mahindra was recognized as the Best Company for CSR in India in a study by the Economic Times. In 2014, Mahindra featured on the Forbes Global 2000, a comprehensive listing of the world's largest, most powerful public companies, as measured by revenue, profit, assets and market value. The Mahindra Group also received the Financial Times 'Boldness in Business' Award in the 'Emerging Markets' category in 2013.

Contacts

Anirban Ghosh,
Group - Chief Sustainability Office

Naresh Patil,
Head, Corporate Sustainability Cell

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About Treeni

Treeni Sustainability Solutions Private Limited is a sustainability consulting and technology solutions company focused on delivering value through consulting-led, low-cost, scalable, innovative solutions to address organisational sustainability challenges. At Treeni's core is the ReSustain platform that offers comprehensive performance management and analytics focused on enterprise sustainability. Founded in December 2015, and we are based out of Pune, Mumbai, Bangalore and Atlanta.

We specialize in end-to-end sustainability strategy and data management solutions. We understand the importance of collaboration and sound sustainability information in disclosures, performance and reporting. We believe technology will change the way sustainability is implemented on the ground, tracked and monitored and reported.

Treeni, as an organisation, believes firmly in delivering high quality work with the goal of making our customers self-sufficient in the least amount of time possible. We have experience in transitioning organizations into a sustainability leadership position. Our consultants have over 30 years of collective experience in building sustainability strategy through a systematic approach focussed on stakeholder engagement. Our consultants are GRI trained and certified, GHG inventory quantifiers and have experience in systemising sustainability performance as per international frameworks for various sectors ranging from Renewables, Automobile, Telecom, ICT and Retail, to Manufacturing, Construction and the Food industry.

Our expertise & services isn't limited to client concerns & broad based sustainability issues but also extend to new age concepts like circularity, shared value, societal valuation etc.

Contacts

Dr. Sunita Purushottam,
Head of Consulting

Sharmistha Shome,
Sr. Consultant

Vinodh Valluri,
Sr. Associate Consultant

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About The Climate Group

The Climate Group is an award-winning, international non-profit. We specialize in bold, catalytic and high-impact climate and energy initiatives with the world's leading businesses and state and regional governments. Our work is at the forefront of ambitious climate action. Our vision is a world of prosperous 'net-zero' emission economies and thriving, sustainable societies.

Our mission is to catalyse climate leadership in government and business to accelerate the shift to a prosperous and thriving 'net-zero' future for all. We do this by communicating to inform, convening to connect, and collaborating to scale and succeed. Founded in 2004, our offices are located in Beijing, Hong Kong, New Delhi, New York and London.

The Climate Group is one of the founding members of We Mean Business – a coalition of organizations working with thousands of the world's most influential businesses and investors. These businesses recognize that the transition to a low carbon economy is the only way to secure sustainable economic growth and prosperity for all. RE100 is an action of the We Mean Business coalition. Businesses must play their role, adopting climate plans such as going 100% renewable. The Climate Group is helping companies that want to achieve this with the RE100 program, which shows how it is possible to provide energy security, help manage fluctuating energy costs, improve reputation and deliver carbon emission reduction goals.

Contacts

Rashi Gupta,
India Partnership Manager

Shilpi Samantray,
Project Officer

Confederation of Indian Industry

The Confederation of Indian Industry (CII) works to create and sustain an environment conducive to the development of India, partnering industry, Government, and civil society, through advisory and consultative processes.

CII is a non-government, not-for-profit, industry-led and industry-managed organization, playing a proactive role in India's development process. Founded in 1895, India's premier business association has over 8000 members, from the private as well as public sectors, including SMEs and MNCs, and an indirect membership of over 200,000 enterprises from around 240 national and regional sectoral industry bodies.

CII charts change by working closely with Government on policy issues, interfacing with thought leaders, and enhancing efficiency, competitiveness and business opportunities for industry through a range of specialized services and strategic global linkages. It also provides a platform for consensus-building and networking on key issues.

Extending its agenda beyond business, CII assists industry to identify and execute corporate citizenship programmes. Partnerships with civil society organizations carry forward corporate initiatives for integrated and inclusive development across diverse domains including affirmative action, healthcare, education, livelihood, diversity management, skill development, empowerment of women, and water, to name a few.

The CII theme for 2016-17, **Building National Competitiveness,** emphasizes Industry's role in partnering Government to accelerate competitiveness across sectors, with sustained global competitiveness as the goal. The focus is on six key enablers: Human Development; Corporate Integrity and Good Citizenship; Ease of Doing Business; Innovation and Technical Capability; Sustainability; and Integration with the World.

With 66 offices, including 9 Centres of Excellence, in India, and 9 overseas offices in Australia, Bahrain, China, Egypt, France, Germany, Singapore, UK, and USA, as well as institutional partnerships with 320 counterpart organizations in 106 countries, CII serves as a reference point for Indian industry and the international business community.

Confederation of Indian Industry
(Western Region)
105, Kakad Chambers 132, Dr. Annie Besant Road, Worli,
Mumbai – 400018 (India)
• T: + 91 22 2493 1790 • F: 91 2224939463 / 24945831
E: ciiwr@cii.in | W: www.cii.in

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Reach us via our Membership Helpline: 00-91-124-4592966 / 00-91-99104 46244
CII Helpline Toll free No: 1800-103-1244