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Renewable energy governance in India: challenges and prospects for achieving the 2022 energy goals

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Abstract

India has set colossal renewable energy (RE) targets (achieving 175GW of renewable energy capacity by 2022) which need a clear strategy roadmap, integrated planning and a whole-of-system approach. However, the loopholes in institutional mechanisms are bound to hinder the process of policy formulation and implementation for the aspired quantum leap. This paper is an attempt to observe governance of renewable energy in India while exploring the issues and challenges that have been stalling the process of clean energy uptake. The paper finds that despite the comprehensive policy and regulatory frameworks, the large disconnect between the central policies and regional needs has created barriers for deployment of renewable technologies. The paper emphasizes the provision for clean energy financial support to be made available to the states for addressing the disparities between RE potential and the development cost, and planning for better grid management systems. The RE targets also demand an intensive capital market development and innovative financial support mechanisms and products. While aligning itself with the clean energy goals, India needs to focus significantly on the energy needs of the rural population which has been grappling with electricity cuts and brownouts. For regions with limited or no electricity supply, the government should aggressively promote the ideas of off-grid solar power and micro grids. The paper also recommends the possibilities for private sector investments, rural entrepreneurship and public- private ventures for filling in the gaps, and thus harnessing the potential of RE-rich states.

Keywords: Renewable Energy, UN Sustainable Development Goals (SDGs), India, Clean Energy, Grid integration, Solar Mission, NAPCC, Climate change, Rural electrification

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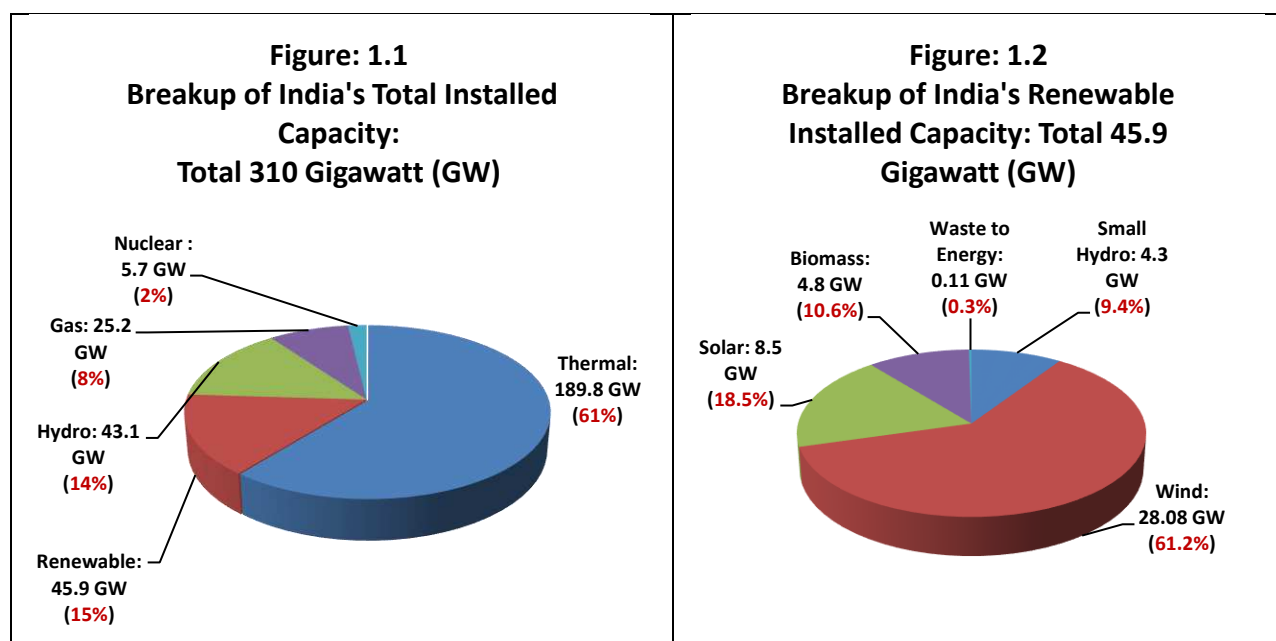
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Introduction

With an aim of establishing one of the largest renewable programs in the world, India aspires to achieve 175GW of renewable energy capacity by the year 2022. The idea is indeed noble, but the path to glory has the most difficult terrain to offer.

India, which is the biggest greenhouse gas emitter after the US and China, has significantly progressed in its commitments towards the adoption of renewable energy. This transition has received a boost after the adoption of the Electricity Act, 2003 which has strengthened policy process. Also reduction in costs of power systems like solar photovoltaic (PV) system has further endorsed the use of renewable energy.

Renewable energy in India has recorded tremendous growth over the past one and a half decades. In 2002, renewable generation capacity (3.4 GW) constituted a very small share of 3.2% in the overall generation capacity in the country. However, from 2002 to 2016, the sector has seen an exponential growth resulting in 45.9 GW as on December 2016, which is 15 % of the total generation capacity. During this period, renewable generation capacity grew at a compound annual growth rate of 20%. In comparison, thermal capacity and nuclear capacity grew at 7.7% and 5.6% respectively (PRAYAS, 2015).



Source: Author's calculations based on the Central Electricity Authority (CEA) data

Figure: 1.1 Central Electricity Authority (CEA) as on 31.12.2016

Figure: 1.2 Central Electricity Authority (CEA) as on 30.09.2016

The expectation to achieve the desired target of renewable energy capacity has increased manifold with the recent forecast of the Indian government, where it said that the country will surpass the renewable energy targets set at the COP21 summit in Paris nearly three and a half years ahead of schedule. A draft 10-year energy blueprint published in December 2015 predicted that 57% of India's total electricity

capacity will come from non-fossil fuel sources by 2027. The Paris climate accord target was 40% by 2030 (SAFI, 2016).

However, with such a massive target ahead, doubts have been raised about the feasibility of these goals. The institutional loopholes which have been ailing the progress of energy transmission in India are bound to hinder the mission unless there is a clear strategy roadmap and integrated planning to implement the same.

One of the key challenges to the expansion of energy access in the country has always been the political interference in the electricity industry leading to immense losses, and affecting its expansion to cater to the needs of a large population.

Another colossal challenge is in the form of financial impediments that are difficult to overcome. As per a report by Bloomberg New Energy Finance (BNEF), a London-based energy consultancy, India requires \$100 billion in asset financing for renewable energy over the next six years (SHAH, 2017). Looking at the present financial structure, the ability of India's capital market to facilitate a massive transition into the renewable sector is highly doubtful.

With the year ender released in December, 2016, the Ministry of New and Renewable Energy expects capacity additions for solar and wind in 2017 to be 12,000 MW and 4,000 MW respectively, while the achievement till October, 2016 has been 1,750 MW and 1,502 MW. As per the experts, these colossal targets are only achievable (alongside a move by the government to scrap two helpful incentives – accelerated depreciation and generation-based incentive in wind energy sector) by getting the states to co-operate (RAMESH, 2017).

The producers of wind power and solar power have to struggle with delayed payments, renewable energy infrastructure, hostile policies, and a number of other situations which they say are specific to various states. Despite the promotion of RE since 2003, states have been reluctant to register an honest support for the sector because of their vested political interests, which includes the provision of keeping the tariffs low.

To look at the States' side of the story- since the centre's idea to place the RE initiative under the Prime Minister's National Action Plan on Climate Change (NAPCC) and thus focusing on its implementation as a climate change mitigation technique gives the states an incorrect message (NAVROZ and JOGESH 2014). Arguably, increased RE targets from the states' side are often set to just comply with the renewable purchase obligations (RPO) targets mandated to them under NAPCC, rather than as a tool to reduce their electricity deficits, decrease their electricity imports and provide quality energy services to underserved communities. This is a result of financial instability, problems with grid infrastructure and insufficient interstate power offtake mechanisms (RAMAMURTHI, 2016).

The on-grid infrastructure in India is incapable of managing the extra energy generated whereas off-grid solutions are facing severe challenges in terms of scaling and financing, which is crucial for rural regions. Instead of pushing India's energy transition as required, the ailing electricity distribution companies of India (DISCOMS) seem to be acting as blockades.

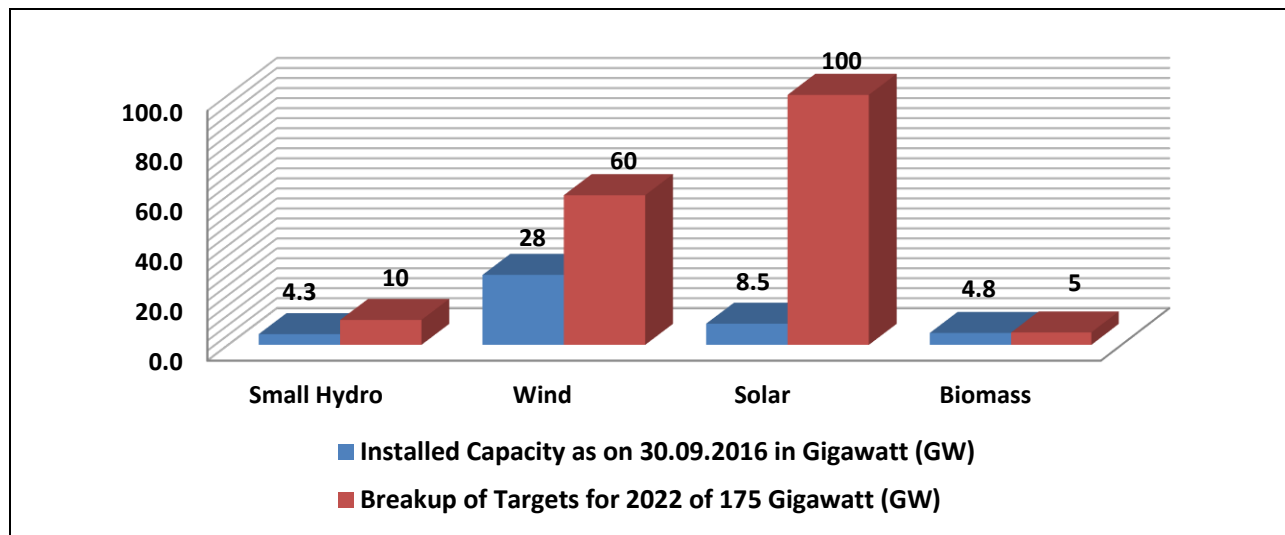
Renewable energy and the way ahead

Soon after assuming office as the 45th President of the United States of America, Donald Trump did away with Barack Obama's climate initiatives on White House's website.

In the section of the updated website dedicated to issues, the page now reads- "For too long, we've been held back by burdensome regulations on our energy industry. President Trump is committed to eliminating harmful and unnecessary policies such as the Climate Action Plan and the Waters of the U.S. rule."

However, some experts believe that Trump's attitude towards climate change is not going to hinder the global expansion of renewable energy due to two significant factors, namely technological advancement and policy in developing nations. The boom in the solar sector (which is no more dependent on government subsidies), and its increasing takeover of the fossil fuels, are being seen as an optimistic sign. Bloomberg's *New Energy Outlook 2016* forecasts that solar PV costs would fall by as much as 60% by 2040, and the sector is going to be preponderant in the electricity generation as scrapping coal plants and building new solar ones in their place will become cheaper.(SMITH, 2016).

Figure: 1.3
Targets for 2022 and Current Capacity of Different Renewable Energy Source in India



Source: Author's calculations based on Central Electricity Authority (CEA) data

Coerced into rapid industrialization and struggling massive population explosion, India has been toiling to make a progress towards its clean energy commitments.

According to the Ministry of New and Renewable Energy, India is the fourth largest country with regard to installed power generation capacity in the field of renewable energy; it has an estimated potential of around 147,615 MW from commercially exploitable sources, which includes 102,772 MW from wind, 84,044 MW from hydro, and 18,000 MW from biomass/ bioenergy. The country can also potentially generate 35 MW/km² using solar photovoltaic and solar thermal energy.

Tapping this potential is not only imperative for meeting the 175GW energy capacity goal but also for providing sufficient and reliable power source for the country's 1.3 billion people who have limited or no access to electricity.

Renewable energy and energy efficiency are also an important part of India's commitment to achieving the UN Sustainable Development Goals (SDGs) during 2016-2030. The silver lining in this journey is the rapid policy push brought in by the central government, especially through the National Solar Mission mentioned in the NAPCC, which reflects its profound commitments towards the development of renewable energy. Mounting investment challenges in the sector is another reason why developing renewable sources of energy is going to be India's bigger bet.

Strengthening political economy for clean energy

Unless the states are on board, the Centre's target of 175 GW of clean energy capacity seems to be a stiff one. A major hurdle originating from the states is their opposition towards the rational electricity pricing concept. For political benefits, many state governments do not want to compromise on the provision of low subsidized electricity tariffs which was formulated around 1970s for enhancing agricultural production.

The state electricity boards, which should ideally be free of any interference from the state governments, have to struggle under political pressure which has put their operations at stake. The biggest failure of the electricity sector after the Electricity Act of 2003 has been its inability to achieve tariff reform. The aggregate losses of INR 691.1 billion (\$10.3 billion) incurred by the DISCOMs selling directly to the consumers during the year 2012-2013, are an alarming indicator of the disorder (KAPSARC, 2016).

The wind and solar power producers selling to DISCOMs have to battle with highly competitive prices for their power, excessively delayed payments and the DISCOMs' refusal to buy the power. On the other hand, direct sellers have to struggle with a number of charges including the cross subsidy surcharge (CSS), a tax that state governments impose to ensure that domestic and agricultural consumers receive power at a more affordable rate, which seems to be taking a toll on the expansion of renewable energy (RAMESH, 2017).

In order to overcome these issues, the Centre and the states should align their renewable energy goals. This could be done by the states by raising their capacity targets, but at the same time, resolving local factors like their debilitated DISCOMs.

For example, to meet the target of meeting 64.4GW solar capacity requirement till 2022 which was set by the Ministry for the states, states like Andhra Pradesh, Karnataka, Madhya Pradesh, Tamil Nadu and Uttarakhand need to increase their targets for production by two to five times, while an increase of an approximately 16, 21 and 41 times is required from the states of Gujarat, Uttar Pradesh and Haryana, respectively. High hopes are resting on the state of Rajasthan (that is rich in solar energy) which has already set a mammoth target of 25GW by 2019 (KAPSARC, 2016).

Further, the electricity pricing in the country needs reconfiguration supported by rationalization of low tariffs, and reduction of the cross subsidy, which will increase the profitability of the DISCOMS.

Revisiting the incentives' mechanism

The renewable energy certificate (REC) market in India, while reeling under tepid demand, has not been able to achieve its goal of promoting and facilitating the compliance of renewable purchase obligations (RPOs) which obligate states to generate certain percentage of electricity from renewable energy. States and utilities, which can't meet their renewable energy requirements, can buy REC from Indian Energy Exchange (IEX) or from Power Exchange India Limited to meet their needs. REC aims at matching the difference between availability of renewable energy resources in a state, and the requirement of the obligated entities to meet the RPO.

Table 1.1 below depicts the demand deficiency in the REC market in India including the solar and non-solar RECs out of the total 19095719 RECs issued; these include both the previous balance till November, 2016 plus the new issues in the month of December, 2016. Only 517931 RECs have been redeemed. These add up to only 3 percent of the total RECs issued, leaving 97% of the RECs as closing balance.

Table: 1.1
Demand Deficiency in India's REC Market

	Opening Balance/previous Balance (A)	REC Issued on December 2016 (B)	Total REC's Issued (A+B)	Total Redeemed/Traded through Power Exchange & R E Generators (C)	Closing Balance (A+B-C)
No of REC's (Solar + Non Solar)	18239606	856113	19095719	517931 (3%)	18577788 (97%)

Source: Author's calculations based on data from Renewable Energy Certificate Registry of India

To achieve the 2022 goal, NAPCC has set an ambitious RPO target of 17% by 2022. The RPOs are set by individual state electricity regulatory commissions (SERCs) which set year-wise targets in their respective states. (See Annexure I- The targets given in the annexure also include the minimum percentage for purchase of solar energy which are around 0.25% and will further go up to 3% by 2022). These targets as set by various SERCs are typically lower than the nationally recommended standard by NAPCC, and still most of the states have failed to meet their RPO targets (KALADHARAN M, 2016).

Despite having the authority to penalize these defaulters, the SERCs and Central Electricity Regulatory Commission (CERC) are often reluctant to fine the defaulters, or force the distributors to buy the RECs. They generally advocate a 'wait and see' policy because most of the distributors are low on funds, and are not in the position to buy costly renewable energy as compared to conventional coal-based energy. Solar power tariffs have gone down significantly (being in the range of 4 – 5 Rupees a unit), but due to

issues like intermittent supply of renewable energy, most of the DISCOMs have to rely on conventional sources of energy to handle load balancing and peak power requirement.

The need of the hour is to make the RPOs enforceable for which the SERCs, CERC and the Centre need to work together. Additionally, the resource-rich states should be incentivized to set higher targets in order to help the weaker states match up to the national RPO target. There is also a need for the revision of REC prices which should be reflective of market prices.

The solution also lies in the Feed-in Tariffs (FiTs) system which offers stability to the RE developers and investors with a reasonable rate of return. But to support the facilitation, the rates of FiTs must be revised by the state electricity regulators in accordance with the technological advancement and fall in prices.

Grid integration and management

Another barrier in achieving the desired RPO targets is the gap between the current installed grid capacity and the capacity required for RE. A whopping investment of INR 1 trillion (\$15 billion) is what the power grid infrastructure (which is currently unable to accommodate the escalating RE capacity) demands (KAPSARC, 2016). Table 1.2 below depicts an example of India's five southern states, where the gap between the required solar capacity for 2021-22 and the grid-connected solar installed capacity is very high.

To cite an example, Northern Karnataka faced the challenge of inadequate grid capacity for its wind energy, where currently around 30% of the installed wind capacity which is around 2000 MW cannot be evacuated (SUSHMA, 2014).

Table: 1.2
Southern States Solar Capacity Target and Grid - Connected Solar Installed Capacity in MW

State	Capacity Required as per 10.5 % RPO (2021-22) in MW	Grid -connected Solar Installed Capacity (in MW)*
Tamil Nadu	8971	385
Kerala	1812	12
Andhra Pradesh	5788	284
Telangana	4238	91
Karnataka	5643	124

Source: TERI (Solar-Market-Mechanisms-in-India TERI)

*MNRE as on 30.11.2015

The power grid infrastructure thus demands investments for efficient supply and demand management.

Coupled with the cost and advancement in efficiency in the large-scale electricity storage and distribution technology, the intermittent sources of electricity (wind and solar) could be used to create

micro-grids. These micro-grids could not only facilitate Smart Cities Mission but could effectively counter the dearth of supply among the rural communities.

The Centre has already proposed the development of 10,000 renewable micro-grids and mini-grids with a combined capacity of 500 MW in June 2016.

However, the harmonized transmission of the conventional and RE sources via grid upgradation requires financial support along with an immediate push to the Green Energy Corridor programme.

Supporting Rural electrification

As far as power supply is concerned, rural regions in India are, unfortunately, still the most deprived ones. Millions of households across several states are still battling electricity cuts and brownouts, some spanning more than an hour, several times during a month.

The irony is that a number of progress reports including the one released by the Central Electricity Authority in 2016 which claimed that the all-India 'power deficit' has been easing (the report stated that from 8.7 per cent in 2012-13, the shortfall was down to 2.1 per cent in 2015-16) do not consider the approximately six crore rural households (also some urban households) that have absolutely no electricity 'connection'.

Studies have highlighted the need for a robust supply of electricity services in rural areas for the socio-economic upliftment of the population, and encouragement of local small enterprises/livelihoods. However, unfortunately, the present schemes for supporting rural electrification like Deendayal Upadhyaya Gram Jyoti Yojana (DDUGJY) and the Decentralized Distributed Generation (DDG) are facing implementation issues.

Apart from an urgent need of grid extension in rural areas, there is also a need for decentralized distributed generation supported by renewable energy in remote areas. With clean energy, households will be able to evade health risks associated with traditional forms of energy (kerosene, charcoal, and disposable batteries) and help the environment by avoiding GHGs and conventional air pollution associated with electricity driven from fossil fuels.

The Centre also needs to revitalise the incentive plan for renewable sources-based projects for rural regions, so that people are compelled to take these up.

Creating financial viability

As per a report by the US-based research organization Institute for Energy Economics and Financial Analysis (IEEFA) in 2015, the public and private investment in the RE sector in India stood at \$10.2 billion, of which government financing only formed a small part. However, the budgetary allocation to the Ministry of New and Renewable Energy was hiked by 8.7% from Rs 5,036 crore for the year 2016-17 to Rs 5,473 crore for the year 2017-18.

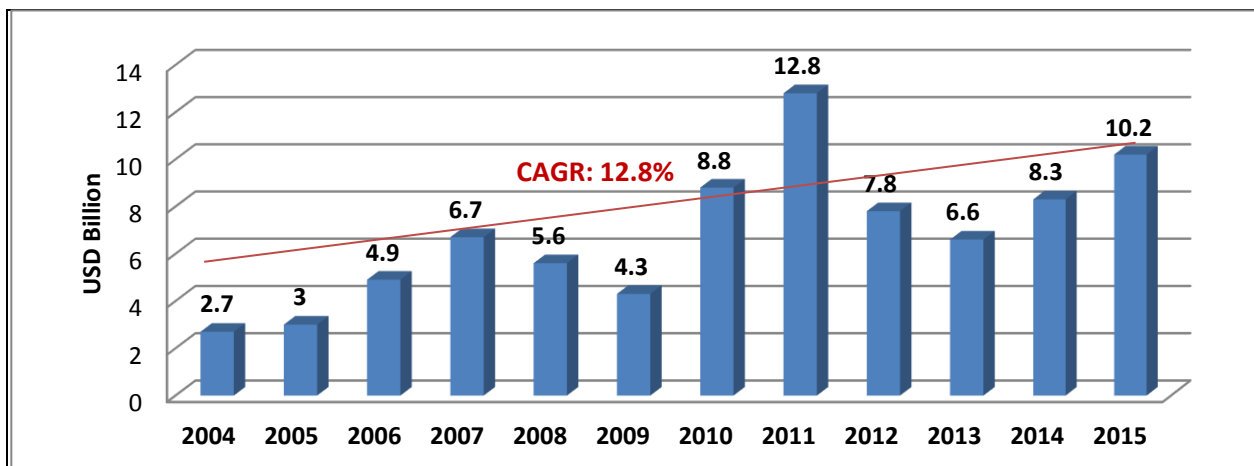
The government therefore needs to reexamine a number of issues.

- In order to facilitate large renewable power to the grid, the government should effectively utilize the funds accumulated under the clean energy cess, (that is levied at the rate of Rs 400 per tonne on production of coal) which could further be used to support hydro power plants. This in turn will meet peak power demands.
- Renewable energy should be kept in the lowest tax bracket after the implementation of the Goods and Services Tax (GST) to prevent the rise in the cost of production in the sector.
- The government should also reconsider its decision on reducing the Accelerated Depreciation (AD) available to the wind sector from 80 per cent to 40 per cent starting April 2017, as this move is expected to have a negative impact on the RE sector.

An estimated Rs. 7-8 lakh crore of capital investment would be required for wind and solar projects including the generation and transmission from 2016-22 (PRAYAS, 2016). Banks, non-banking finance companies, development financial institutions (public sector and multilateral organizations including the World Bank, KfW Development Bank and the Asian Development Bank), foreign investors and the debt capital market are expected to boost investment in RE sector. However, this calls for overhauling of the financial support systems.

On an optimistic note, the recent estimates released by the MNRE show that the RE sector in India received an investment of INR 86,000 crore in the 2013-16 period (GUPTA, 2016). Figure 1.4 given below shows the estimated renewable energy investment in India as per the UNEP 'Global Trends in Renewable Energy Investment' report. As per the figure, the renewable energy investment in India increased from 2.7 Billion USD in 2004 to 10.2 Billion USD in 2010 at a compound annual growth rate (CAGR) of 12.8%.

Figure: 1.4
Estimated Renewable Energy Investment in India



Source: Author's calculations based on data from UNEP 'Global Trends in Renewable Energy Investment' report.

Additionally, Budget 2017-18 has given a boost to renewable energy, announcing another 20,000 MW of solar park development in phase II and a slew of duty reductions on components for fuel cell-based power generating and biogas systems, as well as wind energy equipment. The Budget also announced solar power supply at about 7,000 railway stations in the medium (Singh,2017).

As far as the decentralized generation is concerned, the government additionally needs to endorse private sector investments, public-private ventures and rural entrepreneurship. The government should also extend feasibility of rural loans from rural regional banks (RRBs) and Indian Renewable Energy Development Agency (IREDA), which are currently providing loans at higher interest rates.

Conclusion

At a time when prices for fossil fuels are going down, India is working hard to embrace renewable energy. The challenge is amplified with the current situation of power grid (which requires a massive overhaul) and also the financial snags associated with it.

The government says India has a renewable energy potential of around 900GW, but for achieving the green dream, clarity in policy making is needed. Further, there is a need to effectively utilize the National Clean Energy Fund by allotting certain funds to various state DISCOMs to improve their financial status and by investing more into the research and development.

A significant catalyst for pushing RE has been the decreasing cost of solar energy technology. As a positive sign, the investors are also seeing a great opportunity in India's emerging green economy. However, the market framework needs to be refurbished to accommodate the change in the share of renewable energy in India's energy mix.

India's energy import bill of around \$150 billion is expected to reach \$300 billion by 2030. On the other hand, the country is aiming to bring a 10% cut in energy imports by 2022, and a 50% cut by 2030. The boost in RE energy is expected to facilitate the accomplishment this aim.

In the long run, India is heading towards a cleaner future while trying to keeping up with the UN Sustainable Development Goals.

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Annexure I

State-Wise RPO Targets (Solar + Non-Solar)											
	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22
Andhra Pradesh		5.00%	5.00%	5.00%	5.00%	5.00%					
Arunachal Pradesh		4.20%	5.60%	7.00%							
Assam	2.80%	4.20%	5.60%	7.00%							
Bihar	2.50%	4.00%	4.50%	5.00%							
Chhattisgarh			6.25%	6.75%	7.25%						
Delhi		3.40%	4.80%	6.20%	7.60%	9.00%					
JERC (Goa & UT)	2.00%	3.00%	3.00%	3.30%	3.55%	3.95%	4.30%	4.65%	5.10%	5.50%	6.00%
Gujarat	6.00%	7.00%	7.00%	8.00%	9.00%	10.00%					
Haryana	1.50%	2.00%	3.00%	3.25%	3.50%	3.75%	4.00%	4.50%	4.75%	5.00%	5.50%
Himachal Pradesh	10.01%	10.25%	10.25%	10.25%	11.25%	12.25%	13.50%	14.75%	16%	17.50%	19.00%
Jammu and Kashmir	3.00%	5.00%	5.00%	6.00%	7.50%	9.00%					
Jharkhand	3.00%	4.00%	4.00%	4.00%	4.00%						
Karnataka	10.25% & 7.25%	10.25% & 7.25%	10.25% & 7.25%	10.25% & 7.25%							
Kerala	3.60%	3.90%	4.20%	4.50%	4.80%	5.10%	5.40%	5.70%	6.00%	6.30%	6.60%
Madhya Pradesh	2.50%	4.00%	5.50%	7.00%	7.00%						
Maharashtra	7.00%	8.00%	9.00%	9.00%	9.00%						
Manipur	3.00%	5.00%	5.00%								
Mizoram	6.00%	7.00%	9.00%								
Meghalaya	0.75%	1.00%	1.00%	1.00%							
Nagaland	7.00%	8.00%	8.00%	8.00%							
Orissa	5.00%	5.50%	6.00%	6.50%	7.00%						
Punjab	2.40%	2.90%	3.50%	4.00%							
Rajasthan				9.00%	10.20%	11.40%					
Sikkim*			3.00%	4.00%	5.00%						
Tamil Nadu	9.00%	9.00%	9.00%	11.00%	11%						
Tripura	1.00%	2.00%		2.50%	2.75%	3.00%					
Uttarakhand			6.05%	7.08%	8.10%	9.30%	11.50%				
Uttar Pradesh	5.00%	6.00%	6.00%	6.00%							
West Bengal	3.00%	4.00%	4.00%	4.50%	5.00%	5.50%	6.00%	7.00%	8%		

Source: Indian Renewable Energy and Energy Efficiency Policy Database

*Sikkim is yet to notify its RPO regulations. The targets mentioned above are as set out under the draft regulation issued by the Sikkim State Electricity Regulatory