

## Research Study on Achieving 12% Green Electricity by 2017 and 15% by 2020

### A Brief Summary for Policy Makers

**Background:** The National Action Plan on Climate Change (NAPCC) has recommended that the minimum share of renewable energy in the national grid be set at 5% in 2009/10, subsequently to be increased by 1% every year to reach 15% by 2019/20. In this regard, the World Institute of Sustainable Energy (WISE), supported by Shakti Sustainable Energy Foundation, New Delhi, and with financial assistance from Climate Works Foundation, USA, undertook a study titled 'Achieving 12% Green Electricity by 2017'. In order to project the likely RE capacity addition scenarios at pan-India/state levels, the study critically verifies the adequacy of current government planned RE capacity addition targets over the 12<sup>th</sup> and 13<sup>th</sup> plan periods (including the planned targets under the Jawaharlal Nehru National Solar Mission) and found that they are inadequate to achieve the NAPCC target. It was also found that current non-solar Renewable Purchase Obligation (RPO) targets specified by the 25 State Electricity Regulatory Commissions taken together would also be inadequate to meet the national RPO target of 15% RE by 2020. The focus of the study was to see how the national RE target can be achieved (not whether it can be achieved), scientifically derive the RE capacity additions required for meeting the target and work out the impact of such RE power injection on the Average Power Procurement Cost (APPC). While studying the RE potential in India, it has been noticed that there is no supply-side constraint in achieving the target.

**Methodology:** The anticipated renewable energy injection envisaged under the NAPCC has been calculated by applying the National RPO targets to the all-India electricity demand projections given under the '17<sup>th</sup> Electric Power Survey of India Report' published by the Central Electricity Authority (CEA). The installed RE capacity of 19,973 MW (as on 31<sup>st</sup> March 2011) and corresponding generation was factored in. Different RE capacity addition scenarios were considered, keeping in mind the availability and commercial potential of each RE resource in India at the national and state levels. A progressive growth rate was considered for major RE sources like wind and solar, while the share of other RE sources were defined based on their historical growth rates. The share of individual RE technologies is worked out on the basis of available potential and the normative capacity utilization factors specified by the CERC under CERC RE Tariff Regulation 2010: [wind (23%), solar PV and CSP (21%), SHP (38%), biomass and co-gen (75%), waste to energy (78.9%)].

**Three projected scenarios:** After careful consideration of all facts, three scenarios were finalized viz. (1) Wind dominant, (2) SHP-biomass dominant (on CAGR basis), and (3) Solar dominant. A comparative analysis of all three scenarios is given below.

#### Capacity addition required to achieve 12% RE by 2017 and 15% RE by 2020: 3 Scenarios (Comparative Analysis)

Sr. No	R.E. Technology	Capacity Addition (MW)			Capacity Addition (MW)			Capacity Addition (MW)		
		Scenario 1 (Wind Dominant)			Scenario 2 (SHP-Biomass Dominant)			Scenario 3 (Solar Dominant)		
		12th Plan (2012-17)	13th Plan (2017-20 only)	Total 2011-20	12th Plan (2012-17)	13th Plan (2017-20 only)	Total 2011-20	12th Plan (2012-17)	13th Plan (2017-20 only)	Total 2011-20
1	Wind Power	28,312	28,310	59,965	17,078	17,685	37,028	17,078	17,685	37,028
2	Biomass	2,230	1,565	4,088	3,205	3,790	7,448	2,300	1,300	3,903
3	Small Hydro	1,575	1,040	2,823	2,675	2,250	5,383	1,625	955	2,813
4	Cogeneration	1,800	1,200	3,333	2,465	450	3,333	1,800	1,200	3,333
5	Waste to Energy	63	48	122	91	119	228	91	144	253
6	Solar power	3,700	6,000	9,962	9,486	6,000	15,962	16,976	18,000	35,452
	<b>Total RE</b>	<b>37,680</b>	<b>38,164</b>	<b>80,294</b>	<b>35,000</b>	<b>30,294</b>	<b>69,382</b>	<b>39,870</b>	<b>39,284</b>	<b>82,782</b>

If the projected RE capacity additions in Scenario 1 have to be realized, the total wind power installation during 2011-20 will have to grow to **60 GW**. The projected annual average capacity addition for wind is around 5.25 times the past capacity addition. However, if the capacity addition in 2010/11 (2350 MW) is considered as a benchmark, a CAGR of 20% for the following years (which is realistic) can help to achieve this growth. Under this scenario, during the 12<sup>th</sup> Five Year Plan, India will need to install 37,680 MW of grid-connected capacities from renewables. The cumulative installed capacity of renewables is expected to be 62,103 MW at the end of the 12<sup>th</sup> Plan and 1,00,267 MW by 2020.

If the RE capacity addition targets proposed under Scenario 2 have to be realised, the total biomass and SHP power project installations during 2011-20 need to be raised to **7.4 GW** and **5.3 GW** respectively. In the 12<sup>th</sup> Plan period, on an annual average basis, 1,134 MW and 535 MW biomass and SHP capacity have to be set up. During the 12<sup>th</sup> Five Year Plan, India will have to install 35,000 MW of grid-connected capacity from renewables. The cumulative installed capacity of renewables is expected to be 59,061 at the end of the 12<sup>th</sup> Plan and 89,355 MW by 2020.

Under the Solar dominant Scenario 3, total solar capacity addition of **35 GW** is envisaged to be realised during 2011-2020. During the 12<sup>th</sup> Plan period, on an average annual basis, solar power capacity of 3,395 MW has to be set up if the 12% RE target has to be met along with moderate growth of wind at an average annual capacity addition of 3,400 MW. During the 12<sup>th</sup> Five Year Plan, India will have to install 39,870 MW of grid-connected capacity from renewables. The cumulative installed capacity is expected to be 63,471 MW at the end of the 12<sup>th</sup> Plan and 1,02,755 MW by 2020.

The possible state-wise break-up of the capacities to be added as per Scenarios 1 and 3 have also been worked out, based on RE resource availability, historical growth and pro-rata RPO obligations.

### Key outcomes of the scenario analysis

- The government's (central and state) plans for development of RE are not consistent with national policies. The targets originally planned will have to be revised to achieve the 12% and 15% RE penetration by 2016/17 and 2019/20 respectively.
- The potential of RE in India needs to be re-assessed urgently by MNRE to avoid policy decisions on power generation being skewed in favour of conventional sources.
- Although all the three scenarios are capable of meeting the national RPO of 12% and 15% by year 2017 and 2020 respectively, either Scenario 1 or 3 may be adopted, since they are comparatively more realistic and achievable.
- The discounted impact on Average Power Procurement Cost (APPC) due to purchase of renewable power under the three scenarios varied from 12-16 paisa per kWh under Scenario 1 to 16-20 paisa per kWh under Scenario 3.
- Adoption of Scenario 1 (wind dominant) against that of Scenario 3 (solar dominant) at the national level will reduce the impact on pan-India APPC by 4-5 paise/kWh.
- The targeted capacity addition envisaged under Scenarios 1, 2, and 3, if realized, can avoid approximately 141.82 million tonnes, 143.16 million tonnes, and 142.64 million tonnes of CO<sub>2</sub> respectively beyond 2017.
- The targeted capacity addition envisaged under Scenarios 1, 2, and 3, if realized, can create 15 lakh, 14.7 lakh and 16.6 lakh new jobs respectively by 2020.
- The likely debt requirement for realising the RE capacity addition projected up to 2020 under the three scenarios ranges from Rs 3,61,602 crore to Rs 5,41,659 crore.
- The state-wise RE technology mix emerging from the state-level analysis indicates ample scope for wind, solar, SHP, and biomass development in several Indian states.

### Road map of 10 most critical actions needed

- Revise RE capacity addition plans at central and state levels and integrate them in the planning process **(MNRE/States)**.
- CERC/FOR may persuade SERCs who have not declared RPOs in line with the NAPCC target to do so **(FOR/SERC)**.
- A separate division should be created in CEA for RE transmission planning and adequate funding should be provided for developing RE transmission infrastructure **(CEA)**.
- Multiple measures to prioritize lending to the RE sector and to provide soft loans should be evolved **(Planning Commission)**.
- MNRE should align its strategic plans with the NAPCC target and persuade the states to do so **(MNRE/States)**.
- All states should be persuaded to bring out comprehensive RE policies **(States)**.
- The REC mechanism should be strengthened; smaller denomination RECs permitted, and banking should be allowed **(CERC)**.
- A national programme for comprehensive capacity building of State Nodal Agencies (State Energy Development Agencies) should be undertaken urgently **(MNRE/Planning Commission)**.
- To provide adequate manpower and coordinated curriculum revision, retraining of faculty and new courses should be undertaken in technical educational and training institutions **(MNRE/HRD Ministry)**.
- Revised realistic RE resource assessment needed urgently; availability of such reliable data in public domain to be ensured **(MNRE)**.