Need for an Integrated Approach for Renewable Energy Development Planning

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Alok Jindal enlightens the readers with TERI's Integrated Approach to develop Renewable Energy in the Country.

Renewable energy development in India has peaked up now with lot of emphasis through various conducive policies, incentives and R&D support by Ministry of New and Renewable Energy (MNRE) at central level and the various state nodal agencies for renewable energy development at state level. As on 31 July 2012 India has achieved installation of 25,702 MW grid connected power plants and 753 MWeq of off grid power generation systems

The main drivers for the development of these renewable energy sources were the regular financial support or incentives by the government through capital subsidy, feed in tariff, accelerated depreciation benefit, income tax holiday, custom duty exemption etc. Before the enactment of Jawaharlal Nehru National Solar Mission (JNNSM) the investors interest were mainly towards the wind energy development, but after the JNNSM lot of interest have been shown by the solar power developers and investors and with the very supportive policies on solar power development by the state governments such as Gujarat and Rajasthan, the solar power project installations have peaked up in last 2-3 years. Especially in Gujarat where the state government initiative of solar park development attracted lot of investors, manufacturers and developers of solar power projects.

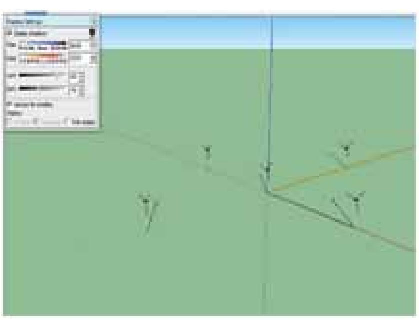

Figure1: Shading Pattern for Wind Turbines.

With these initiatives on solar power and the competitive bidding under the JNNSM Phase 1 by National VidyutVyapar Nigam (NVVN) Limited the cost of Solar PhotoVoltaic (SPV) power has come down from about Rs. 15-16 crores per MW to about Rs. 10-12 crores per MW, and in terms of energy generation it has come down from about Rs. 17 per kWh to Rs. 8 -10 per kWh.

Though there are the supporting policies which promoting the renewable energy development in the country as mentioned above, there are certain challenges like land availability, proper resource assessment and development planning which in some way hinders the growth of renewable energy project development.

Few states like Gujarat, Rajasthan, Karnataka, Maharashtra, Tamil Nadu and MP are rich in both wind and solar power potential; most of the lands are suitable for both solar and wind power project installations. So the prioritization of the technology for land allotment is important, or rather an integrated approach of the development is important. For this prioritization there is a need to first carry out the integrated resource assessment for all renewable energy sources including the land availability assessment and to develop a renewable energy atlas for the state which will give the idea about the resource distribution along with eth wasteland and the other suitable lands for renewable energy project development.

Few recent studies carried out based on the secondary renewable energy resource data and the land use. Land cover data analysis using GIS depicts the huge potential of the renewable energy in the country. A study by The Energy and Resources Institute (TERI) on Gujarat estimates about 749 GW of integrated renewable energy potential in the state, the Laurence Bekerly National Laboratory (LBNL) estimates the wind power potential of 2006 GW in the country. Both the studies used GIS based analysis for land use land cover and the secondary resource data available for renewable energy resources. Here is a description of analysis done by TERI for Gujarat.

Case Study of Gujarat

Gujarat has a large amount of waste land along with good solar radiation and wind flow for most of the year. Biomass, Tidal, Geothermal resources are also available in the state. Proper estimation of potential of any renewable energy technology is essential for planning and promotion of the technology. There has been some state level potential assessment of these resources under the Government of India programs for renewable energies.

In the study carried out by TERI a focus has been made to go beyond the previous approaches, and an integrated approach has been made for renewable energy potential assessment at the district level, considering the availability of the waste land, water, existing electrical transmission network, gas grid network etc. Geographical Information System (GIS) has been used for land use land cover analysis and identification of wasteland for renewable energy projects mainly the solar and wind power projects and mapping the renewable energy potential over the state.

The lands that are appropriate for the installation of solar and wind power projects and the lands having potential for producing

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biomass had been identified based on the LULC map of the state. The available data for all the renewable energy resources, collected from the secondary sources has been mapped and used for the assessment of district wise renewable energy potential. While mapping the potential certain assumptions had been made such as the lands with slope less than 3% have been considered, certain minimum capacity of solar and wind power projects have been considered which can be feasible at commercial scale. Also the prioritization of the technology based on the resource availability such as water and the intensity of the resources.

Further, as stated under the wind power, the foot print area of wind turbine is about only 1-2 Ha per WTG and the WTGs are generally installed at a distance of 5 to 7 times of its rotor diameter.

To minimise the wake losses an analysis has been carried out for estimating the potential for installation of SPV projects in the lands between the wind turbines. For this a shadow analysis (Figure1) has been done to identify the area which will not be affected from the shadow of wind turbines. Based on this it has been found that approximately 75% of the total wind farm area will be unaffected from the shadow of wind turbines and if SPV projects are installed in those lands the average land requirement for combined SPV and wind power projects will be about 3 Ha/MW. This means the overall integrated potential will become much higher.

To estimate the integrated potential, it has been considered that the lands which are suitable for CSP and have water availability will be utilized first for the CSP projects and then the remaining lands will be utilized for SPV and wind power projects.

District	CSP with water availability (GW)	SPV-Wind hybrid (GW)	Only SPV	Only Wind (GW)	Only Biomass (GW)	Total Integrated Potential (GW)
Ahmedabad	1.61	1.45	1.01	0.00	0.06	4.13
Amreli	5.87	6.91	0.00	0.11	0.14	13.03
Anand	0.00	0.00	0.00	0.00	0.02	0.02
Banaskantha	7.74	5.87	0.27	0.95	0.08	14.90
Bharuch	22.74	1.84	0.00	0.24	0.04	24.86
Bhavnagar	3.93	9.04	0.00	0.01	0.19	13.17
Dahod	24.96	5.34	0.00	0.00	0.02	30.32
Gandhinagar	0.80	0.07	1.00	0.00	0.03	1.90
Jamnagar	37.11	12.67	0.41	1.04	0.21	51.44
Junagadh	3.94	5.26	0.38	0.00	0.19	9.77
Kachchh	87.76	148.13	8.92	133.26	0.07	378.14
Kheda	5.48	2.72	0.00	0.00	0.04	8.24
Mahsana	0.33	0.39	0.76	0.00	0.05	1.53
Narmada	17.76	1.69	0.00	0.00	0.03	19.47
Navsari	0.48	0.59	0.14	0.10	0.01	1.32
Panchmahal	7.21	3.39	0.00	0.00	0.01	10.61
Patan	7.03	1.20	0.00	1.87	0.04	10.14
Porbander	0.00	0.94	0.00	0.00	0.04	0.98
Rajkot	17.61	11.19	2.46	0.08	0.23	31.57
Sabarkantha	14.49	5.83	5.27	0.00	0.09	25.68
Surat	25.88	3.70	0.60	0.01	0.03	30.23
Surendranagar	4.26	4.29	0.00	1.11	0.14	9.79
The Dangs	0.00	0.51	0.00	0.00	0.02	0.54
Vadodara	44.00	5.34	0.00	0.00	0.10	49.45
Valsad	4.71	2.24	0.13	0.43	0.02	7.53
Total	345.71	240.60	21.36	139.21	1.89	748.77

And wherever the potential for both, wind and SPV power exists, the land would be utilized for combined SPV-Wind power projects development.

In this manner the study helped in identifying the districts where there are potential for standalone concentrated solar power (CSP) plant, solar photovoltaic (SPV) plant, wind power, biomass power, and also the SPV-WIND hybrid plant development for optimized utilization of lands (Figure2). The total integrated RE potential is estimated to BE 749 GW as seen in the table.

The table shows the renewable energy potential of different areas within the State of Gujarat and compares the potential to an integrated approach.

Conclusion

Developing an integrated approach for the renewable energy potential assessment and planning in the state considering the renewable energy resource availability as well as the other resources such as water, grid infrastructure and the Integrated Renewable Energy Atlas so developed can prove to be an important decision making support tool (Figure3) for the government.

This will surely help in proper planning and optimized land utilization for the huge renewable energy potential tapping that exists in the country.

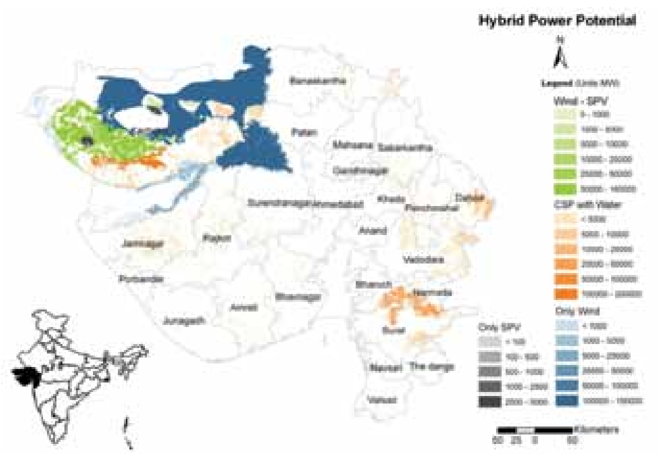

Figure2: Overall RE potential map for Gujarat using GIS.

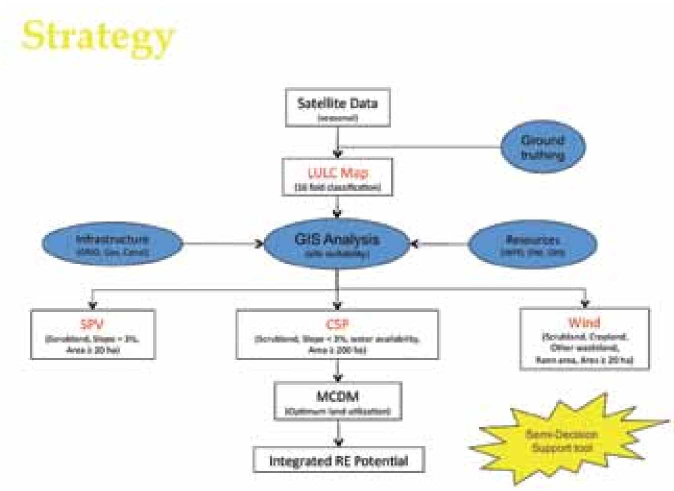

Figure 3.Integrated approach for Renewable Energy potential assessment.

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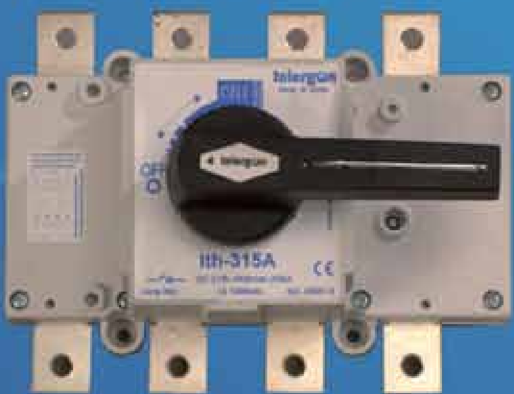


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