RENEWABLE ENERGY

ROUNDTABLE REPORT 5

REPOWERING IN TAMIL NADU

Overview

Wind energy is an abundant natural resource and its intelligent use will serve the country well. But India's remarkable progress in the RE sector has largely sidelined wind power in favour of solar energy. Perhaps the best opportunity in the sector is repowering established plants to make optimum use of the best wind sites in the country by employing the latest technologies. This will significantly improve the capacity utilization factor (CUF) at these sites, augmenting the overall capacity as well. In recognition of this fact, a Repowering Policy was announced in 2016, yet progress on this front has been slow and negligible.

Since Tamil Nadu has the maximum repowering potential, it was chosen as the subject of this roundtable discussion.

> My suggestion is to form a special purpose vehicle to promote repowering. This will be on the lines of Independent Power Producers which promoted the wind sector and renewable energy in general in the past
>
> **S. Gomathinayagam**

The roundtable

Centre for Science and Environment (CSE) is one of India's leading environmental research, advocacy and capacity-building organizations. Our renewable energy (RE) programme has been working extensively to help shape policies at the national and local government levels that lead to deployment of RE technologies, public awareness to strengthen energy access, and facilitation of optimum use of natural resources.

This roundtable, the fifth in the series, was held on 28 January 2021. It has been a Tamil Nadu-specific follow-up of the previous national-level discussion (see *Roundtable Report 2:- Wind Repowering: Need for a Kickstart*). The roundtable explored the evolving role of wind energy in Tamil Nadu, the potential of repowering in the state, gaps in Central- and state-level policies, similarities and differences between the state's wind energy scenario and the scenarios in other states of India, obstructions in the repowering process, reasons for lack of interest among stakeholders, financial and strategic appeal of such projects, and the way ahead.

Mr Samrat Sengupta

Director, Climate Change and Renewable Energy, CSE

Samrat is a development and operations management professional with 24 years of experience in sustainable energy and climate change cross-sectoral domains. His specific interests include renewable energy power projects, low carbon development and mainstreaming climate change in developmental planning. He has worked with power producers (solar, onshore and offshore wind, and hydro), management and engineering consulting houses, international trade associations for renewable energy promotion, national and international civil society organizations, and government research institutions. Samrat holds an MBA with a specialization in energy management from the Indian Institute of Social Welfare and Business Management (IISW and BM), Calcutta. He has also represented Indian and South Asian civil society in various multilateral forums like the UNFCCC, IPCC and G8.

Mr Sengupta moderated the Roundtable.

Dr S. Gomathinayagam

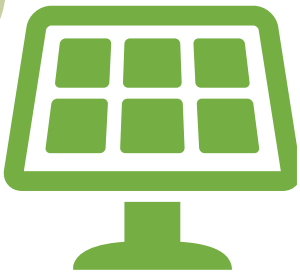
ex-Director General, National Institute of Wind Energy (NIWE)

Dr Gomathinayagam has to his credit several firsts in the NIWE under the Ministry of New and Renewable Ministry (MNRE), demonstrating leadership in the establishment of industry, wind and solar resource national data network and real-time operational wind power forecasting and scheduling. He served in the Council of Scientific and Industrial Research's Structural Engineering Research Centre for over 25 years and developed wide-range knowledge in wind energy and other fields. His successful international collaborations with DAAD, UNDP, AUSAID have resulted in development of business model solutions to various problems in wind industry.

Dr Prabir Dash

Scientist-D, Wind Energy Division, MNRE

Mr Dr Dash has been working on policy, planning and regulatory aspects of wind energy development (onshore and offshore) in India for six years. He is involved in preparation of quality standards for secondary cells and wind turbine generators (WTGs) as a member of the Bureau of Indian Standards technical committees. He has been instrumental in developing the photovoltaic module test laboratory at the Solar Energy Centre (now National Institute of solar energy). Previously, he worked with Bhabha Atomic Research Centre.



REPOWERING IN TAMIL NADU

Mr N. Ramani

Adviser, Suzlon Energy Ltd

Mr Ramani has 39 years of experience in the field of information technology, and wind and solar energy in India. He is advisor to Suzlon Energy's operations in Tamil Nadu, and Atha group of companies. He is the Chief Executive in Energy Space and Windia Green Power Ltd. Previously, he was an advisor on wind projects for Larsen and Toubro (L&T), and also headed the wind business of Orient Green Power Ltd. He holds a bachelor's degree from Indian Institute of Science, Bengaluru.

Mr Rajsekhar Budhavarapu

Founder and Managing Partner at ACESS Advisors LLP

Mr Budhavarapu is an accomplished RE professional. He has successfully spearheaded multiple RE ventures across Indian, Southeast Asian, African and European markets. He has over 28 years of experience in the sector, with nearly 19 years in senior management and leadership roles at Greenko Group (EVP—Commercial and Development), IL&FS Energy (COO and CTO-RE Investment), GL Garrad Hassan (Country Manager—India), Acciona Energy India (Director—Development), EnerconIPP (Head—Wind development Africa and SE Asia) and ECN-Energy Research Center of the Netherlands (European Commission Project Manager).

> "Non-renewal of PPAs and disconnecting older WTGs from the grid will put pressure on the owners and drive them towards repowering
>
> N. Ramani

Mr P.R. Muralidharan

Chief Consultant, Tamil Nadu Energy Development Agency, Chennai

Mr Muralidharan served the Tamil Nadu Electricity Board for 30 years. Throughout his professional life, he has focused on the RE sector. He has the distinction of working on a wide array of projects, from kilowatt scale windmills to large projects. He had been an active member of Tamil Nadu's wind energy growth story, by working towards policy decisions, power evacuation, setting up of dedicated sub-stations for wind power, Integration issue, etc. He also served in Tamil Nadu Energy Development Agency (TEDA), the state nodal agency of MNRE, for nearly seven years.

Mr W. Balan

Head of Operations, Dalmia Wind Farm

Mr. Balan has been heading operations at Dalmia Wind Farm since 2016. Previously, he was associated with Sanmar Foundries Ltd as Executive Manager (Wind Farms) for over ten years. He was also associated with Suzlon Energy Ltd, MBDL wind farm and RAMCO wind farm in engineering capacities.

Ms Pratha Jhawar

Deputy Programme Manager, Renewable Energy, CSE

Pratha is a renewable energy and climate change researcher and analyst, currently associated with Centre for Science and Environment. She has more than eight years of experience in areas ranging from engineering, development, management, policy research and advocacy. Her work on various projects has had a significant impact on the adoption of decentralized renewable energy systems in India.

Earlier, she worked with Bharat Heavy Electricals Limited (BHEL), Bangalore for more than four years in the capacity of a product engineer for solar photovoltaics. She is a Chevening scholar for an MSc in environmental technology from Imperial College London and BTech in electronics engineering from Indian Institute of Technology, Banaras Hindu University (IIT-BHU), Varanasi.

> “I see repowering as a sector and I believe that in order to revive this sector we need to put in place sector-specific narratives programmes and schemes. This can be backed up with Central financial or other regulatory assistance
>
> **Prabir Dash**

Agenda and discussion

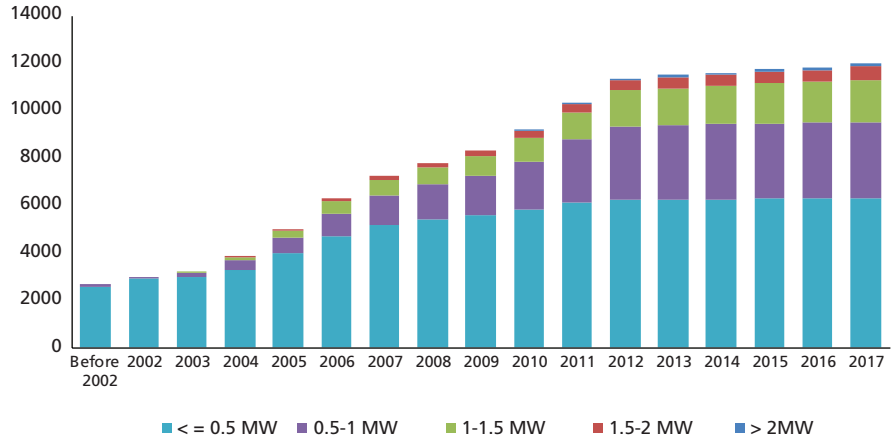
Wind profile of Tamil Nadu

The state offers some unique characteristics vis- -vis wind installations:

- It holds the highest wind portfolio of about 9.5 GW, which is one-fourth of the total installed wind capacity in the country
- It was one of the earliest to start wind projects—therefore, it is ideally placed to take a lead in the next phase, i.e., repowering
- It has the best wind sites in the country, most of which are occupied by turbines running on old technology with low capacity
- Approximately 3,000 turbines, each of less than 1MWcapacity, and with a cumulative installed capacity of 800 MW, have completed their design life

The repowering opportunity in the state is available on a rolling basis (see *Graph 1: Wind turbine profile of Tamil Nadu*).

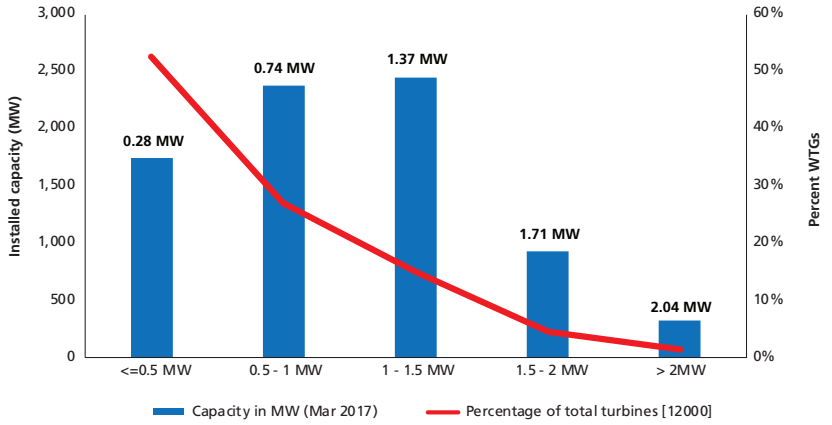
Graph 1: Wind turbine profile of Tamil Nadu



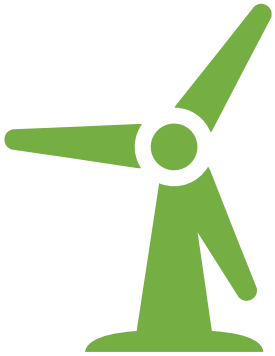
Source: Indian Wind Power Directory, 2017

Average wind turbine capacity in Tamil Nadu is only 650 kW. As of March 2017, of the 12,000 odd wind turbine generators, 52 per cent are of 500kW or less in capacity, and another 27 per cent have between 500kW-1MW capacities. Together, these smaller turbines account for slightly over half of the total installed capacity (see *Graph 2: Installed wind capacity vis- -vis number of wind turbines in Tamil Nadu*).

Graph 2: Installed wind capacity vis-à-vis number of wind turbines in Tamil Nadu



Note: Average capacity of each turbine range is mentioned above the bars
Source: CSE analysis



They can easily be upgraded. If solar power is added to these calculations, leading to hybrid renewable energy projects, annual energy production can go up by more than six times. Solar-wind hybrid projects, in synergy with battery storage, are technically and financially a viable option over new coal plants in the state.

Wind sector's unique challenge in Tamil Nadu

The experts highlighted various issues that impede development of wind power in Tamil Nadu. Wind sector in Tamil Nadu is beset with many a challenge, some generic and other unique to the state. They are also hampering repowering in the state. To summarize, these include:

» **Large wind portfolio:** Wind accounts for close to 30 per cent of the total installed capacity of the state. Wind generators have to face frequent back-downs. Curtailment for wind power plants averaged around 30–35 per cent of generation during the peak season between 2012 and 2015. The curtailment of wind power in 2019 went up to 3.52 hours per day from 1.87 hours per day in 2018. CSE's analysis suggests that the reasons for curtailment are both technical and commercial.

» **Long-term PPAs:** Turbine owners have signed long-term Power Purchase Agreements (PPAs) with the Tamil Nadu Generation and Distribution Company (TANGEDCO). Such PPAs signed entail special requirements. Most potential repowering projects in the coming decade will be under the Feed-in-Tariff (FiT) regime. While determining the tariff, the design life of the plant should be taken into consideration.

» **Highly fragmented ownership:** The tremendous growth of wind energy in Tamil Nadu has been driven by accelerated depreciation (AD), introduced in the state in 1992. Consequently, the state has attracted sizable private investment, supported by turn-key suppliers. Each private player owns one or a few windmills. This has led to fragmented ownership which makes repowering complicated.

> "Repowering is a life-long issue. It is very important that we have a repowering policy, not just stop-gap solutions for a few wind turbines. Repowering of a wind farm or a single wind turbine need not be only in the form of a larger modern wind turbine, other options like hybridization should also be explored
>
> **Rajsekhar Budhavarapu**

Case study

Dalmia Wind Farms, Tamil Nadu

Location: Thickly populated area of Aralvoimozhi, Muppandal, Tamil Nadu
Capacity: 11.5 MW (30 x 250kW + 10 x 400kW)
Project commission: 1993–96

For the last three years, Dalmia Wind Farm has been trying to repower its wind farm in Aralvoimozhi, Muppandal. The site is suitable for turbine sizes of up to 1.8 MW. The project was commissioned in 1996. In the 25 years since then, many developments have taken place in and around the plant. Three high-tension lines traverse the wind-mill area, raising security concerns about the repowering process. Moreover, new, bigger and longer turbines need more space to not only install but also as space between two turbines. Many small houses have been constructed near the windmill area in the two-and-a-half decades, constricting the space.

There is also a lack of clarity on wind farm layout configuration for the process of repowering. Each turbine affects the wind profile in the vicinity. To avoid interference, it is advisable to maintain an optimum distance between two wind turbines. This helps to maximize the energy yield and minimize wake losses (due to interference from nearby turbines). However, limited information is available on array design methodologies. Hence, micro-siting is emerging as a big issue.

Payment for generation often gets delayed by two-three years, and that also works as an impediment to repowering. From an owner's perspective, repowering will become easier if:
» Payment mechanism adhere to timelines of 60-90 days
» Micro-siting norms are relaxed
» Wheeling is allowed for inter-state transmission of power

» **Unwillingness of owners:** Owners of WTGs that have completed their design life but continue to be operational even at very low plant load factors are not willing to do away with their assets. These WTGs have already provided them ample returns on investment, now they just want to squeeze whatever additional profits they can from them.

» **Unmanageably huge number:** TANGEDCO has the humungous task of managing some 10,000 turbines of smaller capacity that have different characteristics and reactive power. These plants inject infirm power that does not match the load profile and can have destabilizing effect on load dispatch centres. This increases the cost of power.

Current situation and possible solutions

The experts deliberated on ways in which the repowering process in Tamil Nadu can be started. The opinion was that both turbine technology and micro-siting have no issues. Appropriate turbine technologies for Class-1 (best wind) sites are available and manufacturers are confident of delivering such turbines. Micro-siting is also becoming easier with improvements in technology. Computational Fluid Dynamics (CFD)-based software capable of emulating any combination of windmills at the site, are available. Intercropping, which means installing other equipment without dismantling the existing wind turbines, can be an option. Apart from installation of additional wind turbines intercropping can done in other combinations as well, including by installation of solar, battery storage, battery charging banks, charging stations for EVs in tandem with older wind installations.

A consensus was built that mandatory dismantling of wind turbines and suitable incentives for the affected owners were important to initiate the repowering process. Renewal of PPAs with wind power plants that have passed their design life should be blocked in order to lead WTG owners towards deployment of more efficient technologies. Further, repowering also provides exciting new investment opportunities that will ensure returns for next 20 years.

It was suggested that the repowering process in Tamil Nadu can be started in the high density region, which has about 5,400 wind turbines of less than 500 kW capacity each,amountingto 1,472 MW in total, in three passes.

Finally, it was agreed upon that a Special Purpose Vehicle (SPV)-driven business-model will be best suited for repowering. The government will act as the facilitator. This SPV is supposed to carry out assessments of the existing assets and wind resources in the state. It will bring all stakeholders onboard to ensure speedy and untroubled repowering of projects.

The way forward

Repowering of wind resources is in the national interest. Stakeholders, including Central and state governments, need to engage in a positive way for repowering to become a reality. A policy framework and regulatory support for repowering should be in place, to enable the private sector to develop viable business models for the sector. Safety standards should be prepared and implemented. A parallel strengthening of power evacuation infrastructure would ensure prevention of large-scale curtailment of power—which is a bane for the sector. Finally, a futuristic approach to repowering, creating space for other technologies like solar and storage, will aid quicker adoption of renewables by making it more convenient for utilities. Power producers will be able to deliver firmer and cleaner energy, matching the demand with better predictability. Tamil Nadu has to take a lead and provide lessons to other states. Repowering is the future, it needs to be empowered.