

A Customised Strategy Can Take Kerala's Power Sector Towards Its Net-Zero Goals

The progress towards India's ambitious net-zero goals requires that all states contribute to it. Some states have been quite proactive, announcing their own (state) net-zero targets. Kerala is one of the first states to do this, besides Gujarat, Maharashtra, Tamil Nadu, and a few more. While India has pledged to achieve net zero by 2070, Kerala aspires to do so by 2050, along with an aim to meet 100% of its energy needs through renewable energy (RE) sources by 2040.

Current Trends in Kerala's Energy Sector

The [current cumulative installed generation capacity of Kerala](#) (as of February 2024) stands at 6,506 MW, of which thermal constitutes 47%, followed by hydro with a 29% share, and nuclear with a 6% share. The remaining 18% (1,203 MW) is made up by solar, wind, small hydro, and biopower sources.

The state recorded its [highest peak demand ever](#) (5,646 MW) on 29 April. Interestingly, the state meets only 30%-35% of its energy needs through internal power generation (majorly via hydropower plants), while the rest is met through imports of coal-based power.

The rising electricity demand and the heavy dependence on thermal imports call for a tailored roadmap that can deal with these issues, while also aligning with Kerala's aim to transition towards RE sources. To support the state's initiatives in this direction, the Center for Study of Science, Technology and Policy (CSTEP) conducted a [study](#) for developing an actionable plan to facilitate Kerala's shift towards clean energy by financial year (FY) 2039-40, specifically by increasing the share of RE in its generation mix.

Energy Transition Outlook for Kerala

Historically, Kerala's electricity demand has been growing at a compound annual growth rate (CAGR) of 3%. The study estimates that the state would witness an electricity demand of 45,519 MU by FY 2039-40. This estimation takes into consideration the impact of 1.7 million electric vehicles (EVs), manifesting in an additional demand of 1,286 MU.

The peak demand too is estimated to reach 7,594 MW by FY 2039-40. Given the state's excessive reliance on imports of coal-based power, it must proactively strategise to meet the rising demand through cleaner energy sources.

The district-wise assessment of solar and wind energy potential indicates that the combined usable potential in the state is approximately 14 GW, which can be utilised by the state for meeting the projected energy demand.

Though Kerala aims to meet 100% of its energy needs through RE sources, RE constituted only about 7% of its energy mix in FY 2022-23. Therefore, the state needs to take steps for aggressive deployment of RE in a phased manner, while reducing reliance on thermal-based sources.

Strategic Interventions for Effective Energy Transition

Kerala can smoothly navigate energy transition and move towards a resilient energy future by adopting a systematic and phased approach that focusses on capacity addition, import curtailment, and storage deployment.

Increasing RE deployment

While Kerala has abundant solar and wind potential, its topography poses challenges to harnessing it. For overcoming them, the state must strategically plan solar and wind deployment by creating land banks and identifying the available land parcels district-wise. Promoting rooftop solar systems also offers benefits, as it would enable the state to procure decentralised power at the load centers. Together, these would help in increasing the share of RE in the state's energy mix to 36%-46% by FY 2039-40.

Reducing reliance on thermal imports and increasing the share of nuclear energy

Reducing the dependence on external thermal sources should be a key priority for Kerala. The above-mentioned increase in RE share will aid in the phased reduction of thermal energy's share—from 56% in FY 2021-22 to 2% by FY 2039-40. However, this reduction in coal-based power imports will hamper the state's ability to meet its base demand and provide round-the-clock power supply. For a smooth transition, this should be compensated for by increasing the share of nuclear energy for the state to 19% in FY 2039-40.

Developing storage capacity

As Kerala progresses towards a higher RE share, the intermittent nature of RE sources will affect the stability of its grid. Moreover, the state's peak demand occurs during nighttime when solar generation is nil. These concerns can be dealt with through appropriate deployment of storage systems. The study estimates that an optimal storage capacity of 3.8 GW to 4.1 GW would be required by the state by FY 2039-40.

The storage systems can be charged during morning hours through solar energy and utilised to meet the demand during deficit hours. The state can also diversify its storage deployment to include pumped-hydro energy storage (PHES) and battery energy storage systems (BESS).

The bottom line is that Kerala's RE potential is significant, which renders it capable of transitioning towards a sustainable and self-sufficient energy landscape. While a comprehensive tailored approach can enable the state to meet its goals, it needs to be prompt in planning its future energy supply.