OPINION: Significance of DRE systems in strengthening the electricity infrastructure

Can National Electricity Policy 2021 lay a robust foundation for the role of distributed renewable energy for the goalpost year 2030?

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New Delhi: The recently released draft National Electricity Policy (NEP) 2021 revisits the power sector infrastructure planning scenario. Since NEP 2005, the sector has witnessed a metamorphosis, recording the fastest growth till date. The total installed capacity has been augmented by 251 gigawatts (GW), of which renewable energy (RE) increase was almost 92 GW. The share of RE in total electricity generation too grew by 10 per cent.

However, the challenges of this transformation, along with the current national ambitions (a 450 GW RE target by 2030; strengthening of grid infrastructure; and decarbonisation and digitisation of the system), may be too much to handle for the conventional grid, which is grappling with an overstretched infrastructure, rising power demands, and peak power deficits. The distribution sector, which faces huge debts (an estimated 6 lakh crore by 2022), adds to the woes.

Distributed Renewable Energy Systems for a Robust Grid

In this scenario, employing distributed renewable energy (DRE) systems can reduce emissions, effect capacity enhancement, build grid resilience, and fetch economic gains.

The draft NEP, besides recognising the significance of RE hybrids (like solar-biomass, solar-hydro) for sustainable generation, highlights the role of DRE in reducing dependency on the transmission network, especially through solar rooftops in urban spaces and mini-grids in remote villages.

However, large-scale deployment of DRE systems will throw up issues related to intermittency, voltage instabilities, variable RE (VRE) curtailments, and network management.

To address these, the NEP should discuss diverse storage options for active voltage control. This will encourage higher uptake of DRE at varying generation scales, and enable all-terrain deployability. The policy must also consider strategies on centralised control automation and bi-directional interaction of DRE network with the central grid. Further, since the DRE ecosystem is market driven, the NEP must rectify commercial issues with developers, such as under-utilised generation, transmission network upgradations, and technological alternatives.

More specifically, a combination of the following can help mitigate these problems:

Energy storage solutions (ESS): Emerging ESS, such as lithium-ion Batteries (LiB), have shown superior traits for active voltage control, like fast ramping, energy density, deployability, and higher performance characteristics. Though presently LiBs are used in the electric-vehicle (EV) ecosystem, the falling prices of batteries (currently at 137 USD/Kwh, and expected to fall to 58/Kwh by 2030) will make them cost-effective for the power sector soon. The prospect can be strengthened through indigenisation of LIB-manufacturing on large scale, leading to economies of scale. This, coupled with a higher uptake of consumer-scale batteries due to the investment boom in the EV industry, will reduce the costs further.

Complementary technologies - Union Budget 2021-2022 announced the National Hydrogen Energy Mission for generating hydrogen from RE sources. Green Hydrogen (GH) can be produced through an electrolyser technology, which can be plugged into the grid as a load and can help improve system stability. GH-based fuel acts as a carrier of clean energy, and provides an alternative for power evacuation without using the transmission network. It has power-to- hydrogen (P2H) applications and feeds into various sectors, such as heavy industries, methane blending, and transportation. Thus, green hydrogen can create a sustainable ecosystem for DRE project developers, by opening up a new revenue opportunity—with improved returns on investment and savings on transmission upgrades—while offsetting VRE curtailments.

Smart network integration: Improved and centralised system integration can be achieved by Supervisory Control and Data Acquisition (SCADA)-based system architecture. It can leverage IT technologies for better bi-directional communication, essential to measure grid system state and transmit resetting parameters for active power nodes, at various points of integration. Smart network can perform dynamic comparisons of the maximum possible generation and strategic utilisation. Union Budget 2021-2022 has proposed the guidelines for smart metering scheme as a citizen-centric measure.

Government Interventions for Strategic Growth

Policy must be both – a statement of intent and an actionable plan. Though several past policies — like the Electricity Act, 2003; Rural Electrification Policy; and NEP, 2005 — have expressed the intent, underscoring the supportive role DRE can play, the actionable component depends on the market investment climate. For example, the cost of project financing and equipment constitute more than half the cost of electricity generated through solar and wind energy. The government can address such issues through investor risk mitigation mechanisms, one-stop solutions for land acquisition processes, and by financially incentivising schemes. The regulatory measures can focus on sustained integration of DRE plants into conventional infrastructure, DRE grid standards, and community-based ownership models of decentralised generation. Simultaneously, India can work on indigenous manufacturing and vertical integration of key RE equipment (in solar and wind technologies), providing cost-reduction benefits to the project developers.

Given the potential of distributed renewable energy, and with draft NEP 2021 endorsing RE, the time is ripe to bring in DRE technologies for supporting the decade-end goals.

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