Meeting India’s electricity needs

One often comes across news about variable renewable energy sources like solar photovoltaic and wind having reached ‘grid parity’. What is the concept of grid parity? Electricity grid is a very complex system. It involves long-distance transmission of electricity at high voltage, step-up and step-down transformers, and a distribution network at load centres. Various electricity generators and consumers are connected to it.

Grid parity can be seen in two different ways: generator-end grid parity and consumer-end grid parity. Generator-end grid parity is limited to the plant boundary and does not include the cost of the grid system. To ensure that electricity is always available to consumers on a reliable basis, a grid manager has to contract enough electric supply from generators available on demand at all times. In India, the peak demand occurs in the evening, when solar is not available and wind may or may not be blowing. Therefore, the capacity of generators capable of despatching electricity on demand, i.e. despatchable sources, connected to the grid should be more than the peak load.

It has to be more because some generators will be under long-term maintenance and some will not be available for the short term due to technical faults. The cost of the grid system is, therefore, more than the cost of towers, wires, and transformers. It also includes capital and operating cost of storage capacity when provided for and capacity charge paid by the grid manager to meet the peak load. When a grid manager is not able to pay adequate capacity charge, the result is load shedding.

However, priority feed-in accorded to solar and wind forces the despatchable generators to lower electricity generation despite their capability to continue operation at full capacity. Thus, while capital investment has to be made in despatchable generators to meet the peak demand, they are not given the opportunity to work on a 24x7 basis by the prevailing policy framework. Despatchable generators have to suffer loss of generation because of intermittency of solar and wind, and this is an aberration for a capital-scarce country like India. The result is stranded assets.

To compensate for intermittency of solar and wind, despatchable generators have to ramp up generation or back down, and the frequent change in generation level causes wear and tear of machines and increases maintenance costs. All costs are ultimately paid by the consumers or as subsidy by the government — that is, tax payers.

To analyse consumer-end grid parity, one will have to add system costs to the plant-level costs, and when so examined, solar and wind are far from achieving grid parity. Therefore, a factually correct statement is that ‘solar and wind have reached generator-end grid parity and more research and development is needed before they achieve consumer-end grid parity.’ Such an articulation provides a correct picture to the policymakers.

Energy economists use the concept of levellised cost of electricity generation to compare various electricity generation options, but limit calculations to the plant-level costs. This doesn’t capture differences in grid-level costs of different technologies. In view of increasing penetration of solar and wind, it is desirable to replace the concept of plant-level levellised cost with system-level levellised costs.

Appropriate ways to deploy solar and wind can be decided by recognising their three characteristics — zero fuelling cost, low capacity factors and intermittency. Solar and wind are eminently suitable for isolated deployment such as for powering irrigation pumps. An irrigation pump directly connected to a solar panel can be useful for a farmer as he doesn’t have to depend on the grid. In this application, intermittency of solar is of no consequence.

In India, there are still communities that have no access to the central electricity grid, or the supply from the central grid is unreliable. A microgrid getting electricity supply from solar and wind, and connected to consumers in an isolated remote community, is helpful in providing electricity for lighting, in charging mobile phones, and small livelihood applications. A storage battery is an integral part of such an isolated microgrid and this increases the cost of electricity. Experience from such installations indicates that consumers are willing to pay for it in return for reliable electric supply. Consumers connected to a community managed microgrid can meet their minimum needs. Until the reliability of the central grid can be assured, solar- and wind-powered microgrid is the way forward for rural and remote communities.

Hopefully, ongoing research in battery technologies will bring down the cost of electricity storage and improve safety of storage, thereby paving the way for a large deployment of solar and wind. One can expect the International Solar Alliance to direct technology development towards the needs of all developing countries. Another option for large-scale penetration of solar and wind is to install gas-based power plants which can be ramped up and down fast. This will be possible only if overland or undersea pipes can be commissioned to transport gas from Central Asia and Iran to India.

But solar and wind cannot meet even a quarter of India's projected electricity requirements. A major share has to come from large hydro, nuclear and coal. Out of these three technologies, one has to prefer low-carbon technologies that is hydro and nuclear. Until electricity generation from hydro and nuclear picks up, coal has to continue to meet India's electricity requirements. Along with investment in solar and wind, the government must plan for increased investment in both hydro and nuclear.

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The India-Japan economic relationship remains underwhelming in relation to strategic ties

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