Curtailment Issue In Renewable Energy

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Curtailment of power generated by wind and solar projects is a persistent problem for renewable energy (RE) developers in India. **Curtailment is a reduction in the output of a generator from what it could otherwise produce given available resources.**

Curtailment typically occurs because of **transmission congestion or lack of transmission access,** but it can occur for a variety of other reasons, such as **excess generation during low load periods. Market-based protocols** that dispatch generation based on economics can also result in curtailment.

In India curtailment is rampant despite a **'must-run' assurance** in regulation.

Reasons for Curtailment

Demand and Supply Mismatch

- After electricity is generated, it must be transmitted and distributed to consumers. The network of transmission and distribution facilities makes up the **power grid.**
- The power distribution grid must respond quickly to shifting demand and continuously generate and route electricity to where it's needed the most.
- However, there is a **difference between peak demand-load periods and peak-energy generation period.**
    - **Solar Energy:** Peak demand-load is at night whereas peak energy generation is at daytime.
    - **Wind Energy:** Peak demand-load is at during summers and winters whereas peak energy generation is at Monsoon.

Power Grid Issues

- The **intra-state grid is unable to accommodate** the excess generation due to low demand and can't transmit it out due to limited inter-connections with the national grid, leading to heavy curtailment.

- Apart from this, **inadequate grid availability** has been a concern in Renewable Energy (RE) rich states.

Violation of Government Norms

- The **Indian Electricity Grid Code 2010 provides for a 'Must-run' clause** for the renewable energy sector, which means that utilities, state load dispatch centres (SLDCs) and distribution companies (discoms) have to prioritise scheduling of renewable power over other generators/sources to incentivise green energy projects except in cases of technical issues.
- However, SLDCs in the garb of grid security (pushed by commercial interests of discoms), violate this 'Must run' clause.

Impact of Curtailment

- This leads to substantial losses as developers do not fully account for them while bidding for projects. In the absence of a restitution mechanism for such losses, the viability of projects becomes challenging, especially as RE companies operate with thin margins and small capital.
- This increases the probability of generation curtailment and adds to the operation risk of projects, discouraging investments.

Way Forward

- The government has taken several positives in this direction. Some of them are:
    - To increase grid flexibility to prepare for increased RE penetration.
    - Increasing flexibility of coal-based power plants.
    - Enlarging geographic and electrical balancing areas.
    - Expanding transmission in strategic locations.
    - Installing grid-scale storage systems.
- **Automation** can reduce curtailment levels. Therefore, attention has to be given to developing real-time market (RTM) for electricity to improve grid reliability and optimise operations, particularly as the share of variable RE in the electricity generation mix (electricity produced from different sources like thermal, hydro, solar, wind etc.) increases.
- Investment for Research and Development in **storage technologies** can curb this curtailment problem.
- **Smart grid technologies** need to be installed, that employ digital technology to more efficiently manage energy resources. It will extend the reach of the grid to access remote sources of renewable energy like geothermal power and wind farms.
- Curtailment challenge is directly related to the financial weakness of the discoms, which requires strong **structural reforms**.

Drishti Mains Question

Curtailment of power generated by wind and solar projects is a persistent problem for renewable energy (RE) developers in India. Discuss.
