VEHICLE TO GRID TECHNOLOGY: SCIENCE & TECHNOLOGY

NEWS: How can V2G technology help India's power sector?

WHAT'S IN THE NEWS?

The Kerala State Electricity Board (KSEB), in collaboration with IIT Bombay, has launched a pilot project to explore Vehicle-to-Grid (V2G) technology in Kerala, a pioneering move to integrate electric vehicles into the power grid.

About the Initiative

- KSEB and IIT Bombay are jointly testing the feasibility of implementing V2G technology in Kerala.
- The pilot project aims to understand the technological, regulatory, and operational aspects of V2G in the Indian context.
- This is one of the earliest attempts in India to explore the potential of EVs as decentralized energy storage.

What is V2G Technology?

- V2G (Vehicle-to-Grid) technology allows bidirectional energy flow between electric vehicles (EVs) and the electricity grid.
- It comprises two modes:
 - G2V (Grid-to-Vehicle) EVs are charged from the grid.
 - V2G (Vehicle-to-Grid) EVs discharge stored energy back to the grid when parked and not in use.
- This enables EVs to function as mobile energy storage units.

Key Benefits of V2G Technology

- Grid Load Management:
 - Helps balance energy supply and demand, especially during peak load periods.
 - Avoids grid overload by absorbing excess energy and discharging it during high demand.
- Renewable Energy Integration:
 - Stores surplus solar or wind energy during the day and supplies it during nonproductive hours like night.
 - Supports grid stability amid the intermittent nature of renewables.
- Improved Grid Resilience:
 - Can act as a backup during grid failures or emergencies.
 - Helps in maintaining voltage and frequency regulation.

• Economic Incentives:

• EV owners can earn by supplying power back to the grid, turning vehicles into revenue-generating assets.

• Tariff incentives like **Time of Use (ToU)** pricing and smart charging can make V2G profitable.

Implementation Challenges

- Regulatory Barriers:
 - Lack of uniform V2G policies and standards in India.
 - Energy regulations do not yet fully recognize V2G systems.

• Technical Complexities:

• Varying charging behaviors of EV users make power availability from vehicles irregular and unpredictable.

• Needs advanced charging infrastructure and bidirectional chargers.

• Cybersecurity and Data Privacy:

- V2G systems require real-time data exchange, raising concerns over data protection.
- Security of the communication interface between EVs and the grid is critical.

• Battery Degradation Concerns:

• Frequent charging and discharging may reduce battery life, discouraging user participation without proper compensation.

Global Best Practices

• United States:

• V2G is used in California for stabilizing the grid and as an emergency energy source during power outages.

• Europe and U.K.:

- Several programs compensate EV owners for feeding power back to the grid.
- Integrated with renewable sources to ensure smoother energy transitions.



Conclusion and Way Forward

- V2G offers a revolutionary way to decarbonize the energy and transport sectors simultaneously.
- With India's push toward e-mobility and clean energy, V2G can be a game-changer if aligned with smart grids and digital infrastructure.
- Future success depends on:
 - Regulatory clarity
 - Development of standards and protocols
 - Stakeholder collaboration (utilities, EV manufacturers, regulators, and consumers)
 - Smart tariff designs and incentives
 - Pilot projects and real-time data collection to guide national scale-up

Source: <u>https://www.thehindu.com/business/Industry/how-can-v2g-technology-help-indias-power-sector-explained/article69462057.ece</u>