

Smart Grid Relevance in India

India has seen a phenomenal development in power sector in the last few decades and will keep on growing in the coming decades to maintain the equilibrium with the fast growing economy. As estimated capacity addition of about 22,470 MW and 60,885 MW will be required from convention sources during 13th and 14th plan respectively. The projected Peak Demand is 235 GW and 317 GW in the year 2021-22 and 2026-7 respectively. India has set an ambitious target of having 175 GW of RES installed capacity by 2022 and planned to add another 100 GW of RES by 2027. If these targets are realized in future then renewable energy generation will contribute 20.3 % and 24.2 % of the total energy requirement in 2021-22 and 2026-27 respectively.

The T&D and AT&C losses are still very high in the power sector and their reduction continues to be the top priority of both utilities and government. The targeted level of AT&C losses to be achieved are < 15% and < 10% by the year 2022 and 2030 respectively. To minimize the AT&C losses the effective Demand Side Management (DSM) will be required and it is also estimated that the energy saving through DSM will be 249 BU in the year 2021-22 and 337 BU in the year 2026-27. If the DSM is executed properly and efficiently it can expect that around 10055 MW and 13225 MW of peak demand can be avoided in the year 2021-22 and 2026-27 respectively.

Increasing pollution is another concern with the fast growing economy. The current average CO₂ emission per kWh is estimated at 0.732 kg and India's aim of bringing it down to 0.581 kg in the year 2021-22 and then to 0.522kg by the end of 2026-27.

Further, India has recently launched a National Mission on Electric Mobility and to roll out EV on streets will require up gradation in electrical distribution infrastructure and use of smarter systems which can control/limit simultaneous charging of hundreds of EVs from the same feeder.

Smart Grid

Moreover, smart grid, is an emergent technology in the field of grid modernization that utilize technological advances in electrical, electronic, communications, and computer

science to overcome the challenges of current power systems. The smart grid is essential to ensure high-quality services, consumer engagement in consumption management, cyber and physical security of the system, system reliability, and integration of renewable energy sources into the grid. The existing grid can be made smart by addition, modification or up gradation of the certain aspect of the grid as mention under:

- Sensing and measurement unit and its infrastructure, namely AMM, AMR, DCU, FPI and PMU, which detects signals and measures the state of the whole system from the utility to consumer end.
- Modern Communication technologies, either wireless or wired which includes BPL, GSM, fiber-optics, Zigbee, RF mesh, PLC, Ethernet etc. which links all the units and control logistics of the smart grid.
- Control system, which is considered to be the brain of the smart grid, encompasses elements like SCADA, EMS, WAMPACS, and ADM.

Financial Analysis of Smart Grid – India’s Scenario

The hurdles for smart grid successful implementation in India are many, it may be a social, political, or technological but certainly, the biggest hurdle is the massive investment required for the smart grid deployment. The IEA has estimated that in India, the investment of around 134-173 USD billion will be required during decade 2020-30 to deploy smart grid. The IEA has also predicted the monetary benefits fetch by smart grid system during the same period.

The Government of India (GoI) has plans for early deployment of smart technologies in its grid system so that environmental, financial and others benefits can be reaped as early as possible. The GoI has taken many steps since 2010 for development and deployment of Smart Grids in India. In this direction GoI has estimated that ₹ 890 crore will be required for all the projects and National Smart Grid Mission activities in the 12th Plan. GoI has also provided the budgetary support of ₹ 338 crore for the same 5-year plan.

The Financial Implication for the 12th plan budgetary support is mentioned in Table 2.

Table 2: Financial Implication for the 12th plan budgetary support for Smart Grid

| S. No. | Activity | Estimated Cost | Proposed Budgetary support |
|--------------|---|----------------|----------------------------|
| | | (₹ - Crore) | |
| 1. | Development of smart grid in Smart Cities | 890 | 267 (30%) |
| 2. | Development of micro grids | 27 | 8 (30%) |
| 3. | Training & Capacity Building (Funding for SGKC etc.) | 8 | 8 (100%) |
| 4. | Consumer Engagement (Funding to State owned DISCOM) | 30 | 30 (100%) |
| 5. | NSGM Establishment, O&M etc. | 25 | 25 (100%) |
| Total | | 980 | 338 |

Therefore, to overcome challenges of the power system and its operation & expand in a reliable, efficient & sustainable manner, smart grid and smart grid technologies implementation may be a mile stone in the power sector.