Challenges in Managing Distribution Sector

Er. S. MAHESH
Former Director, Technical, BESCOM

Preamble

Electricity is a basic vital need for all persons on 24x7x365 basis at declared voltage and frequency. To achieve the above, we need to possess a strong, robust, reliable Generation, transmission and Distribution network. In this article I intend to restrict to discuss technical challenges to mitigate the pains.

Distribution sector in India is complex. It is dense to carry bulk Power in metros. It contains mix of High medium and low voltage lines and additional lines needs for "continuity of Power supply" through "change over" by Auto / manual in the existing area. New lines need to be constructed for Industrial/commercial/residential consumers.

It is scattered and wide spread in Urban/Semi-urban/rural/agriculture belts. Consumers are few and located at remote areas. The network covers consumers using less power, at less voltage and poor Power factor. Every year millions of new consumers are being added. ESCOMs need to monitor the Energy delivered / consumed, issue bills, to make payments.

The challenges to operate, maintain the existing network, build new lines, improve & update the existing line, Web of distribution network for the passage of uninterrupted power to all consumers at declared Voltage and frequency assume paramount importance.

Challenges on Technical front:

Lakhs of Kilometers of distribution lines, some of them passing through dense forest, deep valley with tens of thousands of transformers are to be kept in good condition to ensure uninterrupted power supply at all times. In Urban areas, medium voltage UG cables & ABC cables, RMUs are to be maintained in good condition on a sustained basis. The lines are to be uprated and new lines are to be laid for giving new connections.
Some of pain segments are

1. Aging Infrastructures: Most of distribution lines are more than 50 to 60 years old with parts of grid are more than century old. It is difficult to extend uninterrupted supply when networks are struggling and have served their life time. This makes the decision to replace and maintain more difficult. The cost involving is huge. ESCOMs struggle to provide funds for operation and breakdown maintenance. However, ESCOMs can borrow loans for replacing & creating new infrastructure which again increase the financial burden without distribution more power.

2. Overhead line Sag: when lines are exposed to sun they are vulnerable for damages to be caused by external factors such as severe weather, high speed blowing wind, rain, growth of vegetation and animals moving along the lines. If the lines carry high currents, the conductors expand leading to sag. On reduction of currents the line retains its original length. Over a period of time the line loses its Elasticity. This leads to reduced ground clearance and the increased change of phase conductors swinging into contact besides high currents also cause annealing which increase the chance of break down. The incorrect making contact at jumper connections and isolating switches also cause the break down.

3. Transformer Failure and overloading: Transformer can either fail or overload causing power outage. The failures in rural areas are more than in urban area. In Urban area the transformers are of 100kVA/200kVA or more. The rural area transformers are of 25/50/63/100kVA. The CT ratio at source station end of a rural feeder is 200/1 and overloads earth fault settings are kept at 100 & 10 percent. The means an out of balance current of 20 Amps will have to flow in feeders for the relays to sense the fault to trip on earth fault. But the full load current on 11kV side of transformer ranges from 2 Amps to 15 Amps and out of balance current of 20 Amps will not flow in case of earth fault. Hence, continuous fault current will flow through transformer HV end windings resulting in failure of transformer. Auto Re-closers with adequate relay setting needs to be employed to prevent the above.

4. Underground cable treeing: One of the biggest problems relating to performance of UG cables are Electro chemical and water treeing. This occurs when moisture penetration in the pressure of Electrical field reduce the di-electric strength of cable insulation. That moisture when invading most cable insulation materials will create the pattern of a tree. This leads to degraded insulation in turn electric break down. These occur in the event of lightning or switching. The severity of the damage is linked to thermal age as moisture absorption happens quickly at higher temperature. This can be avoided with the use of tree retardant insulation.

5. Unpredictable demand: ESCOMs shall have to furnish their requirement of power in advance for scheduling. The yearly demand will rise by about 10%. The shift to arrange power supply to Electric vehicle will likely to increase the demand but the economic pressure too plays an important role. The growth of domestic generation and NCE will play a role in complicating demand forecast.

6. Restoration time: Frequent power outages cause a dent on the reputation and revenue. The power outages are bound to happen but being able to identify the location, Cause of the issue is the task. To mitigate this hard ship, condition monitoring of lines and associated equipment will have to be taken up, identity the hotspots or weak points, replace them before occurrence of breakdown by availing pre-arranged outages.

7. Storm occurrences: Heavy blowing of wind, rain, and floods can have massive consequences and are clearly entirely out of control. Restoring a network after collapse of entire infrastructure in an area calls for massive quantities of materials, labour, man power and crisis management protocols.

8. Digitization: GOI has an ambitious programme of having a modern, intelligent grid with smart metering. Information and operational technology must both integrate. Digital asset management. Smart grid technologies and the internet are likely to play a key part.

9. Transmission and distribution losses: The quantum of Energy produced and Energy received at IF Points will be recorded at Generation & receiving stations. The difference of Energy unaccounted is the transmission loss which at present is about 3 to 4 percent. The energy registered at IF points at 11kV and consumer promises will have to accounted and the difference of Energy unaccounted are the distribution loss which is about 10 to 17 percent. T&D Losses are caused by a variety of problems including Energy sold at poor / low voltage, Low power factor, Power flow to decentralized distributed loads over a large area, inadequate investments in the needy segments, improper billing and theft.

10. Non implementation of the new projects: Huge investments are made in non-remunerative rural belts by availing loans. The T&D losses remained the same even after completion of new lines after considerable delay. Committees are set-up at public exchequer put to great expense to derive paper work for all kinds of new plans and progresses. Even the energy audit study which was conceived two decades has not demonstrated desired results. Lots of time is wasted in corporate level meeting, with little results on ground. The action plan implementation, review and monitoring are happening at corporate rooms rather than on ground. Some reduction of AT&C losses was possible in metro feeders.

11. The KERC agreed to identify some urban areas to know the losses, reduce them over a period of time. The data are being furnished to KERC regularly and many of them have higher losses and the purpose of reducing them has not seen the lights of the day. The line losses on rural feeders are not reduced to the desired level.

12. Some Escoms started the concept of model subdivisions to create bench marking of the processes to be show case. But the good intentions are not translated to action in letter and spirit.

Conclusions:

Reforms in the Energy sector were started 20 years ago. Much investment is made in creating distribution lines. But the expected benefits are not seen such as reduction of, AT&C losses and improving the quality of power to the consumers. The situation of Power outages has not improved. Better management, co-ordination needs to done to reduce power outages, increase line delivery efficiency, increase cash flow, better consumer relations, etc. without much capital investment.