Proceedings of GLOGIFT 07
November 15-17, 2007
UP Technical University
Noida, pp. 369-374

FLEXIBILITY IN POWER SECTOR DISTRIBUTION SYSTEM

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Globalization and privatization are demanding many reforms in every industrial sector. No exemptions for power sector. The main objective of power sector is to provide reliable supply to the customer at less cost. Now a days without the power the human beings can't lead their lives comfortably. So it has become essential commodity to the society. The development of the country is also decided according to the energy per capita consumption. Initially power system were using direct current afterwards alternate current was invented .A.C has eliminated the disadvantage of D.C. using A.C. step up and step down transformers is allowable at high voltage levels. In India the power generation sources are insufficient compared to Koria, China etc., but the consumption is increasing year by year exponentially. There is a requirement to utilize the power to the maximum generation capacity. In Andhra Pradesh the generated power is transmitted through Transco to the various distribution companies. Privatization of power sector had greater impact on distribution company activities. In this scenario the distribution companies are facing many challenges in the distribution of power to the various consumers (Industries, farmers, house holders etc.)

The power sector is constituted of mainly three elements. They are power generation, power transmission and power distribution. Majority of investments is utilized (40% to 49%) for generation of power, (30% to 39%) is utilized for distribution and the remaining (16 to 19%) is utilized for transmission. In Andhra Pradesh about approximately 16% to 17% of power generated is under loss. If 1% of loss is reduced, crores of rupees can be saved. The losses can be controlled by aiming optimal substation configurations and by following optimal distribution policies.

The major challenges faced by power distribution system are

- Not able to utilize the power generated to the maximum capacity.
- The power losses are high due to the problems in distribution channel.
- The commercial losses are also remarkable due to lack of consumer awareness and theft.
- Complexity involved in billing.
- Difficulty in fully recovering the billing amount from consumers.
- Political power interference in the bills recovery process.

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- Low employee motivation level at distribution offices..

The power losses are categorized into:

1. Line losses.
2. Pilferage :Taking one category of contract and utilizing higher category
3. Voltage fluctuations in the transmission.
4. Improper maintenance of the equipment in the distribution.
5. Defects in meters & Breakdowns of sub-stations.
6. Occurrence of fuse of calls & Transformer failures.
7. Bill pending with Government organizations.
8. Political interference in the recovery of bills.
9. Theft of power by direct tapping.
10. Theft of conductors.
11. Malpractice in utilization. Consumers utilize more load than contracted load (looping).

(I). The Line Loss occurs in transmission and sub-transmission lines

Losses are of different types :

1. I^2 R loses (Tr. and equipment)
2. Copper Losses
3. Iron Losses

Low line losses result in a low minimum cost per unit. Low line losses optimize the utilization of the sources of energy. ***Eg:*** Oil, Coal.

- Line losses are about 15% to 30%.

The causes of line losses are:

1. *Lengthy distributors:* In rural 400V, 415 V lines length are high, which are radial (I^2R losses are high).
2. *Inadequate size of conductor*
3. Distribution transformers not located at load centers on the secondary distribution system.
4. Over-rated distribution transformers and hence their under – utilization due to unnecessary high capacity DTR's – Iron losses will be increase. Capital cost locked.
5. Low voltage (less than declared voltage) appearing at transformers and consumers terminal. That might be because of Induction motors results in higher current down for the same output.
6. Low power factor.
7. Bad workmanship resulting in poor contacts at joints and connections:

- Joints should be maintained at in number minimum.

(II). Pilferage of energy:

12. Theft of energy.

Unscrupulous consumers extract energy illegally either by-passing the energy meter or by

connecting leads directly to the distribution lines.

Measures are:

1. Surprise inspections need to be carried out by vigilance squads.
2. The energy meter is housed in a separate box sealed and made inaccessible to the consumers. The three cut-outs are provided after the meter.
3. Multi-core PVC cables are used as service mains instead of single core VIR wires.
4. The energy meter manufactures are asked to provide the potential link inside the body of the energy meter in addition to that inside terminal cover. This prevents disconnection of the potential link.
5. Heavy fines are imposed on consumers found committing theft of energy.

(III) Voltage Control can be obtained from

1. Use of generator voltage regulators.
2. Application of voltage – regulating equipment in the distribution substation.
3. Application of capacitors in the distribution substation.
4. Balancing of the loads on the primary feedings.
5. Increasing of feeder conductor sizes.
6. Installing of new substations and primary feeders.

Economic Justification for capacitors:

Shunt capacitors are the most economical source to meet the reactive power requirements of inductive loads and transmission lines.

Benefits of the capacitors are

1. Releases more generation capacity.
2. Releases more transmission capacity.
3. Releases more distribution substations capacity.
4. Reduces energy losses (Copper losses)
5. Revenue increase due to voltage improvement.
6. Postponement or elimination of capital expenditure due to system improvements.

The causes of voltage fluctuation

Quality of service is measured in terms of freedom from interruption and maintenance of satisfactory voltage levels. So, voltage fluctuations and lamp flickers on distribution systems are caused by customer's utilization of apparatus. (due to dip in illumination level)

Measures for reducing voltage fluctuation

1. Using a motor which requires less kilovolt amperes per horse power to start.
2. Choosing a low – starting torque motor.
3. Replacing the large size motor with a smaller size motor / motors.
4. Employing motor starters to reduce the motor inrush current at the start.
5. Using shunt or series capacitors to collect the power factor.

(IV) Maintenance

This maintenance work consists of

1. Inspection – Visual Check.
2. Preventive maintenance and – Periodical operation.
3. Over hauls of an equipment.

Earthing

Connections of electrical equipment machinery or an electrical system with the general mass of earth is termed as Earthing or Grounding.

The Purpose of Earthing is

1. To protect the plant.
2. To improve service reliability.
3. To protect the personnel from expose of power.

   Earthing can be divided as

   a. System grounding/earthing (System Earthing)
   b. Equipment grounding/earthing (Safety Grounding)

System Grounding/ Earthing

The purpose of System Grounding/ Earthing:

1. Protection of Insulation and improvement in quality of service.
2. Helps to clear the faults speedily.
3. Safety of the personnel.
4. Saves the operating personnel from total accidents.
5. Safeguard from the hazard of touch voltage.

System earthing

Types of system earthing are

1. Earthing through resistance.
2. Earthing through a reactance.
3. Earthing through a Peterson coil.
4. Earthing directly or solid earthing (Generally adopted method)

Protection of the system is simplified by virtue of the fault currents resulting from ground faults are comparable in magnitude with inter phase fault currents and there is no need to apply especially sensitive earth fault relays.

Arc Suppression coil earthing or Peterson coil earthing:

In high voltage caused by switching surged or by lightening may cause a line to flash over to earth and lead to “Arcing Grounds”.

To avoid arching grounds Arc-Suppression coil (tuned reactor) is used.

(V) The causes of Interruption of Supply

1. Inadequate grid capacity, due to low generation or break down or shut down of some grid lines resulting staggering of power supply.
2. Break down / Shut down of generating machines and manufacturing equipment like transformers OCB (coil circuit breakers) etc.
3. Break down / Shut down of sub-transmission line size 33/11KV line.
4. Due to natural calamities like heavy rains, winds, cyclones, floods etc..

The flexible measures are

1. Distributing the available capacity in a rational way depending on the essentiality of the services.
2. Giving the publicity to the timing of power supply so that the consumers are aware of the timings.
3. The best way for reducing the period of interruption is by reducing the time of breakdown / shut down by quickly attending to it.
4. Break downs due to natural calamities can't be avoided, but the extent of damage and consequent interruption can be limited by proper maintenance.
5. Preventive maintenance of lines and equipments.
6. The public are to be educated in this direction and enlightened about the loss of revenue to the board, inconvenience to the consumers and danger involved in meddling with hot lines.
7. Ageing of equipment, over loading of lines and equipment and their consequential failure.

(VI) Fuse off Calls

The interruption due to blowing out of the consumer fuses due to blowing off IC cutout fuse blow off, Arial fuse, fuse, section fuse of distribution transformer etc.

- The IC cut-out fuse and Arial fuse blow off can be reduced by properly grading these fuse wires.
- The section fuse blow off and HG fuse blow off may be due to over load, bird fault, tree falling.
- These can be reduced by trimming of trees in time by suitably distributing the loads of the feeders and using proper size of fuse wires.

Suggestible measures are

The line staff phases to pay regular visit to the area covered by him and keeping the fuse off call register at a public place like Panchayat Office for the consumers to register their complaints.

(VII) Behavior of Staff

In the companies mainly service oriented organizations like Power distribution system, the primary duty of each employee is to be courteous; polite with the general public in general and with consumers in particulars.

General types of complaints that occur due to improper behavior of employees are:

1. Staff demands illegal gratification / illegal gratifications gives.

2. Staff misappropriating the materials misusing the vehicles, labour, stores etc.
3. Staffs enrolling NMR, though physically not present.
4. Staff engaged in private owing work.

The suggested innovations in process of distributing the power reduce the extra financial burden on honest law abiding consumers ,high line losses which result in increased consumption of fuel, oil etc. used in the generation of electricity power .This flexibility makes true the national interest that the power line losses to be kept down to a minimum.

"A unit saved is a unit earned for the systems" and this slogan is well worthy of remembering.