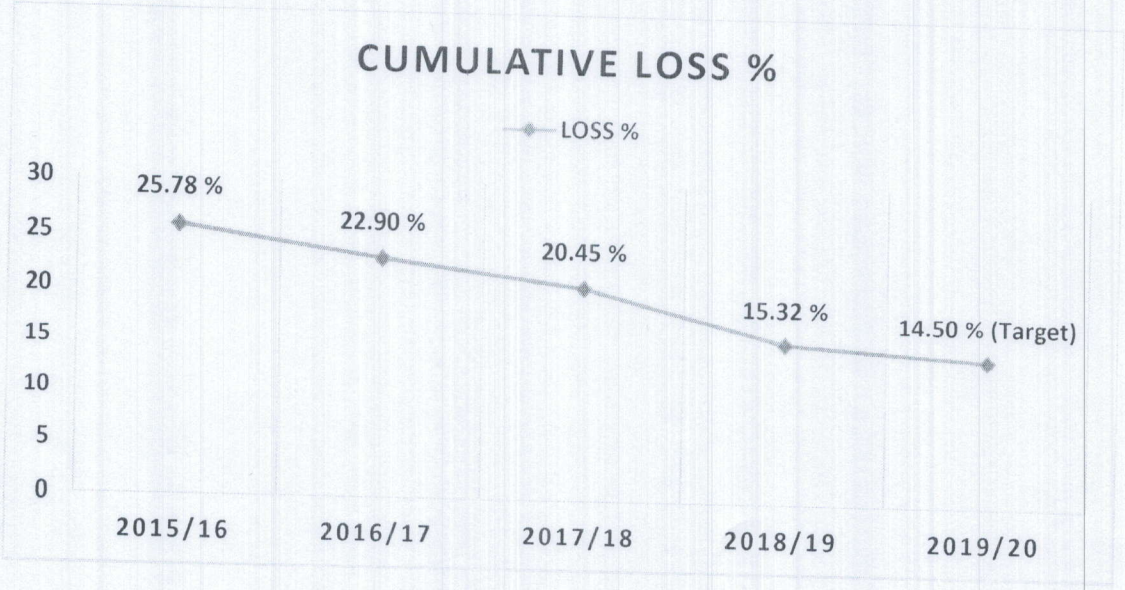
Institutional and Technical Measures for Loss Reduction in NEA's Power System

NEA has made significant improvement in reducing loss to 15.32% in F.Y. 2018/19 from 25.78% of F.Y. 2015/16. Various factors are responsible for the reduction of the loss. Many loss reduction programs were massively utilized in those years and these are still continued. Loss reduction has two-fold benefits to NEA and the country. Firstly, profit margin of NEA increases. Secondly, NEA can invest surplus benefits in the field of additional generation, transmission and distribution resources.



Major Actions Taken for Technical Loss Reduction

More than 50 New Substations & 7000 distribution transformers are installed that significantly reduces the line losses. Distribution lines are Massively Upgraded.

1. **Low Tension (LT line, 0.4kV)**
   - Upgradation of LT line: In urban areas, massive up gradation of all the LT lines by Dog Conductor.
   - Use of three phase lines in place of single or double phase lines.
   - Addition of new transformers to minimize the LT line length.
   - LT Line extension to reduce the length of service cable where consumer take the power through long service cable.

- Encouraging good workmanship in Jumper and Connection joints through training.
- Transformer load balancing.
- Procurement of higher quality materials.
- Installation of Automatic Power Factor Correction devices in distribution transformers.
- Compulsion installation of Capacitor bank for Industries operation in low power factor.
- Encouraging use of efficient equipment.
- Regular Bush cutting.

2. **11 kV lines and Distribution Transformer**

- Upgradation of weasel and rabbit conductor in 11kV feeders by Dog conductor.
- Upgradation of kVA capacity of Distribution Transformers.
- Addition of new Transformers.
- New 33/11 kV substations were built and charged which reduced 11 kV line length and improve voltage quality.
- Procurement of Minimum loss transformer: Completely Self Protected Transformers – 2000 Nos. and remaining Low Loss Transformers.
- Addition of new 11 kV feeders from substations.
- Regular update of GIS mapping helped feeder reconfiguration in many areas.

3. **33 kV Sub-Transmission line and Substation**

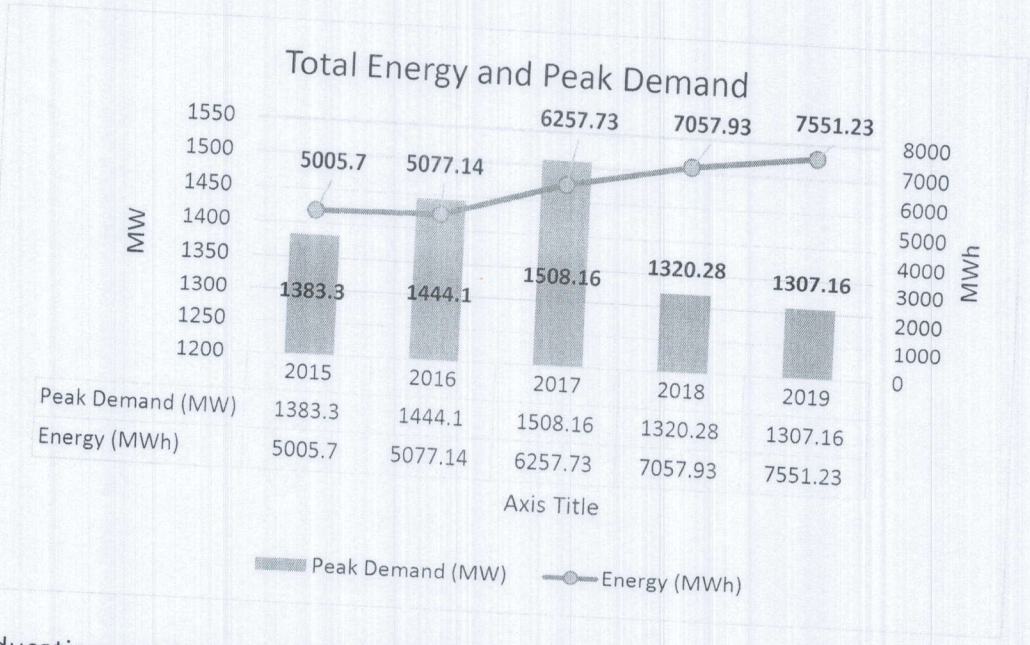
- Upgradation of 33 kV lines.
- Upgradation of 33/11 kV transformers.
- New 132 kV substations were charged which reduced 33 kV line length.
- Installation of Capacitor bank in Substations.
- Upgradation of 132 kV substations.
- Upgradation of 132 kV lines and addition of second circuit.

4. **Demand Side Management**

- Change in consumer's behaviors after elimination of load-shedding.

  Load shedding had created insecurity to the consumers towards the use of electricity which in turn affected their attitude and behavior. During load shedding period, consumers tend to use their all apparatus (for e.g. lights, water

lifting motors, irons, and rice cookers as well as inverters) simultaneously, when supply was available. With the elimination of load shedding, i.e. when supply became regular, consumer started using their electrical goods in their needy hours indicating increment in diversity of power consumption. The peak demand of the system is reduced whereas the energy consumption has increased in 2019 as compared to previous years indicating increase in load diversity and load factor. The load curve of the system has become flatter in recent years.



- Educating consumers to use efficient electrical equipment (like LED bulbs) and minimizing the use of high-power consuming appliances (like motors) during peak hour.
- Shifting Industrial Load to system's off-peak hours.

Because of the reasons mentioned above, Peak Demand decreased and Energy Consumption increased which lead to low loss.

Average system load factor improved to 0.55 in 2019 from 0.44 of 2013, which makes significant contribution in Loss Reduction.

Year	2013	2014	2015	2016	2017	2018	2019
Load Factor	0.44	0.45	0.44	0.42	0.49	0.53	0.55

Major Actions Taken for Non-Technical Loss Reduction

1. Awareness Program

- Awareness campaigns through playing Jingles continuously in many villages and cities. Audio/video television commercials are broadcasted through National media houses.
- Awareness program in different public places and schools.
- Pamphlets are distributed and flex board are displayed in many public places to raise awareness.
- Use of Social networking sites.

2. Action on theft

- Theft control activities are run regularly to find theft by direct hooking and bypassing energy meters. Households with theft are heavily fined.
- A regular team from loss reduction department is mobilized for proper monitoring of loss activities in different distribution centers.
- News related with theft are published in media which creates a very good impact for theft control.
- A theft-control unit is formed in each DCS and are regularly mobilized to control theft of electricity.

Action on Theft Control in F.Y.2018/19	
Particulars	**Numbers**
Mobilized Team	2150
Hooking Control	10036
Theft arrested	1821
Theft Equipment Ceased	9661

3. Correction on Metering

- All time of day (TOD) meters and metering units are checked and downloaded regularly. Stock and unbilled units are recovered.
- Electromechanical demand meters were erroneous due to ageing and are now being replaced by TOD meters.

- Mal-operating meters are being checked regularly; teams are mobilized to seal all the unsealed metering system.
- Automatic Meter Reading (AMR) is being implemented in TOD meters (9,000 Nos.) that gives access for meter reading, data download and monitoring remotely.
- Conventional Three-phase Electromechanical Energy Meters are being replaced by Smart Three-phase Energy Meters (60,000 Nos.).
- Single-phase Electromechanical meters are being replaced by high accuracy Electronic Energy Meters. Pilot projects of replacing EMM meter by digital Smart meters are being implemented in Ratnapark DC and Maharajgunj DC.

Metering Correction Data, 2018/19	
Particulars	**Numbers**
Meter Cross Checked	51578
TOD Meters Download	9000
Meter Reseal	72949
Defect Meter Changed	9874

4. Recovery of stock units

- Improvement in meter-reading:
  - ✓ In past, due to scarcity of meter readers, there was no timely meter-reading. New scheme of incentivizing the meter readers as per the number of meters read (like paying extra money per meter read), meter-readers were encouraged to complete the meter readings in stipulated time.
  - ✓ New scheme of outsourcing the meter-readers was introduced.
  - ✓ Recovery of missed revenues (*"chhut bill"*): All the DCS were strictly advised to download of TOD meters in time as per existing by-laws. Missed revenues from many consumers were collected which generated hefty amount of revenues.

5. Government Policy

- Interaction with local government and Police Department to support loss reduction activities.

- Local Levels are encouraged to make their municipalities as loss free zone.
- Free Energy Meters are provided to poor people by Nepal Government.
- By-laws was modified so that all the people staying in public place can have access to electricity through proper metering.

6. Massive penetration to society for new single phase meter distribution

- Door to door meter distribution.
- Free meter distribution for very poor strata people.

7. Performance agreement with Provincial Chief and DCS Chiefs.

- NEA has started the performance contracts with the provincial chiefs and distribution chiefs.
- The purpose of this Agreement is to:
  - Define and agree objectives and targets with the Second Party (Province Chiefs/DC Chiefs) and to communicate, the First Party's (MD/DMD) expectations out of the Second Party's performance in line with the NEA's objectives and functions.
  - Specify accountability and responsibilities set out in the Key **Performance Activities (KPAs)** and monitor and measure performance against set **Key Performance Indicators (KPIs).**
  - Give effect to the functional and committed performance oriented working relationship between the Parties in attaining improved service delivery; and
  - Appropriately reward the Second Party if performance is outstanding.
- Various targets are being set and the chiefs are made responsible to achieve those targets. Meanwhile the chiefs are given necessary rights so that they can run independently and achieve those targets.
- Major KPIs are calculated as follows :

1) KPA: Execute Loss Reduction activities: Weightage Factor – **55%**

KPIs	Weightage factor	Remarks
Feeder-wise loss is calculated each month and high technical and non-technical loss prone areas are identified and remedial actions taken	2.5%	Full marks for achieving result and zero for none
TOD meter download and monitoring is done as per electricity distribution bylaw.	2.5%	Full marks for achieving result and zero for none

Loss reduction activities are implemented to achieve specified loss target.	50%	

Marking for loss target achievement

Loss reduction target achieved performance	>90%	80-90%	70-<80%	50 – <70%
	1	0.8	0.6	0.4

Others KPAs:

KPAs	KPIs	Weightage Factor	Remarks
2) Enhance Quality of service	Reduce forced outage time of individual feeder, 33 and 11 kV feeder	5%	
3) Introduce effective measures for timely completion of ongoing distribution projects and capital works	Capital work completed or Work in progress shall be evaluated by capital work Index (Cwi). Cwi = Capitalized Amount / Approved budget	5%	
4) Improve no light and new connection services	The consumer intimation/work completion record for no light and new consumer service connection shall be maintained and marking shall be done accordingly	5%	
5) Introduce Any branch payment system Introduce/expand Computerized billing system (M-Power Billing System)	Co-ordinate with regional office for initiation and implement it. Introduce in Distribution Center if not implemented previously and expand in branch / sub branch if already existed in Distribution Center.	2.5%	
6) Street light energy consumption is properly accounted and ownership of electricity poles is maintained	Proper accounting of energy consumed by street lights is made and proper accounting of electricity poles used for Telecom, Private Television and Cable operators, Hoarding boards is made	2.5%	
7) Introduce Queue management system at every Distribution center office	All distribution center office (excluding branch/sub-branch) with consumer number above 15,000 shall have Queue management system within this fiscal year.	2.5%	

8) Safety of personnel and equipment	Following safety measures for personnel and equipment are followed strictly. i) Proper safety tools, tackles and shutdown handling procedures are introduced and made aware to employees within 3 months. ii) Earthing rods for HT/LT lines compulsorily used during maintenance. iii) All distribution transformers are phase balanced, loads measured and neutral grounding checked in every six months. All distribution transformers are to be equipped with drop out fuse/MCCB as per transformer rating. iv) The protection and control system of medium voltage substation are to be checked in every six month and substation resistivity is ensured within limits.	1.25*4 = 5%	
9) Enhance the revenue collection	Average collection period (ACP) shall be reduced as specified in the EPR by activities as line disconnection, revenue from black listed consumers etc.	10%	
10) Introduce Data Reporting system(Management Information System)	All record and reports pertaining to the office are prepared and submitted with recommendation to the concerned higher authority as mentioned in prevailing Bylaw or if not mentioned submitted within 15 days of next month.	2.5%	
11) Improve corporate functions within the jurisdiction of Second Party.	The corporate functions are performed efficiently in time.	5%	

- Altogether, 138 performance contracts were signed with the provincial chiefs and distribution center chiefs.
- A monitoring and evaluation mechanism was established, including a committee of three members leading by a Director formed to evaluate the performance as per contract. Performance contracts are evaluated on an annual basis. The evaluation

results go into the personal human resource file and are taken in to consideration for promotion, training and other career advancement opportunities.

8. **Responsibility is taken by management.**

   - Higher management is taking all kinds of pressures from various level while implementing theft reduction activities and encouraging DCS chiefs and staff at the same time. Higher management has advised the DCS chiefs to transfer the pressures to upper level which cannot be handled by themselves while conducting theft reduction activities. Such things have encouraged DCS's and have made them confident to reduce electricity theft.
   - Adaptation of Distribution Activity Information System to monitor the system losses and loss reduction activities on a systematic, regular basis at the center, provincial and local level. All the Distribution center are instructed to carry out necessary loss reduction activities on daily basis and the information should be updated on distribution activity information system weekly. The distribution activity information system includes almost all of the activities run by DCs including loss reduction activities. The major information updated on the system by the respective DCs are number of awareness program ran, number of team movement, number of hooking removed, no of theft controlled and punished, amount of money collected from theft, number of TOD meter downloaded, number of three and single phase meter inspected and resealed etc. The weekly updated information are monitored by provincial and central office.

9. **Local level coordination**

   - Coordination with District Coordination Committee, Municipalities, Rural Municipalities, Ward Offices and Police Department to discourage electricity theft.

10. **Ministry level coordination**

    - Proper coordination with Home Ministry to provide security for the Electricity Theft Control Team of NEA DCS offices.

11. **Mobilization of additional resources for loss reduction activities:**

    - Provision of renting vehicles.

    With the presence of limited vehicles in distribution center, they are already engaged in managing daily no light complains. For non-technical loss reduction activities like

hooking control, it is necessary to mobilize staffs with armed police security mostly in off hours such as mid night, early morning. Hence, additional vehicles are necessary for such job. Due to the allocation of separate vehicles, more effective and efficient loss reduction activities is achieved.

- Outsourcing of additional manpower in contractual basis.

  Sufficient number of manpower are required to run the non-technical loss reduction activities. The manpower of DCs are engaged in daily complain management so they are unable to manage time for loss reduction activities. Outsourcing of additional man power has minimized the problem related to insufficient manpower required for loss reduction activities.

- Allocation of budget in loss reduction activities.

  While allocating the budget for loss reduction activities, certain amount is separated for incentives/allowances to staffs and security personals involved in loss reduction related work. It has significantly increased motivation and regularity for such work.

12. Replacing ACSR conductors with ABC cables:

The Distribution Centers are encouraged to evaluate the Technical and Non-Technical losses in the high loss prone areas, and the tentative cost for implementing loss reduction measures. The DCs are asked to evaluate the tangible and non-tangible benefits of the proposed measures and compare the Benefit-Cost ratio (BCR). Based on this comparison efficient tasks are selected for implementation. Upgradation of conductor in feeder lines and use of ABC cables in non-technical loss prone areas has reduced theft of electricity (like hooking). Due to the implementation measures selected as above, also reduced the cost and expand the scope in many ways.