Power System Losses: Evaluation & Mitigation

Reduction of Technical & Non Technical Losses
Case Study From Bangladesh

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BRIEF INTRODUCTION OF MAIN RESOURCE PERSON

SHAH ZULFIQAR HAIDER, PEng, CEA (USA), MBA

- Garrison Engineer - Military Engineering Services
- Director (Energy Efficiency & Conservation)
- General Manager - Electric Utility

International Speaker/Trainer/Facilitator:
Future Energy, Smart Grid, Energy Efficiency, Renewable Energy, Rural Electrification, Climate Change, Infrastructure etc in

- USA, Belgium, Malaysia, Singapore, Indonesia, Vietnam Morocco, Manila, Nepal, Pakistan, India, Japan etc
BRIEF INTRODUCTION OF MAIN RESOURCE PERSON

SHAH ZULFIQAR HAIDER, PEng, CEA (USA), MBA

- **Life Fellow**: IEB, Bangladesh & Computer Society
- **Member**:
  - World Energy Council
  - Guide Point Global Advisors, USA
  - American Council for an Energy-Efficient Economy
  - International Association of Engineers (IAENG)
  - Global Village Energy Partnership (GVEP), UK etc.

- **International Publications**:
  - Springer, Stanford University, ADB,
  - LEDS Asia, SEC, WEC etc.
BRIEF INTRODUCTION OF SO-AUTHOR

ENGR FAHAD HAIDER

• B.S Engineer, Sydney, Australia
• R & D Engineer - Benelac Pty Ltd, Australia
• Researcher, EMI Consultants
• International Publications on Energy, Renewable Energy, Climate Change, Energy Efficiency
• International Speaker
Loss Reduction vs Savings & Efficiency

- Loss Reduction – Customer no interested
- How to influence them:
- Energy saving was the answer
- A Penny saved is a Penny earned
- Demand Increase at Geometric rate - Supply?
- Environmental issues
- Reduces utility bill & Individual bills
Actions to reduce Technical losses ($I^2R$)

- Power Factor improvement to reduce system loss
- Capacitor Bank & Voltage regulator installation
- Voluntary checking of proper grounding of industries
- Connector installed against twisting
- Line renovated to reduce technical loss
- All three phase meters regularly checked
- Phase balancing / re arrangement of feeder load
Actions to reduce Technical losses (I^2R)

- Old Meter renovated at consumer end
- Overloaded Conductors changed to proper size
- Under loaded/Overloaded Transformer changed
- New sub station to minimize technical loss
- Meter Service drop renovated
- Line maintenance to reduce outage at consumer end
- Prepaid Meters
Actions to Reduce Non-Technical Losses

Action taken to reduce Non Technical losses-1,
Energy saving & Energy Efficiency (Reduce I²R)

- Illegal connection removed
- Mobile Magistrate Court from local administration
- Any illegal consumer bought under billing & metered
- Not running and defective meters changed
- Clearing Right of way of all distribution lines
- Special drive and night operation to resist illegal use
Actions to Reduce Losses

Energy saving & Energy Efficiency (Reduce I^2R)

- 100% Proper Meter reading & bill serve
- Meter report/meter checked regularly
- Solar panel use increased
- Every Sunday “Public hearing day” is going on
- Motivation meeting at school, collage, bazar, Union Council etc regularly
Power Factor

Active and Reactive Power

- Active power (kW): Real power used
- Reactive power (kVAR): Virtual power that determines load/demand
- Utility pays for total power (kVA)

$$kVA = \sqrt{(KW)^2 + (KVAR)^2}$$
Reduce Technical loss by Power Factor Improvement at Consumer end

Lower PF More Loss  Higher PF, Less Loss

\[ P = VI \cos \phi \]

**Transformer Loss:**
- A 1000 kVA Transformer with PF = 95% - 950 kW Output
- A 1000 kVA Transformer with PF = 80% - 800 kW Output
- For 15% Less PF, 150 kW less output or Loss
$P = VI \cos \phi$

Improved voltage reduce $I^2R$

Utility Loss:

For Total Power = 1000 kVA, PF = 80% - 800 kW for Billing
For Total Power = 1000 kVA, PF = 95% - 950 kW for Billing
For PF = 80%, Utility will get 150 kWh less Bill for 1 hour
Voluntary Grounding Checking Service
Ground Loss minimize
Wiring Check & Phase balance

Regular Checking of Industrial Wiring
Leakage Loss, Imbalance Load loss etc minimized
Not Running & Analog Old Meters changed to Digital Meters

3 Phase & Single Phase Meters periodical Checking

All Meters Outdoor
Energy Saving Light use increased at consumer end

Say NO to Incandescent & Inefficient Lamps

Energy Saving Lamps reduce Electric Bill & Losses (reduce $I^2R$)
Tree Cutting or ROW to reduce Losses

Improper ROW increase Loss

Proper ROW decrease Loss/Interruption
Loss Reduction Through Digital Technologies
Mandatory Solar Panel installation for New Connections

Industry/Commercial: 7% upto 50 kW, 10% >50 kW
Only Garments: 5%
Residential > 2kW, 3%
Actions to reduce Technical losses (Reduce $I^2R$)

- Connector installed against twisting
- Line renovated to reduce technical loss
- Phase balancing / re arrangement of feeder load
- Overloaded Conductors changed to proper size
- Under loaded/Overloaded Transformer changed
- New sub station at Load center to minimize technical loss
- Meter Service drop renovated
- Line maintenance to reduce outage at consumer end
- Prepaid Meters
Actions to reduce Technical losses

Action taken to reduce Non Technical losses-1,
Energy saving & Energy Efficiency (Reduce I²R)

- Illegal connection removed
- Mobile Magistrate Court from local administration
- All other illegal consumer under billing metered
- Special drive and night operation to resist illegal use
Actions to reduce losses

Action taken by PBS to reduce losses Energy saving & Energy Efficiency (Reduce I²R)

- 100% Proper Meter reading & bill serve
- Meter report/meter checked regularly
- Every Sunday “Public hearing day” is going on
- Motivation meeting at school, collage, bazar, Union Council etc regularly
### NPBS – SYSTEM LOSS REDUCTION & ENERGY SAVING THROUGH POWER FACTOR IMPROVEMENT (STD PF-90%)

<table>
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<tr>
<th>Month</th>
<th>System Loss %</th>
<th>PBS P.F %</th>
<th>Remarks</th>
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<tbody>
<tr>
<td>Jan 10</td>
<td>12.11</td>
<td>86.89</td>
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<tr>
<td>Jun 10</td>
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<td>Dec 10</td>
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<td>Jun 12</td>
<td>9.47</td>
<td>97.00</td>
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<tr>
<td>Sep 12</td>
<td>9.08</td>
<td>97.00</td>
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</tbody>
</table>
LOSS REDUCTION/EE/ES by GM “Meeting in Narayanganj DC Office attended by MPs, DC, SP, Dept Heads & media”
View of motivation meeting at Union level Baddair bazar Union Parish, Sonargaon
A motivation meeting was held in Sharmin Smriti School, Tarabo by Narayanganj PBS, 10 Nov’2013.
A Loss reduction/Energy Saving motivation meeting held in Sonargaon among the school students conducted by Narayanganj PBS, 09 Nov’ 2013.
MOTIVATION THROUGH PRINT MEDIA
Peak demand June 2010 - 178 MW

In 2010 N’ganj PBS saved - 14 MW *

Connection given till June 2013 - 118 MW

Considering Diversity Factor 0.50 - 59 MW

Peak demand expected 2013 - 237 MW

Actual Peak demand - 220 MW

Energy saved - 17 MW

Savings with DF=0.60 - 29 MW

Program will have a big impact on Electricity saving and Power Quality

* This saving was presented in the Ministry
Thank You for attending the session

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