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 I^2R)

- 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% Proprer 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 Ø

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

Capacitor Banks & Voltage Regulators

P= VI Cos Ø

Improved voltage reduce I^2R

Utility Loss:

For Total Power= 1000 kVA , PF = 8O% - 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

Grounding Checking

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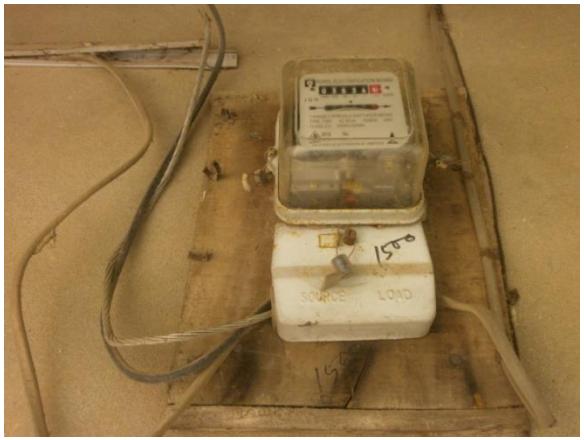
Voluntary Grounding Checking Service
Ground Loss minimize

Wiring Check & Phase balance

Regular Checking of Industrial Wiring

Leakage Loss, Imbalance Load loss etc minimized

Not Running & Analog Old Meters changed to Digital

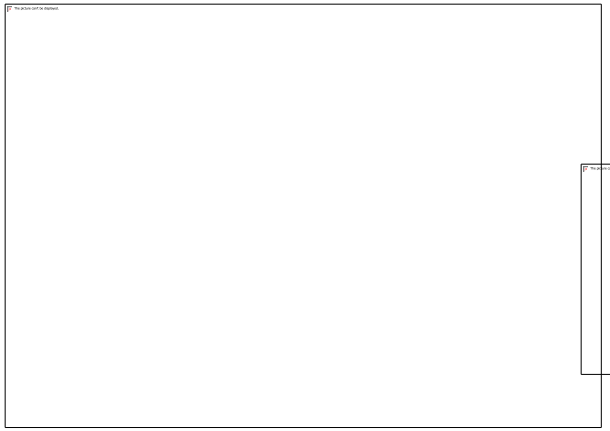


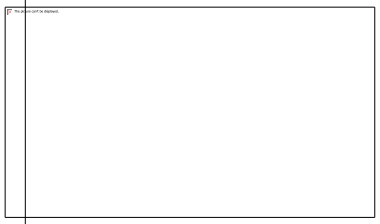
3 Phase & Single Phase Meters periodical Checking

Not

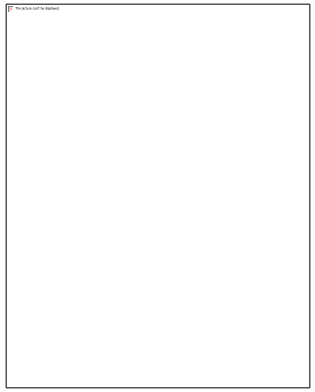
All Meters Outdoor

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

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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 I^2R)

- 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 I^2R)

- **100% Proprer 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%)

Month	System Loss %	PBS P.F %	Remarks
Jan 10	12.11	86.89	
Jun 10	13.08	87.78	
Dec 10	7.42	98.10	
Jun 11	12.21	98.59	
Dec 11	9.56	96.07	
Jun 12	9.47	97.00	
Sep 12	9.08	97.00	

MOTIVATION MEETING IN PICTURES

LOSS REDUCTION/EE/ES by GM “Meeting in Narayanganj DC Office attended by MPs, DC, SP, Dept Heads & media”

ENERGY SAVING MOTIVATION MEETING

View of motivation meeting at Union level Baddair bazar Union Parished, Sonargaon

A motivation meeting was held in Sharmin Smriti School, Tarabo by Narayanganj PBS,10 Nov’2013.

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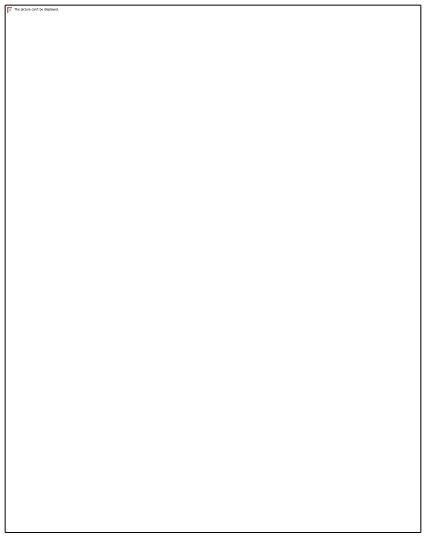
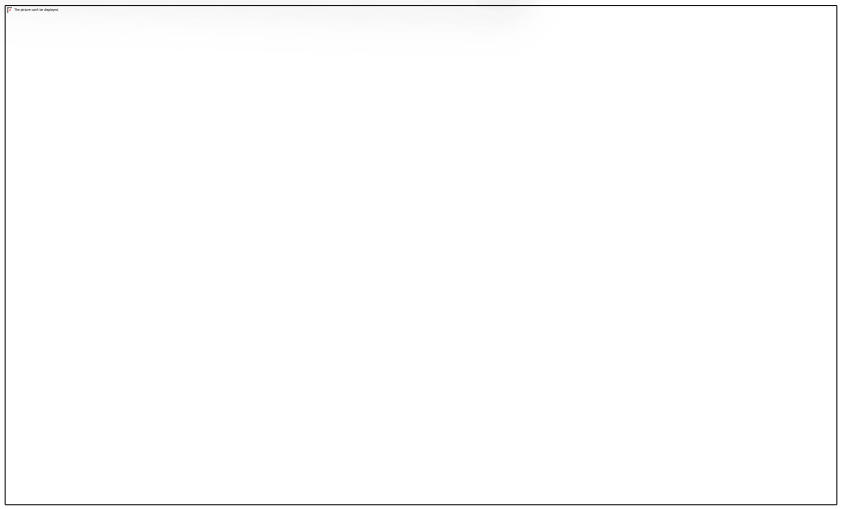
A Loss reduction/Energy Saving motivation meeting held in Sonargaon among the school students conducted by Narayanganj PBS, 09 Nov’ 2013.

MOTIVATION THROUGH PRINT MEDIA





NARAYANGANJ PBS STARTED ENERGY SAVINGS WKS SINCE 2010

- 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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