Indiana Utility Regulatory Commission

Construction, Management and Engineering Practices that Lead to Low Losses

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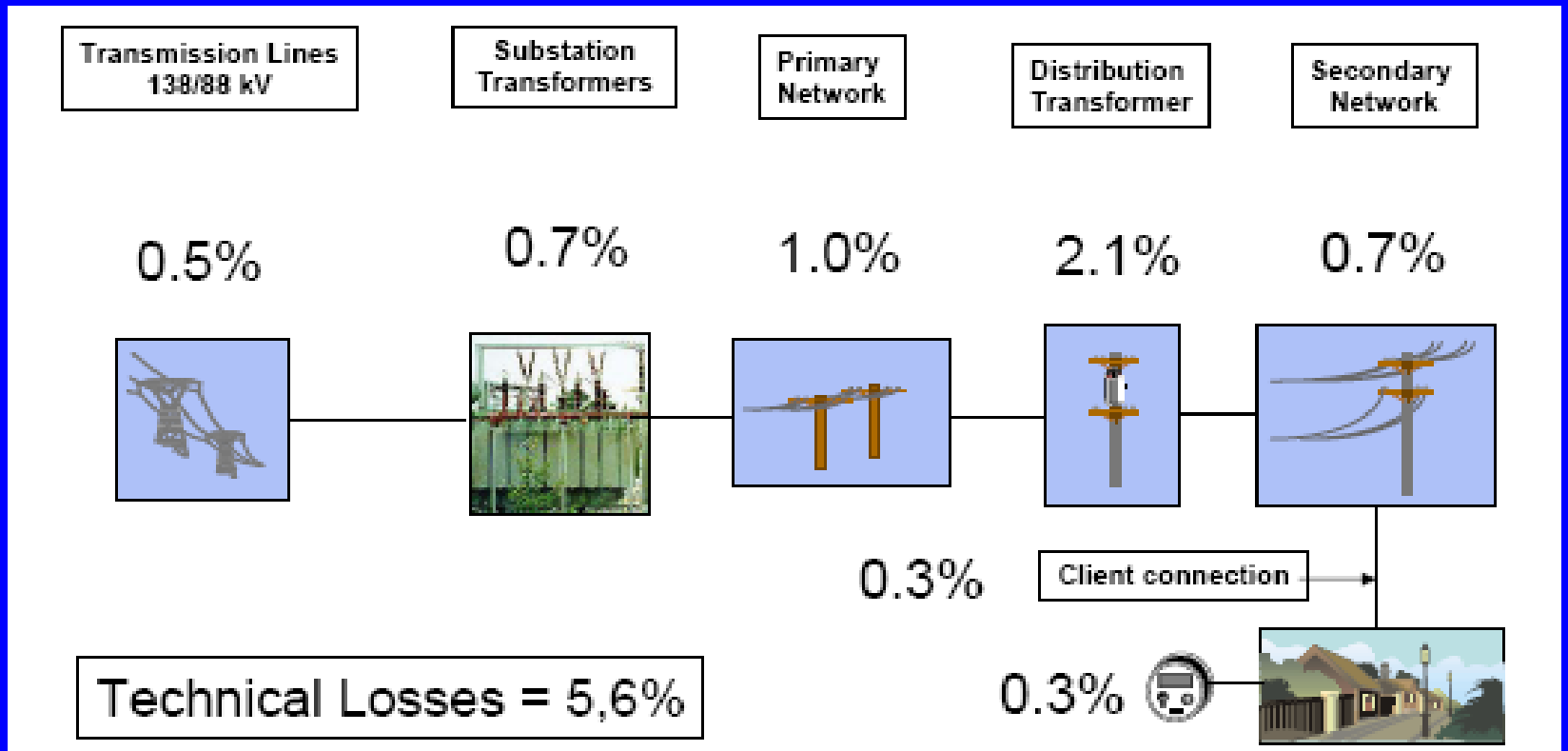
Note

- This presentation is based on the October 6, 2006, presentation in Indianapolis by Al Such of Indianapolis Power and Light

Electric Utility Losses

- Technical (5-6%)
  - Those inherent to transport and operation of the electrical system and that represent costs.
  - Can be optimized to a level which the return on investment becomes profitable.
  - I^2R
- Non-technical (0-1%)

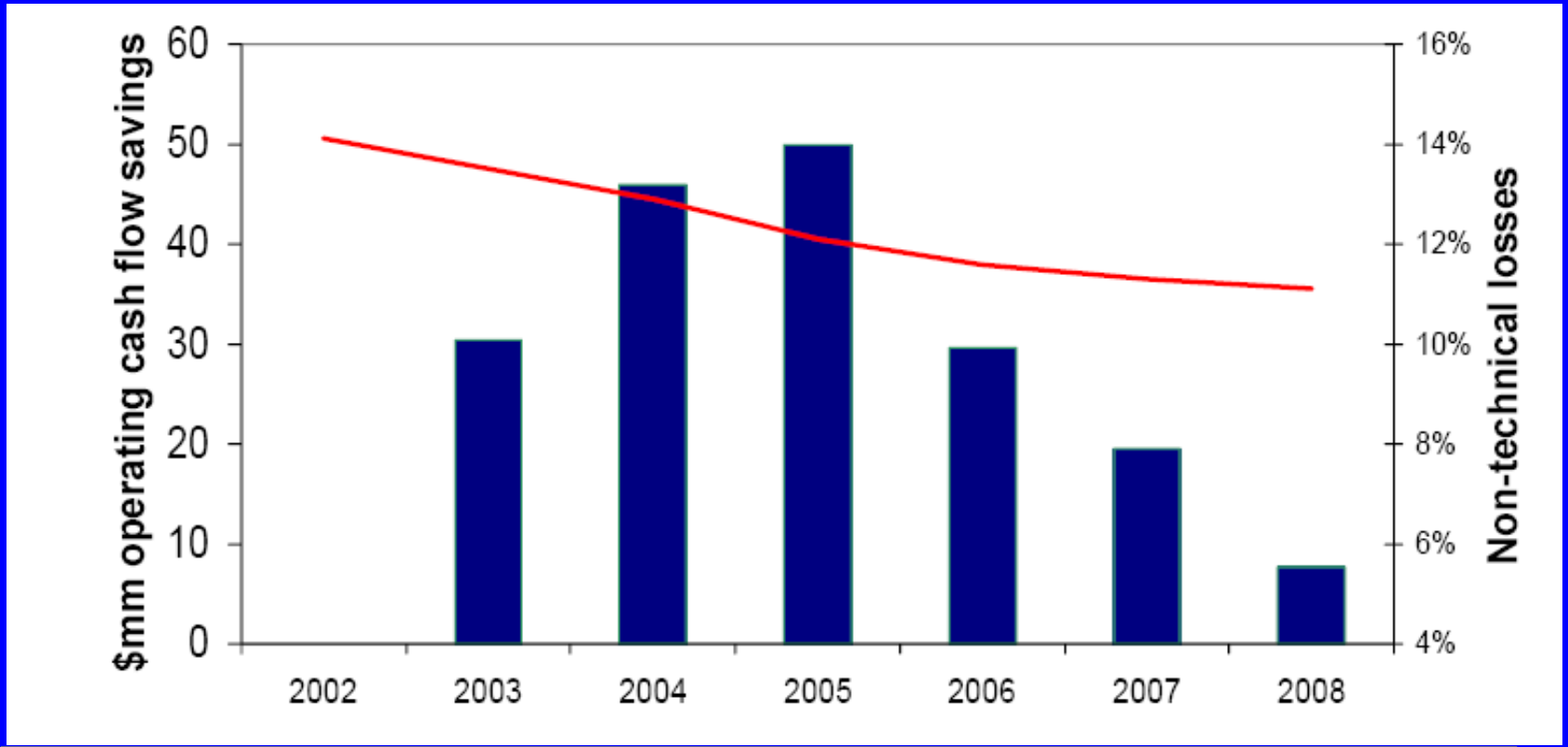
Technical Losses



Non-Technical Losses

- External
  - Frauds
  - Illegal connections
  - Meter tampering
- Internal
  - Administrative
  - Defects on installation
  - Data base errors

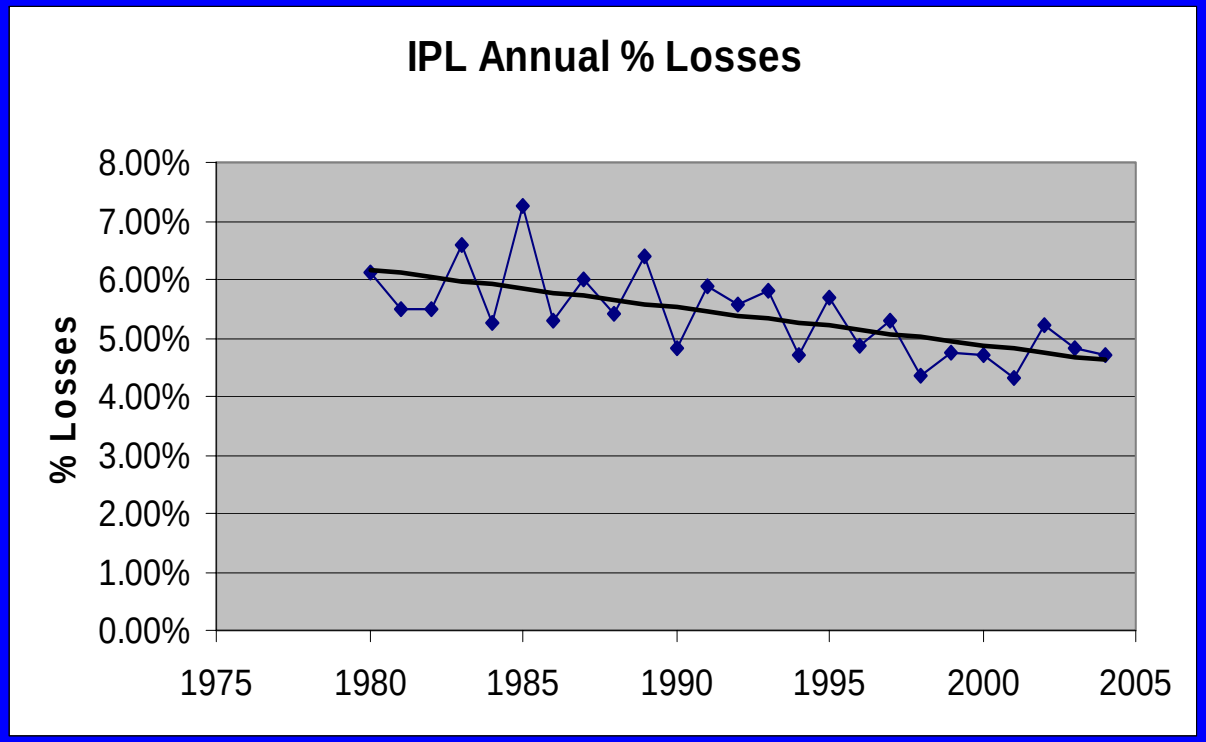
Non-Technical Loss Improvement
Indiana Utility Example



Good Utility Practices

- Construction Standards
- Automatic Meter Reading
- Governmental - Utility Energy Assistance
- Credit Reports
- Credit Guidelines – Proper Risk Management
- Credit Pilot Program – Educate Customers
  - Firm Pay arrangement guidelines consistent with utility policies
- Security Deposits – 2 months
- Delinquent bills are assessed late charges (10% of the first $3 and 3% of remaining)
- Timely Disconnects for Non-Payment
- Disconnect / Reconnect Fees
- Tampering Charges- Unauthorized Reconnect $25 – Damaged Meter $37
- Monitor Arrears Tracking Reports
- Timely Referral to Outside Collection Agencies
- Indiana Utility Regulatory Commission (IURC)

Annual Energy Losses
IPL Loss Reduction History



Annual Technical Energy Losses

COMPONENT	MWH	Percent
GSUs	39.7	5.6
TRANSMISSION	142.7	20.0
138 kV TRANSFORMERS	71.4	10.0
34 kV SUBTRANSMISSION	12.5	1.8
34 kV TRANSFORMERS	16.5	2.3
PRIMARY	158.1	22.2
DISTRIBUTION TRANSFORMERS	244.6	34.3
SECONDARY	27.4	3.8
TOTAL	712.9	100.0
NET SYSTEM LOAD	13,328	
% ENERGY LOSS	5.35%	

Technical Loss Reduction
Transformer Losses

- Purchasing practice
  - **Transformer specifications include cost of losses.**
  - **Manufacturer quotes guaranteed loss.**
  - **Determine total owning costs.**
- Cost of Losses
  - **Determine capitalized cost of core losses**
    - Demand charge (T&D capacity cost)
    - Energy charge
      - PV of Off-Peak Market Price * Core Loss Factor
  - **Determine capitalized cost of copper losses**
    - Demand charge
      - T&D capacity cost * Peak Responsibility Factor
    - Energy charge
      - PV of Peak Market Price * Copper Loss Factor

Technical Loss Reduction
Voltage Regulation

- Losses are indirectly reduced through voltage regulation efforts
  - Generation – VAR control
  - Transmission
    - 138 kV 100 MVAR Capacitor bank - .5MW reduction
    - Seasonal auto-transformer tap changes
    - 34 kV capacitor bank control
  - Distribution
    - ULTC
    - 13.8 kV Capacitor banks

Technical Loss Reduction
Misc. Reduction Activities

- Conversion of 4.1 kV to 13.8 kV
  - Beginning in 1973, IPL began a conversion from 4.1kV to 13.8 kV to eliminate an antiquated and overloaded distribution system.
- Balancing Distribution Circuits
  - Losses are indirectly reduced by balancing three phase circuits.
- Distribution Circuit Configuration
  - Reconfiguring primary circuits for optimum voltage and load operation indirectly reduces losses.

Technical Loss Reduction
Misc. Activities

- Tariffs
  - Industrial rates structured to encourage customers to smooth demand.
  - Industrial rates include power factor correction incentives

Non-Technical Loss Reduction Revenue Protection

- Internally Generated Losses
  - Revenue Management
    - Prevent errors in billing etc.
    - Prevent fraud by personnel
  - Fieldwork at the Meter
    - Prevent errors by field personnel
    - Prevent fraud by field personnel
    - Improve fieldwork processes

Non-Technical Loss Reduction Revenue Protection

- Revenue Management
  - Read meter
  - Process Bill
  - Process Payment
  - Collection Follow-up

Non-Technical Loss Reduction Revenue Protection

- Fieldwork at the Meter (personnel at the customer interface)
  - New Customer Connection
  - Metering
  - Revenue Protection
  - Customer Maintenance
  - Disconnect / Reconnect

Non-Technical Loss Reduction Revenue Protection

Meter Testing Objectives

- Determine Optimal Recalibration Cycle
- Determine Optimal Replacement Cycle
- Evaluate Metering Technology by Customer Type

- Validation of Meter Readings
  - Re-read meter if an anomaly is detected
  - Inspect Meter and Connection
  - Check Customer History
  - Record Observations
  - Move to Next Meter

Meter Reading and Billing System

- On an ongoing basis the meter reader is the first point of contact with potential defrauding customers. Meter readers should, therefore, be an integral part in the prevention of losses. Meter readers themselves have limited capacity to conduct fraud inspections. Time constraints and lack of training allow them to detect only the most obvious frauds; however mobile data terminals (handheld data recording devices) enable detection of both malfunctioning meters and some forms of customer fraud.

Meter Reading Process

- A formalized process of meter reading should be developed to incorporate error checking and losses and fraud detection. For example, the meter reader should:
  - Locate the client's address and the meter to be read.
  - If the meter cannot be located, record an anomaly on the terminal using the appropriate anomaly code
  - If the meter can be located, verify the condition of the meter, including evidence of tampering, direct connection and safety infractions. Any suspected fraud should also be entered on the mobile data terminal
  - Before reading, validate the tariff via information included in the mobile terminal
  - Confirm that the meter's identification number conforms to the identification number contained in the terminal
  - Record and verify the meter reading on the mobile data terminal
  - If the terminal emits an alarm, verify the reading and enter the data on the terminal. The alarm should sound if:
    - the consumption is outside the normal range for the customer's usage profile,
    - significant increase or decrease in consumption over the previous read or average of a number of previous months
    - there is zero consumption
  - Record all unread meters and all meters that could not be located.
  - The terminal should reconstruct a reading route for all unread and un-located meters.
  - Submit the mobile data terminals to billing staff

Non-Technical Loss Reduction Revenue Protection

Externally Generated Losses

- Defrauding Customers
  - Identify high loss high value system elements through energy balancing
  - Identify potential defrauding customers through data mining
- Illegal Consumers
  - Develop antitheft network to limit access and illegal connection
  - Develop metering strategy to minimize cost of billing and collections
  - Secure regulatory agreement to recover investment and operating cost

Interrogation of Databases

- Data mining, as with energy balancing described above, is concerned with energy theft detection. Like working with mobile data terminals, data interrogation may be regarded as a work identification sub-process of Fraud Inspection Work Management. In the case of energy balancing, high value, high loss *locations* are identified, so that loss reduction efforts may be geographically focused. Data mining is a complementary approach, in which potential defrauding *customers* are identified. Data mining is more of a laser-strike than a blitz.

Data Interrogation Process

- Select Customer Characteristics and Run Queries
- Select Promising Queries
- Perform Inspections and Record Results
- Analyze Results and Measure Success
- Retain and Improve Successful Strategies

Construction, Management and Engineering Practices that Lead to Low Losses

- Discussion
- Questions