Reducing Electric System Losses

NYS DPS Technical Conference

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Q1: How Do Electric Companies and the ISO Define "System Losses?"

- Central Hudson defines "Electric System Losses" for its own territory as the difference between Outputs (MWHrs) and Sales (MWHrs).
- Outputs are all system receipts (purchases made on behalf of full service customers, receipt of energy for delivery to retail access customers, and internal generation).
- Sales are metered usage (full service sales and retail access deliveries).

Q2: What Is the Current Level of Losses on the Electric T&D System?

- Central Hudson’s current percent loss is 4.03%.

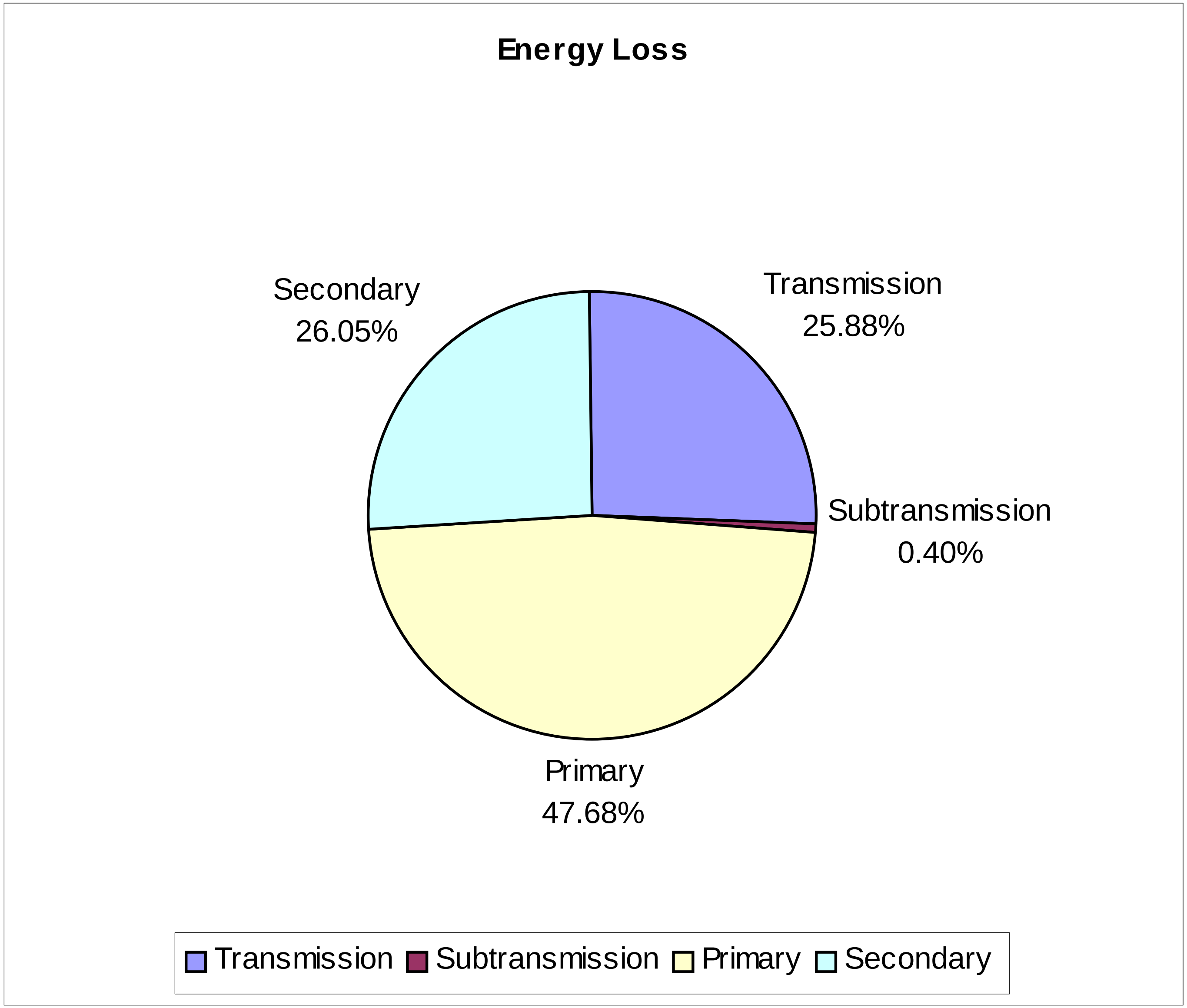
Q3: What Are the Sources of the Losses?

- Losses are present in all lines and transformers
- These losses are a function of the physical parameters of the lines and transformers and the loading
- Line losses can be calculated by I^2R
- Transformer losses include a load component (copper losses) and a no-load component (core losses)

Q4: Provide a Breakdown of the Information According to Specific Source, And/or Type of Equipment at All System Levels

- Central Hudson's last load loss analysis was performed in 1999/2000 on 1998 system data. The following chart provides a breakdown of the losses in 1998.

Q4 Continued



Q5: How are loss levels determined?

- Leaf 104 (General Information Section 29)
  - **Factor of Adjustment:** is used to adjust certain costs for lost and unaccounted for kilowatthours. The factor of adjustment shall be set at 1.0420 and will be determined in each Company rate case.
- The current percent loss is 4.03% (based on calendar years 2003, 2004 and 2005). This is calculated based on a ratio of output and sales over a three-year period. The outputs are all system receipts (purchases made on behalf of full service customers, receipt of energy for delivery to retail access customers, and internal generation). The sales are metered usage (full service sales and retail access deliveries). This percentage is used to calculate the Factor of Adjustment.

Q6: What is the company’s philosophy on power factor correction for the system?

- Central Hudson’s Policy is to install capacitors as close to the VAR load as possible. In order of preference; (1) on the distribution circuits, (2) on the distribution buses in substations, and (3) on the transmission buses in substations
- Central Hudson’s policy is to correct power factor on typical distribution circuits to100% on peak.

Q7: Provide Data on Your System Power Factor. At What Time Intervals and Voltage Levels (I.E. Bulk Transmission, Local Transmission, Sub-transmission, and Distribution) Is This Data Recorded? At What Locations Is It Recorded?

Year	Peak MW	System pf
2007	1185	.981
2006	1295	.966
2005	1204	.975
2004	1051	.978
2003	1074	.975
2002	1125	.920

Q7 Continued

- Central Hudson annually performs a Summer and Winter System Power Factor Review.
- Metered system values are recorded at the system peak load value.
- The Power Factor Review is on the non-bulk system. Meter locations for bulk power system inputs are either the highside of the 345/115 kV transformers or compensated to the highside of these transformers.

Q8: What level of reactive compensation currently exists on each of the bulk transmission, local transmission, sub-transmission and distribution systems at peak and off-peak load levels How much reactive flow in terms of MVARs flows down from the higher-level system)?

Q8 Continued

- Installed capacitors

Source	**MVAr**
345 kV	270.0
115-13.8 kV	170.6
Distribution	352.0
Total	792.6

Q8 Continued

- Example: Summer 2007 Peak Load Flow

Source	**MW**	**MVAr**	**pf**
345 kV	710.1	408.2	
115&69 kV	-0.1	-188.8	
Generation	461.6	9.2	
Total	1171.6	228.6	0.981

Q9: What are the annual costs for reactive power compensation for each of the bulk transmission, local transmission, sub-transmission and distribution systems?

Voltage Level	Gross Plant	Net Plant	Carrying Charge
345 kV	$4,251,996	$2,833,713	$564,240
115 kV – 13.8 kV Substation	2,280,769	1,606,263	302,658
Distribution	1,416,155	1,020,882	249,527
Total	$7,948,920	$5,460,858	$1,116,425

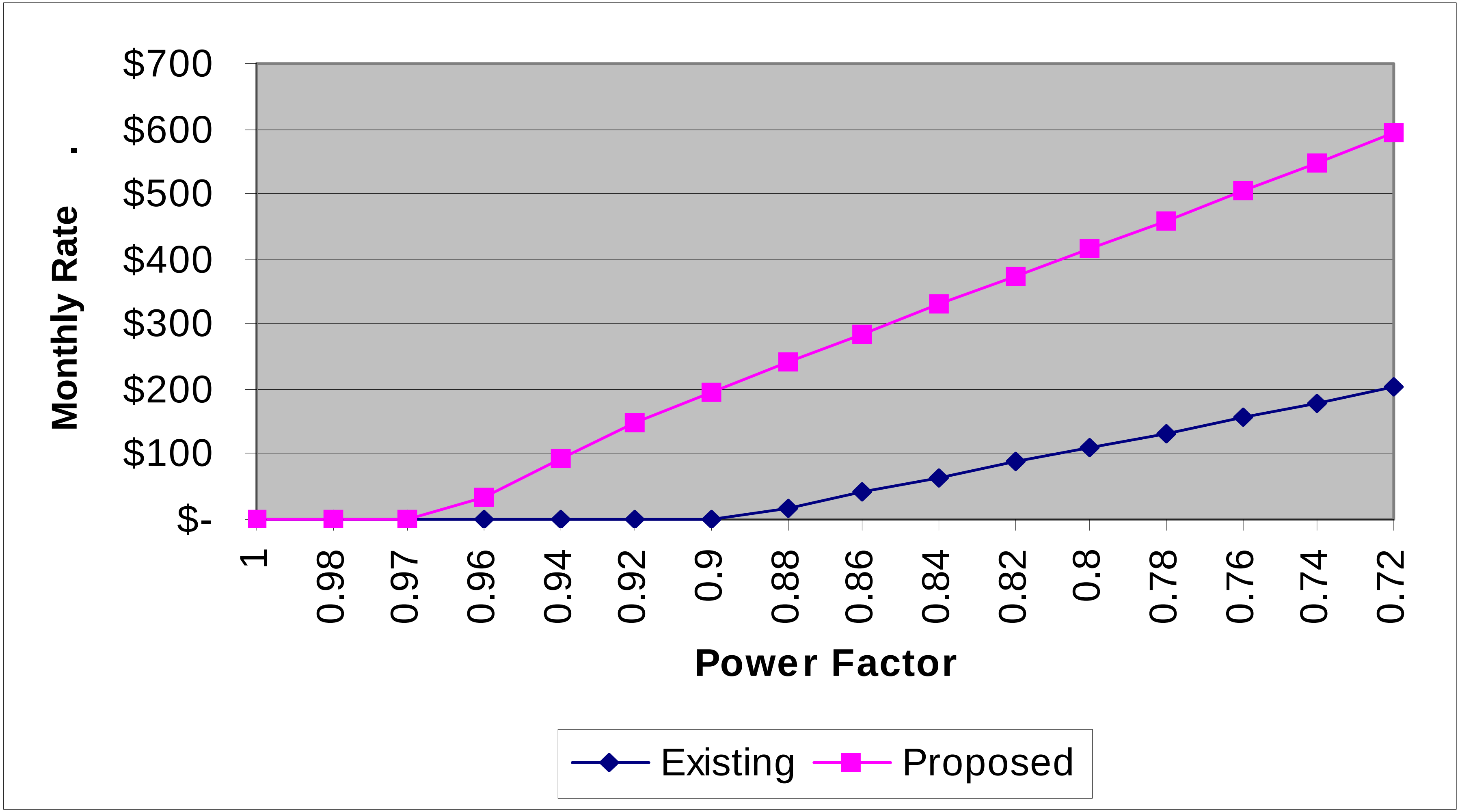
Q10: What issues do utilities, the ISO and other electric companies face relating to the metering and billing for bulk transmission losses between the ISO and transmission owners?

- Central Hudson has no issues related to bulk transmission losses
- The Central Hudson owned bulk power system facilities are wholly included in the Central Hudson sub-zone, and thus losses are included in the Central Hudson local calculation.

Q11: What provisions are currently in tariffs related to power factor requirements and associated charges?

- Current Tariff Language
  - Leaf 185, 246 and 246.1
    - Reactive Demand Charge per Rkva = $0.44
  - Leaf 186.1 and 248
    - Determination of Demand: The Reactive Demand will be the highest 15-minute integrated kilovoltamperes of lagging reactive demand established during the month less **one-half** of the highest 15 minute integrated kilowatt demand established during that month.
- Proposed Tariff Language
  - Proposed: RkVA = $0.83, less "**one-quarter**" kW demand

Q11 Continued



Q12: How are the costs related to system losses currently recovered? Specify how system losses are reflected in rate design and revenue requirements.

- Leaf 104
  - The Market Price Charge (MPC) is designed to recover the cost of providing electric power supply to full service delivery customers.
- Leaf 105
  - The total MPC for each MPC Group, as so determined, will be divided by an estimate of billed sales for each MPC Group to determine the MPC factor.

Q12 Continued

- Leaf 253
  - For customers who are taking **transmission service** and who are leasing substation equipment from the Company, measured billing units will be multiplied by 1.004 to recover demand and energy losses in the transformation system.

Q12 Continued

- Leaf 184.2 (SC2), Leaf 202.2 (SC3), Leaf 267.2 (SC13)
  - **Hourly Pricing Provision**: For each billing period, the customer's total energy supply cost will be calculated as the sum of: (1) the hourly DAM multiplied by the customer's hourly measured loads, adjusted by the Factor of Adjustment set forth in General Information Section 29, and …

Q12 Continued

- Leaf 130
  - For delivery service under the **Retail Access Program**, the Company agrees to deliver to the Retail Supplier’s customers, energy, less losses as defined in General Information Section 29, received at an agreed upon receipt point in the state of New York (Central Hudson tie point)…

Q13: How are system losses currently considered in planning and operations (including the design and specification of equipment) for both the transmission and distribution systems?

- Planning
  - Transformer Loss Evaluation
    - A Factor (core losses) = Annual levelized cost of no load losses
    - B Factor (load, copper losses) = Annual levelized cost of load loss
    - Evaluated Transformer Cost = Bid Cost + (A x NL) + (B x LL)
    - Applied to both substation and distribution transformers
    - For 2008, A = $6.97/W and B = $1.64/W
  - Economic wire size evaluation
    - Total Life Cycle Cost includes present worth of Annual Loss Costs
- Operations
  - Substation capacitor bank switching is primarily performed for maintaining system voltage within limits.

Q14: What procedures and/or programs do you have in place (or are planning to have in place) to set budget priorities, construct capital projects and/or change operations to specifically help reduce electrical system losses?

- Central Hudson performs an annual study and prepares a report on System Power Factor
  - This report provides recommendations for additional capacitor bank installations consistent with policies on power factor correction.
  - Central Hudson currently has a program to install distribution capacitor banks as recommended in the report.
  - Starting to utilize switched distribution capacitor banks to avoid overcompensation on light load.
- Central Hudson has no procedures and/or programs in place that specifically target reductions in system losses. Losses are considered in the following:
  - Transformer purchase decisions, i.e. loss evaluations
  - Distribution conductor sizing

Q15: What studies have been performed on installing capacitors at the customer meter, or on any other customer-based loss-reduction or power-factor correcting measures? Describe.

- Industrial Customer Example #1
  - Customer served from customer owned 115 kV transmission substation
  - Customer identified planned load increase
  - Post contingency voltage issue identified
  - Customer funded project to increase 13.2 kV capacitor bank size from 23.5 MVAr to 68 MVAr
  - Project will also reduce customer losses
- Industrial Customer Example #2
  - Customer served from distribution circuit
  - Customer currently has a poor power factor (0.80)
  - Customer identified power quality issue with voltage sags
  - Customer owned capacitor bank identified
  - Proposed Reactive Demand Charge reduces payback period from 10 years to 3.5 years

Q16: If you believe additional information would be useful to set the stage for this proceeding, please include it in your presentation.

- 7/15/2008 NYISO Press Release on 2008 Comprehensive Reliability Plan stated that "New York must maintain and enhance an aging bulk power system."
  - There is an opportunity to reduce losses on the bulk power system. Much of the Bulk Power System is old and conductors may be undersized based on today's increased focus on economic transfers. Additionally, usage to support renewables, which are generally sited remote from load, will tend to incur greater losses.
- EPRI "Green Circuits" Program
  - Central Hudson attended the Northeast Workshop (December 2007)
- EPRI Survey on Transmission System Loss Evaluation and Reduction (deadline July 21, 2008)

Q16 Continued

- Line Losses Working Group (Fall 2007)
  - Developed draft study objective and methodology
  - Identified potential line loss reduction methodologies for evaluation
    - Upgrade to higher voltages (lower current, reduced I^2R losses)
      - Distribution (i.e. 34.5kV versus 13.8kV)
      - Transmission (i.e. 765kV versus 345kV)
    - Increase in wire size (lower resistance, reduced I^2R losses)
    - Transformer design
      - Effect of DOE transformer specification, increased efficiency requirements at higher rated capacity
      - Use of amorphous core transformers
    - Transformer size management
      - Minimizing of load and no-load losses in size selection

Q16 Continued

- Line Losses Working Group (Fall 2007)
  - Power transformer tap selection (impact on load losses and no-load losses)
  - Circuit/Substation load balancing (reduced I^2R for same VA)
  - Fixed capacitor power factor correction (decreased VAR flow from system)
    - Load-side versus source-side of meter
    - Transmission / distribution
  - Switched capacitor power factor correction
  - Smart grid / AMI technology (improved system operating data)
    - Optimized transformer size management
    - Optimized circuit load balancing
    - Actively managed VAR flow

Q16 Continued

- Line Losses Working Group (Fall 2007)
  - Rates
    - Poor power factor penalties (decrease VAR flow at the end user)
    - Time of use / real time pricing (improve load factor, reduced transformer sizing, reduced no-load losses)
    - Interruptible loads
  - Distributed generation
    - Impact of various levels of penetration
    - Load-side versus source-side of meter
    - Solar versus wind (peak coincident versus non coincident)
    - Voltage / VAR support capabilities
  - Generation siting (Article X)
    - Reduction of cross state transfers
  - Least losses dispatch
  - Conservation voltage reduction