Reducing Electric System Losses

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Technical Conference to Identify the Sources of Electric System Losses and the Means of Reducing Them
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Reducing Electric System Losses

- **Four Goals of the Conference**
  - *Quantify current level of losses in the system and cost of the losses*
  - *Identify sources of losses and quantity for each source*
  - *How losses are currently considered in operations and planning*
  - *Current tariff provisions regarding power factor requirements and charges*

The NYISO Will Address...

- Sources of Losses, and Correction (Compensation) of Losses
- Current Level of Losses on the Bulk Electric System
- The Dispatch of Reactive Resources
- OPF Technology in the Context of Losses
- Status of the Reactive Power Working Group
- Issues Related to the Metering and Billing for Bulk Electric System Losses

Compensation Issues

- **Distribution Compensation**
  - *At the distribution bus*
  - *The substation transformer reactive losses on the low side distribution bus*
  - *Mostly using capacitors on the lines or at primarily substations (thus forgoing any loss improvement on the distribution circuits)*
  - *Control methods vary - use capacitors on time clocks (that incorporate day of week as week) or radio controlled from the dispatch center*
- **Transmission Compensation**
  - *Transmission voltage constraints dictate where comp. is needed*
  - *System operations optimization*
    - Loss minimization, stability improvement, transfer capability improvement

Distribution Compensation

0.8 Lagging Load Power Factor

- **Total Peak Losses**
  - *143 kW / 489 kVAR*
  - *(10 kW of 143 kW in sub transformer)*
- **Annual Energy Loss**
  - *113 MWhr of a total of annual 4,415 MWhr energy delivered to loads*
  - *2.55% losses as a percent of delivered power*

0.9 Lagging Load Power Factor

- **Total Peak Losses**
  - *109 kW / 373 kVAR*
  - *(8 kW of 109 kW in sub transformer)*
- **Annual Energy Loss**
  - *86 MWhr of a total of annual 4,415 MWhr energy delivered to loads*
  - *1.95% losses as a percent of delivered power*

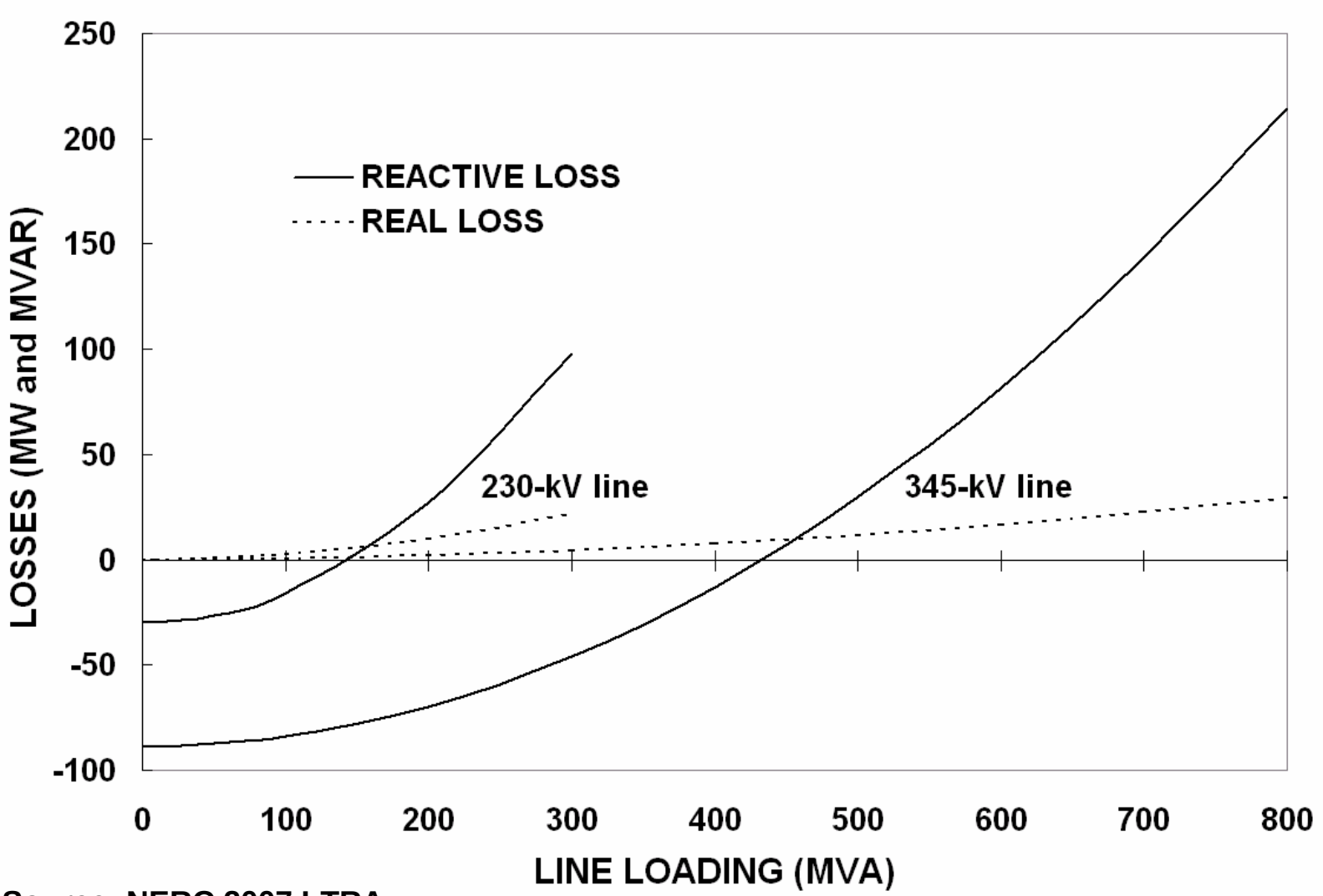
Unity Load Power Factor

- **Total Peak Losses**
  - *84 kW / 284 kVAR*
  - *(6 kW of 84 kW in sub transformer)*
- **Annual Energy Loss**
  - *66 MWhr of a total of annual 4,415 MWhr energy delivered to loads*
  - *1.50% losses as a percent of delivered power*

Comments (*all scenarios*):

- **Correction of load power factor to unity is possible but technically challenging**
- **Any correction would need to be partially switchable to reflect circuit load to maintain (approximate) power factor**

Transmission Line Losses



Source: NERC 2007 LTRA

Measuring Electric System Losses

- **Bulk Power System Losses**
  - *Seasonal and On/Off Peak (MW)*

Season	On-Peak *6 AM - 6 PM*	Off-Peak *6 PM - 6 AM*
Winter	538	482
Spring	509	433
Summer	509	453
Fall	456	411

All-time maximum losses - 828 MW

Losses in Operations and Planning

- **SCUC/SCED Considers Losses in its Real Power Dispatch**
  - ***Reactive Power Resources Subsequently Dispatched***
    - Static and Dynamic
  - ***ISO Directs TOs for Desired Voltage***
    - TOs set static devices, transformer taps, and direct generators
  - ***Optimum Power Flow***
    - Theoretically could help further reduce losses, but:
      - Impractical in Real Time
      - Technically challenging (e.g. execution time, no reactive power market design, need to balance BPS vs. sub-transmission/distribution)

Measuring Electric System Losses

- **Improved BPS/Wholesale Metering Will Improve Loss Calculations**
  - *ISO-TO Agreement Requires Revenue Grade Metering*
    - Work Group established to address detailed requirements
  - *Less Deviation Between Sub-zonal Loads and Retail Aggregation*
  - *Unaccounted For Energy (UFE) Allocated to Retail Customers*
    - Currently under discussion between LSEs and regulators
- **Smart Grid Technology**
  - *Phasor Measurement Units (PMUs)*
    - Dynamic Analyses and Improved State Estimation
    - Improved Management of Reactive Power
    - Improved Transfer Capability

Reactive Power Working Group

- **Focus Areas of Reactive Power Working Group (RPWG)**
- **NYISO Proposed Reactive Power Criteria in 2004**
- **2006 FERC Order**
- **Ongoing RWPG Work**

NEW YORK INDEPENDENT SYSTEM OPERATOR

The New York Independent System Operator (NYISO) is a not-for-profit corporation that began operations in 1999. The NYISO operates New York's bulk electricity grid, administers the state's wholesale electricity markets, and provides comprehensive reliability planning for the state's bulk electricity system.

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