

Need for the 345 kV Loop

- Without the 345 kV Loop:
 - Bulk system reliability criteria cannot be met
 - Cascading blackouts could occur
 - System operators will need to resort to "pre-cautionary" load shedding to maintain overall grid stability

Inefficiency Costs of Existing Transmission System

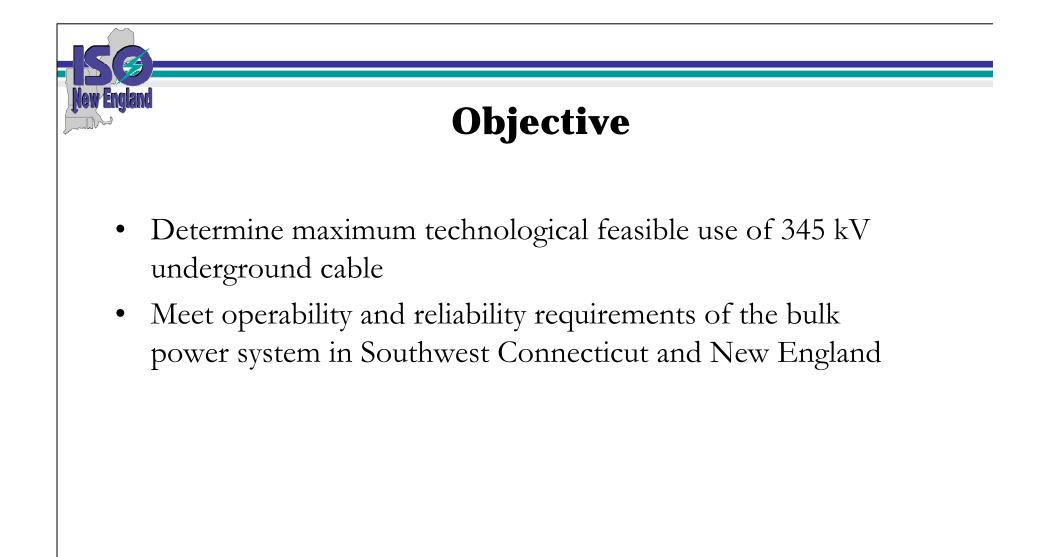
• Estimated annual inefficiency costs for Connecticut (2005)

 RMR Agreements: 	\$240 Million*
– GAP RFP:	\$33 Million
– Congestion:	\$4 Million
 Running uneconomic generators: 	\$31 Million
– Total:	\$308 Million

* Includes agreements in effect and pending

Reliability and Operability Committee

- Committee Members:
 - ISO New England
 - Project Applicants: Connecticut Light and Power and United Illuminating
- Process:
 - ROC established: June 2004
 - Interim Reports: August 16, October 8
 - Final Report: December 20



Scope of Investigation

- An unprecedented amount of technical study conducted on this project due to:
 - Extreme weakness of the Southwest Connecticut system
 - Immediate and pending need for transmission upgrades
- Exhaustive technical analysis conducted
 - Harmonic frequency scans
 - Dynamic voltage analysis
- Multiple lengths of underground cable evaluated

Methods of Investigation World-wide experts employed GE, PB Power, Shawnee Power, EnerNex, Teshmont, ABB, EPRI Solutions, and K & R Consulting Consulting team designed to work in parallel fashion Engineers and consultants worked thousands of hours to complete necessary studies

- Provide review of each others' work
- Expedite study completion

General Findings

- As the length of underground cable increases, so do the variables that must be considered
 - Studies show high sensitivity to load levels, load types, amount of capacitance, etc.
 - Highly volatile and unpredictable results demonstrated
 - Operating in this manner is unprecedented world-wide
- Weakness of the Southwest Connecticut system limits the amount of underground cable that can be used
 - Voltage peaks/durations adversely impact existing system equipment
 - Ability to install new substation capacitor banks to solve local area problems

General Findings, cont.

- ROC has identified solutions that will work:
 - 4 linear miles of underground cable
 - 13 linear miles of underground cable
 - 24 linear miles of underground cable <u>if mitigating measures</u> <u>employed</u>
 - Substitute cable type (XLPE for HPFF) to reduce capacitance and harmonic effects
 - Extensive replacement of substation surge arresters and utilization of higher voltage rated equipment (circuit breakers rated 400 kV rather than 345 kV)
- Maximum use of 345 kV underground cable: 24 linear miles

Other Studies and Determinations

• KEMA

- KEMA report in October suggested use of C-Type filters to mitigate harmonics issues and add undergrounding
- Suggested further study to verify results
- ROC conducted further study and determined C-Type filters help in some cases and hurt in others
- KEMA approach would not be technologically feasible solution to add 345 kV underground cable

Other Studies and Determinations, cont.

- ABB
 - ABB proposed direct current (DC) project to be embedded in an alternating current (AC) system
 - ROC determined ABB approach would:
 - Not mitigate Southwest Connecticut reliability issues
 - Be a high risk, first of its kind multi-terminal "network" DC application
 - Result in unacceptable complexity
 - Cost nearly double and would be less likely to get any support for regional cost recovery
- The reasons above apply to the multi-terminal installation
 - Another option was for a less complex installation but it did not meet the project objectives

