Appendix G

TEAC 13 Presentation: December 5, 2002

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TEAC13

December 5, 2002

Institute of Technology and Business Development

New Britain, Connecticut

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TEAC13 Agenda

- Welcoming Remarks
- RTEP Overview
- Southwest Connecticut Reliability Study
  - Study Objectives
  - Current Status
  - 345 kV Loop
  - 345/115 kV Alternative
- LRP03
- Assessment Connecticut Resources
- Connecticut Projects Status

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RTEP Overview

Mike Henderson

ISO-New Englandz

Director System Planning

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RTEP
As Approved by FERC

Is	Is Not
System Assessment	Market Design
Facilitator for Market Responses (Generation, Demand Response, Merchant Transmission)	Determination of Market Potential
Considerate of Environmental Issues	Environmental Externalities Study
Transmission Plan	Traditional IRP

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RTEP

- Stakeholder Involvement
- Resource Reliability Analysis
- Transmission Congestion Analysis
- Transmission Network Analysis
- Develop Solutions

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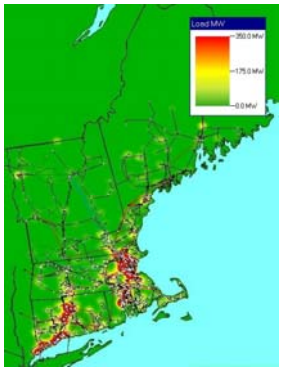

2006 Summer Peak - New England Load Density

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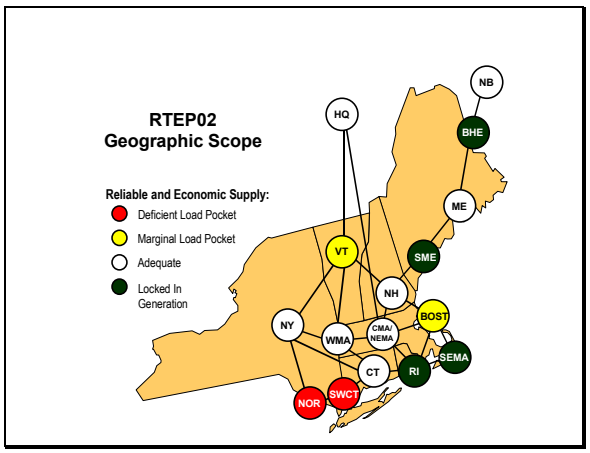

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RTEP02 Findings

- SWCT and Norwalk
  - Short-term improvements – big benefits
  - Further transmission improvements are necessary
  - Stopgap DSM and LRP
- Resource Adequacy
  - Meets LOLE requirements until 2011
    BUT
  - Retirements could quickly change the results
- Congestion
  - Driven by SWCT and Norwalk
  - Highly variable with load levels and generator outages

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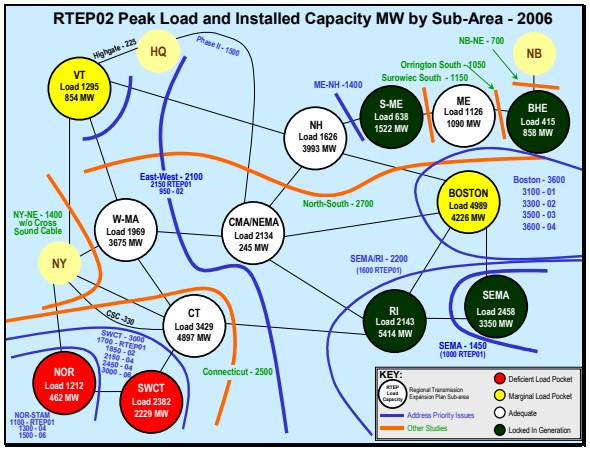

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Summary

- RTEP meets the requirements of the NEPOOL Tariff.
- Continue monitoring market responses and modify plan accordingly.
- Seek stakeholder input through TEAC.
  - Submit comments and request for information to TEACMATTERS@iso-ne.com
- The plan is comprehensive.
- The process is continuous.
- The RTEP02 Approved Report and Appendices can be downloaded from:

http://www.iso-ne.com/transmission/Regional_Transmission_Expansion_Plan/RTEP02/

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SWCT/NOR Improvements

- Pursue additional Distributed Resource options in the near term while at the same time proceeding with the short and long-term transmission upgrades that will improve reliability and will alleviate potential economic congestion costs in the SWCT and NOR sub-areas.

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SWCT/NOR Improvements (cont.)

- Long Mountain breakers and capacitors at the Rocky River and Stony Hill substations (work completed)
- Upgrade of overstressed circuit breakers in the Norwalk-Stamford area
- Glenbrook Statcom
- SWCT 345 kV Phases I and II

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Southwest Connecticut Reliability Study

December 5, 2002

Rich Kowalski, ISO-New England

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- Recap of RTEP02 CT Studies
- SWCT Electric Reliability Study
  - Final SWCT Power Flow, Voltage, Short Circuit Analysis on 345kV Plan (345kV Loop)
  - Remaining Analyses
- Comparison – 345kV Loop versus 345kV/2-115kV Plan
- Other Alternatives

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RTEP02 Findings

- **SWCT and Norwalk**
  - **Short-term improvements – big benefits**
  - **Transmission facilities are inadequate**
  - **Stopgap DSM and LRP**
- **Resource Adequacy**
  - **Meets LOLE requirements until 2011**
    - **Doesn't Account for Myriad SWCT Internal Problems**
  - **Retirements could quickly change the results**
- **Congestion**
  - **Driven by SWCT and Norwalk**
  - **Highly variable with load levels and generator outages**

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SWCT Electric Reliability Study Objectives

- **Formulate a long-term transmission solution for Southwestern Connecticut that**
  - **Satisfies reliability criteria**
    - **Eliminates operating difficulties**
    - **Eliminates first contingency (including double circuit) overloads**
    - **Eliminates threat of voltage collapse**
  - **Mitigates congestion by increasing SWCT and Nor-Stam transfer limits**

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SWCT Electric Reliability Study Objectives - continued

•Provides the base transmission infrastructure to support additional generation expansion and retirements
•Eliminates short circuit restrictions
•Eliminates conditional dependence of generator operation
•Provides an operable system during construction periods
•Allows increased bi-directional transfer capability to other areas

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SWCT Electric Reliability Study Interim Report

- **Interim Report - Thermal and voltage analysis @ 27700MW; Formulate solution; Check field feasibility with design engineers; Perform preliminary short-circuit analysis**
  - **Load forecast reviewed by NEPOOL**
  - **Discussed at 1/24/2002 TEAC meeting**
  - **Report was also distributed at that time**

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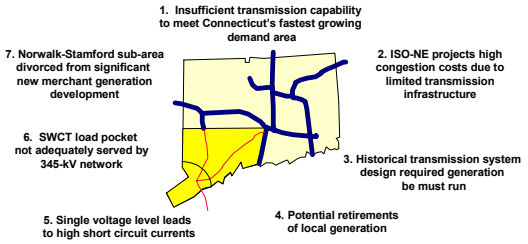
Transmission Constraints



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Transmission Corridors

- map redacted

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Problems Found – Base 27700 MW System (existing)

- 54 instances of post contingent load flow non-convergence due to voltage collapse
- 36 instances of normal overloads with all facilities normally in service (up to 31% overloaded)

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Problems Found (cont.)

- Severe single line contingencies examples (redacted)

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Problems Found (cont.)

- Critical double circuit contingencies
- (redacted)

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Transmission Options Considered

- **Transmission**
  - **Existing line upgrades**
    - **Various corridors;** Frost Bridge, Southington, East Shore
  - **Up rate operating voltages**
  - **Separation of towers on the problematic contingencies**
  - **New transmission tie-lines**
  - **New transmission lines (115 kV, 230 kV & 345 kV)**
  - **New DC transmission lines**
  - **Hybrid combination of one or more of the above options**

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Transmission Options Considered

- **115 kV Only**
  1. **Devon-Norwalk**
  2. **Devon-Norwalk and Plumtree-Norwalk**
  3. **Devon-Pequonnock-Norwalk**
  4. **Middletown-Devon-Pequonnock-Norwalk**
- **345 kV and 115 kV Hybrid**
  1. **345 kV Beseck-Devon and 115 kV Devon-Norwalk**
  2. **345 kV Beseck-Devon, 115 kV Devon-Norwalk and 115 kV Plumtree-Norwalk**
  3. **345 kV Beseck-Devon , 115 kV Devon-Pequonnock-Norwalk, 115 kV Plumtree-Norwalk**
  4. **345 kV Beseck Devon, 115 kV Devon-Norwalk, 115 kV Pequonnock-Glenbrook and 115 kV Plumtree-Norwalk**
- **345 kV Only**
  1. **Beseck-Devon, Devon-Norwalk and Plumtree-Norwalk**
  2. **Beseck-Devon, Devon-Pequonnock-Norwalk, and Plumtree-Norwalk**

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Recommended Solution: 345-kV Loop

- Plumtree - Norwalk - Pequonnock - Devon – Beseck - Glenbrook 345kV
  - 2008 In-service date
  - ~100 miles - mostly on existing ROW
  - Includes associated 115kV improvements
  - ~$500 to 600 million
- Meets study objectives

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Recommended Solution: 345-kV Loop

- Preliminary Planning transfer limits
  - SWCT: in excess of 2800 MW
  - Nor-Stam: in excess of 1300 MW
  - Will probably eliminate the need for the Nor-Stam interface definition

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Benefits of Proposed 345-kV Transmission Plan for Southwestern Connecticut

- Reliably serve projected peak demands
- Reduce projected congestion costs
- Reduce dependence on must run generation
- Reduce reliability impacts to local generation retirements
- Reduce high short circuit current levels & energy losses
- Integrate regional and local 345-kV transmission systems for efficient operation
- Provide infrastructure to support development of new generation

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Upgrade Recommendations

1. Add new 345kV Substations at Plumtree, Norwalk, Pequonnock, Devon, Glenbrook & Beseck Junction
2. Add new 345kV loop from Plumtree to Beseck Junction with radial tap from Norwalk down to Glenbrook
3. Add (1) 3-200MVA auto transformers at Norwalk, (1) at Pequonnock, (1) at Devon, and (1) at Glenbrook
4. Add (1) 3-200 MVA auto transformers at Pequonnock to shift Bridgeport Energy output to 345kV
5. Add new 115kV between Norwalk Harbor and Glenbrook
6. Establish new 115kV substation at Devon (East Devon)
7. Other 115kV work a/w new 345kV structures

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345-kV Loop

- diagram redacted

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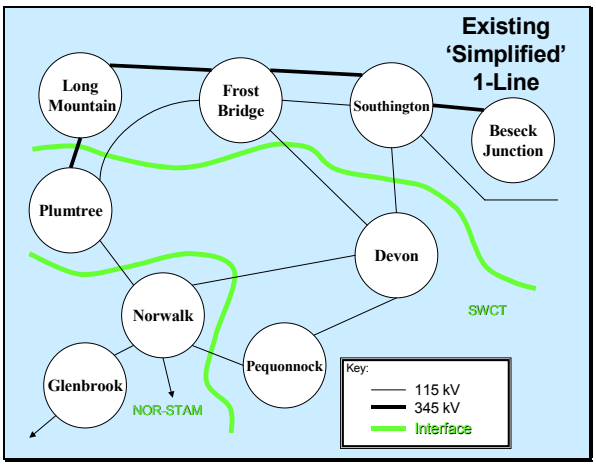

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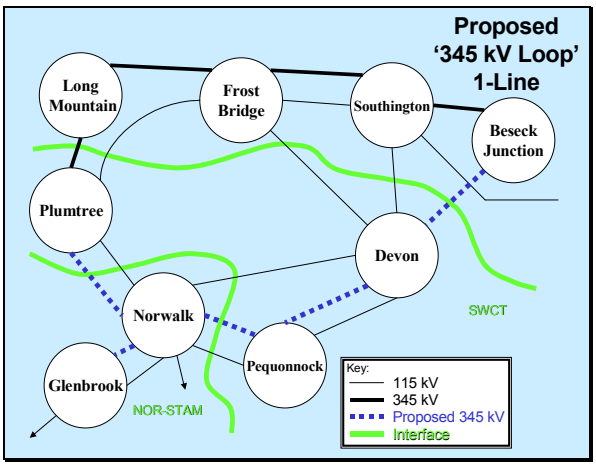

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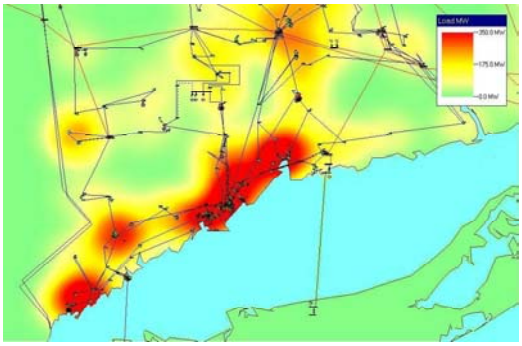

Load Densities - Southwestern Connecticut

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(map redacted)

Existing Transmission - Loss of 1618 and 321 Lines

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(map redacted)

Existing Transmission - Loss of 1618 and 321 Lines

36

(map redacted)

Phase 1 - Loss of 1618 and 321 Lines

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(map redacted)

Phase 2 - Loss of 1618 and 321 Lines

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345kV Plan vs. 345kV/2-115kV Plan

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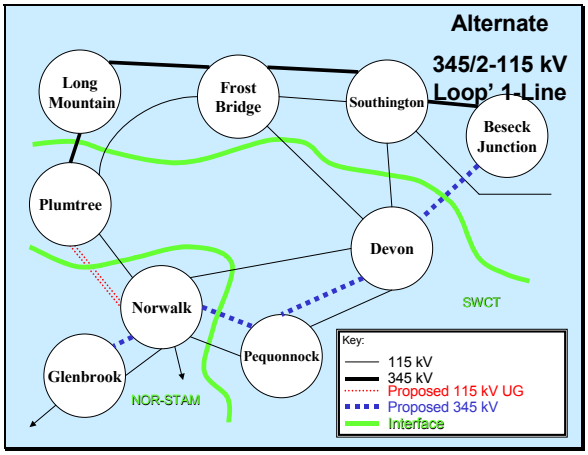

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Origin

- A 2-115kV underground alternative for Plumtree to Norwalk proposed by Synapse Energy Economics as an alternative to overhead 345kV
- TEAC requested ISO-NE to compare this alternative

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Performance Comparison

- Quantity of Thermal and Voltage Violations
- Relative transfer capabilities to examine operating performance and assess differences in lives of alternatives
- Losses
- Short Circuit Current Availabilities
- Cost

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Assumptions

- 2 alternatives for full loop, Phase II, analyzed (Phase I alone is insufficient to meet SWCT reliability needs) – 27700 & 30000 MW future load levels tested
  - All 345 kV
  - (2) 115 Plumtree-Norwalk & 345kV Beseck-Devon-Pequonnock-Norwalk-Glenbrook
- Phase I alternatives compared, as requested - 27700 MW load level tested

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Thermal – Full Loop – 27700MW

PHASE II COMPARISON @ 27,700 MW LOAD LEVEL

	345/2-115 Plan						345kV Plan					
	Quantity Of Overloads						Quantity Of Overloads					
Gen.	Pre-	Post-Cont. Range				NC	Pre-	Post-Cont. Range				NC
Disp.	Cont.	0 - 10%	10 - 20%	> 20%	Total	Cases	Cont.	0 - 10%	10 - 20%	> 20%	Total	Cases
2	0	2	0	0	**2**	0	0	0	0	0	**0**	0
3	0	0	0	0	**0**	0	0	0	0	0	**0**	0
4	0	0	0	0	**0**	0	0	0	0	0	**0**	0
5	0	0	0	0	**0**	0	0	0	0	0	**0**	0
Total	**0**	**2**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

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Thermal –Full Loop – 30000MW

PHASE II COMPARISON @ 30,000 MW LOAD LEVEL

	345/2-115 Plan						345kV Plan					
	Quantity Of Overloads						Quantity Of Overloads					
Gen.	Pre-	Post-Cont. Range				NC	Pre-	Post-Cont. Range				NC
Disp.	Cont.	0 - 10%	10 - 20%	> 20%	Total	Cases	Cont.	0 - 10%	10 - 20%	> 20%	Total	Cases
2	0	9	2	2	**13**	0	0	2	0	0	**2**	0
3	0	3	0	0	**3**	0	0	0	0	0	**0**	0
4	0	2	0	0	**2**	0	0	1	0	0	**1**	0
5	0	0	0	0	**0**	0	0	0	0	0	**0**	0
Total	**0**	**14**	**2**	**2**	**18**	**0**	**0**	**3**	**0**	**0**	**3**	**0**

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345/2-115kV Plan Thermal Problems @ 30000MW

- Baird A-Cngres2A : 10%
- Baird B-Cngres2B : 10%
- Barnum A – Baird A : 25%
- Barnum B – Baird B : 25%
- Beacon Falls – Towantic : 4%
- Norwalk – Flax Hill : 1%
- Sackett – Mix Avenue : 4%
- Stevenson – Sandy Hook : 7%

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345kV Plan Thermal Problems @ 30000MW

- **Sackett – Mix Avenue : 4%**

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Voltage Violations

POST-CONTINGENCY VOLTAGE VIOLATIONS SUMMARY

Number of Voltage Violations

	345/2-115kVPlan				345kV Plan			
Gen.	Phase I	Phase II			Phase I	Phase II		
Disp.	27700	27700	30000	Total	27700	27700	30000	Total
2	1	0	0	1	0	0	0	0
3	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0
5	3	0	0	3	0	0	0	0
Total	**4**	**0**	**0**	**4**	**0**	**0**	**0**	**0**

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Thermal – Phase I – 27700MW

PHASE I COMPARISON @ 27,700 MW LOAD LEVEL

	2-115 Phase I						345kV Phase I					
	Quantity Of Overloads						Quantity Of Overloads					
Gen.	Pre-	Post-Cont. Range				NC	Pre-	Post-Cont. Range				NC
Disp.	Cont.	0 - 10%	10 - 20%	> 20%	Total	Cases	Cont.	0 - 10%	10 - 20%	> 20%	Total	Cases
2	2	90	39	38	**167**	19	2	57	25	44	**126**	17
3	3	81	30	29	**140**	13	1	48	12	30	**90**	13
4	2	10	6	15	**31**	13	1	10	8	12	**30**	12
5	0	40	12	10	**62**	14	0	10	8	12	**30**	12
Total	**7**	**221**	**87**	**92**	**400**	**59**	**4**	**125**	**53**	**98**	**276**	**54**

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Summary of Problem Occurrences

Case	Normal Overloads (1)	Contingency Overloads (2)	Voltage Violations (3)	Non-convergent Contingencies (4)
Base – 27700 MW	36	82	31	54
Phase I – 27700 MW				
345kV Plan	4	16	0	16
2-115kV Plan	7	18	4	19
Phase II – 27700 MW				
345kV Plan	0	0	0	0
2-115kV Plan	0	2	0	0
Phase II - 30000MW				
345kV Plan	0	1	0	0
2-115kV Plan	0	8	0	0

(1)number of occurrences-could be same line for different dispatches
(2)number of different line segments that show up at least for one contingency
(3)number of different busses that show up for at least one contingency
(4)number of different contingencies that do not result in a solved case

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Transfer Capability Preliminary Assessments

- SWCT Import Capability - Thermal
  - Existing 2050 – 2400 MW
  - Phase I
    - 345kv 2300 – 2600 MW
    - (2) 115 2150 – 2500 MW
  - Full Loop
    - 345 kV: 3050 – 3450 MW
    - (2) 115 –345 kV: 3000 – 3200 MW
- Norwalk/Stamford import capability
  - Existing 850 –1150
  - Post Phase I 345 kV 1100 – 1400
  - Post Phase I (2) 115 kV 1050 – 1300

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Losses

	Phase I		
	27700MW		
Gen.	Alternative		Diff
Disp.	115kV	345kV	
2	708	690	18
3	628	622	6
4	613	613	0
5	685	676	8

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Losses

	Phase II					
	27700MW			30000MW		
Gen.	Alternative		Diff	Alternative		Diff
Disp.	115kV	345kV		115kV	345kV	
2	656	654	2	914	911	3
3	602	603	-1	829	829	0
4	604	603	1	821	820	1
5	651	651	0	923	922	1

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Short Circuit – Phase II

- The re-connection of the Milford & Bridgeport Energy Center plants associated with Phase II implementation result in reduced fault current availability, as intended

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Short Circuit – Phase I

- Both Phase I projects result in the same circuit breakers (Norwalk, Glenbrook) being overstressed – just to differing degrees
- Moot issue – breakers are currently slated for replacement prior to project implementation
- Pequonnock circuit breakers overstressed pre-Phase I, some form of mitigation required.

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Conclusions

- The (2)-115 kV plan starts to become overstressed by the time it goes in service
- The 345kV Plan is a more robust solution, which outperforms the 345/2-115kV Plan at both the 27700 and the 30000MW load levels as far as thermal and voltage performance
- 345kV loop will provide at least five years of additional load growth margin beyond the 345/2-115kV alternative
- The 345 kV plan reduces energy losses in the short term and provides greater import capability
- Comparable Costs (NU Preliminary Estimates)
  - 345 kV Phase I $ 124 M
  - 2 - 115 kV Phase I $ 118 M + $ 46 M for Phase II

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SMD Load Response Programs

Robert Burke – ISO-NE
TEAC 13
December 5, 2002

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Objective and Outline of Presentation

- Development of SMD demand response
- Schedule
- Summary of demand response programs
- Implementation schedule

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SMD Demand Response Development

- NEPOOL Participants Committee Approval – June 21, 2002
- Joint NEPOOL/ISO-NE Filing with FERC – July 15, 2002
- LRP Manual Reviewed by MC – Aug. 13, 2002
- NEDRI/FERC Demand Response Conference – Sept. 19-20, 2002
- FERC Order on SMD – Sept. 20, 2002
- Joint NEPOOL/ISO-NE Compliance Filing – Oct. 22, 2002
- NEDRI Consultant Recommendations – Nov. 19, 2002
- Revised LRP Manual Reviewed by MC – Nov. 25, 2002
- NPC vote on MR 1-Appendix E & LRP Manual – Dec. 6, 2002

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Going Forward

- MC Reviewed & Recommend Approval – Nov. 25, 2002
  - LRP Manual
  - MR 1 Appendix E (minor revisions)
- NPC Review & Approval – Dec. 6, 2002
  - LRP Manual
  - MR 1 Appendix E (minor revisions)
  - Programs for implementation on March 1, 2003
  - Additional programs implemented when 1st update of software
- FERC Filing – Mid-December 2002
- FERC Acceptance – Mid-February 2003
- Go Live – March 1, 2003
- First Update – To be announced

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Summary of Programs for 2003

- March 1, 2003
  - Real-Time 30-Minute Notice Demand Response
  - Real-Time 2-Hour Notice Demand Response
  - Real-Time Profiled Response
  - Real-Time Price Response
- Available 1st Update
  - Day-Ahead Demand Response

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Real-Time Demand Response

- Real-Time Demand Response -
  - 30-minute or up to 2-hour response (similar to Type 6 Class 1)
  - Require the Internet-Based Communication System
  - Receive real-time LMP for interruption (measured against the base line)
  - Resources eligible for ICAP credit per LRP Manual
  - Called by ISO on a zonal or system wide basis
- 30-minute Demand Response
  - Called as part of NOP 4 – Action 9 & Action 12
  - Guaranteed minimum payment of $150/MWh for up to 2 hours
- 2-Hour Demand Response
  - Called as part of NOP 4 Actions 3-5 and 7-8
  - Guaranteed minimum payment of $100/MWh for up to 2 hours

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Real-Time Profile Response

- Real-Time Profile Response -
  - Only group without interval metering (minimum 1 MW)
  - Load capable of interruption on demand (with 30-minutes)
  - Requires Internet-Based Communication System with LSE/DRP
    - Interruption instruction sent by ISO to Participant
    - Participant has direct control of interruption
  - Aggregated (super-thermostats, pool pumps)
  - Response determined through statistical means (research meters)
  - Receive real-time LMP for interruption (statistically determined)
  - Call by ISO at NOP 4 Action 9 on a zonal or system wide basis
  - Resources eligible for ICAP credit
  - Guaranteed minimum payment of $100/MWh

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Real-Time Price Response

- Real-Time Price Response -
  - Similar to Type 6 Class 2
  - Receive notification of event
    - Internet-Based Communication System (IBCS)
    - Low Tech option
  - Receive real-time LMP for interruption (measured against the base line)
  - Call by ISO on a zonal basis based upon day-ahead
  - Guaranteed minimum payment of $100/MWh
  - Provide meter readings
    - Daily meter data
    - Super Low Tech (before 90 day resettlement)

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Day-Ahead Demand Response

- Day-Ahead Demand Response -
  - Submit offer in day-ahead market (minimum increment of 1 MW)
  - Minimum bid of $50/MWh to avoid free ride (for example, annual facility shutdown)
  - Maximum bid of $500/MWh required to insure that resource might be dispatched at least during times of high loads
    - Necessary since the resource receives ICAP credit
  - If resource is interrupted day-ahead, resource is financially bound for accepted interruption
  - If not cleared day-ahead, can participate in RT Price Response
  - In real-time, deviations from day-ahead are charged/credited at real-time LMP
  - Resources eligible for ICAP credit per LRP Manual

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Features Available on March 1, 2003

- Real-Time 30-Minute Notice Demand Response
  - Activated NOP #4 Action 9 (without emergency generation)
  - Activated NOP #4 Action 12 (with emergency generation)
- Real-Time 2-Hour Notice Demand Response
- Real-Time Profiled Response
- Real-Time Price Response
- ICAP credit based on declared/proven response level with Reserve Component
- DRP participation in ICAP Supply Auction

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Features Incorporated in 1st Update

- Allocate program incentives to Network Load
- Recognize temporarily unavailable customers
- Customer baseline adjustment for consecutive event days
- Day-Ahead Demand Response Program

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Assessment of the Generating Resources Required to Reliably Operate Connecticut's Electrical System for 2003 and 2006

Presentation to TEAC 13
December 5, 2002

Richard Kowalski, Manager, ISO Transmission Planning

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Purpose 1

Determine which existing CT generating facilities are necessary to ensure the reliable operation of the system for 2003 and 2006.

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Purpose 2

Determine what additional resources are needed to reliably serve the load in 2003 and 2006 in the 52 towns in Southwest Connecticut

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Why the assessment?

- Determine if any existing generation can be considered surplus from a reliability perspective.
- Provide basis for planning interim measures to maintain the reliability of service in SWCT Connecticut, i.e. "Gap RFP"

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Assessment Findings

- All of Connecticut's electric generating facilities are required to reliably serve electrical loads during the 2003 time period.
- From 100 to 300 MW of additional resources are required in SWCT for 2003 and 2006*.

* Assumes the 2 Milford units are in service.

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Assessment Approach: 3 Methods

- Generation Resource Adequacy (LOLE)
- Day Ahead Unit Commitment (DAUC)
- Security Constrained Economic Dispatch (SCED)

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Assumptions

- Loads: RTEP02
- Existing Capacity in Connecticut
- New Generation Uncertainty: Milford
- Capacity Forced Out of Service

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Assumptions: Load MW (RTEP02)

	New England	CT
• 2003:		
– Ref	24,760	6,736
– High	26,150	7,114
• 2006		
– Ref	25,817	7,023
– High	27,300	7,418

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Assumptions: Existing Capacity CT

- Winter Season Claimed Capability 7574
  - w/o Lake Road and 1/3 quick start **6222**
- Summer Season Claimed Capability 7051
  - w/o Lake Road and 1/3 quick start **5916**

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LOLE Analysis

Peter Wong – ISO-NE

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LOLE Study Objectives

Using GE MARS identify the minimum amount of installed capacity needed in Connecticut to allow NEPOOL to meet the 1 day in 10 years Loss of Load Expectation (LOLE) Criterion and reflecting sub-area transmission constraints.

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LOLE Assumptions

RTEP02 assumptions plus:

- New Boston 2 retired
- Devon 10 deactivated
- One Milford unit assumed in-service
- Meriden Power construction delayed

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LOLE Load and Capacity Assumptions

Sub-Areas	Summer Peak Load (MW)	Installed Capacity (MW)	Import Capability (MW)
NEPOOL	24,760	32,477	1,800
NOR	1,163	462	1,100
SWCT	2,284	1,944	1,850
NECT *	3,289	4,361	2,500
TOTAL CT	6,736	6,767	2,500

**** Previously identified as CT in RTEP02***

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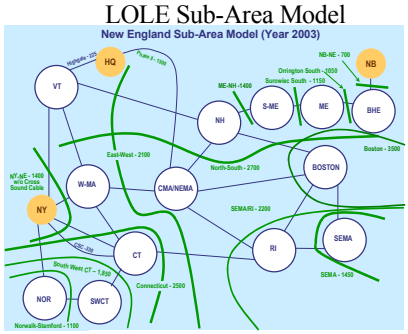
LOLE Sub-Area Model



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LOLE: 4 Cases w/ Existing System

- 2003 Ref Demand
- 2003 Ref Demand plus 1 Milford unit (268 MW)
- 2003 Ref Demand plus Waterside units (70 MW)
- 2003 25,000 MW Demand plus 1 Milford unit

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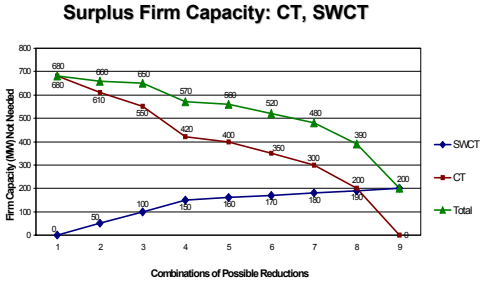
Results: 2003 Ref Load, 1 Milford



83

LOLE Results: 4 Cases

2003 Case Description	NEPOOL LOLE	Surplus Firm Capacity
1. Ref Demand with Existing System	0.113	NO SURPLUS CAPACITY Requires 20 MW to meet criteria
2. Ref Demand with Existing System Plus One Milford Unit	0.020	200 to 680 MW
3. Ref Demand with Existing System Plus Waterside Units	0.081	25 to 400 MW
4. 25,000 MW Demand with Existing System plus 1 Milford Unit	0.031	135 to 550 MW

84

LOLE Results for 2003

With the assumed load, installed capacity and import limits:

- All generating resources are needed in NOR (accounts for the deactivation of Cos Cob station)
- A total of approximately 680 MW of 100% available generating capacity could be removed from Connecticut (SWCT & CT RTEP sub-areas)
- Up to 200 MW of 100% available generating resources could be removed from SWCT, if zero MW is removed from CT

85

LOLE Results for 2003

- Up to approximately 1,250 MW of installed generating resources could be removed from Northeast Connecticut* while meeting the NEPOOL LOLE criterion
- The amount of MW that could be removed various with the generation location, the unit size and their assumed forced outage rate

** Previously identified as CT in RTEP02*

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Examples of Generation Not Needed for LOLE Purposes

- Millstone 3 (1,136 MW) and Middletown 2 (117 MW)
- Middletown 2, 3, 4, and 10 (total 770 MW)

87

Day-Ahead Unit Commitment Analysis (DAUC)

Rich Kowalski – ISO-NE

88

DAUC Criteria

Using a deterministic approach, commit adequate generation for next day system conditions recognizing critical contingencies and import limits, as defined in NEPOOL Operating Procedure No. 19.

89

DAUC Risks

What is the desired risk associated with choosing the assumption of CT Capacity forced out in the DAUC analysis?

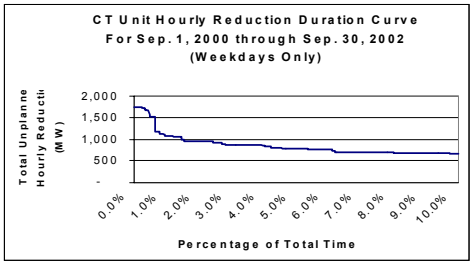
90

DAUC Assumptions

- Connecticut's historical EFOR = 6.8%
- Multiply EFOR by total CT installed generation of 6,516 MW = 440 MW (Lake Road not included)
- ---
- 2nd largest Unit = Millstone Point #2 (860 MW)
- Maximum 2 yr Historical OOS = 1,750 MW
  - 1% of the time = 1,075 MW or more
  - 5% of the time = 785 MW or more
  - 10% of the time = 664 MW or more

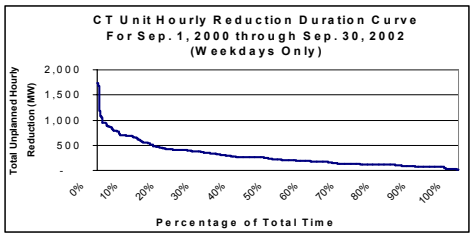
91

DAUC Assumptions



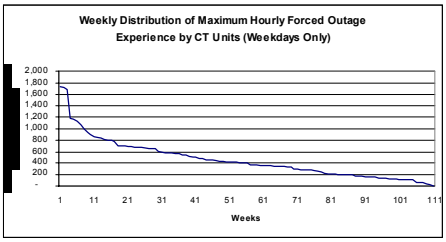
92

DAUC Assumptions



93

DAUC Assumptions



94

DAUC Assumptions

Empirical evidence suggests using 860 MW for the assumption of CT capacity forced out in the DAUC analysis

(Note: Millstone 2 = 860 MW)

95

DAUC Results: 2003

Planning for 2003 Peak Load					
			Results: Capacity Surplus/Deficiency MW		
Year	Load Level	Day-Ahead Outage	Existing System	Existing + 1 Milford	Existing + 2 Milfords
2003	Ref 24,760 MW	440	490	758	808
		860	70	338	388
2003	High 26,150 MW	440	108	376	426
		860	-312	-44	6

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DAUC Results: 2006

Planning for 2006 Peak Load					
			Results: Capacity Surplus/Deficiency MW		
Year	Load Level	Day-Ahead Outage	Existing System	Existing + 1 Milford	Existing + 2 Milfords
2006	Ref 25,817 MW	440	200	468	518
		860	-220	48	98
2006	High 27,300 MW	440	-208	60	110
		860	-628	-360	-310

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DAUC Conclusions

Conclusions from Day Ahead Unit Commitment Analysis….

"All of Connecticut's electric generating facilities are required to reliably serve electrical loads during the 2003 time period"

98

Security Constrained Economic Dispatch (SCED) Analysis

99

SCED Criteria

"Economically re-dispatch generation levels while simultaneously accounting for transmission limitations under various system topologies"

100

SCED Assumptions

- Analysis similar to SCED analysis in "Devon Deactivation" Report
- Assumptions similar to RTEP02
- DC Load flow & redispatch for 1st contingency
  Power on LI 1385 Cable can flow with a higher cost than Cos Cob and during contingencies.
- 1/3 of quick start units will not start
- Static import limits

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SCED Assumptions: New Generation

- To meet planning criteria placed 70 MW dummy generators at 11 bulk substations in SWCT.
- These were set at the same high cost so they would "generate" only to relieve overloads during contingencies.

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SCED Results: 2003

Planning for 2003 Peak Load					
			Incremental Resources Required MW		
Year	Load Level	Day-Ahead Outage	Existing System	Existing + 1 Milford	Existing + 2 Milfords
2003	Ref 24,760 MW	0	14		0
		162	106		0
		268			0
		389	327		38
2003	High 26,150 MW	0	184		0
		168	307		0
		268			137
		389	533		214

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SCED Results: 2006

Planning for 2006 Peak Load					
			Incremental Resources Required MW		
Year	Load Level	Day-Ahead Outage	Existing System	Existing + 1 Milford	Existing + 2 Milfords
2006	Ref 25,817 MW	0	139		0
		162	258		0
		268			95
		389	480		170
2006	High 27,300 MW	0	349		68
		168	475		153
		268			293
		389	730		386

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SCED Conclusions

Conclusions from SCED analysis….

"All of Connecticut's existing electric generating facilities are required to reliably serve electrical loads during the 2003 time period, plus 100 to 300 MW of additional resources in SWCT are required."

105

Other Considerations

Peter Wong – ISO-NE

106

Fuel Mix Considerations

Two "gas-only" generating units in Connecticut totaling approximately 775 MW, cause the ISO to lean in favor using a CT average FOR (MW) in the DAUC spreadsheets. This closely reflects the magnitude range of the 2nd largest unit (860 MW).

Any perturbation on Gulf coast natural gas supply chain or the interstate pipeline delivery system would be equivalent to the need to cover the 2nd largest (unit) contingency.

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Fuel Mix Considerations

- Dual fuel capability (gas & oil) in Conn. = 2,536 MW
- Primary gas with secondary fuel oil (#2) = 1,634 MW
- Primary fuel oil (#6) with secondary gas = 902 MW
- ----------
- Primary gas-only capacity in Connecticut = 778 MW
- Bridgeport Energy (527 MW) – Iroquois pipeline
- Wallingford Peakers (251 MW) – Algonquin pipeline

108

Fuel Mix Considerations

Both Tennessee & Algonquin interstate natural gas pipelines have their supply basins originate in Louisiana gulf-coast (Henry Hub)

- *Two of the longest gas transmission pipeline systems in North America (1,700 miles)*
- *New England is at the end of these two pipelines*
- *Susceptible to supply disruptions (Hurricanes)*
- *Common mode failures in supply & delivery chains*
- *Operational Flow Orders will always curtail deliveries*

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Environmental Considerations

- Additional restrictive environmental requirements will impact overall generation capacity, availability, forced outages, & annual maintenance requirements, O&M costs, etc…...
  - Overall compliance with both state and federal SO2 and NOx programs/legislation will start to impact unit operation
  - Compliance with Federal OTC NOx Program starting in 2003 and compliance by 2005 (SIP CALL)
  - Recent CT SO_2 Legislation prohibits trading of SO_2 Allowances
  - Environmental air permits already limit operation of some peaking facilities. Hard limits of 500 to 1,000 hours per year

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Fuel Mix Considerations

Conclusions from the Fuel Mix Considerations

"All of Connecticut's electric generating facilities are required to reliably serve electrical loads during the 2003 time period"

111

Assessment Conclusions

- CT has no surplus generation until new resources are added.
- SWCT needs from 100 to 300 MW of new resources strategically located to reliably serve the load for 2003. The range depends on the capacity forced out and the Milford units operating.

112

Other Connecticut Studies

Frank Mezzanotte – ISO-NE

113

Voltage Improvement Study

- Operating import limit currently based on voltage limits
- Glenbrook Statcom may not benefit SWCT voltage-based import limit as much as originally anticipated
- Studying western CT 115 kV for possible small FACTS device installation, additional reactive compensation

114

345kV Submarine Cable

- Testing alternatives to 345kV Loop - land installations using LI Sound
- Currently – Devon to Pequonnock to Glenbrook scenario (completion 12/31)
- Future – East Shore to Pequonnock to Glenbrook (Spring, 03)

115

Total 115kV Scenario

- Will be investigating extent of 115kV that would satisfy design requirements
- Key concern – can system be fractionalized to limit short circuit currents to safe operating levels while maintaining reliability?
- Spring, 03

116

The Keswick GCX SPS

- Implemented to protect the New Brunswick Tie from tripping due to overloads caused by large load losses within the Maritimes Area or a severe transient swing.
- Senses frequency at the Keswick 345 kV Bus, and the apparent impedance of the Keswick-Chester-Orrington 345 kV Line, Section 396. When activated up to 550 MW of generation and/or HVDC imports in the Maritimes is tripped or backed down.
- The Keswick GCX SPS is intended not to operate for design contingencies or loss of source events external to the Maritimes.

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Resolution of GCX Issue

- Stability studies have shown that this relay unnecessarily operates for numerous fault conditions throughout New England, even when not required for system security
- Currently seeking a solution to this far-reaching problem that will simplify stability studies in the future, including the upcoming SWCT stability study

118

Short Circuit Studies

- Need to consider short-term means to mitigate Pequonnock overstress.
  - Series reactor in Norwalk Harbor-Northport 138 kV 1385 cable?
  - Build Singer station (part of Phase II)?
  - Fractionalize System?

119

STATUS OF CONNECTICUT PROJECTS

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Generator Plans

- NRG – Currently in FERC cost-of-service mediation – owns Devon, Cos Cob, Norwalk Harbor
- NRG – Meriden construction schedule uncertain
- Calpine's Towantic construction schedule uncertain
- Waterside availability
- CMEEC – proposed S Norwalk 100MW or smaller

121

Cross Sound Cable

- Owned by TransEnergie (merchant project)
- ±150kV DC – approx 300MW
- East Shore to Shoreham on LI
- External to SWCT

122

Cross Sound Cable

- Construction difficulties in New Haven Harbor
- Currently not allowed to operate except for testing
- Working with with CT DEP and ACE on methods of construction
- Completed preliminary terminal testing
- Estimated in service Jan. 03

123

1385 Line – Existing CT-LI Tie

- 11/16 – cables damaged again
- 4 severed and capped
- Circuit removed from service
- Damage and repair still being assessed
- Alternatives being considered
  - Place 3 of 7 cables I/S by summer 2003 (150MVA)
  - Return full ckt to service by summer 2003 (300MVA)
  - Advance replacement project

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1385 Replacement Project

- Remove existing liquid-filled cables
- Replace with 3- solid dielectric cables (3-3 phase circuits each having capacity of roughly 150MVA)
- Still being discussed as to whether all 3 cables are necessary
- Scheduled for 2004

125

Northport Phase Angle Regulator

- Old PAR has been replaced as of 11/2002
- Old – 300 MVA ± 25 degrees of shift
- New – 450 MVA ± 50 degrees of shift
- Had been experiencing age / operating problems
  - De-rated due to fear of failure under full load operation
  - Could no longer compensate under all conditions

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Glenbrook STATCOM

- STATCOM = Static Synchronous Compensator = Static Condenser
- Static = Not Spinning = Solid State
- Thyristor-controlled capacitors
- Provides smooth and continuous voltage control RAPIDLY – very fast device

Glenbrook STATCOM

- 12/13/02 Project Award
- Alstrom, Siemens, ABB, Mitsubishi
- Engineer, Design, Procure & Build
- 3/18/03 Construction Start
- 12/1/03 Construction Finish
- Testing
- 12/31/03 In-Service