STATE OF CONNECTICUT
CONNECTICUT SITING COUNCIL

NORTHEAST UTILITIES SERVICE COMPANY **DOCKET NO. 272**
APPLICATION TO THE CONNECTICUT SITING COUNCIL FOR A CERTIFICATE OF ENVIRONMENTAL COMPATIBILITY AND PUBLIC NEED ("CERTIFICATE") FOR THE CONSTRUCTION OF A NEW 345-KV ELECTRIC TRANSMISSION LINE FACILITY AND ASSOCIATED FACILITIES BETWEEN SCOVILL ROCK SWITCHING STATION IN MIDDLETOWN AND NORWALK SUBSTATION IN NORWALK, INCLUDING THE RECONSTRUCTION OF PORTIONS OF EXISTING 115-KV AND 345-KV ELECTRIC TRANSMISSION LINES, THE CONSTRUCTION OF BESECK SWITCHING STATION IN WALLINGFORD, EAST DEVON SUBSTATION IN MILFORD, AND SINGER SUBSTATION IN BRIDGEPORT, MODIFICATIONS AT SCOVILL ROCK SWITCHING STATION AND NORWALK SUBSTATION, AND THE RECONFIGURATION OF CERTAIN INTERCONNECTIONS **MARCH 16, 2005**

BRIEF OF ISO NEW ENGLAND INC.

Anthony M. Macleod
Whitman Breed Abbott & Morgan LLC
100 Field Point Road
Greenwich, Connecticut 06830
(203) 862-2458

Attorneys for
ISO New England Inc.

TABLE OF CONTENTS

INTRODUCTION

Background

On October 9, 2003, The Connecticut Light and Power Company ("CL&P") and The United Illuminating Company ("UI," together with CL&P referred to herein as the "Applicants") filed an application (the "Application") with the Connecticut Siting Council (the "Council") pursuant to Section 16-50k(a) and 16-50l(a) of the Connecticut General Statutes ("CGS") for a certificate of environmental compatibility and public need (the "Certificate") for a 345,000-volt ("345kV") transmission line facility of approximately 69 miles between the Scovill Rock Switching Station in Middletown and the Norwalk Substation in Norwalk, along with associated facilities, all as more particularly set forth in the Application (the "Project"). The Application proposed that the Project would consist of 45 miles of overhead transmission line from the Scovill Rock Switching Station in Middletown to the East Devon Substation in Milford and 24 miles of high pressure fluid-filled ("HPFF") underground cable from East Devon to the Norwalk Substation in Norwalk.

The Application also contained various alternatives, including Alternative A, which involved 13.3 miles of underground cable from East Devon to Fairfield, and Alternative B, a so-called "all overhead" route which in fact involved 4.2 miles of underground cable in Bridgeport.

ISO had expressed concerns about issues raised by the extent of underground cable proposed by the Applicants as early as March, 2004, when Mr. Kowalski testified

that the 24 mile proposal may have gone "past the limit,"[1] and in April hearings before the Council, these concerns were acknowledged by the Applicants, who indicated that work toward a resolution was continuing.[2] In June, in accordance with the Council's schedule for ISO to return to hearings involving underground cable technology and respond to questions foreshadowed by Council members at the March 23, 2004 hearing,[3] ISO notified the Council that no resolution or practical and effective mitigation of reliability and operability concerns associated with the Applicants' proposal had emerged, and ISO therefore could not support the Project as then configured. (ISO Ex. 8, p. 6).

At the close of the legislative session in 2004, Public Act 04-246 was enacted as an amendment to the Public Utility Environmental Standards Act ("PUESA").[4] As passed, P.A. 04-246 expressed a policy favoring the construction of underground cable rather than overhead line for new 345 kV transmission projects adjacent to certain areas

[1] 3/23/04 Tr. 150; *See* 3/23/04 Tr. 147-151. The Attorney General persists in an inaccurate portrayal of ISO as having waited for several months until June to announce its concerns, thereby delaying the course of this proceeding. The record in this proceeding, as cited in these footnotes and in the related text, does not support the Attorney General's rendition of events, as set forth in paragraphs 4 through 9 of his Proposed Findings of Fact.

[2] The Applicants were aware of ISO's reliability concerns and the Applicants informed the Siting Council of those concerns and of the ongoing efforts to resolve them. Mr. Zaklukiewicz, CL&P's lead witness, made several comments in his testimony on April 20 and 21, 2004 both indicating the Applicants' awareness of ISO's concerns with the amount of underground cable proposed and a history of mutual efforts to address those concerns. For example, on April 20, Mr. Zaklukiewicz stated that ISO was "still studying specific cases where the system is still not responding in a manner that makes them feel comfortable that it's a reliable system" (4/20/04 Tr. 21-22) and on April 21, he testified as follows:

> And something today where we've been studying it now for probably more than a year is still -- does not have satisfactory answers to, and that was the testimony you heard from Mr. Kowalski at ISO. I mean we -- we have been trying to make this work. And to date there are still some in the technical community who are not in full agreement or buy in that what is proposed before you will totally work. And some of the issues have to do with dealing with the capacitance of the 24 miles of cable out there…" (4/21/04 Tr. 121-22)

[3] See, e.g., 3/23/04 Transcript, pp. 169, 173-74.

[4] CGS Chapter 277a.

and facilities, unless technologically infeasible, and set forth certain buffer zone requirements for overhead transmission lines passing such areas and facilities.

Following both the passage of P.A. 04-246 and ISO's indication that concerns surrounding the installation of underground cable issues would need to be addressed further, the Applicants and ISO formed the Reliability and Operability Committee (the "ROC") on June 23, 2004, to investigate modified configurations and technologies which would maximize the length of underground cable that would (a) be technologically feasible to install in the Project, consistent with reliability, operability, and electric system needs as identified in RTEP and (b) be able to be supported by ISO in the process of approval pursuant to Section 18.4 of the Restated NEPOOL Agreement,[5] it being understood that such support in the ROC process would not be a substitute for 18.4 approval, nor a guarantee of such approval.

Status of ISO in this proceeding

ISO New England Inc. ("ISO") requested intervenor status in this proceeding on November 24, 2003, pursuant to CGS Sections 16-50n and 4-177a and Section 16-50j-15a of the Regulations of Connecticut State Agencies ("RCSA"), and the Council granted ISO's request on December 9, 2003. ISO's interest in this proceeding is based on its concern for the reliability of the bulk power system in over fifty towns which comprise the Southwestern Connecticut ("SWCT") sub-area of the New England power system and its key role in assessing system needs and providing transmission planning throughout

[5] Effective February 1, 2005, Section 18.4 of the Restated NEPOOL Agreement is now Section I.3.9 of the ISO New England Transmission, Markets and Services Tariff, FERC Electric Tariff No. 3 (the "Tariff"). Because this section has been referred to throughout this docket as "Section 18.4," it will continue to be

New England. The bulk power system in the New England region is a tightly interconnected power grid, and the consequences of a power failure in SWCT can cause serious power disruptions elsewhere in New England and in neighboring electric systems, including New York.

ISO is responsible for the reliable daily operation of the New England power grid[6] and has exclusive authority from the Federal Energy Regulatory Commission ("FERC") for transmission planning throughout the New England region.[7] (ISO Ex. 1, Whitley 3/09/04 PFT, pp. 5-6, 8; ISO Admin Notice 1; ISO Admin Notice 2; ISO Admin Notice 4).

As a non-profit organization without stockholders, ISO is not motivated by money or the prospect of financial gain to participate in this proceeding nor is its testimony steered by compensation toward any particular result. (ISO Ex. 1, pp. 5-6, 13). Reliability is ISO's top priority and bottom line, and ISO brings to the Council the results of an evaluative process which involves expertise, objectivity, openness and inclusivity.

ISO discharges its regional planning responsibilities through an ongoing review of the New England bulk electric power system which results in an annual regional transmission expansion plan ("RTEP")[8]. Each RTEP is a comprehensive

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referred to as "Section 18.4" in this Brief as a convenience to the Council and participants (ISO Admin Notice 12, Section I.3.9)

[6] New England Power Pool, Order Conditionally Authorizing Establishment of as Independent System Operator and Disposition of Control Over Jurisdictional Facilities, 79 FERC 61,374 (1997) (authorizing formation of ISO New England Inc.); Promoting Wholesale Competition Through Open Access, Non-Discriminatory Transmission Services by Public Utilities; Recovery of Stranded Costs by Public Utilities and Transmitting Utilities, Order No. 888, 75 FERC 31,036 (1996) (establishing principles for ISO's operation and governance).

[7] ISO New England Inc. & New England Power Pool, Order on Rehearing Requests and Compliance Filings, 95 FERC 61,384 (2001) (authorizing ISO to oversee regional transmission planning)

[8] The annual regional plan will, after February 1, 2005, be known as the "Regional System Plan," or "RSP" rather than the "Regional Transmission Expansion Plan" or "RTEP". (ISO Ex. 12, Section II.48 *et seq*.).

electrical engineering assessment comprised of numerous studies and analyses of New England's bulk electric power system. By identifying problem areas, the RTEP is intended to provide appropriate information to the wholesale electricity marketplace on power system problems and the needs that may be addressed through investment in market solutions.[9] The RTEP is developed through an interactive process with New England stakeholders through the Transmission Expansion Advisory Committee ("TEAC").[10] The RTEP has, beginning in 2001, recognized the critical transmission inadequacies in SWCT, signaled the need for solutions to the problems identified, and then recommended a 345 kV full loop (the "345 kV Full Loop") in two phases, first from Plumtree Substation in Bethel to Norwalk, as approved by the Council in Docket No. 217 (sometimes referred to as "Phase I") and next from Scovill Rock Substation in Middletown to Norwalk Substation, as proposed in this Docket (sometimes referred to as "Phase II").

The Council is charged under CGS Section 16-50p with the statutory responsibility of determining both the public need for the Applicant's proposed 345 kV line and the facility's probable environmental impacts (including effects on state policies

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However, as the RTEP designation has been used throughout this proceeding and the regional plans which identify the need for the Project are RTEP01 through RTEP03, the "RTEP" designation will be continued in this Brief.

[9] Market responses might include investment in generation, merchant transmission facilities, distributed resources and demand response programs. If the market does not respond with adequate solutions to defined system needs, ISO is charged with providing a coordinated transmission plan that identifies appropriate upgrades for reliability and economic needs. (ISO Ex. 1, p. 8)

[10] Effective February 1, 2005, the Transmission Expansion Advisory Committee, whose periodic meetings have been attended by a number of Connecticut governmental representatives, including the Attorney General's Office and both DPUC and OCC staff, is now known as the Planning Advisory Committee ("PAC"). It performs the same functions as TEAC and its membership will continue to be open to the same group of industry stakeholders and regulatory and governmental officials as before. (ISO Ex. 12, Section II.48 *et seq.*). The "TEAC" designation will continue to be used in this Brief as it has been used throughout this proceeding.

regarding the environment, health and safety, flora and fauna, and scenic, historic and recreational values) and then assessing whether the environmental impacts are sufficient reason to deny the Application. In addition, this proceeding represents the Council's first opportunity to consider and apply the requirements of P.A. 04-246.

ISO believes its expertise in this proceeding is most relevant to the issues of public need for the Project, the reliability and operability of various proposals for the Project, and the maximum amount of underground cable that is technologically feasible for the Project. Accordingly, ISO's participation has been geared toward providing assistance to the Council's consideration of these issues, and it has devoted particular attention and extensive resources, working with the Applicants through the ROC, to the issue of determining the maximum amount of underground cable that is technologically feasible for use in the Project. ISO will comment primarily on these matters, leaving the development of environmental and health issues, which it fully respects, to other participants.

SUMMARY

The bulk power system serving Southwestern Connecticut does not meet national and regional reliability criteria because of inadequate transmission infrastructure. Without appropriate transmission upgrades, the system will be unable to meet projected peak loads in the 2006-2011 time frame, and under current system conditions, the system is already unable to meet summer peak demand in the event of multiple contingencies and extreme weather conditions. The shortfall in the SWCT system's ability to meet peak load has compelled ISO to obtain, through issuance of a Request for Proposal in

December 2003 (the "Gap RFP"), temporary demand response resources and emergency generation for possibly the next five years until permanent infrastructure improvements, including Phase I, are in service.

There is a compelling public need to upgrade transmission through the Project. In the Case 5 configuration now proposed by the Applicants, the Project represents a compromise between (a) regional reliability criteria and system operability and (b) the Connecticut legislature's interest in maximizing the use of underground cable. The Project will improve system performance with a manageable degree of risk, provided that other improvements and mitigation measures are also made, including replacing a substantial number of surge arresters and utilizing 500 kV rated circuit breakers rather than 345 kV rated circuit breakers. The Project is also consistent with a long term plan for the expansion of Connecticut's bulk power system in that it is necessary to help bring Connecticut into compliance with applicable reliability criteria and would also provide benefits to Connecticut utilities and customers through the reduction of various costs attributable to transmission constraints.

The ROC, after exhaustive study, found three configurations to be reliable. They were the original so-called "all-overhead" route, which actually involved approximately 4.2 miles of underground cable (originally "Alternative B" in the Application), a 13.3 mile underground configuration studied by the ROC as Case 2 ("Case 2," which was originally "Alternative A" in the Application) and the presently proposed configuration involving 24 miles[11] of underground XLPE cable between Norwalk and East Devon Substation in Milford, which the ROC studied as Case 5 ("Case 5").

[11] As presently proposed, the Project contemplates 24 linear miles of underground XLPE cable between East Devon and Norwalk, but this proposal actually involves a total of 48 circuit miles of underground

While configurations with less underground cable are preferable to ISO because they involve more reliability and less operational risk, ISO is willing to express support for Case 5 if other improvements are also made which will reduce the system's capacitance and increase its ability to withstand temporary overvoltages. ISO believes it should be understood that Case 2 would be a more acceptable engineering solution and that Case 5 presents more risk in terms of system operability and reliability. However, ISO will accept Case 5 as the maximum underground transmission that can be installed and the maximum risk that can be tolerated within the bounds of technological feasibility.

From the perspective of obtaining regional cost support, while any proposal will be subject to review by the NEPOOL Reliability Committee under Schedule 12C of the ISO New England Transmission, Markets and Services Tariff, FERC Electric Tariff No. 3 (the "Tariff"),[12] any underground facilities or capital expenditures that are not necessary for engineering design reasons or otherwise are more expensive than overhead construction will likely be subject to significant opposition by stakeholders from other New England states in the Schedule 12C review process.

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cable. While it is the number of circuit miles, not linear miles, that count with respect to limiting the use of underground cable, this Brief will for the most part refer to the proposal in terms of its linear mile length as a matter of convenient reference, as Case 5 has generally been discussed as involving 24 miles in this proceeding.

[12] Effective February 1, 2005, Schedules 12, 12B and 12C of the Restated NEPOOL Agreement are now respectively Section II, Schedules12, 12B and 12C of the Transmission, Markets and Services Tariff, FERC Electric Tariff No. 3 (the "Tariff").

DISCUSSION

Applicants' Project Conforms with a Long Range Energy Plan for the State

The Regional Transmission Expansion Plan issued in October, 2001 ("RTEP01") identified SWCT as the most critical problem area in New England region and recommended that further studies be undertaken to examine the problems and propose a resolution for SWCT. ISO formed a working group (the "SWCT Working Group") with CL&P and UI, as the utilities serving the affected area, that produced a collection of studies which form the Southwest Connecticut Reliability Study, including the Southwestern Connecticut Electric Reliability Study, a Comparative Analysis of a 345kV Plumtree-Norwalk Overhead Line Versus 2 – 115 kV Cables from Plumtree-Norwalk (Phase I, Phase II, December 2002) (the "Comparison Study") (ISO Ex. 5), the December 2002 Southwestern Connecticut Reliability Study –Volume I – Final Power Flow, Voltage and Short Circuit Report (the "Reliability Study") (ISO Ex. 4), and the Southwest Connecticut Electric Reliability Study, 345-kV Plumtree-Norwalk Project Final Power-Flow, Voltage and Short-Circuit Report, Revision 3, November 11, 2003 the "Phase I Report"). (App. Ex. 13a; ISO Ex. 6). (The Reliability Study, the Comparison Study and the Phase I Report are all sometimes collectively referred to herein as the "Studies"). In these evaluations and Studies, ISO applied its expertise and experience in bulk power system planning and operation to objective reliability standards developed by national and regional authorities, utilizing assumptions and parameters which have been reviewed and vetted through the TEAC process. (ISO Ex. 1, pp. 10-12).

The solution identified by the SWCT Working Group and approved in RTEP02 and subsequent regional plans was a 345 kV Full Loop consisting of two

phases.[13] It is worthy of note that the 345 kV Full Loop, as approved in the RTEP, was essentially an all-overhead line, with the exception of a few miles of underground cable through urban areas in Bridgeport.

ISO's position regarding the current status of the power system serving Southwestern Connecticut and the need for short and long term corrective measures may be summarized by reference to its 2002 Regional Transmission Expansion Plan Report ("RTEP02"):

> The most urgent system reliability need is in the SWCT and NOR Sub-Areas. The combined area lacks the required transmission infrastructure to provide adequate reliability to its electric customers. Without transmission infrastructure upgrades, studies demonstrate widespread violations of transmission planning criteria. As a result, without such upgrades, it is doubtful that the existing system could reliably support projected loads in the long term. In the short term, without significantly increased implementation of DSM and LRP it is doubtful that the existing system can reliably support the projected loads. ISO-NE has determined that the existing transmission system configuration cannot provide for significant generation expansion or even the simultaneous operation of the existing generation at full load. (ISO Admin Notice 10, p. 13).

The Executive Summary of RTEP03[14] expressed continued support for the approval of a 345 kV line from Middletown to Norwalk and repeated the foregoing admonition that the most urgent system reliability need in New England continues to be in SWCT, again warning that the existing transmission system in Southwest Connecticut can neither provide for significant generation expansion nor fully utilize the area's generating resources during times of need. (ISO Ex. 1, p. 12)

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[13] *See* p. 5, *supra*. The Studies looked at possible 115kV, 230kV and 345kV solutions to SWCT's inadequacies and concluded that the 345kV full loop is needed. The ISO Board of Directors approved the Full Loop as an appropriate solution in the 2002 Regional Transmission Expansion Plan Report ("RTEP02"). (ISO Admin Notice 10).

[14] http://www.isone.com/smd/transmission_planning/Regional_Transmission_Expansion_Plan/RTEP_2003/

In its "Connecticut Energy Plan Framework: Recommended Solutions and Actions for the State of Connecticut, January 4, 2005 (Report to Connecticut Energy Advisory Board)," ISO told the Connecticut Energy Advisory Board that the Project, along with the Phase I upgrade approved in Docket No. 217, is identified by RTEP04 as the long-term solution to the reliability problems and the growing electricity demand in Southwest Connecticut. (CSC Admin Notice 30, p. 18).

The Project, as part of the 345kV Full Loop, is needed for the provision of reliable electricity service in SWCT.

There is Widespread Agreement About the Public Need for the Project

The public need for upgrading the transmission infrastructure in SWCT is undoubtedly the least controversial aspect of this proceeding. *No one has disputed the need to install a 345 kV transmission facility between Middletown and Norwalk in order to complete the Full Loop.* Southwestern Connecticut is at the same time one of the fastest growing and economically vital regions of Connecticut and one of the worst transmission-constrained areas in the country. (ISO Ex. 1, p. 12). The debate in this proceeding involves the route the Project should travel and how much of it can be placed underground.

Consensus Exists Regarding the Need for a Transmission Upgrade

Demand for electricity in SWCT significantly exceeds supply, load growth continues at the annual rate of approximately 1.5%, and the current transmission infrastructure is simply inadequate to import enough power into the area to meet peak demand in a reasonably foreseeable scenario involving multiple contingencies or to reliably move it around within the area as needed when the system is stressed. (CSC

Admin Notice 15, FF 41; ISO Ex. 1, p. 21). As a result, there are an unacceptable number of violations of the NEPOOL Reliability Standards when the system is tested and modeled in accordance with those Standards. (ISO Ex. 1, pp. 13-14). Transmission system inadequacies could also hamper new generation from addressing growing load in the region. (*Ibid.*)

These deficiencies were recognized in Docket 217, as was the contemplation that the Project was on the drawing board as a needed Phase II of the Full Loop. The imbalance between supply and demand in SWCT has caused ISO, through a Gap RFP issued in December of 2004, to obtain 300MW of short-term demand response and emergency generation resources to cover the gap until transmission upgrades are in place.

Warnings of the system's inability to meet load in SWCT have been sounded in the form of several occasions during the summers of 2001 and 2002 when the area came uncomfortably close to load shedding. (ISO Ex. 1, p. 15). The Northeast Disturbance, which occurred on August 14, 2003, did not disrupt power in most of New England. Much of the SWCT sub-area, the weakest part of the New England grid, however, was blacked out for close to 12 hours. No other part of the New England system was affected as seriously or lost so much load. (ISO Ex. 1, pp. 7, 16)

The Public Need for Reliable Electric Service is Clear and Undisputed

While there is no statutory definition of "public need," at least one reviewing court has cited the dictionary definition of "need" as "a necessary duty" or "a want of something requisite, desirable or useful." Citizens for Defense of Oxford v. Connecticut Siting Council, 2000 WL 1785118 Conn.Super (Nov. 14, 2000) at p.3. That electricity is essential to Connecticut's quality of life and economic stability, something that is indeed

"requisite, desirable or useful," is indisputable. Homes need electricity for cooking, washing, cleaning, communicating, studying and sometimes staying warm. Businesses large and small depend on it in a computerized age to conduct operations, buy and sell goods and services, transfer funds and keep records – in short, to function. According to the Connecticut Business and Industry Association, 43% percent of respondents in a survey of 4,000 businesses across the state would consider an electric outage of just one hour's duration "serious or catastrophic," triggering losses of up to $100,000 in half of them. (CBIA PFT, p. 2).

A facility has been found to meet a public need where it enhanced the reliability of the electric system and contributed to the need to meet forecast requirements. Town of Preston v. Connecticut Siting Council, 20 Conn. App. 474, 568 A.2d 799 (1990). The Council's determination of public need has also been upheld where a proposed facility would improve system performance. Town of Westport v. Connecticut Siting Council, 47 Conn.App. 382, 797 A.2d 655 (2001). The record in this case is replete with evidence that the power system serving Southwestern Connecticut is not reliable and that the Applicants' proposed Project will enhance system performance and is necessary to maintain its reliability with forecasted requirements. The record thus compels a finding of public need for the proposed Project.

Approximately 400 miles of overhead 345 kV transmission line is already located in Connecticut. Electric utilities serving the state have deferred for many years construction of an integral piece of the 345kV transmission system in Connecticut which would connect Southwestern Connecticut to the rest of the 345kV grid in Connecticut and New England. (ISO Ex. 3, pp. 5-7). The implementation of an adequate transmission

system can no longer be put off, as the system in Southwestern Connecticut is out of compliance with reliability criteria and standards established by the North American Electric Reliability Council ("NERC"), the Northeast Power Coordinating Council ("NPCC") and the New England Power Pool ("NEPOOL"). (ISO Ex. 1, pp. 13-14,18-19).

The Electric System in SWCT Is Presently Unreliable

Reviewing the ability of the power system in Southwestern Connecticut to meet peak summer demands, the Connecticut Department of Public Utility Control (the "DPUC"), in its July 3, 2002 Decision in Docket No. 02-04-12, DPUC Investigation into Possible Shortages of Electricity in Southwest Connecticut During Summer Periods of Peak Demand, questioned the system's ability to withstand even a single contingency:

> Unanticipated SWCT load growth during the last six years and the lack of transmission expansion has caused the transmission system to be loaded to a level where it will not operate reliably after many single contingencies. During the past year, unacceptable reliability conditions can and have occurred under normal loads as well as under peak loads. During the summer of 2001, the SWCT area operating with all generation units on-line would have required load shedding for the loss of a single generating unit or transmission line. (App. Admin. Notice 5, p. 20).

The bulk power system in SWCT is currently in violation of reliability criteria and will remain so even after Phase I is in service. (3/23/04 Tr. 106-107). The Comparison Study indicates that while system performance improves at the design peak load level of 27,700 MW with the installation of the 345 kV line from Bethel to Norwalk, significant thermal overloads and criteria violations continue to exist following construction of this line: 276 contingency overloads would occur on 40 lines and there would be 17 non-convergent contingencies. A non-convergent contingency is one for which there is no mathematical solution, and it signals the potential for voltage collapse

and the possibility of cascading outages. The results of the system modeling are summarized below:

Case	Normal Overloads	Contingency Overloads	Voltage Violations	Nonconvergent Contingencies
Base	36	82	31	54
With Phase I 345-kV Line	4	40	0	17

(ISO Ex. 1, pp. 18-19; CSC Admin Notice 15, FF 40; ISO Ex. 5, p. 9, Tables 6-7; 3/23/04 Tr. 106-107)

In short, the Studies show that the system serving SWCT is unreliable, even with Phase I in operation. The Project will eliminate many of the criteria violations which remain after Phase I. (ISO Ex. 1, p. 4).

Transmission Inadequacies Create an Unacceptable Risk of Blackouts

Transmission inadequacies limit the ability to import sufficient power into SWCT. (ISO Ex. 1, p. 15; App. Admin No. 5, p. 22). As the peak demand of the Norwalk-Stamford sub-area of SWCT, for example, is 2.5 times the amount of local generation, and this area of Connecticut is critically dependent on a 138-kV transmission line from Long Island, New York in the event of severe demands for electricity. This 138-kV line has, however, been unavailable for prolonged periods of time and has an uncertain future. (ISO Ex. 1, pp. 13-15).

System operators constantly face problems in getting power to the load pockets in Southwestern Connecticut, and their last available tool to prevent widespread outages is selective load-shedding. (ISO Ex. 13, p.2; 1/11/05 Tr. 23-24.). As load continues to grow, the risk of necessary resort to such controlled, rolling blackouts to prevent broader scale power disruptions also increases.

There Are Costs Attributable to Inadequate Transmission

Transmission constraints prevent SWCT from importing cheaper, cleaner power from generators in the northeastern part of Connecticut and the rest of New England and from fully utilizing the power available to it in SWCT. Instead, the SWCT is dependent on a transmission system that is nearing its limits in transporting energy from generating units and on higher cost electricity from aging and inefficient local units that would not be able to bid competitively in an efficient transmission grid. It is estimated that transmission constraints will cost Connecticut utility customers approximately $308 million in 2005 alone, and these costs will recur annually, perhaps increasing as load grows and the consequences of transmission constraints become more severe. (ISO Ex. 13, p.3; 1/11/05 Tr. 24-26).

In summary, the public need for the Applicants' proposed Project 345kV is based on the need for a reliable bulk power system in Southwestern Connecticut and the critical need to remedy reliability criteria violations caused by the inadequate transmission system serving the SWCT sub-area.

The Need for a Reliable Solution

The need for a reliable solution to SWCT's inadequate transmission infrastructure will obviously not be met by any proposal which is not itself reliable. The solution must respect established thermal, voltage, stability and short circuit criteria (ISO Ex. 1, p. 21; 3/23/04 Tr. 31), and it must also avoid the creation of low order harmonic resonances that, under normal and usual operating conditions, can cause high and sustained

overvoltages on the system. (App. Ex. 7, Att. B, pp. E-1, E-2, 6-1; App. Ex. 44 CSC-28, pp. 3-4; ISO Ex. 10, p. 21)

The ROC and its consultants have conducted a massive, unprecedented amount of study to determine where the imposition of maximum underground cable between Middletown and Norwalk would touch the limits of reliability, and they have concluded that Case 5's 24 mile underground configuration is the maximum amount of cable that is technologically feasible to use in the Project. (App. Ex 147; 1/11/05 Tr. 23; App. Ex. 176, pp. 4-5, 24-25, 38-40; App. Ex. 178; App. Ex. 179;1/13/05 Tr. 44, 82, 204-205) Their work has been scrutinized by the Council's consultant, KEMA. It may fairly be observed that KEMA's involvement demanded the best of the ROC's consultants, as Mr. Gunther of Enernex and Mr. Walling and Ms. Pratico of GE testified that they had never in their combined experience of over 50 years been involved in such an exhaustive study. 1/13/05 Tr. 88-89). KEMA's questions and recommendations caused the ROC and its consultants to consider all available mitigation measures and compile an enormous amount of data upon which to base a determination regarding the maximum cable length to be employed in the Project. After all such studies had been performed by the ROC and considered by KEMA, there was no dispute between the ROC consultants and KEMA that Case 5 represented the maximum technologically feasible use of underground cable in the Project.

No studies were put forward by any other participant in this proceeding which would suggest the technological feasibility of using more than 24 miles of underground cable in the Project. While the record contains preferences of various municipalities for routes which might result in more than 24 miles of cable, and while several legislators

have worked diligently to represent their constituents' desires to have more of the Project placed underground, *no scientific, engineering or other technical support has been offered to the Council for extending the underground cable* by even two more miles beyond Case 5. Studies performed by the ROC and its consultants demonstrate that any underground extension beyond 24 miles is in fact technologically unsupportable.

The Requirements of Public Act 04-246

While it is sometimes asserted that P.A. 04-246 requires new 345 kV transmission facilities to be placed underground, the legislation contains no such absolute requirement. P.A. 04-246 relates in large part to the protection of designated areas and facilities from electromagnetic fields ("EMFs"). The areas and facilities specified by the Act for such protection are residential areas, private or public schools, licensed child day care facilities, licensed youth camps or public playgrounds ("Protected Areas").[15]

P.A. 04-246 does not prohibit or restrict overhead 345 kV lines in any locations other than those adjacent to Protected Areas, which essentially gain two protections under P.A. 04-246: (1) overhead transmission of 345 kV or greater adjacent to Protected Areas is presumed to be inconsistent with PUESA unless it can be demonstrated that it would be technologically infeasible, based on the reliability and operability[16] of Connecticut's electric transmission system, to bury the transmission facility[17] and (2) the overhead

[15] *See, e.g.,* Sec 1(a)(1)(C) of the P.A. 04-246.

[16] The legislative intent in passing HB 5418 (Public Act 04-246) was that reliability was synonymous with operability. *See* quoted dialogue between Representatives Backer and DelGobbo, pp. 34-35, *infra*.

[17] *See* Sec. 7 of the Act, amending CGS Section 16-50p by adding a new subsection (h) as follows:

> (h) For a facility described in subdivision (1) of subsection (a) of section 16-50i, as amended, with a capacity of three hundred forty-five kilovolts or greater, there shall be a presumption that a

portions of an electric transmission line shall be contained within a "buffer zone" that protects the public health and safety, taking into consideration Protected Areas adjacent to the proposed overhead transmission route and the proposed voltage level of such overhead transmission line.[18]

Nothing in P.A. 04-246 requires or allows the Council to take action inconsistent with the reliability of the transmission system. The policy set forth in CGS Section 16-50p(h) of undergrounding 345 kV transmission facilities adjacent to Protected Areas explicitly recognizes that such transmission cannot be buried where it would be

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> proposal to place the overhead portions, if any, of such facility adjacent to residential areas, private or public schools, licensed child day care facilities, licensed youth camps or public playgrounds is inconsistent with the purposes of this chapter. An applicant may rebut this presumption by demonstrating to the council that it will be technologically infeasible to bury the facility. In determining such infeasibility, the council shall consider the effect of burying the facility on the reliability of the electric transmission system of the state.

[18]Section 4(a)(3)(D) of P.A. 04-246, amending Section 16-50p(a)(3)(D) of the Connecticut General Statutes ("CGS"), requires the following determination by the Council in certifying a proposed transmission facility:

> (D) *In the case of an electric transmission line,* (i) what part, if any, of the facility shall be located overhead, (ii) *that the facility* conforms to a long-range plan for expansion of the electric power grid of the electric systems serving the state and interconnected utility systems and *will serve the interests of electric system economy and reliability,* and (iii) that the overhead portions, if any, of the facility are cost effective and the most appropriate alternative based on a life-cycle cost analysis of the facility and underground alternatives to such facility, are consistent with the purposes of this chapter, with such regulations or standards as the council may adopt pursuant to section 16-50t, including, but limited to, the council's best management practices for electric and magnet fields for electric transmission lines and with the Federal Power Commission "Guidelines for the Protection of Natural Historic Scenic and Recreational Values in the Design and Location of Rights-of-Way and Transmission Facilities" or any successor guidelines and any other applicable federal guidelines and are to be contained within an area that provides a buffer zone that protects the public health and safety, as determined by the council. In establishing such buffer zone, the council shall take into consideration, among other things, residential areas, private or public schools, licensed child day care facilities, licensed youth camps or public playgrounds adjacent to the proposed route of the overhead portions and the level of the voltage of the overhead portions and any existing overhead transmission lines on the proposed route. At a minimum, the existing right-of-way shall serve as the buffer zone; (*emphasis added*)

technologically infeasible to do so, and reliability of the electric system is the basis upon which the determination of such infeasibility is to be made. Representative DelGobbo, Ranking Member of the Energy and Technology Committee, emphasized the criticality of reliability and its importance to the people of Connecticut in his legislative remarks in connection with the passage of H. B. 5418, *An Act Concerning Electric Transmission Line Siting Criteria*, which became P.A. 04-246:

REP. DELGOBBO: (70th)

> Let's begin with the premise - and I hope it's understood by all the members of the House -- that as we began this issue we understood one critical fact and that is that energy reliability is not - as in the words of the Chairman of the Department of Public Utility Control - it's not just a sort of important issue. It's not just something that we should do. It is an absolutely critical issue not just to energy but to the health, safety and welfare of the people of this State. (5/3/04 House of Representatives Session Tr. at p. 236).

Furthermore, subdivision (3)(D)(ii) of Section 16-50p(a), which was amended by P.A. 04-246, requires that the Council must determine, in certifying a new transmission facility, that "the facility … will serve the interests of electric system economy and reliability". (*See* footnote 18). This particular provision is unchanged from previous editions of PUESA. Had the legislature intended that the Council experiment with unreliability, it would not have allowed the aforequoted language to survive the passage of P.A. 04-246. Lastly, the state's policy of eliminating overhead transmission lines is not new. This long-term goal has been set forth in Section 16-50t(a)[19] both before and

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[19] Section 16-50t(a), as amended by Section 10 of P.A. 04-246, provides in pertinent part as follows:

> (a) The council shall prescribe and establish such reasonable regulations and standards in accordance with the provisions of chapter 54 as it deems necessary and in the public interest with respect to application fees, siting of facilities and environmental standards applicable to facilities, including, but not limited to, regulations or standards relating to: (1) Reliability, effluents, thermal effects, air and water emissions, protection of fish and wildlife and other environmental factors; (2) the methodical upgrading or elimination of facilities over appropriate periods of time to meet the standards established pursuant to this subsection or other applicable laws, standards or

after the adoption of P.A. 04-246, but it still continues to be tempered by the statutory directive that such elimination be accomplished in accordance with existing technology and the need to provide electric service at the lowest reasonable cost to consumers. (CGS Section 16-50t(a)(3)).

Council Inquiries Regarding P.A. 04-246

The Council has posed several questions that bear upon the proper interpretation of P.A. 04-246. ISO will comment on the first three questions asked by the Council, but not to the last two questions, which are not pertinent to the issues and interests which form the basis for ISO's intervention in this case.

1(a) Since 16-50p(h) is in a separate section from 16-50p (a)(3)(D), which considers costs, does subsection (h) prohibit the Council from considering costs in determining whether to put portions of the facility adjacent to listed facilities underground? If not, does the overall statute require the Council to consider costs in determining whether or not to put portions of the transmission facility adjacent to protected facilities underground? If yes, is there some point when costs are so great that the Council should consider them?

The Council's first set of inquiries questioned the interrelationship of Sections 16-50p(h) regarding underground lines and 16-50p(a)(3)(D) regarding costs. Costs remain a consideration because the Council is statutorily required to make determinations about electric system economy in approving any transmission facility, and a balancing of the need to provide utility service at the lowest reasonable cost with the need to protect the environment remains a fundamental purpose of PUESA, even after the adoption of P.A. 04-246.

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regulations; and (3) the elimination of overhead electric transmission and distribution lines over appropriate periods of time *in accordance with existing applicable technology and the need to provide electric service at the lowest reasonable cost to consumers*. (*emphasis added*).

Following tenets of statutory construction that dictate that different parts of a statute are to be construed harmoniously so that each part is reconciled and given effect and the statute is construed as a whole, thus rendering a reasonable overall statutory interpretation, (Connecticut v. Lake Spears, 234 Conn. 78, 93, 662 A.2d 80 (1995); Peck v. Jacquemin, 196 Conn. 53, 63, 66, 491 A.2d 1043 (1985)), ISO observes that CGS Sections 16-50p(h) and 16-50p(a)(3)(D) are both parts of PUESA. There is nothing in Section 16-50p(h) that references costs, either as an item to be included or excluded from consideration. CGS Section 16-50p(a)(3)(D) requires the Council to make the following determinations with respect to new transmission lines:

> (D) *In the case of an electric transmission line,* (i) what part, if any, of the facility shall be located overhead, (ii) *that the facility* conforms to a long-range plan for expansion of the electric power grid of the electric systems serving the state and interconnected utility systems and *will serve the interests of electric system economy and reliability*, and (iii) that the overhead portions, if any, of the facility are cost effective and the most appropriate alternative based on a life-cycle cost analysis of the facility and underground alternatives to such facility…(*emphasis added*).

Subdivisions (ii) and (iii) of the foregoing statute are cost-related, but subdivision (i) makes clear that the statute applies to underground and overhead portions of transmission facilities. Subdivision (ii) applies to all transmission facilities and therefore requires that the Council, in certifying any transmission facility, find that it serves the interests of electric system economy. Subdivision (iii) gives specific instruction regarding cost determinations to be made with respect to overhead facilities, but it does not prohibit consideration of costs for underground transmission proposals. Pursuant to Section 16-50p(a)(3)(D)(ii), therefore, the Council should consider the costs of underground transmission facilities as part of its determination that underground transmission will serve electric system economy.

The foregoing conclusion is buttressed by the overall purposes of PUESA, as set forth in CGS Section 16-50g, which include the following:

> To provide for the balancing of the need for adequate and reliable public utility services *at the lowest reasonable cost* to consumers with the need to protect the environment and ecology of the state…(*emphasis added*)

The statement of legislative purpose quoted above does not envision disregard of costs. Instead it supposes a balance between the provision of reliable service at the "lowest reasonable cost" and protection of the environment and ecology. That purpose will not be achieved if underground cables are utilized, even if adjacent to Protected Areas, without any consideration of their costs, which are generally substantially greater than overhead lines. In order to make its determination that the proposed underground cable serves the interests of electric system economy, the Council must consider such costs in every instance, and in the absence of legislative direction to disregard costs with respect to installation of underground cable adjacent to Protected Areas, it is within the Council's discretion, based on the facts of each case, to determine when such costs become prohibitive.

ISO notes that if the purpose of P.A. 04-246 relates to perceived health risks associated with EMFs, another New England state has had recent occasion to consider the impact of costs on EMF mitigation measures. In Vermont, the Public Service Board ("VPSB") just reaffirmed its policy of "prudent avoidance" with respect to EMFs and, in so doing, declined to take "drastic" measures such as requiring high voltage transmission lines to be placed underground when EMF concerns were raised. *See* Vermont Public Service Board Decision in Docket No. 6860, Petitions of Vermont Electric Power Company (VELCO) and Green Mountain Power Company for a Certificate of Public

Good, Pursuant to Section 30 VSA 248, Authorizing VELCO to Construct the Northwest Vermont Reliability Project. (App. Admin Notice 29, pp. 6-7, 75-76).[20]

1(b) Does "adjacent" mean the transmission line goes through or borders the property of the listed facility, or that the transmission line has to be a certain distance from the facility? If a large parcel, must the line be underground even if it is, for example, 300 feet from actual facility, and conversely, if a small parcel, must line be underground if within, for example, 100 feet from actual facility even if line doesn't border or go through the property?

ISO shares the Council's curiosity regarding the interpretation of the term "adjacent" as used in P.A. 04-246. Connecticut case law suggests that the term "adjacent" has no fixed meaning but must be interpreted in light of relevant surrounding circumstances, although the term "connotes nonetheless a site which, although not contiguous, will be near to, or in the general vicinity of a stated point of reference," Mimms v. Westport Planning & Zoning Commission, (Superior Ct, Bridgeport, CV 0289405 S, 1993 Conn. Super. LEXIS 1448, p. 10) (citing Welles v. East Windsor, 185 Conn. 556, 560-61, 441 A.2d 174 (1981)). Mimms also cites State v. Angus, 83 Conn. 137, 141, 75 A. 623 (1910), for the somewhat ambiguous definition that "adjacent" means "lying near, neighboring." Mimms, p.10. The dictionary is similarly imprecise,

[20] The VPSB's summary regarding its position on EMF mitigation and prudent avoidance is as follows:

> As part of its analysis, the Board has given specific consideration to assertions that the electromagnetic fields ("EMF") that will result from the proposed Project will produce undue adverse health effects. We have examined, with both care and sympathy, all the factual evidence and expert testimony in the evidentiary record and have concluded that the overall state of scientific knowledge is best expressed in the report of the National Institute of Environmental Health Sciences, stating that: "[t]he scientific evidence suggesting that ELF-EMF [extremely low frequency EMF, such as is produced by transmission lines] exposure poses any health risk is weak." In particular, EMF levels drop rapidly to extremely low levels with even small increases in distance from transmission lines. As a result, the Board is continuing Vermont's policy of "prudent avoidance." In practice this means "policies that limit magnetic field exposure whenever this can be done for a small investment of money and effort." However, we are not persuaded that prudent avoidance requires a general policy of placing all transmission lines underground, regardless of local conditions and cost. Instead, the Board has considered EMF issues as one, limited, factor in the multi-factor determination of whether to place any specific sections of a line underground on a site-specific basis. (App. Admin Notice 29, pp. 6-7)

with Webster's defining "adjacent" as "a: not distant; b: having a common endpoint or border; c: immediately preceding or following." (Webster's Ninth New Collegiate Dictionary, 1989 ed.). No set distance is given for determining whether one thing is "adjacent to" something else.

Other than stating that the existing right-of-way shall be the minimum buffer zone, P.A. 04-246 does not contain specific qualitative or quantitative criteria that indicate how far overhead transmission must be from Protected Areas. As a result, the Council would have the authority to exercise reasonable discretion, balanced by cost considerations dictated by Sections 16-50g and 16-50p(a)(3)(D)(ii) and (iii), to determine what portions of the transmission facility would be considered "adjacent to" Protected Areas for purposes of either applying P.A. 04-246's presumption against overhead transmission with respect to Protected Areas or determining its buffer zone requirement with respect to Protected Areas.

In the context of this proceeding, P.A. 04-246 would require that the Middletown-Norwalk transmission facility be placed underground in areas adjacent to Protected Areas, only if technologically feasible to do so. If underground placement in areas adjacent to Protected Areas is technologically infeasible, based on the impact such underground placement would have on the reliability and operability of the power grid, then overhead portions of the transmission line adjacent to Protected Areas would have to be placed in an appropriate buffer zone which would be no less than the existing right-of-way.

1(c) In defining "technologically infeasible" can the Council consider theoretically possible but unproven technology to be not reliable and therefore not feasible, or must the Council consider theoretically possible approaches unless proven unworkable or unreliable? Does the Council have discretion to approve technology which is not proven either reliable or unreliable? If placing a segment underground increases EMF, can the Council deem it technologically infeasible to bury that segment?

In connection with the concept of "technological infeasibility," which is not defined in P.A. 04-246, the Council has asked whether theoretically possible but unproven technology may be considered unreliable and therefore infeasible or, alternatively, whether the Council should defer a determination of technological infeasibility until a theoretically possible approach is proven unworkable or unreliable. The short answer is that the Council may not consider theoretically possible or unproven technology to be a technologically feasible solution.

The concept of Good Utility Practice is relevant to the Council's inquiry in this regard. ISO and NEPOOL members (including the Applicants) are required to follow Good Utility Practice. Good Utility Practice and applicable reliability criteria of NERC, NPCC and ISO System Rules are used to define the system facilities required to maintain reliability in evaluating proposed Reliability Transmission Upgrades. (ISO Admin Notice 12, Sections II.1.117, II.1.125)

"Good Utility Practice" is defined in Section II.1.35 of the Tariff as:

> Any of the practices, methods and acts engaged in or approved by a significant portion of the electric utility industry during the relevant time period, or any of the practices, methods and acts which, in the exercise of reasonable judgment in light of the facts known at the time the Proposed Project decision was made, could have been expected to accomplish the desired result at a reasonable cost consistent with good business practices, reliability, safety and expedition. Good Utility Practice is not intended to be limited to the optimum practice, method, or act to the exclusion of all others, but rather includes all acceptable practices, methods, or acts generally accepted in the region. (ISO Admin Notice 12, Section II.1.35)

In response to the Council's inquiry regarding unproven technology, ISO suggests that unproven technology does not satisfy a necessary characteristic of Good Utility Practice: that it have been engaged in or approved by a significant portion of the electric industry. Furthermore, the use of unproven technology, such as unprecedented extensive underground cable, C-type filters, STATCOMs or voltage source converter-HVDC, cannot be regarded as being consistent with good business practices or reliability where the consequences of failure are as immense as they are in Southwestern Connecticut.

Dr. Wakefield of KEMA stated as follows:

> We believe that to be technologically feasible, the technology – the mitigation technology in this case must be proven in actual industry practice. And that practice must be practice that is similar in application to the application proposed here, which is mitigating temporary overvoltages that occur after transients on the system.
> …
> [T]here is still to this date no record of any established industry practice in using C-type filters for mitigating temporary overvoltages. Therefore, we do not believe it is an established industry practice for that purpose. And therefore, there is some significant risk in employing it in actual practice in a manner that could affect customer loads and power supply equipment. (2/17/05 Tr. 17-18)

KEMA itself cautioned that untried methods should first be attempted in small applications where the risk of failure will not translate into significant system problems. (CSC Ex. 25, p. 2; 2/17/05 Tr. 23). The KEMA consultants opined, for example, that SWCT represented too large scale a project to serve as the first effort to apply C-type Filters to mitigate temporary overvoltages. (2/17/05 Tr. 19-20). Instead, they advocated a conservative, stepwise introduction and escalation of new technology. (2/17/05 Tr. 18-19).

ISO agrees with KEMA.[21] Installation of new technologies may be considered where the risks associated with failure of that technology are small. The Council should not consider unproven technology to be reliable until such technology is proven workable. Any contrary approach would subvert the appropriate order of priorities, making customers unacceptably subservient to experiments. It would exalt the search for new technology over the reliability of the electric system, which ISO is mandated by FERC to maintain. Lastly, it would be gambling on a colossal scale, given the fact that major system improvements can cost many hundreds of millions of dollars to design, permit and build and given further the enormous economic damage of a widespread blackout. It would not be prudent to spend vastly on an idea that might or might not work, only to find that the effort and expense would have to be duplicated to replace a failed project with a workable solution. The consequences of finding out that unproven technology is unworkable preclude any presumption of reliability, especially in large scale applications such as SWCT. In short, the ISO could not support such a solution.

The Council has asked whether it can deem it technologically infeasible to bury a transmission segment if placing it underground would increase EMF levels. In ISO's frame of reference, technological feasibility relates primarily to reliability and operability of the system, while EMFs have traditionally been approached as a health issue. While ISO has not entered the debate concerning EMFs in siting proceedings, it notes the course taken by the VPSB in its Decision this year in Docket 6860 regarding VELCO's Northwest Vermont Reliability Project, where the VPSB relied upon the following

[21] It should not be assumed that no new technology is attempted or permitted in New England. The Glenbrook STATCOM represents the application of new technology, and insofar as it is not yet operating smoothly, it represents an example of new technology that needs to be further refined before being applied on a large scale. (App. Ex. 164, p. 6).

position of the National Institute of Environmental Health Sciences regarding EMFs: "[t]he scientific evidence suggesting that ELF-EMF [extremely low frequency EMF, such as is produced by transmission lines] exposure poses any health risk is weak." (App. Admin Notice 29, p. 6).

Given the foregoing, there appears to be little reason for declaring an otherwise workable and reliable cable segment to be technologically infeasible because it increases EMFs. Even if the increase in EMFs from an underground cable segment were so great, and the status of a link between EMFs and human health so well established, as to justify a conclusion that the underground cable emitted levels of EMFs that were hazardous to human health, ISO believes that such a situation should be approached as a health issue, not as a matter of technological infeasibility.

With respect to the foregoing question, ISO also observes that P.A. 04-246 may have been adopted out of a desire to minimize exposure to EMFs, but there is nothing in the statute that equates technological feasibility with EMF levels. There is simply a broad directive to place 345 kV or greater transmission facilities underground, if adjacent to Protected Areas, unless it is technologically infeasible to do so. Technological infeasibility thus provides an exemption from the policy of underground transmission facilities adjacent to Protected Areas. The present legislation appears to allow only the use of a buffer zone at least as wide as the existing right-of-way as an alternative means of minimizing EMFs if it is technologically infeasible to bury transmission.

2. A crucial factual issue in these hearings is whether there is a limit to the amount of the proposed line that can be technologically and reliably buried, and if so, how many miles. Parties and intervenors are to present their positions, whether in briefs or proposed findings and cite to supporting evidence. Parties and intervenors who believe there is a limit, should further state whether they believe the underground portion must be one continuous portion or whether the Council can allocate underground miles along different

portions of the route. For parties and intervenors who believe the Council can divide underground portions, be explicit about how porpoising of the line can be accomplished. A related legal issue is whether the Council must take portions from segments not passing adjacent to listed facilities and reallocate underground adjacent to protected facilities. Can this be reliably and technologically accomplished?

Out of all the electrical system complexities that have arisen in this proceeding and all of the studies that have been performed by numerous experts to examine the causes and effects of using various lengths of limits of underground cable in the Project, one simple and compelling fact has emerged: *no technical expert proposes or endorses more than the 24 linear miles* (i.e., 48 circuit miles) *of underground cable* that are proposed for segments 3 and 4 of the Project.

ISO has already submitted detailed Proposed Findings of Fact in which it indicates that no more than 24 miles of underground cable can be placed in two circuits between Norwalk and East Devon, thus amounting to 48 circuit miles. (ISO FF 121-123). Furthermore, this limit is only achievable if other modifications and upgrades are made, including the use of XLPE cable rather than HPFF and the replacement of a substantial number of surge arrestors and circuit breakers in the systems of both CL&P and UI.[22] ISO's Proposed Findings of Fact also present the reasons why the use of underground cable in the Project must be limited. (*See*, e.g., ISO FF 71-89,108-110, 119-120, 124). ISO believes its Proposed Findings of Fact fully set forth its position regarding underground cable and the reasons why it would not be technologically feasible to add any cable beyond the 24 miles in segments 3 and 4, but ISO will take this opportunity for further clarification.

[22] From this perspective, it must be observed that the installation of 24 miles of underground cable will apparently require the rebuilding of existing elements of the Applicants' transmission systems – actions that would otherwise not appear to be required by statute

There is nothing inherently wrong with underground cable, nor does ISO have any generic distaste for underground cable. However, it must be recognized that underground cable has significantly greater capacitance than overhead line and that severe complications result from adding capacitance to a weak system, such as SWCT. This relationship has in fact been acknowledged by every expert who has testified in this proceeding (*See*, e.g., 2/17/05 Tr. 19, 37-40, 46, 57 (KEMA); 6/15/04 Tr. 18, 22-23 and App. Ex. 109, pp. 3, 4 (GE); App. Ex. 176, Appendix C, p. 8 (Enernex); ISO Ex. 10, p.20 (PB Power)), and it must be respected.

High capacitance in a relatively weak system is of paramount concern because of its propensity to cause lower-order harmonic resonance conditions on the system and thus increase the risk of high and sustained overvoltage problems on the system. (App. Ex. 44, CSC-28, pp. 3-4). Such low-order harmonic resonances can amplify harmonic voltage and current distortion to unacceptable levels. The capacitance associated with underground cables increases the potential for excessive temporary overvoltages ("TOVs"), which are sustained overvoltages lasting for more than two cycles. (App. Ex. 176, pp. 3-4, 16). If system resonance is near, at, or below the third harmonic in a weak system, sustained overvoltages are generally worse and can damage both customer and utility equipment, possibly leading to voltage collapse and outages. (App. Ex. 109; App. Ex. 110, p. 4; ISO Ex. 10, pp. 10-11; 1/13/05 Tr. 101-102). Operation near, at, or below the third harmonic level is undesirable because of these reasons and because resonances at these low order levels are difficult to mitigate. (App. Ex. 109; ISO Ex. 10, pp. 10-11).

If utility equipment cannot withstand TOVs, and if circuit breakers are incapable of successful interruption under contingencies such as faults and equipment failures,

system operation will be compromised. (App. Ex. 25.f, p. 5-1). While the ROC consultants had performed substantial analysis in connection with the submission of the final ROC Report on December 20, 2004, and while these studies showed that C-type Filters improved performance in some instances but degraded performance in many others (App. Ex. 176, pp. 35-36), the ROC consultants performed even further TNA analyses after KEMA's January 19, 2005 "White Paper" questioned the support for the ROC's conclusions (App. Ex. 199; 2/17/05 Tr. 112-115). These analyses indicated, with respect to TOVs at 2 cycles, that the addition to Case 5 of even five miles of underground cable between East Devon and Beseck would create 15 TOVs exceeding equipment ratings and 195 TOVs that exceeded the margin of safety which both the ROC and KEMA deemed appropriate for TOV limits. (App. Ex. 199; 2/17/05 Tr. 112-115). Instances in which TOV limits and safety margins were exceeded were even more rampant if longer increments of underground cable were added to Case 5. For example, there were 54 TOVs in excess of equipment ratings for Case 5 plus 10 miles and 289 TOVs in the safety margin for Case 5 plus twenty miles of additional cable (*Ibid*).

The KEMA consultants admitted that the TOVs were greater than they had expected them to be when they first proposed C-type filters as a possible mitigation technique, and KEMA agreed with the ROC that neither the technical nor operational feasibility of underground cable beyond 24 miles in the Project can be confirmed. (CSC Ex. 25, p. 3; 2/17/05 Tr. 108).

It bears emphasis that KEMA never reached any final conclusion that more than 24 miles of underground cable could be used in the Project, nor did its final concurrence with a 24 mile underground limit constitute a change of position. KEMA's preliminary

expression of the possibility of perhaps 10 to 20 further miles of underground cable was clearly and carefully conditioned on the performance of TNAs which KEMA had not been able to conduct. Its review of the ROC report was more of an inquiry as to the support for the ROC's conclusions than a dispute as to the substance of the ROC's conclusions. In the final analysis, when all of the support for the ROC's conclusions was clarified for KEMA and further studies suggested by KEMA were performed by the ROC's consultants, KEMA deemed the studies adequate to support the ROC's conclusions. KEMA, on behalf of the Council and the people of Connecticut, demanded exacting analysis and thorough support for the conclusion that it would be technologically infeasible to install more than 24 miles of underground cable in the Project. ISO submits that the extensive studies performed to satisfy KEMA constitute thorough justification for that conclusion.

The allocation of underground cable into sections along different portions of the route, as opposed to one continuous length of cable, does present reliability issues. ISO has not studied any particular case that would involve a decrease of the proposed 24 mile cable between Norwalk and East Devon and an allocation of cable or porpoising between East Devon and Beseck, and therefore offers only the following generic comments in response to the Council's inquiry in this regard.

A configuration involving less underground cable in segments 3 and 4 than is proposed in Case 5 in order to install a portion of underground cable between East Devon and Beseck would not be as reliable as Case 5 because it involves "porpoising" and additional substation construction. (2/17/05 Tr. 101-102) The number of underground sections in a line must be limited because of technical issues. A transmission facility

should not be designed to porpoise frequently from overhead to underground and back because such a design exposes the line to a high risk of damage due to overvoltages caused by "reflections," as transient surge voltages travel back and forth between the overhead and underground portions, which have different impedance characteristics, at the speed of light in the event of a lightning strikes and switching events on the network. A transition (termination) station would also be required at each end of each underground section. Connection to a substation would be preferable to a transition station because a substation would provide a strong ground grid that might provide greater protection against unwanted fault currents flowing on cross-bonded sheath used in XLPE cable.

In relation to allocation of the underground portion of the Project, the Council asks whether the Council is legally obligated to take portions from segments not passing adjacent to Protected Areas and reallocate underground adjacent to Protected Areas and it asks further whether this can be reliably and technologically accomplished.

P.A. 04-246 does not prioritize among Protected Areas, and therefore, no one Protected Area or listed facility has any greater statutory claim to underground cable than any other, whether it be a senior citizens' housing complex, a golf course, a day care center, a hockey rink or a community college. It might be virtually impossible to design and operate a transmission facility that would be reliable and that could switch from overhead to underground as often as might be desired to pass all Protected Areas underground. There is clearly some limit, in terms of reliability and technological feasibility, to the extent to which a transmission facility can switch from overhead to underground. The extent, if any, to which the Council must engage in underground allocation will depend, in the context of any particular case, on the length of the proposed

transmission facility, the number of Protected Areas involved, their spatial relationship to one another, space requirements for transition stations, and the strength available to ground the underground cable. It may also depend on the need to install underground cable in areas which, although not Protected Areas, *require such installation for technical or engineering reasons*, given the complex interaction of underground cable with the existing system, and in dense urban areas where cable has traditionally been used.

3. Can or must the Council consider whether configuration it approves is likely to be approved by ISO?

The statutory factors which the Council must consider and the findings and determinations it must make in acting upon an application, including those set forth in CGS Section 16-50p(a)(3)(D), do not state that the Council must consider whether or not the configuration it approves is likely to be approved by ISO, nor do they prohibit the Council from considering all relevant evidence in the record. On the other hand, CGS Section 16-50p(a)(3)(D)(ii) requires the Council, in approving any transmission line, to determine that it conforms with a long-range energy plan for expansion of the electric power grid of the electric systems serving the state and interconnected utility systems, and FERC has assigned the responsibility for regional system planning to ISO. Consequently, as there is some confluence of responsibilities and interests, it would seem constructive for ISO to provide information to the Council, as it has in this proceeding, and for the Council to consider such information as relevant to its determination. In short, if a proposed project design did *not* conform to a long-range energy plan because of its unworkability, the Council should consider that fact.

ISO is a non-governmental, non-profit corporation which intervenes in state proceedings such as this transmission siting docket in order to make its expertise in bulk

power system planning and operation available to the administrative agency that has jurisdiction over the proceeding and because it has an interest, by virtue of the responsibility FERC has placed in ISO for both regional planning and reliable operation of the bulk power grid, in the outcome of the proceeding.

Exhibits and expert testimony provided by ISO witnesses and consultants are part of the record evidence in this proceeding, and such exhibits and testimony are therefore available for consideration by the Council, including any evidence that may pertain to possible approval or disapproval by ISO of any configuration approved by the Council.

The record in this case includes evidence of ISO's planning and operational responsibilities under various FERC Orders (ISO Ex. 1, pp. 4-5, 8), its duty to assure that no proposed upgrade will cause system harm under Section 18.4 of the Restated NEPOOL Agreement (now Section I.3.9 of the Tariff) (ISO Admin Notice 12), the reliability criteria and planning procedures applicable to the New England bulk power system (ISO Admin Notice 7; ISO Admin Notice 8) and various provisions of the Tariff which inform ISO's decision-making and implementation of its duties, such as the definitions of Good Utility Practice (ISO Admin Notice 12, Section II.1.35) and Reliability Transmission Upgrade (*Id*. at Section II.1.125). It is not irrelevant for the Council to take these provisions into consideration, and it contributes to principles of administrative efficiency for the Council to be aware of ISO's views.

As a final point in this regard, the legislative intent of P.A. 04-246 backs the argument that the Council, in making its determinations regarding technological feasibility, was meant to consider ISO's views regarding technological feasibility. The legislature intended the reliability standards utilized by ISO in operating the system to

apply to the issue of technological feasibility. During floor debate on the proposed legislation, discussion between Representative Backer, Co-Chair of the Energy and Technology Committee, and Representative DelGobbo, Ranking Member of that Committee, indicated that "reliability" as used in the bill meant a system that would function in accordance with ISO standards and technological feasibility, and ISO's operability of the transmission system was referred to as a common standard for reliability. Pertinent excerpts from their discussion follow:

Rep. Backer: (121st)

> … When we speak of reliability in the bill we obviously are speaking to a system that would function. That it would function in accordance with the standards of ISO and what is technically feasible. So I think the simple answer to that question is yes. Reliability and operability are very much one in the same. You can't have something that is operable if it's not reliable.
>
> And it's not operable the inverse is true. So I think the simple question is operability and reliability for the sake of this are married together. (5/3/04 House of Representatives Session Tr. at p. 238).

…

Rep. DelGobbo: (70th)

> ...we go through so many arcane elements of this issue that in fact the term about reliability in my understanding refers to the independent system operators [sic] operability of the electric transmission system. That is sort of a common standard. Is that your understanding?

…

Rep. Backer: (121st)

> … the answer is yes that is exactly what I mean. (5/3/04 House of Representatives Session Tr. at pp. 238-39).

Technological feasibility under CGS Section 16-50p(h) is based on reliability, and reliability means a system that will function in accordance with the standards of ISO and will be operable by ISO. As a result, and as indicated by the preceding dialogue, it follows that ISO's views regarding the technological feasibility of a transmission upgrade

subject to the provisions of CGS Section 16-50p(h) are germane to the Council's consideration.

CONCLUSION

ISO firmly believes that there is a compelling public need for the Applicants' proposed transmission improvements and that a Certificate of Environmental Compatibility and Public Need should be granted for the purpose of allowing the Applicants to construct their Project from Scovill Rock Substation in Middletown to Norwalk Substation, utilizing not more than 24 miles of underground cable in the configuration of Case 5.

Respectfully submitted,

ISO NEW ENGLAND INC.

By _____

Anthony M. Macleod
Whitman Breed Abbott & Morgan LLC
100 Field Point Road
Greenwich, Connecticut 06830
Telephone: 203-869-3800
Its Attorneys

CERTIFICATION

I hereby certify that a copy of the foregoing was hand delivered or sent via email or first class mail postage prepaid, on March 16, 2005 to all parties and intervenors of record as shown on the attached service list.

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Anthony M. Macleod
Commissioner of the Superior Court