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BY HAND DELIVERY

July 7, 2009

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CONNECTICUT
SITING COUNCIL

S. Derek Phelps
Executive Director
State of Connecticut
Connecticut Siting Council
10 Franklin Square
New Britain CT 06051

Re: Docket No. 370A: CL&P Application for the Greater Springfield Reliability Project and the Manchester to Meekville Jct. Circuit Separation Project

Docket No. 370B: NRG Energy, Inc. Application Pursuant to C. G.S. § 16-50*l*(a)(3) for Consideration for a 530 MW Combined Cycle Generation Plant in Meriden, CT.

Dear Mr. Phelps,

I enclose the original and 20 copies of the Pre-filed Direct Testimony submitted on behalf of The Connecticut Light and Power Company, consisting of two volumes.

The first volume is a binder containing the following testimony, with exhibits:

Witness	**Subject**
Allen W. Scarfone	Electric System Need and Benefits
Robert E. Carberry and Scott E. Newland	Engineering, Design, Siting, Construction and EMF Characteristics
Louise Mango	Environmental Effects
Maria Fusco Scheller	System Alternatives
Julia Frayer	Economic Benefits

Please note that Exhibits CN-7A and CN-7B to the testimony of Messrs. Carberry and Newland consist of information on Compact Discs. Copies of the CD's have been provided to those on the mail service list. For the convenience of those on the electronic service list, the same information has been posted on a project website and a link to it has been provided in the testimony.

The second volume of testimony is a collection of the résumés of the witnesses submitting pre-filed testimony and of others who may be called upon to provide testimony in response to questions from parties and intervenors.

Very truly yours,

Anthony M. Fitzgerald

AMF / kas
Enclosures
cc: Attached Service List

LIST OF PARTIES AND INTERVENORS
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Applicant	☒ U.S. Mail	The Connecticut Light & Power Co. P.O. Box 270 Hartford, CT 06141-0270	Robert E. Carberry, Manager NEEWS Projects Siting and Permitting Northeast Utilities Service Company P.O. Box 270 Hartford, CT 06141-0270 (860) 665-6774 carbere@nu.com
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Intervenor (granted on February 19, 2009) **Competing Applicant as of 03/19/2009**	☒ U.S. Mail	NRG Energy, Inc.	NRG Energy, Inc. c/o Julie L. Friedberg, Senior Counsel – NE 211 Carnegie Center Princeton, NJ 08540
	☒ U.S. Mail		Andrew W. Lord, Esq. Murtha Cullina LLP CityPlace I, 185 Asylum Street Hartford, CT 06103-3469 (860) 240-6180 (860) 240-5723 – fax alord@murthalaw.com

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Party (granted November 20, 2008)	☒ E-mail ☒ U.S. Mail	Town of East Granby	Donald R. Holtman, Esq. Katz & Seligman, LLC 130 Washington Street Hartford, CT 06106 (860) 547-1857 (860) 241-9127 dholtman@katzandseligman.com The Honorable James Hayden First Selectman Town of East Granby P.O. Box 1858 East Granby, CT 06026

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Intervenor (granted December 4, 2008)	☒ E-mail ☒ U.S. Mail	ISO New England Inc.	Anthony M. Macleod Whitman Breed Abbott & Morgan LLC 500 West Putnam Avenue, P.O. Box 2250 Greenwich, CT 06830-2250 (203) 862-2458 amacleod@wbamct.com Kevin Flynn, Esq. Regulatory Counsel ISO New England One Sullivan Road Holyoke, MA 01040 (413) 535-4177 kflynn@iso-ne.com
Party (granted on January 8, 2009)	☒ U.S. Mail ☒ E- Mail	Office of Consumer Counsel	Mary J. Healey Consumer Counsel Ten Franklin Square New Britain, CT 06051 Mary.healey@ct.gov Bruce C. Johnson Principal Attorney Office of Consumer Counsel Ten Franklin Square New Britain, CT 06051 Bruce.johnson@ct.gov

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Party (granted on April 7, 2009)	☒ E-Mail	The United Illuminating Company (UI)	John J. Prete The United Illuminating Company 157 Church Street, P.O. Box 1564 New Haven, CT 06506-1904 (203) 499-3701 (203) 499-3728 neews-ui@uinet.com
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Party (granted on June 4, 2009)	☒ E-Mail ☒ U.S. Mail	Connecticut Department of Transportation	Eileen Meskill Assistant Attorney General Office of the Attorney General 55 Elm Street P.O. Box 120 Hartford, CT 06141-0120 Eileen.meskill@po.state.ct.us Thomas A. Harley, P.E. Chief Engineer Connecticut Dept. of Transportation 2800 Berlin Turnpike Newington, CT 06131
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Party (granted on June 4, 2009)	☒ U.S. Mail	Citizens Against Overhead Power Line Construction	Citizens Against Overhead Power Line Construction c/o Richard Legere 1204 Newgate Road West Suffield, CT 06093 (860) 668- 0848 (860) 668-0848 rlegere@cox.net

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STATE OF CONNECTICUT

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Docket 370A: The Connecticut Light and Power Company application for a Certificate of Environmental Compatibility and Public Need for (1) The Greater Springfield Reliability Project consisting of a new 345-kV electric transmission line and associated facilities from the North Bloomfield Substation in Bloomfield to the Connecticut/Massachusetts border, together with associated improvements to the North Bloomfield Substation, and potentially including portions of a new 345-kV electric transmission line between Ludlow and Agawam, Massachusetts that would be located in the Towns of Suffield and Enfield, Connecticut; and (2) the Manchester Substation to Meekville Junction Circuit Separation Project in Manchester, Connecticut.	**DOCKET 370**
Docket 370B: NRG Energy, Inc. application pursuant to C.G.S. § 16-50*l*(a)(3) for consideration of a 530 MW combined cycle generating plant in Meriden, Connecticut	July 7, 2009

DIRECT TESTIMONY

ON BEHALF OF

THE CONNECTICUT LIGHT AND POWER COMPANY

Witness	Subject
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DIRECT TESTIMONY OF ALLEN W. SCARFONE

CONCERNING THE NEED FOR
THE GREATER SPRINGFIELD RELIABILITY PROJECT
AND
THE MANCHESTER TO MEEKVILLE CIRCUIT SEPARATION PROJECT

Table of Contents

1.0 Introduction

Qualifications and Relevant Experience of the Witness

Q. Please state your name, business address and occupation.

A. My name is Allen W. Scarfone. My business address is Northeast Utilities Service Company ("NUSCO"), 107 Selden Street, Berlin, Connecticut 06037. I am an electrical engineer employed as the manager of transmission system planning at NUSCO.

Q. In what type of engineering do you have special training and experience?

A. I have special training and experience in the areas of power system modeling and transmission planning analyses.

Q. Please describe your education and employment history.

A. I received a bachelor's of science degree in electrical engineering with a concentration in power systems from Purdue University, West Lafayette, Indiana in 1982. I have been employed by NUSCO since 1992 and have performed numerous transmission planning studies for the Northeast Utilities System Companies, including The Connecticut Light and Power Company (CL&P), Western Massachusetts Electric Company (WMECO) and Public Service Company of New Hampshire. My resume is included on the separate volume of resumes filed as part of CL&P's pre-filed written testimony (Resume Volume).

Q. Have you testified previously before administrative agencies concerning electric power transmission?

A. Yes, I have provided testimony on behalf of CL&P in proceedings before the Connecticut Siting Council. I have also provided testimony to the Federal Energy Regulatory Commission (FERC), the Connecticut Department of Public Utility Control (DPUC), the New Hampshire Public Utilities Commission, and the Massachusetts Department of Public Utilities.

Q. What is the purpose of your testimony?

A. The primary purpose of my testimony is to support CL&P's application in this Docket (Application) by describing the need and scope of the proposed transmission reinforcement plan for the Greater Springfield Reliability Project (GSRP) and the Manchester Substation to Meekville Junction Circuit Separation Project (MMP) and its system benefits. I will also describe alternative assessments undertaken and the expected cost treatment by the Independent System Operator – New England (ISO-NE). Finally, I will provide the expected in-service date.

Q. Please describe NUSCO's work in identifying the need for the GSRP.

A. In 2004, ISO-NE convened a working group (the "Working Group") to study a set of reliability problems in the southern New England transmission system, which had been identified in ISO-NE's 2003 Regional Transmission Expansion Plan, and which had been recognized as most probably inter-related. My NUSCO planning colleague Tim Laskowski[1], who is here with me today, was a member of the Working Group, along with representatives of National Grid and ISO-NE. Membership in the Working Group was open to all New England Transmission Owners ("TO"). The Working Group identified multiple inter-related problems with the southern New England transmission system, and developed a long range plan to address these problems. This plan was initially called the Southern New England Transmission Reliability Plan (SNETR) and later the New England East-West Solution (NEEWS). It consists of four separate, but inter-related projects, one of which is the GSRP.

Q. How was the design of the GSRP determined?

A. Once the Working Group identified the required basic elements of each project, it evaluated a large number of potential electrical configurations for each of them, which it called "Options." A small number of potentially acceptable "Options" for each element of NEEWS was then identified. This work is described in a report provided as part of

[1] A copy of Mr. Laskowski's resume is also included in the Resume Volume.

Volume 5 of the Application, referred to as the ISO-NE "Options Report."[2] NUSCO and National Grid then undertook a further study of the Options to determine the best solution for each of the four projects, taking into account system performance, routing, environmental and cost considerations. This work is described in the "Greater Springfield Solutions Report" also filed as part of Volume 5 of the Application.

Q. When did you personally become involved in the planning effort for the GSRP?

A. I supervised NUSCO's work on the effort of identifying the best configuration of the GSRP from among the various Options that the Working Group had identified. This work on the GSRP eventually led us to identify the need for and design the MMP.

Q. What work have you done on the GSRP since its optimum configuration and the requirement for the MMP were identified?

A. In the course of our work on the GSRP and the MMP, NUSCO and National Grid were required to make several presentations to ISO-NE committees, particularly its Planning Advisory Committee, and to the Reliability Committee of the New England Power Pool (NEPOOL). I participated in those presentations. In particular, I was involved in the presentations that resulted in the issuance of ISO-NE technical approval for the NEEWS projects.

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[2] The full title of the report is New England East-West Solutions (formerly Southern New England Transmission Reliability Options Analysis).

Finally, I have continued to perform transmission planning analyses concerning the need for the GSRP and the MMP since the original need studies were performed by the Working Group. The original need studies were based on power-flow simulations using future loads forecast by ISO-NE in its 2005 Capacity, Energy, Loads and Transmission (CELT) Report and the solutions were modeled assuming that all of the NEEWS projects were built. Shortly before filing the Application, I updated those analyses by: (i) modeling the impact of the proposed GSRP and MMP by themselves – without the two future Connecticut NEEWS projects (the Interstate Reliability Project and the Central Connecticut Reliability Project); and (ii) using ISO-NE's 2008 CELT forecast data. The results of this updated Needs Analysis (the 2008 Needs Analysis) were presented in the Application.

Most recently, I have performed yet another updated need analysis for the GSRP and the MMP (the 2009 Needs Analysis). This most recent analysis takes into account the forecasted loads in ISO-NE's 2009 CELT Report and includes the relevant new resources that have cleared the second ISO-NE forward capacity auction (FCA) held in December, 2008 and all new and proposed resources for which procurement contracts have been ordered by the DPUC. These results were submitted to the Council on June 22, 2009, as a supplemental response to OCC Data Request OCC-1, Q-OCC-009-SPO1.

Q. Why has it taken five years since the Working Group started its work to get to this point in the siting process?

A. Documenting the need for and settling on the design for the GSRP and the MMP was part of a larger and very complex process of designing a long range plan and integrated set of solutions for several interrelated problems in southern New England, involving two companies and transmission plans in three states. Each element of the overall solution had to be designed to work together optimally with the others and also to stand on its own or to work with less than all of the others, if required to do so. This was a much more complex and time consuming effort than designing a single project to address a limited and geographically confined set of problems. The ultimate solutions had to be taken through the ISO-NE review process. Then, in order to present the projects to the Siting Council, updated need and solution analyses of the GSRP as a stand alone project (but with the MMP) had to be developed. Ultimately, we filed this Application, in October of 2008, after a municipal consultation process that had taken nearly five months, rather than the minimum of 60 days, and which extended to nine municipalities in Massachusetts and nine in Connecticut. Finally, this was the first transmission project to be subjected to the CEAB process, which has taken up significant additional time and a large commitment of resources by the NUSCO planning staff.

2.0 Regional Transmission Planning Entities and Concepts

Q. Please explain some of the terms and references you used in telling us about your experience with this project. First, what is ISO-NE?

A. ISO-NE is the organization that manages New England's bulk electric power system, operates the region's wholesale electricity market and conducts regional transmission planning. ISO-NE's transmission planning responsibilities include maintaining a level of system reliability that meets planning and operating standards approved by FERC and developed by the North American Electric Reliability Corporation (NERC) and the Northeast Power Coordinating Council (NPCC). In accordance with the responsibilities embodied in the ISO-NE Tariff, ISO-NE is responsible for developing a comprehensive Regional System Plan (RSP), a ten-year plan that uses ISO-NE load demand and energy forecasts, generation and load response capabilities and reserve requirements to identify the need and location for additional resources and additional transmission system infrastructure enhancements that are essential to ensure continuity of electric service for all New England electric customers.

ISO-NE was established by FERC in 1997 to support competitive electricity markets by providing independent, open and fair access to the region's transmission system; establishing a non-discriminatory governance structure; facilitating market based wholesale electricity rates; and ensuring the efficient management and reliable operation of the regional bulk power system. In June 2001, FERC conferred additional authority on

ISO-NE making it responsible for the regional transmission planning process. In June 2003, FERC confirmed ISO-NE's authority to approve planning for transmission upgrades and changes to supply and demand-side resources. On February 1, 2005, ISO-NE began operation as the New England Regional Transmission Organization with expanded authority under the terms of the ISO-NE Transmission, Markets, and Services Tariff referred to as the ISO-NE Tariff.

Q. You referred in one of your previous answers to presentations made to the ISO-NE Planning Advisory Committee. What is that?

A. In order to make its planning process open and transparent to stakeholders, ISO-NE conducts regular planning meetings with the Planning Advisory Committee (PAC), a stakeholder group that is open to any interested entity, including but not limited to, generators, load serving supply entities, wholesale transmission customers, transmission owners, market participants and various officials of the New England states. Through these planning meetings, stakeholders are provided the opportunity to address ISO-NE assumptions, methodologies and analyses.

Q. You also mentioned presentations to the NEPOOL Reliability Committee. What is that?

A. NEPOOL was established in 1971 as a voluntary organization by New England electric public utilities to coordinate system operations and generation dispatch on a regional basis. As a result of the Energy Policy Act of 1992 and FERC Order 888 in 1996, those functions are now performed by ISO-NE, and NEPOOL serves only as an advisor to ISO-NE, through the activities of various NEPOOL committees. Pursuant to Section I.3.9 of the ISO-NE Tariff, the NEPOOL Reliability Committee provides ISO-NE with advisory input with respect to ISO-NE's evaluation whether a proposed transmission or generation project will or will not have a significant adverse impact on New England's transmission system or on a neighboring market participant. This is commonly known as the adverse impact test. A determination that a proposed project will not have such an adverse impact, known as an I.3.9 Approval or a technical approval, is required for a project to be built and energized. The Reliability Committee makes a non-binding recommendation to ISO-NE on technical approvals by a formal vote of the committee members, after reviews by dedicated task forces of the committee.

Q. You referred to the ISO-NE CELT forecasts of different vintage years. Please explain what the CELT is and how it is used in the transmission planning process.

A. As previously noted, CELT stands for Capacity, Energy, Loads and Transmission. ISO-NE publishes the CELT Report annually, and the New England utilities rely upon information in these Reports for their transmission planning analyses. The ISO-NE load forecast used for transmission planning studies is a 90/10 forecast. This means that the actual peak load has a 10 percent chance of exceeding the forecasted load level and a 90 percent chance of falling below the forecasted load level for each planned seasonal peak. ISO-NE uses this 90/10 demand forecast philosophy to develop its transmission plans to provide greater certainty of reliable electric service under severe conditions. This approach is consistent with national and regional standards that require contingency testing to include simulated conditions for forecasted loads that "reasonably stress" the system. The forecasts look ahead for 10 years and estimate both total energy use and seasonal peak loads for New England as a whole and by each of the six New England states.

The distribution substations in the greater Springfield area and in Connecticut that are relevant to the GSRP need analysis are identified in the Application along with their peak metered loads in 2007 and their projected peak loads for the years up to 2014, reflecting the 90/10 peak load assumption used by ISO-NE for transmission planning. The power-flow analyses contained in this Application are based on the forecasted load for 2014. My most recent power-flow analysis is also based on forecasted load for 2014, but uses the most recent (2009) CELT projections.

Use of the ISO-NE forecasts in transmission planning studies is complicated by a change in the methodology of accounting for the effects of demand-reducing strategies (called Demand-Response (DR) resources) that ISO-NE adopted in 2007. Whereas previously ISO-NE would reduce its forecasts to account for the predictable effects of certain "passive" DR programs, ISO-NE then decided to treat new DR resources as "capacity" resources, so as to put them on an equal footing with other capacity-related resources (such as new generation) in future forward capacity auctions.

Accordingly, 90/10 load forecasts should be adjusted for future DR effects when modeling future system conditions for transmission planning. Otherwise, such forecasts would likely overestimate future loads and the need for transmission improvements.

Q. Finally, you referred in one of your previous answers to ISO-NE Forward Capacity Auctions. What are they?

A. These are auctions held by ISO-NE annually, in which providers of generation and demand–response resources bid to provide future capacity. The purpose of the auctions is to assure that sufficient resources will be available to serve customer peak demands for electricity in the near term. At each auction, existing and proposed generation resources are committed to fulfill dispatch obligations to meet peak customer demands for a one year period starting three years in the future. The price at which such capacity will be provided is set by the auction process, as the lowest uniform price at which the required amount and types of capacity can be procured. In addition to generation, both active and passive measures for reducing load, now known as demand–response "resources," are procured through the FCA, on an equal footing as a generating resource. Resources that are selected to receive capacity payments by ISO-NE as the result of the auction process are said to have "cleared" the FCA. FCA1 was held in February, 2008. FCA2 was held in December, 2008. FCA3 is scheduled for October, 2009.

Q. What is the difference between "active" and "passive" DR programs?

A. In general, active demand-response systems are dispatchable in a manner similar to generation units, whereas passive systems are continuously in effect and require no special action to be activated.

Q. Is there any difference in the results of the 2009 power-flow study as compared to the 2008 Needs Analysis?

A. There is no significant difference. Because the load was slightly lower in the later ISO-NE CELT forecasts, the results were slightly less severe. However, the need and the performance of the solution projects remained the same.

3.0 The Electric Transmission System

Q. How does the regional transmission grid deliver electric power to customers?

A. Electric power is delivered across New England and beyond it by an interconnected transmission network, sometimes called a "grid" or "system". Collectively, transmission circuits provide the transportation infrastructure that moves electric energy from where it is produced to where it is used. The integrated transmission network or grid is designed to safely and reliably deliver energy resources to all customer electric demands at all times. The grid is also designed to ensure that maintenance can be performed without service interruptions and that delivery of energy resources to and from neighboring electric systems can be accomplished both in normal times and during emergency situations.

Within New England, moving large quantities of electric energy is achieved primarily by the interconnected 345-kV bulk power system, which transmits energy from large central generating stations and power imported from neighboring utilities throughout New England and to neighboring control areas. A design objective for the 345-kV bulk power system is to build closed "loops" which allow power interrupted on one segment of the "loop" to be replaced instantaneously by power reaching the desired destination from the other direction. The 345-kV system is somewhat analogous to a limited access interstate highway system, except that the 345-kV system adjusts to emergencies much faster. Like the interstate highway system, the 345-kV bulk power system crosses state lines to make necessary connections. At major bulk-power substations throughout the region, the 345-kV system interconnects with the 115-kV system.

Some bulk-power substations include large autotransformers that transform the voltage from 345 kV to 115 kV, so that it can then be transmitted by the 115-kV system, which is somewhat analogous to a state highway system. By design, the 115-kV transmission system loops around high density load centers and frequently these transmission "loops" cross state borders. This underlying 115-kV transmission system allows the movement of power from the smaller central generating stations and bulk power substations to distribution step-down substations that supply local area load centers at distribution voltages. The distribution network includes the shorter and smaller pole lines alongside city streets and country roads, as well as extensive underground networks in high load density urban areas. Extending the highway analogy, the distribution lines are analogous to city streets and local town roads.

4.0 Transmission Planning

Q. You have referred several times to power-flow simulations. What are they?

A. To evaluate compliance with applicable reliability standards and criteria, transmission planners simulate the electrical characteristics and location of transmission system facilities with computer models developed to represent actual and future system generating units, transmission system facilities and customer load demand conditions. The simulations determine whether transmission circuits will overload and whether system voltages will remain within acceptable limits following contingency events that the system must be designed to withstand. The results of these power-flow analyses indicate where and to what extent the existing system needs reinforcement. Potential solutions to each violation are developed and further studies are conducted to arrive at the optimal solution.

Q. What are the "contingencies" that are simulated in these computer models?

A. A "contingency" is an unintentional event, usually involving the loss of one or more system elements, which affects the power system. When a generating unit or a transmission circuit is removed from service, increased power flows must immediately be carried on transmission circuits that remain in service. Thus, transmission capacity for an area must be designed not only to transmit the power required under normal conditions, but also to transmit power reliably following specific contingencies that the system is required to withstand. Otherwise, circuit flows could exceed emergency transmission circuit ratings or voltages could drop below acceptable limits, forcing the utility to disrupt service to large blocks of customers to prevent permanent damage to the electric system and an uncontrolled loss of additional load.

Q. How are the "contingencies" determined that a system must withstand determined?

A. They are determined in accordance with mandatory national reliability standards developed and approved by the NERC under the authority of the FERC; regional reliability criteria adopted by the NPCC and ISO-NE; and local criteria adopted by Transmission Owners. These standards and criteria are identified and explained in more detail in Section F of Volume 1 of CL&P's Application.

Q Is there any difference between reliability "standards" and "criteria?"

A. Although their dictionary definitions are essentially the same, and the terms are sometimes used interchangeably even by planners at times, the correct industry usage generally refers to "standards" as the mandatory requirements developed by NERC and approved by FERC. "Criteria" are the requirements independently maintained and enforced by regional reliability councils such as NPCC and followed by Regional

Transmission Organizations such as ISO-NE. The purpose or objectives of "standards" and "criteria" is to ensure the bulk power system is designed and operated to a level of reliability such that the loss of a major portion of the transmission system or unintentional separation of a major portion will not result following any credible contingency event.

Q. How are the reliability standards and criteria derived?

A. They have been derived over many years by engineers involved in the design and operation of power delivery systems, based on their experience, as a "best practices" consensus for analyzing the system and preventing blackouts. They are tests of the strength of the system. The number of things that could go wrong on a power system is almost infinite as power systems contain a multitude of elements. Accordingly, these standards and criteria do not attempt to identify and address every possible or probable event that could occur on the transmission system but rather to assure that when contingency events do occur, their effect are manageable and their impact on the transmission system is acceptable.

Q. Please explain, in general terms, how power-flow studies are designed to test the compliance of the transmission system with national reliability standards and regional reliability criteria by modeling system performance following contingency events.

A. First, base power-flow cases are assembled. The load forecast is the 90/10 forecast described above. In addition, one or more generation dispatch scenarios and appropriate transfer conditions (transfers between neighboring systems and within systems) are selected – all for the express purpose of "stressing" the system, as is required by all applicable standards and criteria. The system in the so-called "all-lines-in" (or N-0) condition must satisfy the relevant standards and criteria. Then, the credible contingencies defined by the NERC standards (and, for Massachusetts and Connecticut the NPCC and ISO-NE criteria) are chosen and applied to the power system for each generation/transfer scenario. Some of the contingencies will involve the sudden loss of a single transmission element (N-1) – a generating unit or a critical transmission line. Others are more complex, and could involve the simultaneous loss of two related elements – such as both circuits of a double-circuit transmission line. These are also classified as N-1 contingencies, since the loss of both elements can be caused by a single event. Finally, some will consist of the loss of two unrelated transmission system elements (N-1-1), with the opportunity to make manual system adjustments in the time (generally between ten and thirty minutes) between the two contingencies. During this time, adjustments are assumed to occur which result in the lowering of power flows on heavily loaded transmission circuits and increasing voltage support at critical transmission substations. In each of these situations, the system should not experience transmission element overloads, low voltages, cascading outages, instability, or blackouts.

Q. What is meant by generation dispatch scenarios that "stress" the system?

A. Because power-flow simulations are meant to test the strength and robustness of the transmission system, the simulations do not assume that the load is being served by the most proximate available area generating units. Rather, some generation is assumed to be unavailable, thus requiring a greater reliance on the transmission system to deliver the required power from remote sources than would be the case if all existing generation in the area were available to serve the peak load. Consistent with these principles, ISO-NE Planning Procedure 5-3 stipulates that "Generally inter-area transfers will be simulated at or near their established limits (in the direction to produce 'worst case' results)". Similarly, ISO-NE Planning Procedure 3 stipulates: "Anticipated transfers of power from one **area** to another, as well as within **areas,** should be considered in the design of inter-Area and intra-Area transmission facilities. Therefore, design studies will assume applicable transfers and the most severe load and **resource** conditions that can be reasonably expected."

Q. Why are such "stressed" dispatches used in power-flow simulations?

A. The system must be planned to withstand a virtually infinite range of operating conditions, and it is impossible to anticipate and test each of them. These conditions will be produced not just by the existing system topology, but by future system conditions that can not be predicted with certainty. This is particularly true in an age when the companies responsible for the transmission system can no longer control what generation is built and where it is built – or when and where generation is retired. Requiring the transmission system to operate effectively under the stress caused by the assumed unavailability of multiple generating units recognizes that 1) existing generating units may be unavailable at any time for many reasons – such as economics, equipment failure, fuel supply and maintenance and 2) that stress may be caused by unpredictable future system conditions in which the transmission system must perform well.

Q. **What difference has the regulated utilities' loss of control over generation made to the use of stressed dispatches?**

A. We have always used stressed dispatches when considering transfers across New England. Previously, NUSCO used only lightly stressed dispatches to test portions of its own system when there was sufficient generation under its own control. Before 2000, we generally assumed only one generator unavailable within a load pocket under study. Since then we and other New England utilities have assumed more stressed generation dispatches.

Q. **Do NERC's reliability standards require such "stressing" of the system in power-flow simulations?**

A. Yes, NERC's TPL-002 and TPL-003 planning standards, for example, require that the pre-disturbance system assume "critical system conditions". This requirement is fulfilled by using stressed dispatches.

Q. **Do NERC and ISO-NE provide guidance for determining the severity of the stress that should be assumed?**

A. Yes. They provide general guidance. NERC states in its February 8, 2005 interpretation of Standards TPL-002 and -003 that "a variety of possible dispatches should be included in planning analyses." According to ISO-NE Planning Procedure PP5-3, "Testing should not be restricted to only typical dispatch; rather the dispatch(es) should be developed to reasonably test the proposed additions or changes."

Q. **Do NERC or ISO-NE prescribe any specific number of generating units or megawatts of capacity that should be assumed to be unavailable to stress the system in a given case?**

A. No. Because of the extreme variability of system characteristics and weaknesses, this is left to the sound engineering judgment of transmission planners. Thus, NERC specifies in its February 8, 2005 guidance document that the "selection of 'critical system conditions' and its associated generation dispatch falls within the purview of [the Planning Coordinator's] 'methodology.' " NERC further directs the "Planning Coordinator [to] formulate critical system conditions that may involve a range of critical generator unit outages as part of the possible generator dispatch scenarios."

Q. In exercising engineering judgment to select stressed dispatches, what factors do planners consider?

A. The NUSCO planning guidelines include a long list of specific factors that we are required to consider, such as, for instance, seasonal variations in river flow and/or pond capacity for hydro-electric generating plants. Generally, it is important to use a range of dispatches, not just a single dispatch; and for the dispatches to be sufficiently severe to test the strength of the system, but not so severe as to be unreasonable or incredible.

Q. Does this mean that the dispatches assumed should be typical of those that actually occur on most hot days?

A. No. Because we are testing the strength of the system, some dispatches will be atypical, but they will represent conditions that the experienced planner will recognize could occur.

5.0 Principal Existing Facilities in the Study Area

Q. What was the "study area' in which the reliability problems to be addressed by the GSRP and the MMP were identified?

A. The "study area' consisted of the greater Springfield area and north-central Connecticut. Greater Springfield includes the City of Springfield and extends west to Blandford, south to the Connecticut border, north to Amherst, and east to Ludlow. WMECO serves the major portion of the load in this area. The north-central Connecticut area included in the study borders the greater Springfield area to the north and extends south to the City of

Harford and its surrounding suburbs. Connecticut towns in this study area include Manchester, East Hartford, Hartford, West Hartford, Avon, South Windsor, Windsor, Bloomfield, Simsbury, East Windsor, Windsor Locks, East Granby, Enfield, Suffield and Granby. The "study area," including the principal elements of the existing electric supply system within it, is attached to this testimony as Exhibit AWS-1.

Q. **Please identify the specific principal elements of the electric grid in the study area shown on Exhibit AWS-1.**

A. The **Ludlow Substation**, located to the northeast of the City of Springfield, is the major bulk-power substation in the Springfield area where the 345-kV and 115-kV transmission networks interconnect. It is a strong source with 345-kV connections to three other 345-kV substations and to one nearby large generating station (Stony Brook). Bulk power generated within Massachusetts and imported from neighboring states over WMECO's four 345-kV tie-lines with other systems is delivered to the Springfield area over its 115-kV transmission system. Emanating from the Ludlow Substation are 115-kV transmission circuits that loop into and around the greater Springfield area. The loops create parallel paths for the delivery of power from the Ludlow Substation into the greater Springfield area.

In addition to serving Massachusetts load, the Ludlow Substation serves as a strong source of supply to the Connecticut system, through its 345-kV connection to the **Barbour Hill Substation**, located in South Windsor, Connecticut. As I explain later, under typical dispatch conditions, the 345-kV circuit from Ludlow may supply 30% of the maximum transfer capability of approximately 2,500 MW across the Connecticut Import interface.

The Barbour Hill Substation located east of the Connecticut River is in turn connected, through **Meekville Junction,** by a 345-kV "three terminal" circuit to both the **Manchester Substation** in Manchester, Connecticut and the **North Bloomfield Substation** in Bloomfield, Connecticut. The existing 345-kV supply to the North Bloomfield Substation is a "radial" 345-kV circuit; it is served from only one direction. A 345-kV loop presently does not exist in this study area. The North Bloomfield and Manchester Substations are also directly connected by a 115-kV circuit and by other 115-kV loops that circle in and around the greater Hartford area. At the North Bloomfield Substation there are three 115-kV transmission circuits that emanate from two Massachusetts substations located close to the Connecticut/Massachusetts border. These substations are connected to one or more 115-kV loops in the greater Springfield area. They are supplied by both local Massachusetts generators and the 345/115-kV autotransformers at the Ludlow Substation. These circuits are described below with reference to the Massachusetts substations where they originate.

The **Agawam Substation** in Agawam, Massachusetts is to the southwest of the city of Springfield on the opposite side of the Connecticut River. This substation connects to multiple 115-kV circuits serving the greater Springfield area. It is not connected to the 345-kV system.

The **South Agawam Switching Station,** located in South Agawam, Massachusetts, just south of the Agawam Substation, is connected to five 115-kV circuits and the Berkshire Power generating station. Two of the five 115-kV circuits connect to the North Bloomfield Substation in Connecticut.

The **Southwick Substation,** in Southwick, Massachusetts, to the southwest of the South Agawam Switching Station, is also connected, by a single 115-kV circuit, to the North Bloomfield Substation. These three 115-kV circuits (two from South Agawam, one from Southwick) are often referred to as the "115-kV tie-lines." Under typical dispatch conditions, collectively the three 115-kV tie-lines between Massachusetts and the North Bloomfield Substation supply approximately seven percent of the power that flows across the Connecticut Import interface.

Q. Does the study area depicted in Exhibit AWS-1 include all of the transmission elements that were simulated in the computer model when the power-flow studies were performed?

A. No. There are system elements outside the study area that were included in the computer model because their electrical performance has a material effect on the contingency analyses. In particular, the study area contains only four of the seven transmission elements that form the "electrical interface" over which power flows between the Connecticut area and its neighboring transmission areas (New York, Massachusetts and Rhode Island). I will describe the importance of these other transmission elements that define the Connecticut Import interface later on in this testimony.

6.0 Need for the GSRP and the MMP

Q. Why are the GSRP and the MMP needed?

A. In high load conditions, if certain local generators in the Springfield area are not operating or have not been dispatched, the Springfield area transmission system and the regional bulk power system that connects western Massachusetts and north-central Connecticut are at risk of thermal overloads and voltage collapse that could lead to extended blackouts. This risk is compounded by transfers of electric power into Connecticut.

Q. How has this need been demonstrated?

A. The need was documented first in the Working Group's Needs Analysis and more recently in the 2008 and 2009 power-flow studies that I performed.

Q. What forecasted loads were assumed in the recent studies?

A. The loads assumed were 2014 loads projected in the 2008 and 2009 CELT forecasts. It is important to note, however, that many of the documented problems occur with loads at levels that have already been experienced. Temporary strategies, to maintain reliability, such as RMR contracts, are therefore required.

Q. In the 2008 and 2009 power-flow simulations that documented the need for the GSRP and the MMP, what assumptions did you make with respect to the Springfield area generation in order to stress the system?

A. We used similar dispatches in both the 2008 update and in the recently completed 2009 update that took the results of FCA2 into account. In both cases, we used three different dispatches – one with all existing generation "on" and two that assumed certain units to be unavailable. The dispatches for the most recent simulation were as follows:

Greater Springfield Area Generation Dispatch Scenarios

Generation	Dispatch 1 MW	Dispatch 2 MW	Dispatch 3 MW
Stony Brook	425	425	0
Berkshire Power	0	229	229
Mt Tom	0	144	0
West Springfield #3	0	94	94
MASSPOWER 1	82	82	0
MASSPOWER 2	82	82	0
MASSPOWER 3	75	75	0
West Springfield #1	0	37	37
West Springfield #2	0	37	37
West Springfield Jet	0	17	0
Cobble Mt	17	17	17

Thus, in Dispatch 2, we assumed that all 1,239 MW of area generation was available; in Dispatch 1, we assumed that about half of this generation was available; and in Dispatch 3, less than half of the area generation was assumed to be available. However, the worst results were produced by Dispatch 1, because of the location of generation assumed to be unavailable.

Q. Were these realistic assumptions?

A. Yes. Experience has shown that multiple units in the same area can be simultaneously unavailable, and these assumptions are less severe than conditions that have actually occurred. For example, when ISO-NE set a record for peak winter load on January 21, 2003, eight generating units in SWCT, with a total capacity of approximately 1,038 MW, were unavailable due to problems associated with the extremely cold weather. And for over 12 hours on June 30, 2008, Milford Power Units 1 and 2 tripped off line during a three-day-long forced outage of Millstone Unit 2, making about 1,470 MWs of Connecticut-based generation unavailable on a summer day. In 1996, Connecticut suffered the unplanned loss of 3,200 MWs of nuclear generating capacity that lasted for many months, some of it permanently.

Q. What assumptions did you make with respect to Connecticut generation in the power-flow simulations for the GSRP need analysis?

A. We did not assume specific Connecticut units to be "on" or "off," but rather assumed that the generation mix would be such that Connecticut would be importing power at the upper limit of its transfer capability determined by ISO-NE. This is 2,500 MW under normal conditions and 1,700 MW under contingency conditions.

Q. Why did you make that assumption?

A. We recognized that the Springfield reliability problems were exacerbated when the existing 115-kV system was called upon to do the double duty of serving local area loads and also transmitting power to Connecticut substations. Since Connecticut is consistently a net importer of power, including over the western Massachusetts tie-lines, this was assumed to be a reasonable stress on the Springfield area system.

Q. Is there anything in the criteria documents that supports this approach?

A. Yes, the approach is consistent with the provisions concerning transfers in both ISO-NE Planning Procedure 5-3 and ISO-NE Planning Procedure 3, which I have quoted earlier in this testimony.

Q. What assumptions did you make concerning exports to New York from Connecticut in the updated power-flow analyses?

A. We assumed an approximate 350 MW transfer to Long Island on the Cross Sound HVDC cable interconnection. For the GSRP, it was not necessary to simulate power transfers on the AC tie-lines between New England and New York, as would be the case in typical ISO-NE project power-flow studies, because of the severity of the transmission system overloads in the greater Springfield area.

Q. Were these reasonable assumptions for the purpose of stressing the system?

A. Yes. In fact, the transfer on the Cross Sound Cable is a normal operating system condition. There is a firm contract between Long Island Power Authority (LIPA) and a New England generator for the delivery of at least 100 MW on the Cross Sound Cable. Accordingly, this condition is very likely to be in effect before the occurrence of a contingency as it is a typical daily operating condition.

Q. What do the power-flow study results reveal?

A. I can not provide a detailed description of the results in this direct testimony because of the constraints of federal Confidential Energy Infrastructure Information (CEII). In accordance with these policies, we have filed the detailed results of the power-flow studies subject to a protective order. The specific contingency events that were modeled are set forth in detail in the Application and in the supplemental response to OCC Data Request OCC-O1, Q-OCC-009-SPO1. However, in general, during peak-demand periods, power flow from the Ludlow Substation through multiple 115-kV circuits moves west to the Agawam Substation along parallel paths of an interior 115-kV loop and south around Springfield on an outer 115-kV loop to the South Agawam Switching Station. From there, power flows north to close the loop at the Agawam Substation or south into Connecticut. Power-flow studies show that if one or more of these circuits are interrupted, power will automatically redistribute onto the other 115-kV transmission circuits and may cause thermal overloads and unacceptable low voltage conditions in violation of national and regional standards and criteria.

The impact of such contingencies is compounded by the fact that many of the 115-kV transmission circuits in the Springfield area share common support structures. NERC reliability standards require that the simultaneous failure of both circuits supported by a double-circuit tower structure be considered a single contingency event when power-flow studies are performed.

Moreover, during peak-demand periods, contingencies beyond western Massachusetts can cause redistribution of power flows through the Springfield area, overloading the 345-kV connection between the Ludlow Substation and the Barbour Hill Substation.

Q. **Do the GSRP facilities proposed to be built in Massachusetts and those proposed to be built in Connecticut serve separate needs of each state?**

A. No. The GSRP and the MMP have been designed to serve one set of interrelated reliability problems, which cause thermal overloads and unacceptable low voltages on the transmission system within the simulated study area, which includes transmission circuits within Massachusetts, tie-lines between Massachusetts and Connecticut and transmission circuits within Connecticut.

A key element of the solution proposed in the Application is constructing new 345-kV lines in both Connecticut and Massachusetts that will, together with existing 345-kV lines in both Connecticut and Massachusetts complete a 345-kV "loop" that will increase the reliability of the supply from all of the substations served by that loop, principally the Ludlow Substation and the new Agawam Substation in Massachusetts, and the Barbour Hill and North Bloomfield Substations in Connecticut. While Connecticut would still be a resource deficient area during peak-load periods, the GSRP will improve the capability of the Connecticut system to import power. However, that Connecticut benefit is not the primary justification for the Connecticut facilities. The proposed GSRP and MMP facilities have been designed to resolve numerous transmission circuit thermal overloads and unacceptable low voltage conditions in two states. The improvements proposed to be constructed in each state do not simply address deficiencies in that state; they work together to address interrelated reliability problems in both states.

Thermal Overloads

Q. Please describe the thermal overloads that resulted from the power-flow studies.

A. Again, I can describe the study results here only in general terms. In the 2008 study included in the Application, the N-1 contingency analyses determined that there were thermal overloads on multiple transmission circuits in the greater Springfield area and on the 345-kV tie-line between the Ludlow Substation and the Barbour Hill Substation in Connecticut. The N-1-1 study analyses determined that multiple thermal overloads occurred on transmission circuits in the greater Springfield area including the 115-kV tie-lines between western Massachusetts and the North Bloomfield Substation in Connecticut. In the 2009 analyses provided in the supplemental response to OCC Data Request OCC-O1, Q-OCC-009-SPO1, the same results occurred.

Voltage Stability Issues

Q. What did the power-flow study results show with respect to system voltages remaining within acceptable limits?

A. Again, because of CEII concerns, the detailed results have had to be provided pursuant to a protective order. However, I can describe the results here in general terms. First of all, the results of the 2009 study were less severe than those of the 2008 study. However, under certain N-1 contingencies, unacceptable low voltages engendering the potential of a voltage collapse of the greater Springfield area that could cascade into north-central Connecticut persisted. The risk of a system collapse was greater under N-1-1 contingencies.

7.0 Proposed Solution for the Need

Q. What solution is NUSCO proposing to solve these reliability problems?

A. NUSCO recommends the construction of the GSRP and the MMP. Together, they improve both the 345-kV and 115-kV systems in Massachusetts and Connecticut.

Q. Please describe the recommended 345-kV line construction.

A. NUSCO proposes the construction of a new 345-kV transmission line that, together with existing 345-kV transmission lines, would complete a 345-kV "loop" around Springfield and into north-central Connecticut. The new line would extend from Ludlow Substation along an existing WMECO transmission right-of-way to a proposed new 345-kV switchyard to be located at the existing Agawam Substation; and would then extend south to the CL&P North Bloomfield Substation. The new circuit would form a 345-kV "loop" with the existing North Bloomfield–Barbour Hill–Ludlow 345-kV circuits. Figure E-1 in the Application, a copy of which is attached to this testimony as Exhibit AWS-2, shows the completed loop with the proposed 345-kV line between the Agawam and the Ludlow Substations being located along the preferred Northern route. I recognize that there is an alternate route for the 345-kV transmission line under consideration as well. Route selection will be discussed by other witnesses.

Q. What substation improvements would be required to accommodate the proposed 345-kV transmission line?

A. NUSCO proposes to build the new 345/115-kV Agawam Substation that I referred to previously; and to expand the existing Ludlow Substation by adding new positions to terminate the new 345-kV transmission circuit and reterminate one of the existing 345/115-kV autotransformers. Finally, we also propose to expand the existing 345-kV facilities at the North Bloomfield Substation. This substation was originally designed to terminate a single 345-kV transmission circuit and a single 345/115-kV autotransformer. A new 345-kV switchyard is necessary to terminate the proposed 345-kV transmission circuit from Agawam Substation, the existing 345-kV transmission circuit from Barbour Hill and Manchester Substations and two 345/115-kV autotransformers.

Q. What changes to the 115-kV system is NUSCO proposing as part of the GSRP?

A. Along a 17 mile right-of-way in Massachusetts, two, and in some cases, three 115-kV circuits connect several substations and switching stations between the Ludlow and Agawam Substations. On each segment of the right-of-way, two circuits presently are carried on common support structures. All of these 115-kV circuits would be replaced by circuits with larger capacity conductors. One new line of structures would support one or two of the reconstructed 115-kV circuits. Another new line of structures would support the remaining reconstructed 115-kV circuit and the new 345-kV line, in a double-circuit configuration. The two existing 115-kV circuits going south from the South Agawam Switching Station would be rebuilt between the substation and the Massachusetts / Connecticut border and placed on the same structures with the new 345-kV circuit. From the border south, the existing 115-kV circuits would be bundled into a single circuit on the existing structures and then connected at Granby Junction with the single 115-kV circuit that terminates at the Southwick Substation, forming a 115-kV loop. The three existing 115-kV circuits that presently continue to the North Bloomfield Substation - the 115-kV tie-lines - would be opened at Granby Junction and would no longer function as tie-lines between Connecticut and Massachusetts. In the City of Springfield, the underground 115-kV cable through-path, which is part of a loop from the Ludlow Substation to the Agawam Substation, would be "opened" at the 115-kV bus in the Breckwood Substation, converting the through-path into two radial underground transmission circuits, each of which would terminate at the Breckwood Substation.

Q. Why does NUSCO plan to permanently open the existing 115-kV tie-lines between western Massachusetts and the North Bloomfield Substation?

A. The existing 115-kV tie-lines will no longer be needed under normal conditions because they will be functionally replaced by a 345-kV circuit with much higher power flow capacity. Nor will they be needed as a back-up parallel path to the new 345-kV circuit because it will be part of a "looped" supply.

Q. What are the improvements proposed by the MMP?

A. Presently, on 2.2 miles of the 2.6 mile right-of-way between Manchester Substation in Manchester, Connecticut and Meekville Junction, also in Manchester, the Manchester–North Bloomfield–Barbour Hill 345-kV transmission circuit and the Manchester–Rood Avenue 115-kV transmission circuit are supported on a common line of structures. The MMP involves the placement of the 115-kV transmission circuit on a separate line of transmission structures.

8.0 System Benefits of the GSRP and the MMP

Q. Please describe area power-flow study results with the addition of the GSRP and MMP.

A. The performance of the system was tested employing the same combination of system conditions. Pre- and post-project analyses used the same New England generation dispatches. With the project modeled in-service the power-flow studies indicate that following N-1 and N-1-1 contingency events, power flows on area 345-kV and 115-kV transmission circuits do not exceed their emergency thermal ratings and that low voltage conditions on the transmission system are mitigated. The sole exception is that a single N-1-1 contingency in north – central Connecticut remains unresolved. This contingency will be addressed by the Central Connecticut Reliability Project or, if that project should not go forward for any reason, by a local area transmission solution.

Q. How will the GSRP address the reliability problems in the study area?

A. The new high-capacity 345-kV loop through western Massachusetts and north-central Connecticut will relieve congestion on the 115-kV system that serves the Springfield area and will enable increased power transfers across the Connecticut Import interface. Completion of the loop will have an effect analogous to completing a multi-lane circumferential highway that was previously constructed only part of the way around an urban area, leaving a large gap in the circumferential highway system that forced traffic to traverse congested city streets to gain access to the next section of highway. The upgrading of Massachusetts 115-kV transmission circuits will provide a parallel path to the proposed 345-kV transmission circuit from the Ludlow to the Agawam Substations, and will solve the numerous problems on the underlying 115-kV loops in Springfield that arise when power flows must be redistributed in response to an interruption on a section of one of the loops.

Q. How will the MMP improve system reliability?

A. With the addition of the GSRP transmission improvements modeled, power-flow study results showed that thermal overloads could occur on a portion of the Connecticut 115-kV system following the simultaneous loss of the 345-kV and 115-kV transmission circuits that are presently supported on a line of common structures for approximately two miles. National and regional planning standards and criteria mandate that planning studies be conducted to evaluate the loss of both circuits that share a line of common transmission structures; this contingency is considered a single contingency event. Separation of the circuits, so that each is supported by its own line of structures, eliminates the need to test for the double-circuit tower contingency and mitigates the thermal overloads on certain 115-kV transmission circuits in the greater Hartford area.

Q. What is the date of need for the GSRP and MMP?

A. The projects are needed now. In the original Needs Analysis, the Working Group estimated that the project would be needed under contingency conditions during peak load periods that could be experienced as early as 2009. Recent updated analyses by NUSCO and by ISO-NE confirm that the thermal overloads and low voltage conditions remain valid even when the more recent load forecasts and system additions are modeled. The need will continue to grow more acute with time.

Q. How will the projects affect Connecticut's capability to import power from other areas?

A. The capability of a transmission system interface to transfer power between its neighboring systems is determined by ISO-NE, using very complex computer modeling. The results are always properly expressed as a range of values. NUSCO has made its own estimate of the impact of the GSRP and the MMP on the Connecticut Import interface transfer limits, pending an official determination by ISO-NE. Our calculations indicate that the GSRP and the MMP are likely to increase the maximum Connecticut Import interface transfer limit of 2,500 MW by approximately 200 to 300 MW; and that construction of the remaining NEEWS projects could further increase the state's maximum transfer limit to approximately 3,600 – 4,000 MW.

Q. What are the benefits of increasing Connecticut's import capability?

A. Higher Connecticut Import interface transfer limits increase system reliability during both high and low load periods by permitting greater amounts of power to move across the interface and into the deficient area during normal "all lines in" conditions and following the unexpected loss of a generating unit or transmission circuit. Increased Connecticut Import interface transfer limits also enable greater use of newer, more economic out-of-state generation, including renewable and non-carbon resources, to meet the state's customer load demands. The ability to import greater amounts of power across the Connecticut Import interface should also have a favorable impact on energy cost because the same broadened base of supply should reduce the instances of federally mandated reliability agreements and other charges that are associated with restricted transfer limitations.

Q. Is increasing transfer capability particularly important to Connecticut?

A. Yes. Some of the overloads in the power-flow simulations occur on circuits that define the Connecticut Import interface. This is an indication of insufficient transmission capability to support desired levels of imported power across the Connecticut Import interface. Presently, Connecticut relies to a far greater extent on internal generation resources to meet customer demands for electric energy than any other New England state.

The peak load in Connecticut is forecasted by ISO-NE to reach approximately 8,400 MW by 2014. Presently, the upper limit of the Connecticut Import interface transfer capability is approximately 2,500 MW; this represents about 30% of its projected 2014 peak load demand. Other New England states can import much higher percentages of their peak load. Connecticut thus has far less opportunity and flexibility to access newer, more economic regional generation than customers in neighboring states.

9.0 Long-Range Plan for Expansion of the Electric Power Grid

Q. How long will the new 345-kV line satisfy transmission requirements in the Springfield study area before further expansion is required?

A. Assuming no significant changes in projected future load growth or generation location and availability, the new 345-kV line should satisfy the Springfield area requirements for at least 20 years.

Q. Are the GSRP and the MMP part of a long-range plan for expansion of the electric power grid serving the state and interconnected utility systems that will serve the public need for adequate, reliable and economic service?

A. Yes. First, the NEEWS projects are in themselves a long-range plan for southern New England including Massachusetts, Connecticut and Rhode Island.

The NEEWS Plan

In addition to addressing the reliability problems in the greater Springfield area and north-central Connecticut study area, the four main NEEWS projects will work together to address other weaknesses in the southern New England transmission system; resolve thermal overloads and low voltage reliability problems on the Rhode Island transmission system; increase system capability to reliably move greater amounts of power across southern New England; significantly increase the Connecticut Import interface transfer limits; and increase the capability of the Connecticut transmission system to move power from east to west across the state to reach the concentrated load pockets in southwest Connecticut. Approximately five years of intensive planning and design effort have been devoted to assuring that the proposed NEEWS projects represent the most efficient and cost-effective solutions to the identified reliability problems. As a whole, the NEEWS projects address all of the major near term problems of the southern New England transmission system as identified by the Working Group. In addition, the NEEWS plan has been closely designed and integrated with the recently completed 345-kV transmission loop in SWCT.

The ISO-NE Regional System Plan

Second, the NEEWS plan is part of a larger long-range plan for expansion of the southern New England grid to provide adequate, reliable and economic electric service to southern New England. NEEWS has been developed as part of the ISO-NE Regional System Plan process, which I touched on earlier in this testimony. The components of the NEEWS projects have been a part of each RSP since the "SNETR" plan was initially presented in 2005.

Q. **What do you foresee as the next element of a long-range plan for Connecticut after the NEEWS projects are completed?**

A. Looking into the future, it is probable that at some point the tie-lines with New York from the Frost Bridge Substation in Watertown, Connecticut should be reinforced with a looped 345-kV supply, thereby providing a stronger transmission interconnection with New York similar to the proposed strong transmission interconnections with Massachusetts and Rhode Island that will be provided by the NEEWS projects.

10.0 System Alternatives

Q. What alternatives to the GSRP have been evaluated?

A. In the course of the initial needs study, the Working Group evaluated a "no action" alternative. ISO-NE, independent of the Working Group, evaluated and dismissed a generation alternative. In developing the GSRP and the MMP, NUSCO considered numerous transmission system alternatives. NUSCO also retained a consulting firm, ICF International, to evaluate non-transmission alternatives, including both generation and demand side management alternatives such as conservation and load management programs and demand response. Finally, NUSCO has itself evaluated suggested generation alternatives by further conducting a series of power-flow studies.

Q. Why was the "no action" alternative rejected?

A. The "no action" alternative was rejected because doing nothing to eliminate violations of national and regional reliability standards and criteria would be inconsistent with the mission of CL&P and WMECO to provide reliable transmission service for their customers and the region. CL&P and WMECO are obligated under the ISO-NE Tariff to develop "backstop" transmission solutions that can be implemented in a timely manner to ensure the reliability of the transmission system when market solutions do not exist or do not come forward. Failure to develop and construct "backstop" transmission solutions would be subject to federal fines for failing to take action to address known violations of mandatory NERC standards.

Q. Please describe ISO-NE's early determination that additional generation would not provide a solution to the problems addressed by the GSRP.

A. In December of 2006, ISO-NE announced to the PAC that it had conducted a feasibility study of the potential for new generation to defer the need for each of the NEEWS projects and it had determined that "a generic generation alternative to the Springfield area transmission projects that is practical and feasible does not exist." ISO-NE reiterated its conclusion in a letter to the Connecticut Energy Advisory Board in March of 2007. (At the same time, ISO-NE stated that its analysis had suggested that a generic generation alternative could potentially "defer" the need for the Interstate and Connecticut East-West components of the SNETR Plan provided that, among other things, the Springfield area transmission problems were addressed.)

Q. Please describe the process in which transmission system alternatives were evaluated, resulting in the selection of the proposed GSRP and MMP transmission configurations.

A. As explained in detail in the *GSRP Solution Report*, a copy of which is included in Volume 5 of the Application, NUSCO closely evaluated many combinations of 345-kV and 115-kV improvements in developing the proposals to be submitted to the Massachusetts and Connecticut siting authorities. Since there were routing alternatives for many of the components of these "Top System Solutions," NUSCO screened numerous system/route combinations. The complexity of this process was largely related to the design of the 115-kV improvements in Massachusetts. Those design choices are described in detail in the Solution Report.

Q. Please describe how the configuration of the 345-kV portion of the GSRP and the MMP were determined.

A. To understand how we identified the North Bloomfield to Agawam to Ludlow facilities as the optimal 345-kV configuration, an understanding of how projects are designed to meet the primary transmission planning goal of reliably transmitting power from generators to area load centers is helpful. Basic principles include:

- *Build Transmission Loops.* A looped system is far more reliable than a radial circuit because a "looped" system can withstand the loss of one of the transmission circuits without an interruption to service.

- *Use High Voltage Lines.* High voltage transmission circuits can serve more customers more efficiently and over longer distances.

- *Regional Interconnections Enhance Reliability.* Transmission connections to neighboring electric systems improve the reliability and robustness of the overall transmission grid, by providing access to generation in other areas under normal and emergency conditions. The ability to import power from neighboring areas reduces local resource requirements. Connecticut's transmission system interconnects with three other electric power systems in Massachusetts, Rhode Island and New York.

- *Diversify Transmission Sources.* No large load center should rely on a single source of power or single transmission element such as single transmission line or autotransformer. The transmission system should be designed so that the loss of a single substation, autotransformer or transmission circuit does not result in the cascading loss of other transmission circuits, substations or the catastrophic interruption of customer load. Multiple transmission "loops" are important as they allow maintenance to be performed on transmission facilities, maintain system operability following single contingency events and opportunities for future expansion of both generation and transmission.

- *Access Diverse Generation Sources.* Generation sources change with time. A transmission system should not be solely dependent upon a single generating station, but should be able to access multiple, diverse resources. This is particularly important in the restructured competitive generation marketplace.

- *Use Strong Sources.* Substations that are electrically connected to multiple diverse transmission circuits and generating stations are very important in maintaining system security and service continuity.

Q. Please explain further what you mean by a "strong source"?

A. A substation or switching station is considered a strong source if it is electrically close to a number of large central generating stations and/or multiple transmission interconnections, some of which are segments of a transmission loop. A weak source, in contrast, is electrically farther away from large central generating stations and/or has far fewer 345-kV and 115-kV transmission interconnections. By way of illustration, a substation not electrically close to a major generating station and served by a single radial 345-kV circuit is considered a weak source. If that same substation is connected to two or more 345-kV transmission circuits that are served from two different directions, do not share the same transmission right-of-way, and are not connected to a single generating station, the substation would be considered a stronger source. If that substation is electrically close and connected to several large generating stations and is in addition connected to multiple "looped" 345-kV transmission circuits from different directions located on separate rights of ways, it would be considered a very strong source.

Q. Why does it matter whether an area is served from a strong source or a weak source?

A. All transmission facilities must be designed with the capability to operate effectively under a wide range of system conditions. Small and moderate changes in system conditions would have a negligible impact on an area's overall performance when connected to multiple strong source substations or switching stations. The electric system would continue to reliably transmit electricity because it is highly integrated and electrically close to multiple large generating stations. Strong sources can move large blocks of power to load centers because the availability of alternate paths minimizes the risk of thermal overloads and unacceptable low voltage conditions in the event of a contingency. On the other hand, small changes in system conditions can have a significant adverse impact on an area's reliability served by a single weak source substation or switching stations. These impacts can include thermal overloads, low voltage conditions, and blackouts.

Q. Is the design of the GSRP consistent with these principles?

A. Yes. The configuration of the GSRP is consistent with these principles. The Ludlow Substation is already a strong source. The addition of a "looped" 345-kV transmission circuit will make it even stronger. The new Agawam 345/115-kV Substation will become a second strong source in the greater Springfield area and the proposed Ludlow–

Agawam–North Bloomfield transmission circuit will significantly strengthen the North Bloomfield Substation by connecting it to a "looped" 345-kV transmission source.

Replacing the existing 115-kV tie-lines with a 345-kV tie-line strengthens the regional interconnections. The proposed 345-kV tie-line enables higher transfers between Connecticut and Massachusetts as well as between Connecticut and Rhode Island. Shifting virtually all power flow into Connecticut from the 115-kV system onto the 345-kV system also improves system efficiency by reducing line losses.

Q. Were any 345-kV configurations other than the North Bloomfield–Agawam–Ludlow facilities considered in the planning of the GSRP?

A. Yes. The Working Group identified three different electrical configurations for the 345-kV component of the GSRP that exhibited acceptable performance: the configuration presented in this Application (called "Option A") and the following two alternatives:

- A 345-kV line from the North Bloomfield to the Ludlow Substations that did not tie into the Agawam Substation ("Option B"); and
- A 345-kV line from Manchester Substation in Manchester, Connecticut to the Ludlow Substation ("Option C").

NUSCO determined Option A to be superior to the alternatives because it was most consistent with the principles described above. It was the only solution that established a new strong 345-kV substation source west of the Springfield area load pocket (the new 345/115-kV Agawam Substation); eliminated the weak western Massachusetts/Connecticut 115-kV tie-lines; did not require expensive and complex phase shifters on the 115-kV transmission system to control power flows being wheeled through the Springfield area; and significantly strengthened the North Bloomfield Substation by providing it with a "looped" 345-kV supply from geographically diverse rights-of-way.

Option C provided fewer system benefits than Option A and in any case was eliminated on cost grounds, since (unlike Options A and B) it would have required extensive reconstruction of the 115-kV system in and near the greater Hartford area, at a preliminary cost estimated at $230 million. In contrast, the only ancillary work required south of North Bloomfield Substation if Options A or B were selected, that would not be associated with Option C, is the MMP, which was estimated to cost $14 million. Therefore, Option C had a cost disadvantage relating to the Connecticut 115-kV work alone of approximately $216 million, based on these preliminary cost estimates, as compared to Options A and B. (The scope and cost of the required 115-kV transmission system work in Massachusetts associated with all three options is essentially the same.)

Option B was also determined to be more costly than Option A, because of the high cost of the phase shifting transformers that would have to be installed at the Agawam Substation. Although Option B eliminated the expansion of the Agawam Substation to connect two 345-kV transmission circuits and two 345/115-kV autotransformers and avoided the modest cost of reconfiguring the three 115-kV tie-lines to Connecticut (connected at the South Agawam Switching Station and the Southwick Substation), the preliminary cost estimate of installing the phase shifters was estimated to exceed, by $56 million, the costs saved to modify the existing Agawam Substation and to modify and reconfigure the 115-kV tie-lines.

Accordingly, the Ludlow–Agawam–North Bloomfield 345-kV transmission line solution, in combination with the MMP, was selected because they provided the greatest system benefits and the most economic solution. This option left unresolved the selection of a route between Agawam and Ludlow for the 345-kV line, which other witnesses will address.

Q. What were the principal configuration alternatives considered for the 115-kV upgrades in Massachusetts?

A. There were two principal weaknesses that needed to be addressed: (1) the 115-kV path through the City of Springfield, from East Springfield to Breckwood to West Springfield is undersized and subject to overloads following numerous N-1 and N-1-1 contingency events; and (2) the 115-kV transmission system between Ludlow Substation and the Connecticut border is subject to overloads and unacceptable low voltage conditions following contingency events. These problems arise because the conductors on the transmission circuits are small and have limited current carrying capability; and because numerous transmission circuits are supported on double-circuit structures.

The overloads on the Springfield through-path could be avoided either by rebuilding the underground cable circuits from East Springfield to Breckwood to West Springfield beneath city streets and the Connecticut River, or by opening a circuit breaker at the Breckwood Substation and providing a new and more robust path for transfers between Massachusetts and Connecticut. We selected the former solution, because it was much less costly and had far fewer construction and environmental impacts. The decision was made in consultation with ISO-NE, which encouraged the exploration of alternative designs that would reduce the overall costs of the greater Springfield area transmission improvements.

Q. Did NUSCO consider non-transmission system alternatives in the course of examining the need for, and designing, the GSRP and the MMP?

A. No. In the course of planning the GSRP and the other NEEWS projects, NUSCO did not undertake an analysis of possible non-transmission system alternatives (NTA's). As a regulated provider of transmission service, NUSCO is obligated to design and pursue backstop transmission solutions to reliability problems. However, in preparation for this proceeding, NUSCO contracted with an international consulting firm with expertise in these subject-matter areas to perform a comprehensive NTA analysis.

Q. **With whom did NUSCO contract for the NTA evaluation?**

A. NUSCO commissioned ICF Resources LLC (ICF) to perform the evaluation. ICF is a management, technology and policy consulting firm that has an extensive energy practice. Maria Fusco Scheller of ICF is presenting separate pre-filed testimony concerning its work.

Q. **Did NUSCO perform any analyses of NTA's itself?**

A. Yes. After the responses to the CEAB's request for proposals for alternative solutions to the need that would be addressed by the GSRP and the MMP were published, NUSCO performed power-flow simulations to assess the impact of adding a generation project that was proposed as an alternative. This was the NRG Meriden Plant in Meriden. In these simulations we shut off an equivalent amount of Connecticut generation such that the transfers into the state remained at approximately 2,500 MW. This assumption is based on the planning criteria concerning modeling transfers that I cited earlier, and our belief that the proposed addition of the Meriden Plant would displace less cost-effective and environmentally challenged existing generation in Connecticut. Copies of this study were submitted to the Council in response to CSC Data Request CSC-01, Q-CSC-018.

Q. What were the results of these analyses?

A. The Meriden Plant, did not resolve the thermal overloads and unacceptably low voltage conditions in the study area.

Q. Did you perform additional analyses?

A. Yes. In addition we performed power-flow studies where the Connecticut Import interface level was reduced by the capacity of the proposed NRG Meriden generating station (the "Meriden Plant"). As expected, the Meriden plant did not resolve the thermal overloads and unacceptably low voltage conditions in the study area.

11.0 Project Cost Recovery

Q. How do CL&P and WMECO intend to recover the cost of the GSRP and the MMP?

A. CL&P and WMECO expect that the costs of these projects will be recovered through, and in accordance with, the FERC approved Transmission, Markets and Services Tariff (ISO-NE Tariff).

Q. What is the origin of the ISO-NE Tariff?

A. In 1997, the New England states proposed, and FERC approved, the restructuring of NEPOOL and approved the current method used in allocating transmission costs.

Q. What are the transmission services contained in the ISO-NE Tariff and how do they define cost recovery of transmission facilities?

A. The ISO-NE Tariff contains two basic transmission services: Regional Network Service (RNS) and Local Network Service (LNS). RNS defines the terms and conditions for New_England's pool transmission facilities (PTF), and LNS defines those for the non-pool transmission facilities (Non-PTF).

Q. What are pool transmission facilities?

A. Pool transmission facilities are defined as those facilities that are rated 69 kV or above and are required to allow energy from significant power sources to move freely on the New England transmission system. In general these facilities form the interconnected power grid. They exclude facilities such as radial lines, which are considered non-pool transmission facilities.

Q. What is the basic principle underlying this different rate treatment?

A. The ISO-NE Tariff recognizes that all New England customers benefit from reliable and economic power flows throughout the region. PTF facilities provide utilities with reliability benefits and access to remote generation resources. Accordingly, transmission improvements required to enable reliable power to flow throughout the region are deemed by FERC to benefit all regional customers. For these reasons, New England customers all share and support the recovery of transmission costs. Non-PTF facilities that provide only a local area benefit are recovered under LNS service and charged to local area system customers.

Q. What is the method used to allocate RNS costs?

A. The method used to allocate RNS costs is defined as load ratio share (LRS). LRS is the ratio of a local area peak demand to the New England system peak demand at the same hour.

Q. What are the load ratio shares of Massachusetts and Connecticut?

A. Massachusetts' share is approximately 50%. Connecticut's share is approximately 27%. These costs would ultimately be borne by all electric customers in each state respectively, not just CL&P and WMECO customers.

Q. Will the GSRP and the MMP facilities provide regional benefits such that you would expect them to qualify for RNS rate treatment?

A. Yes, provided that they are built to comply with traditional utility construction practices for the area in which the facilities are being constructed and consistent with similar transmission construction practices across New England. Any extra construction costs incurred to satisfy local requirements would be considered to be "gold plating" and would not be eligible for RNS treatment

Q. How will the regional treatment of the costs be determined?

A. A project proponent must file an application with ISO-NE. The NEPOOL Reliability Committee advises ISO-NE on the allocation of project capital construction costs, or portions thereof, eligible for regional rate treatment. The NEPOOL Reliability Committee will conduct a comprehensive review of each project element and its associated cost and recommend that ISO-NE approve the regional cost treatment for specific eligible project elements. The final determination of the cost treatment associated with any transmission project is made by ISO-NE.

Q. How are local costs recovered?

A. Costs determined by ISO-NE to be local would be recovered through the appropriate rate recovery mechanism within the state in which the facility is located.

Q. Do you expect that any portions of the project will receive LNS rate treatment?

A. Yes, the costs associated with converting the cables from the Breckwood Substation in Massachusetts to a radial configuration, including the substation work, will receive LNS treatment.

Q. What do you expect would happen if a portion of the GSRP were required by siting authorities to be placed underground?

A. Since underground construction would not be required by standard utility practices in any of the areas where the GSRP will be constructed, I expect that the cost increments for any underground construction of any facilities would be borne by the load in the state that required the facility to be constructed underground. The additional incremental cost of any underground facilities would not be borne by the New England region.

Q. What cost recovery treatment do you expect the additional costs incurred for reducing magnetic fields pursuant to the Council's EMF Best Management Practices will receive?

A. I can not predict what treatment those costs will receive, because ISO-NE has not as yet taken a position with respect to such costs. CL&P is currently engaged in a transmission cost allocation proceeding with respect to the Middletown to Norwalk (M-N) 345-kV project and in that proceeding we are seeking RNS cost treatment for all of our overhead construction costs, including the costs attributable to reducing magnetic filed levels. ISO-NE's ruling on this issue in the M-N proceeding will likely set the precedent for the GSRP.

12.0 In Service Date

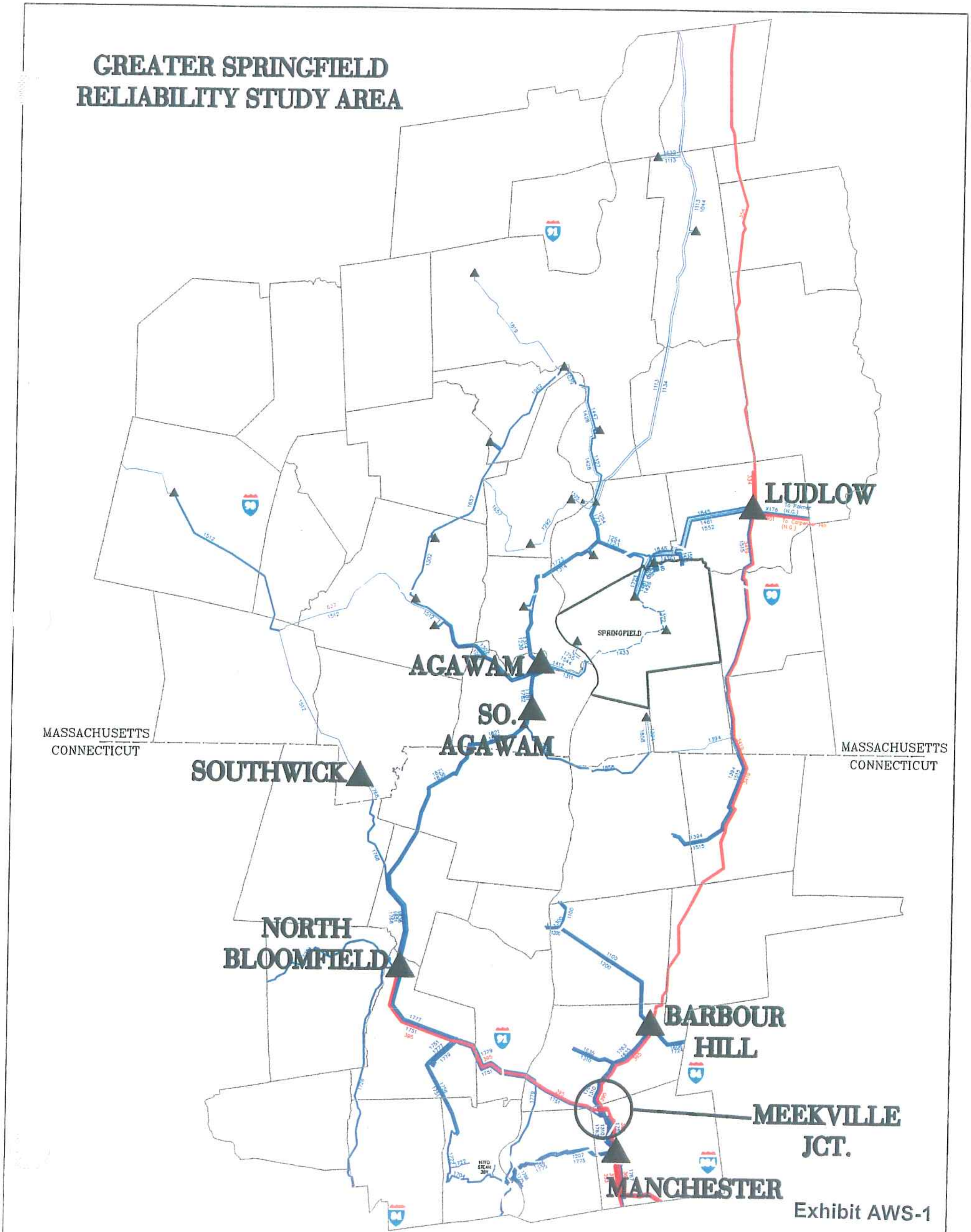
Q. What is the projected in-service date for the GSRP and the MMP?

A. CL&P and WMECO propose to begin construction as soon as possible after receiving the required siting approvals and necessary environmental permits. Currently, the proposed construction schedule for the individual projects would commence in 2011 and be completed in late 2013, so that the project would be in-service in late 2013.

13.0 Conclusion

Q. Please summarize and conclude your testimony.

A. The GSRP and the MMP are needed to provide reliable electric service to the greater Springfield area and north-central Connecticut and should be constructed as soon as possible. The projects are needed on their own and are part of a long range plan for the expansion of the electric systems of the state and the interconnected systems of neighboring states. They will provide local and regional benefits, and if they are constructed as all overhead projects, nearly all of their costs should be apportioned across New England.


GREATER SPRINGFIELD
RELIABILITY STUDY AREA
LUDLOW
SPRINGFIELD
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MASSACHUSETTS
CONNECTICUT
NORTH
BLOOMFIELD
BARBOUR
HILL
MEEKVILLE
JCT.
MANCHESTER
Exhibit AWS-1

Figure E-1 Preferred and Existing 345-kV Transmission Lines

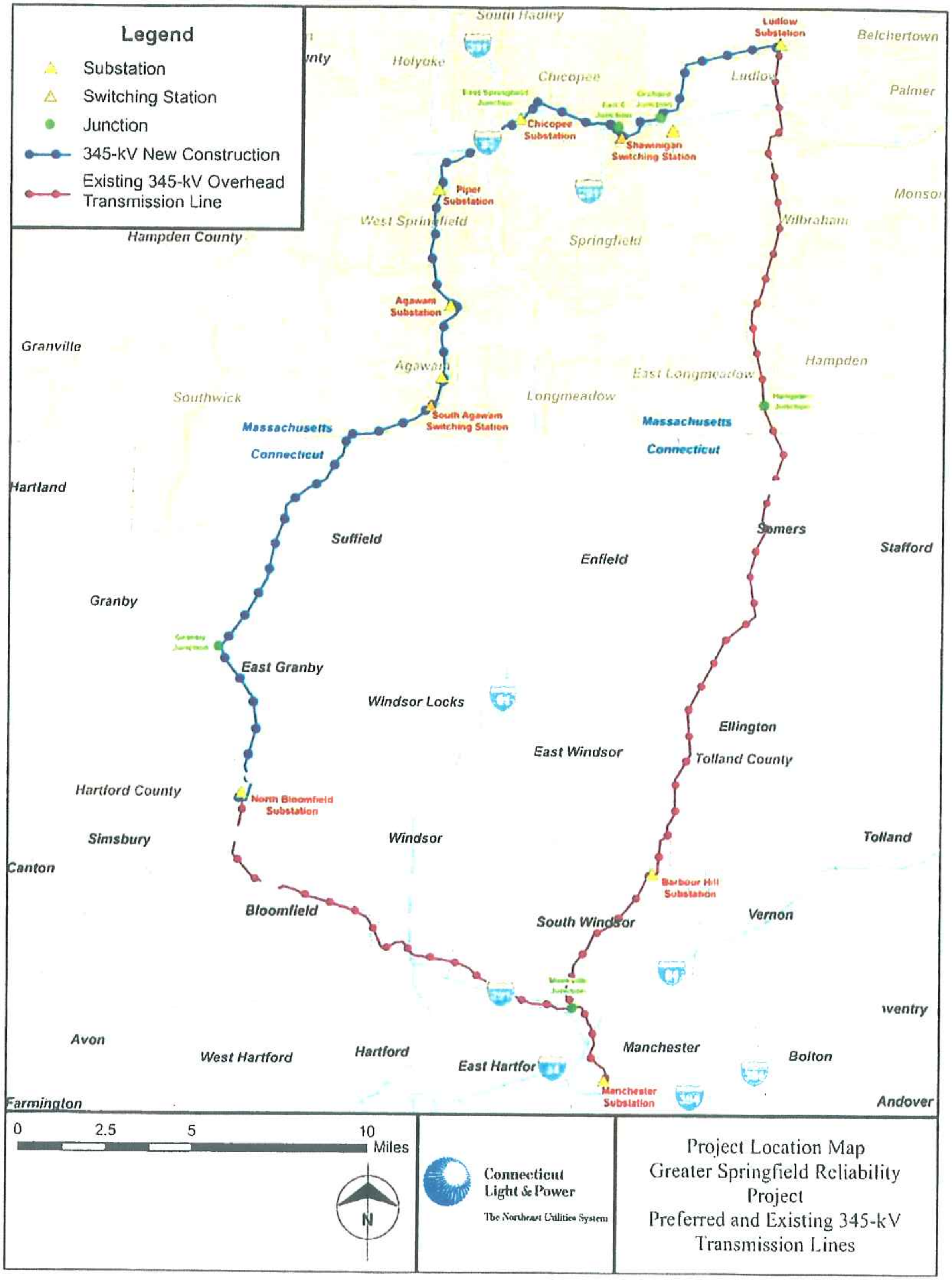

Exhibit AWS-2

STATE OF CONNECTICUT

SITING COUNCIL

Docket 370A: The Connecticut Light and Power Company application for a Certificate of Environmental Compatibility and Public Need for (1) The Greater Springfield Reliability Project consisting of a new 345-kV electric transmission line and associated facilities from the North Bloomfield Substation in Bloomfield to the Connecticut/Massachusetts border, together with associated improvements to the North Bloomfield Substation, and potentially including portions of a new 345-kV electric transmission line between Ludlow and Agawam, Massachusetts that would be located in the Towns of Suffield and Enfield, Connecticut; and (2) the Manchester Substation to Meekville Junction Circuit Separation Project in Manchester, Connecticut.	**DOCKET 370**
Docket 370B: NRG Energy, Inc. application pursuant to C.G.S. § 16-50*l*(a)(3) for consideration of a 530 MW combined cycle generating plant in Meriden, Connecticut	July 7, 2009

DIRECT TESTIMONY OF ROBERT CARBERRY AND SCOTT NEWLAND

CONCERNING ENGINEERING, DESIGN, SITING, CONSTRUCTION AND EMF CHARACTERISTICS OF THE CONNECTICUT VALLEY ELECTRIC TRANSMISSION PROJECTS

The Connecticut Portion of the Greater Springfield Reliability Project
and
The Manchester Substation to Meekville Circuit Separation Project

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1.0 <u>INTRODUCTION</u>

Q. Please identify yourself and the other members of the panel who may assist you in responding to cross examination.

A. We are Robert E. Carberry, of Northeast Utilities Service Company ("NUSCO") and Scott E. Newland, of Burns & McDonnell Engineering. With us on this panel are John C. Case of NUSCO; James Hogan and Paul Williams of Burns & McDonnell; and Anthony Coggan, of Truescape, any of whom may be called upon to assist us in answering specific questions. Our resumes, and those of our colleagues who might be called upon to testify, are provided in the accompanying Resume Volume. The Resume Volume also includes that of Dr. William H. Bailey, who will respond to any questions concerning EMF health science issues. Dr. Bailey will be available for examination during the hearings scheduled for July 28 and 29, 2009.

Q. What are your positions in your respective organizations, and their relationship to the projects you are here to testify about today?

A. Robert Carberry is Project Manager, NEEWS Siting and Permitting at NUSCO, and Scott Newland is NEEWS Program Manager at Burns &McDonnell. NUSCO is a subsidiary of Northeast Utilities that provides administrative and engineering services to the NU operating subsidiaries, including The Connecticut Light and Power Company (CL&P) and Western Massachusetts Electric Company (WMECO). NUSCO has provided the in-house resources for the development of the Greater Springfield Reliability Project (GSRP) and the Manchester Substation to Meekville Junction Circuit Separation Project (MMP). Burns and McDonnell is an international engineering consulting firm. Its areas of core competence include the engineering, design, and construction of electric transmission facilities. Burns & McDonnell has acted under contract with NUSCO to provide a wide range of services in connection with the development of the GSRP and the MMP.

Q. What personal responsibility have each of you had with respect to the application to the Connecticut Siting Council ("Council") that is the subject of Docket 370A (the "Application")?

A. We have supervised the preparation of the entire Application, drafted portions of it ourselves, have reviewed the entire Application as it was prepared, and approved it for filing with the Council.

Q. What is the purpose of your testimony?

A. The purpose of our testimony is to summarize the information presented to the Council concerning the engineering, design, routing, construction and EMF characteristics of the Connecticut portion of the proposed GSRP and the MMP (which we sometimes will refer to together as the "Projects") and their compliance with the Council's EMF Best Management Practices. Our testimony will complement that of NUSCO planner Allen W. Scarfone concerning the Need for the Projects and that of CL&P consultant Louise Mango of Phenix Environmental, Inc., concerning their environmental effects.

2.0 DESCRIPTION OF PROPOSED GSRP FACILITIES

Q. Mr. Scarfone has described in his testimony the 345-kV facilities in Connecticut, and the 345-kV and 115-kV facilities in Massachusetts, that are proposed for the GSRP. Would you please show the Council where these facilities are proposed to be built?

A. Yes. Please refer to Figure ES-1 in Volume 1 of the Application, a copy of which is attached to this testimony as Exhibit CN-1. The connected blue dots show the location of the proposed new 345-kV line from North Bloomfield Substation, in Bloomfield, extending generally north to the Connecticut border, continuing northerly to the Agawam Substation in Massachusetts, and a second new 345-kV line extending north and east from the Agawam Substation to the Ludlow Substation. It also shows the proposed 115-kV line construction in Massachusetts, in green connected dots.

Q. How does the construction scope of the Connecticut portion of GSRP compare with that of the Massachusetts portion?

A. By far most of the facilities and most of the construction effort will be in Massachusetts. In Massachusetts, 23 miles of new 345-kV line are proposed, as compared to 12 in Connecticut; and 59 circuit miles of new 115-kV line are proposed as compared to none in Connecticut. The substation and switching station work in Massachusetts will also be much greater. In Connecticut, there will be extensive 345-kV equipment additions to and reconfiguration of the North Bloomfield Substation, but the Massachusetts work will be much more extensive. In Massachusetts, the GSRP requires 345-kV equipment additions to both the Agawam and Ludlow Substations, as well as two new 115-kV switching stations. Accordingly, of the total estimated project cost of $714 million, approximately $581 Million (over 80%) is estimated for the Massachusetts work and facilities, and approximately $133 million (less than 20%) is estimated for Connecticut work and facilities.

A. <u>The Proposed 345-kV Line from North Bloomfield Substation to the State Border</u>

Q. What towns will the Connecticut seetion of the proposed new 345-kV line-route traverse?

A. As shown in Figure ES-8 from the Application, a copy of which is attached to this testimony as <u>Exhibit CN-2</u>, the proposed 345-kV line route in Connecticut would extend from the North Bloomfield Substation in Bloomfield, along an existing transmission right-of-way (ROW) through portions of Bloomfield, East Granby and Suffield to the Connecticut / Massachusetts border.

Q. Please briefly describe the historical use of this ROW.

A. The ROW was established some time before 1924. In that year, the lattice tower line running from the South Meadow Substation in Hartford, Connecticut to Agawam was built as a double-circuit 69-kV line. Connecticut substations, including North Bloomfield and Bloomfield, were later connected to this line. In the early 1930s, the line was upgraded for future 115-kV operation, and operation of these circuits at 115 kV began in 1941-42. In 1957, an adjacent 115-kV H-frame line from North Bloomfield Substation to Southwick, Massachusetts was built. Later on, the double-circuit 115-kV line was bundled to operate as a single 115-kV circuit. In 1997, the line was restored to a double-circuit use, and associated modifications were made to the North Bloomfield Substation, both as described in CL&P's Petition No. 362 to the

Council, which the Council granted. The original ROW was 100 feet wide; over the years, it was expanded to its present width.

Q. In connection with the 1997 work, did CL&P make any modifications to reduce magnetic fields (MF) associated with this line?

A. Yes. In accordance with the Council's EMF Best Management Practices, which were then in effect, CL&P connected the phases of the two circuits with unlike or reverse phasing so as to produce additional cancelation of magnetic fields, thus reducing the levels of the magnetic fields associated with the line.

Q. Is the existing ROW wide enough to accommodate the proposed 345-kV line?

A. There is ample room on the existing ROW for a new 345-kV line, except for two short segments where the ROW will have to be widened by the acquisition of additional easement rights over adjoining land. Both segments are in Suffield. An additional 100 feet of width would be required for a linear distance of approximately 1,000 feet between Phelps Road and Mountain Road; and an additional 100 to 120 feet of width would be required for a linear distance of approximately 400 feet east of Ratley Road.

Q. What facilities are now on the ROW?

A. The ROW has two distinct segments, characterized by different widths and different sets of structures. Starting at North Bloomfield Substation, the first section is 4.7 miles long, and ends at Granby Junction. It is 385 feet wide. There are three lines of structures on that section: a line of lattice-steel towers, averaging 70 feet high, which supports two 115-kV circuits; a line of wood poles, averaging 40 feet high, which supports a 23-kV distribution line; and a line of wood-pole H-frame structures, averaging 60 feet high, which supports a single 115-kV circuit. This ROW section and the lines on it are depicted in cross section on the left-hand side of Figure O-3 of the Application, a copy of which is attached to this testimony as Exhibit CN-3.

The second section of ROW extends for 7.2 miles from Granby Junction to the Connecticut / Massachusetts state border. It is typically 305 feet wide. Only one line continues north from Granby Junction along this section of ROW – the line on 70 foot high lattice steel towers, that supports two 115-kV circuits. This section and the line on it are depicted in cross section on the left-hand side of in Figure O-5 of the Application, a copy of which is attached to this testimony as Exhibit CN-4.

Both segments of ROW traverse some NU properties. In these locations, the ROW does not have a legally defined width.

Q. What type of support structures would be used for the new 345-kV line that would be added to the ROW?

A. That will be determined in the course of this proceeding. As required by the Council's EMF Best Management Practices (BMP), CL&P has identified both a "a base line" design and several potential "reduced EMF" line designs. In addition, CL&P has identified a "BMP focus area" where use of one of the reduced EMF designs would be appropriate according to the BMP, and has recommended the selection of one of those designs. Later on in this testimony, Mr. Carberry will explain how the BMP focus area was identified and the recommended BMP design was selected. At this point, we will just describe the structure types for the base line and BMP designs and where each may be used.

The base line design calls for steel- or wood-pole H frame structures, typically 90 feet high centered to the east of the existing 115-kV double-circuit lattice tower 115-kV line, which is on the western side of the ROW. The two sections of ROW, as they would appear after construction of the new 345-kV line with this design, are shown in cross section on the right-hand side of Ex. CN-3 and CN-4.

The BMP design calls for the new 345-kV line to be supported by a line of steel monopoles, averaging 110 feet high, with the conductors arranged in a "delta", or triangular, configuration. This design is recommended for the "BMP focus area" between existing line structures 3191 and 3221. This section of ROW is approximately 3.2 miles long, and extends from the location where Country Club Lane in East Granby comes closest to the ROW to the ROW crossing of Phelps Road in Suffield. This section of ROW, as it would appear with a new line of 110-foot-high delta-configured monopoles, is shown in cross section on the right-hand side of Figure O-7 in the application, a copy of which is attached to this testimony as Exhibit CN-5.

Q. What additional clearing and maintenance of vegetation on the ROW would be required for the new line?

A. The approximately 180- to 195-foot width of the North Bloomfield Substation to Granby Junction ROW that is now maintained would increase to approximately 290 feet, leaving approximately 95 feet on the east side of the ROW unaffected. From Granby Junction to the state border, the currently maintained width of approximately 100 to 110 feet will increase to approximately 205 feet, leaving approximately 100 feet on the east side of the ROW unaffected wherever the base H-frame line design is used. If monopole structures were chosen for the BMP focus area, the required additional width for vegetation clearing and maintenance would be reduced by about 10 feet.

Q. Mr. Scarfone has explained that the existing 115-kV tie lines between Connecticut and Massachusetts will be functionally replaced by the new 345-kV line. What does CL&P intend to do with the existing 115-kV lines between North Bloomfield and the border when the new 345-kV line is in service?

A. The two 115-kV circuits now on the lattice-steel towers between Granby Junction and the state border will be reconfigured as part of a single circuit from the South Agawam (MA) Switching Station to Granby Junction to Southwick (MA). The appearance of this section of line will remain the same, because the six conductors that presently make up the two 115-kV circuits will be reconfigured to function as a single "split phased" circuit. (Mr. Carberry will explain split-phasing later on.) Between North Bloomfield Substation and Granby Junction, the 115-kV lines will be de-energized. Unless CL&P determines that there may be a near-term need to reuse any of these line sections at a distribution voltage for a circuit from North Bloomfield Substation, it will file a petition with the CSC for approval to remove the line sections after the GSRP has been completed.

B. <u>The Proposed North Bloomfield Substation Additions</u>

Q. Where is the North Bloomfield Substation located?

A The North Bloomfield Substation is located on the northeast portion of CL&P's 34-acre property located on Hoskins Road in Bloomfield, near its intersection with Tariffville Road.

Q. How long has the North Bloomfield Substation been in operation at the existing site?

A. There has been a substation at that site since at least the mid-1950's. 345-kV equipment has been in operation there since 1981.

Q. What new facilities will be installed at the North Bloomfield Substation as part of the GSRP?

A. Three new single-phase 345/115-kV, 200-MVA autotransformers and new 345-kV circuit breakers and associated switches and bus work will be installed to create two complete breaker-and-a-half bays. Reconfiguration, improvement, and replacements of the existing 345-kV and some 115-kV equipment will also be required. The substation yard will be expanded to accommodate this new equipment and to provide room for a new 345-kV line position anticipated to be required in the future when the 345-kV system is extended from the North Bloomfield Substation to the west. In order to accommodate the new facilities, the existing fenced area will be extended to encompass an additional 2.7 acres, after which the footprint of the substation will be approximately 9.7 acres, contained within the 34-acre site owned by CL&P.

Q. Has CL&P submitted drawings for the North Bloomfield Substation additions?

A. Yes. Volume 7 of the Application contains an aerial view, general arrangement plan and site layout for the North Bloomfield Substation additions. Please note that his layout shows a third bay of which only a small portion will be built as part of the GSRP improvements.

The complete bay will be proposed in the future when a 345-kV line from North Bloomfield is extended to the west.

Q. What is the tallest height of any new structures to be constructed within the fenced-in substation area?

A. The tallest proposed structure to be constructed within the fenced-in substation area will be approximately 100-110 feet in height. This will be the lightning mast on top of the new terminal structure. It will be the same height as the mast on the existing terminal structure. The new structure, like the existing one, will be located in the portion of the substation that is furthest from Haskins Road.

Q. What will be the construction sequence for the North Bloomfield Substation improvements?

A. We anticipate that the construction sequence would be as follows:

- Site preparation: installing temporary soil erosion and sedimentation controls, vegetation clearing, creating temporary access, grading, excavating unsuitable soils, installing fencing
- Foundation construction: excavation, form work, use of steel reinforcement, construction of transformer sumps, concrete placement
- Erection of structures and equipment, including cable trench, ground grid and conduits and cables
- Testing and interconnections
- Final cleanup, site security and landscaping

A final detailed construction sequence will be developed for the Development and Management (D&M) Plan that must be submitted to the Council and approved before construction may begin..

Q. How long will the construction on the North Bloomfield Substation additions take?

A. Approximately 18 months.

C. <u>Line Construction Process</u>

Q. What construction steps will be followed for construction of the new 345-kV line on the ROW between the North Bloomfield Substation and the Connecticut / Massachusetts border?

A. The overhead transmission line construction will occur in several stages as outlined in detail Section J.1.1 on pp. J-1 – J-3 of the Application and will generally consist of survey/marking of features, establishment of construction areas and soil and erosion control measures, clearing, construction or improvement of access roads, work area preparation, construction of foundations and erection/assembly of new structures, wire stringing, testing, commissioning and restoration.

Q. What temporary uses of land will be needed as part of the proposed construction process for the transmission facilities?

A. Storage areas generally 2 to 5 acres in size will be needed to store mobile construction offices, construction materials, equipment and supplies, and for parking. They would be located near active work locations and would be moved as the construction progresses. Staging areas, generally less than 2 acres in area, would be used for temporarily stockpiling components of the transmission support structures. Laydown areas, typically located within the

ROW, would be used for the placement of materials and equipment associated with the dismantlement of existing structures or the erection of new structures. To the greatest extent practical, CL&P would use its own property for these purposes. When these areas are no longer needed for the construction effort, they will be restored.

Q. Has CL&P identified potential storage and staging areas that are not on its property?

A. Yes, potential storage and staging areas on the property of others that have been identified to date are listed in Table J-1 on page J-6 of Volume 1 of the Application. Final locations will be identified in the D&M Plan.

Q. What ROW access does CL&P require to construct the new line?

A. Crews must have access from public highways or private roads to each location on the ROW where a structure will be located, both to build it and for future maintenance. It will not be necessary for vehicles and heavy equipment to be able to travel everywhere along the ROW.

Q. How will construction vehicles and equipment gain access to the portions of the ROW where the construction work will be performed?

A. First, there is an existing network of access roads that are available to provide access for maintenance of the existing ROW. However, many of them have been in existence for over 80 years, and will have to be improved to accommodate modern heavy construction equipment. Typically, grades of 10% or less and a level travel-way 15 to 20 feet wide will be required. Second, some new access roads will also have to be established. Finally, in some cases the vehicles and equipment will have to travel along the ROW from one construction site to another.

Q. How are the locations of new access roads determined?

A. The areas to which access is required and for which there are no existing access roads are identified. Then locations for roads are selected based on suitable terrain, avoidance of sensitive environmental resources, and minimizing construction traffic disturbances to nearby property owners.

Q. Where will new access roads be needed?

A. Table J-2 on p. J-11 of the Application lists the potential locations of new access roads that have been identified so far. The final designation will be in the Development and Management Plan.

Q. How is the ROW used for access roads?

A. Roads that provide access from off the ROW of course extend into the ROW to the construction site itself. In addition, where access to a construction site from an off-ROW access road is not available, a roadway sufficient to support the construction vehicles and equipment must be established within the ROW, between the access point and the construction site.

D. Appearance of the ROW After Construction of the Line

Q. How can the Council visualize what the GSRP ROW will look like after the proposed construction is complete?

A. We have provided several visual aids for this purpose. First, Volume 10 of the Application includes drawings of the type attached to this testimony as Exhibits CN-3, CN-4, and CN-5. These are plan and profile drawings, based on aerial photography from 2007 and show a view from overhead and an elevation view from the side. The elevation view shows both the conductors and structure elevations above ground and the horizontal distance along the ROW, along with the elevation of vegetation abutting the ROW. The structure heights appear taller on these drawings due to the dual scale of 1 inch = 80 feet in the vertical direction and 1 inch = 400 feet in the horizontal direction. In addition, Volume 10 also contains photographs of the ROW and the existing facilities on it, together with corresponding photosimulations of the same parts of the ROW as they will appear when construction is complete. An example of one of these pairings of photographs and photosimulations, relating to the North Bloomfield Substation to East Granby Junction section of the ROW, is attached to this testimony as Exhibit CN-6.

Q. Are the photosimulations in Volume 10 reasonably accurate?

A. Yes. The photosimulations were prepared by a company specializing in computerized simulations. Based on our own knowledge of the proposed construction, and our experience with such construction, we are satisfied that they are reasonably accurate.

Q. What else can you provide to assist the Council and other docket participants to visualize how the ROW will look after construction is complete?

A. CL&P commissioned Truescape, a company that has expertise in preparing computer simulations of projected conditions, to prepare animated simulations and still photo simulations of the post-construction lines One set of these simulations assumes that the new 345-kV line would be built throughout this section of ROW using the base H-frame line design with horizontally configured conductors and a typical structure height of 90 feet. The other assumes that the new 345-kV line would built in the BMP focus area using the BMP recommended design of steel-monopole structures supporting conductors arranged in a delta configuration, with a typical structure height of 110 feet. The Truescape simulations are available on the website for the Projects at www.NEEWSprojects.com and have been provided to those on the mail service list on compact discs. We have designated the CD's as CN-Exhibit 7A and 7B to this testimony. Exhibit CN-7A shows the baseline configuration and Exhibit CN-7B shows the BMP configuration.

Q. Please summarize what the Truescape simulations show.

A. The animations show the views of the existing and new lines on the ROW as they will be able to be seen by the occupant of an automobile being driven along Newgate Road and Phelps Road in Suffield and East Granby; and as they will appear in a panoramic prospect from the Metacomet Trail on Suffield Mountain. The views represented would be during a season when the trees are leafed. The panoramic prospect from Suffield Mountain is also shown in the still photosimulations.

Q. Are the Truescape simulations a fair and accurate representation of the matters that they purport to depict?

A. Yes. They are very accurate.

Q. Will Truescape personnel be available for cross-examination in this Docket?

A. Yes.

E. <u>Cost and Schedule</u>

Q. What is the estimated cost of the proposed GSRP with the base line design?

A. The estimated cost is $714 million, assuming all overhead line construction and not including extra costs for BMP line configurations. That estimate includes "all-in" capital cost, escalated to future years of spending (assuming an in-service date of 2013). As previously noted, approximately $133 million of that cost (less than 20%) is attributable to facilities in Connecticut. Costs are being continually reassessed as the project design becomes more detailed and we learn more about specific conditions. The specific elements of the estimated cost may increase and decrease as we go forward. However, we continue to believe that the overall total of $714 million continues to be a good estimate.

Q. What is the anticipated construction timetable for the GSRP construction?

A. Construction on the Projects is expected to start in the third quarter of 2010 and be completed in the fourth quarter of 2013.

Q. What is the tentative in-service date for GSRP?

A. We hope to have the project in service before the end of 2013.

3.0 <u>THE CONNECTICUT PORTION OF THE "SOUTHERN" ALTERNATE TO THE AGAWAM TO LUDLOW NORTHERN ROUTE</u>

Q. Please explain what is meant by the Connecticut portion of the Southern Route Alternative.

A. This phrase refers to an alternate route for the new 345-kV line between the Ludlow (MA) and Agawam (MA) Substations, two short lengths of which would dip below the Massachusetts / Connecticut state border into Connecticut. This route, including the two short lengths in Connecticut, is shown in connected orange dots in Figure ES-1 from the Application, reproduced as <u>Exhibit CN-1</u> to this testimony. Pursuant to Massachusetts siting requirements, Western Massachusetts Electric Company (WMECO), which would own and operate the Massachusetts GSRP facilities, identified this route to the Massachusetts Energy Facilities Siting Board (EFSB) as a "geographically distinct alternative" to its proposed and preferred route for a 345-kV line between Ludlow and Agawam, which is shown on <u>Exhibit CN-1</u> in blue connected dots. As the map shows, the preferred route extends from Agawam Substation around the north side of Springfield, and then to Ludlow, whereas the alternative route extends south from Agawam and to the south of Springfield to Ludlow. Hence, the preferred route is also called the "Northern" route and the alternate route is called the alternate Southern route or "Southern Route Alternative." The Council should note that <u>Exhibit CN</u>-1 also shows that the existing 115-kV lines on the "northern" ROW in Massachusetts are to be reconstructed. This work will be required to take place on that ROW regardless of which route is chosen for the new 345-kV line.

Q. Please describe the portions of the Southern Route that would be in Connecticut.

A. The two segments of Southern Route that would be in Connecticut are: (1) a 1.1-mile segment in Suffield on the west side of the Connecticut River; and (2) a 4.3-mile segment in Enfield on the east side of the Connecticut River. In between these two segments, the route re-enters Massachusetts for a distance of about 0.5 miles and crosses the Connecticut River. The locations of these segments are shown in detail in Figure E-3 of Volume 1 of the CL&P's application.

Q. Describe the existing corridor in Suffield and Enfield Connecticut that would be affected by the Southern Route.

A. The existing ROW in Connecticut is 280 to 300 feet wide. There is a single 115-kV circuit on the ROW, supported by wood-pole H-frame structures, except for three structures in Enfield, where the circuit is in a vertical configuration on steel monopoles.

Q. What new facilities would be placed in the ROW in Connecticut as part of the Southern Route?

A. The base design for the new 345-kV line would be steel- or wood-pole H-frame structures, typically 90 feet tall. However, CL&P has identified a "BMP focus area" for 3.7 miles of the 4.4-mile segment in Enfield, where it recommends using steel monopoles with the conductors in a delta configuration, which would typically be 110 feet tall.

Q. Would the use of the Southern Route for a new Agawam to Ludlow 345-kV line affect the proposed use of the ROW between North Bloomfield Substation and the state border for a new 345-kV line?

A. No. The "Southern Route" is **not** an alternative to construction of the new 345-kV line on the ROW from North Bloomfield to the Agawam Substation in Massachusetts. It is an alternative only for the new 345-kV line from Agawam to Ludlow.

Q. Why is WMECO recommending the Northern Route?

A. The Northern Route in both states satisfies the objectives of the Projects; it is the most direct route; has fewer adverse environmental effects; and is more cost-effective than the Southern Route alternative for the Agawam to Ludlow 345-kV line. Because extensive 115-kV line work will be required along the Northern route in any case, selection of the Northern route as the site of the new 345-kV line enables the construction effort to be concentrated in a single corridor rather than spread over two widely separated corridors.

Q. What is CL&P asking the Council to do if the Southern Route is approved by the EFSB, given that the Connecticut portion of a 345-kV line on the Southern Route has not been fully designed?

A. CL&P is asking for a contingent approval of the Connecticut portion of the Southern Route if the EFSB has not made a decision before the Council acts. If the EFSB approves the Southern Route for the Agawam to Ludlow 345-kV line, then CL&P will include full details of the Connecticut portion of the Southern Route in the Development and Management Plan, which must also be approved by the Council.

Alternatively, if the Council is not comfortable acting on this request on the state of the record when all the evidence is in, particularly since it now appears likely that the EFSB may have some way to go then in making its own decision, the Council could decide to deny the request for a certificate for the Connecticut portion of the Southern Route without prejudice. Then, if the EFSB ordered the Southern Route, the Council could re-open this proceeding based on changed circumstances and further consider CL&P's request related to the Southern Route Alternative. This procedure would be similar to that the Council followed in the Bethel to Norwalk matter, Docket No. 217, in order to consider the "Configuration X" proposal that was presented to the Council very late in the proceeding.

4.0 UNDERGROUND ALTERNATIVES TO THE NORTH BLOOMFIELD TO AGAWAM ROUTE

Q. In its analysis of line-route alternatives for the North Bloomfield to Agawam 345-kV line, what challenges did CL&P face?

A. Alternatives must meet routing objectives in two states while achieving the required reliability improvements to the transmission system. In particular, practical route alternatives were defined by the locations of the existing substations, North Bloomfield, Agawam and Ludlow, to which 345-kV transmission lines must connect cost-effectively and efficiently, while minimizing adverse environmental, cultural and economic effects.

Q. What were the specific route selection objectives used in the initial planning and in the identification of alternative routes for the GSRP?

A. Route selection objectives included:

- Comply with all statutory requirements, regulations and state and federal siting agency policies
- Achieve a reliable, operable, constructible and cost-effective solution
- Maximize the reasonable, practical and feasible use of existing linear corridors (e.g., transmission lines, highways, pipelines)
- Minimize the need to acquire property by eminent domain
- Minimize adverse effects to sensitive environmental resources, significant cultural recourses (archaeological and historical) and on designated scenic resources
- Minimize conflicts with local, state and federal land use plans and resource policies
- Maintain public health and safety

Q. Did overhead line construction on an existing right-of-way best meet these objectives?

A. Yes, it did.

Q. Did CL&P nevertheless consider an all-underground line route for the Connecticut portion of the North Bloomfield to Agawam line?

A. Yes we did, as we are required to do by statute.

Q. What circumstances warrant consideration of underground transmission cable systems?

A. An underground cable system will be considered for applications where overhead construction is impossible or impractical, such as where extensive water bodies must be crossed (as in the case of the Long Island Sound cables). Overhead lines are often found to be impractical in densely settled urban areas such as New York City and Boston. In some circumstances (as was the case with a 24-mile segment of the Middletown – Norwalk line), expansion of an overhead line ROW can require the acquisition of so many houses that the social cost is undesirable and the economic cost is close to that of underground line construction. Finally, Connecticut statutes require applicants seeking approval of electric transmission lines from the Siting Council to consider both all-underground construction of the proposed line and, as discussed later in this testimony, underground construction of segments of a 345-kV line that, if built overhead, would be adjacent to a "residential area" or other specified land uses, sometimes collectively called, for convenience, "statutory facilities".

Q. What considerations must be taken into account in evaluating an underground alternative to an overhead 345-kV line?

A. First, the fundamental differences between the transmission technology of overhead lines and underground cable systems must be considered. If underground construction is found to be technically achievable, its impact on reliability and operability of the system must still be considered. The availability and suitability of a potential route must be evaluated. When all of these considerations have been taken into account, the cost of underground line construction is evaluated, and often proves decisive.

Q. What are the technical differences that must be considered for evaluating underground facilities?

A. There are six categories of technical considerations:

(1) When long lengths of underground extra-high-voltage cables are installed in suburban or rural settings, which usually are remote from strong electrical sources, the large amounts of cable-charging current associated with long cable lengths, combined with moderate system strength, require careful consideration to prevent damage and disruptions to the transmission system and potential damage to customer equipment;

(2) Since underground 345-kV cables have much lower current-carrying capability, to achieve the same power-transfer capacity as an overhead transmission line, multiple underground cables must be installed;

(3) Special switching devices and large shunt reactors may be required to compensate for the high capacitive charging of underground 345-kV cable systems so as to prevent unacceptably high system voltages during normal operating conditions. These devices add operating complexity, decrease system reliability, require additional land, and add appreciable cost;

(4) When underground cables are installed in isolated segments of an overhead 345-kV transmission circuit, a line transition station must be installed where the overhead transmission line conductors and the underground cables connect. Within the transition station, switching equipment to isolate the underground cables from the overhead line conductors and large shunt reactors may be installed, depending upon the underground cable segment's location in the circuit and its length;

(5) When transmission lines or transformers are switched in a transmission system that has a circuit made up of overhead line and underground cable sections, potential problems can arise because of traveling wave reflections; and

(6) Because of these technical considerations and lower electrical impedances of cables, detailed 60-Hertz load-flow and harmonic transient voltage studies would have to be conducted by power-system engineers to determine the maximum length of 345-kV underground cables that could be installed at any location on the transmission grid without adversely affecting the New England transmission system.

Q. Please explain the transmission system operational considerations related to the use of underground cables.

A. Complexity in operation of 345-kV underground cable systems can arise as follows:

(1) When a long underground cable circuit or circuit segment is initially energized, even though it may not be carrying any load, all associated shunt reactors need to be energized to maintain voltages within acceptable levels. When this circuit starts to carry load, the voltage on portions of the system will instantaneously drop until a sufficient percentage of shunt reactors can be disconnected. If the shunt reactors are not sized properly, or the steps in which a shunt reactor's impedance is changed are too large, unacceptable voltage swings can occur on the system; and

(2) Because only a portion of the shunt reactors are in service (typically one-third) and the remaining portion of the shunt reactors cannot be connected instantaneously to increase their compensation for the capacitive charging of the cables, voltages could rise to

unacceptably high levels within portions of the transmission system. Unlike an all-overhead transmission system, when long underground cables are present, system operators must be thoroughly trained on the sequential steps that must be followed when placing a system element in service or removing it from service and the interdependence of their actions on the transmission system to ensure that voltages remain within acceptable ranges. In critical or emergency situations, the time required to perform these crucial operating steps could be detrimental to the integrated transmission system.

Q. Please explain the power-quality concerns presented by the use of underground cables.

A. Day-to-day switching events, like the energizing and de-energizing of transmission circuits that occur in the normal operation of the transmission system, can cause amplification of harmonic voltages and current that can lead to system component failures and severe power quality problems. These failures/problems can have a detrimental effect on customer equipment and processes.

Q. Please explain the concerns related to an underground cable system's recovery from outages.

A. When an outage occurs on a partial or completely underground transmission circuit, significantly longer time is required to isolate a faulted segment of cable before repairs may commence; and once the faulted area is located, repair times can take weeks to complete vs. hours or a few days for most overhead line failure modes.

Q. What assumption did CL&P make as to the use of underground technology in its evaluation of an all-underground line route from North Bloomfield Substation to the Connecticut / Massachusetts border?

A. CL&P assumed that there was no technical "fatal flaw" (e.g., serious overvoltage conditions) that would prevent building the 345-kV cable system underground for this 12-mile length. Later studies validated this assumption.

Q. What assumption did CL&P make as to the particular underground cable system technology to be employed on the GSRP?

A. CL&P assumed that a solid-dielectric, cross-linked polyethylene (XLPE)-insulated cable system would be used and that the cable and associated splice chambers would be installed and maintained in accordance with standard procedures. Nine cables would be installed; six would be operated at any one time.

Q. Does the Application explain how an XLPE-insulated cable system works?

A. Yes, volume 6 of the Application contains a very useful tutorial on the XLPE and other underground cable technologies.

Q. What criteria were used to evaluate potential underground line-route options?

A. Criteria included siting away from significant environmental resources; availability of useable ROW for the construction work area (typically 40 to 60 feet wide) and burying three splice vaults (each typically 10 feet x 10 feet and 32 feet in length, external dimensions) every 1,600 feet; engineering considerations such as relatively straight and direct routes with gradual slopes and inclines (to minimize construction and maintenance costs and avoid downhill cable migration); and social considerations, such as minimizing installation through residential areas and central business districts, as well as avoiding potential conflicts with other in-ground utilities, and land availability (2 to 4 acres) for line transition stations.

Q. Of the 2-4 acres needed for a line transition station, how much land is needed for a fenced area around the equipment?

A. A fenced area of 1.7 acres would be needed for connecting three sets of underground 345-kV cables to one overhead 345-kV line at a typical transition station. That area would increase if compensating shunt reactors were required. The additional land outside the fenced-in area is necessary for setback distances from property lines, cable and overhead line entries, access and site-specific requirements.

Q. What all-underground construction between North Bloomfield Substation and the state border did CL&P consider?

A. CL&P considered two all-underground line routes: an "in-ROW" alternative and a road alternative, both of which are described in Section H.3.3 of Volume 1 of CL&P's Application.

Q. What did CL&P's evaluation of these alternatives conclude?

A. The Council's regulations require a route to be "technically, environmentally, and economically practical". These all-underground alternatives were assumed to be technically practical although causing operating complexity. However, we understand that the in-ROW alternative is unlikely to be environmentally practical given the direct impacts to water resources and the resulting difficulties in obtaining U.S. Army Corps of Engineers and Connecticut Department of Environmental Protection permits. Finally, neither variation is economically practical based on the cost comparisons included in Appendix H-1 of the Application.

Q. Briefly describe the cost comparisons of the all-underground variations.

A. For the all-underground in-ROW variation, the initial capital cost is estimated to be approximately $455 million as compared to $41 million for an overhead line, with life-cycle costs estimated to be $648 million as compared to $85 million for an overhead line. For the all-underground in-road alternative, the initial capital cost is estimated to be approximately $479 million, with life-cycle costs estimated to be $682 million. This vast cost differential becomes much greater when the cost to Connecticut ratepayers is considered, because the excess costs of underground construction, as compared to overhead construction, must be assumed to be "localized" under the rate treatment explained by Mr. Scarfone in his testimony. By way of illustration, considering the preliminary estimated initial capital cost for the line of $41 million (overhead) as compared to $ 455 million (underground), the cost to Connecticut ratepayers for the overhead line construction would be $11.7 million ($41 MM x 27% = $11.7 MM), as compared to $425.7 million for underground line construction [$455 MM - $41 MM = $414 MM + $11.7 MM = $ 425.7 MM]. In either case, Connecticut ratepayers would also pay a 27% share of the North Bloomfield Substation costs (which we assume to be the same for both overhead and underground line construction) and the same share of the cost of the Massachusetts construction.

5.0 ELECTRIC & MAGNETIC FIELDS

Q. Mr. Carberry, what are Electric and Magnetic Fields?

A. Electric and Magnetic Fields are invisible lines of force that are associated with all electric conductors and appliances. Electric Fields ("EF") are produced when a voltage is applied to a conductor. The level of an electric field at a given location near to a power line depends on the magnitude of the voltage applied, the spacing of the conductors and the distance from the conductors to the location.

Magnetic Fields ("MF") are produced when electric current flows on a conductor. The level of a magnetic field at a given location near to a power line depends on the magnitude of the current, the spacing of the conductors, and the distance from the conductors to the location.

EF and MF are collectively referred to as "EMF". Levels of each field fall off quickly as the distance from the conductor source is increased. Objects such as trees or building walls weaken or block electric fields, but magnetic fields are not affected by most materials. In the case of parallel lines of circuit conductors, the levels of EF and MF also depend upon the phasing of the circuit conductors and, for MF, the directions of current flow.

Q. Has CL&P evaluated the effect of the Projects on the current range of levels of EF and MF along the GSRP ROWs?

A. Yes. Section O of the Application provides a thorough analysis of the effect of the Connecticut portion of the Projects on EF and MF. The work supporting this section of the application was done by engineers at Exponent, Inc. and Burns & McDonnell under Mr. Carberry's supervision.

Q. Has the CL&P considered the Council's EMF Best Management Practices?

A. Yes. The design of the Projects will incorporate field management practices that are consistent with the Connecticut Siting Council's Electric and Magnetic Field Best Management Practices For the Construction of Electric Transmission Lines in Connecticut, December 14, 2007 (the "BMPs").

Q. Mr. Carberry, who was primarily involved on behalf of CL&P in the Council's process leading to the adoption of the current version of the BMPs?

A. I was.

Q. What was the nature of your involvement, Mr. Carberry?

A. As CL&P's EMF issues manager, I closely followed the proceedings and actively participated in the drafting of the CL&P /UI comments on draft documents developed by the Council. In addition, I testified on a joint CL&P/UI witness panel at the Council's public hearing held on January 9, 2007. Finally, I worked with counsel and the Connecticut Department of Public Health on the development of a joint proposal to the Council.

Q. Please explain the process for the development of the current version of the BMPs.

A. In 2005, the Council initiated a proceeding to revise its BMP, which had been in place since 1993. CL&P and the United Illuminating Company ("UI") participated in that proceeding.

Q. What was the outcome of the proceeding?

A. The Council adopted new requirements based on policies previously implemented by the State of California.

Q. Was the scientific community involved in the proceeding?

A. Yes, the Council retained an independent scientist, Dr. Peter Valberg; a panel of scientists was presented by the Connecticut Department of Public Health and scientists were presented by CL&P and UI, including Dr. Michael Repacholi, the recently retired coordinator of the World Health Organization's Radiation and Environmental Health Unit.

Q. What were the Council's conclusions in its decision in that Docket with respect to the state of the science concerning potential health effects of transmission line exposure?

A. The Council concluded that "the weight of scientific evidence indicates that exposure to electric fields, beyond levels traditionally established for safety, does not cause adverse health effects" and that scientific literature "reflects the lack of credible scientific evidence for a causal relationship between MF exposure and adverse health effects".

Q. What do the BMP require with respect to examining that conclusion in subsequent certification proceedings?

A. The applicant is required to present evidence of any new developments in scientific research addressing MF and public health effects or changes in scientific consensus group positions regarding MF.

Q. As part of this Application, has CL&P commissioned an analysis of new developments in scientific knowledge concerning potential health effects of MF or position changes regarding MF?

A. Yes. CL&P retained William H. Bailey, Ph.D. of Exponent, Inc. to perform such an analysis.

Q. What did Dr. Bailey's analysis consist of?

A. Dr. Bailey performed a systematic literature review and a critical evaluation of epidemiologic and *in vivo* studies published after the World Health Organization ("WHO") report of 2007, relied on by the Council in the development of the revised BMPs.

Q. Did Dr. Bailey provide a report of his analysis?

A. Yes. Dr. Bailey provided a report entitled "EMF and Health: Review and Update of the Scientific Research of December 2007 – June 2008" that is included in Appendix O-6 of the Application.

Q. What was Dr. Bailey's conclusion?

A. Dr. Bailey concluded that the updated research does not provide evidence to alter the opinion of the WHO and other health and scientific agencies that the research evidence is insufficient to suggest that EF or MF are a cause of cancer or any other disease process at the levels we encounter in our everyday environment.

A. **<u>Pre and Post Project EMF Values for Proposed Base Line Construction</u>**

Q. What are the major sources of EMF associated with the Projects?

A. The proposed and existing transmission lines on the existing ROW are the major sources of EMF. Transformers and other equipment within the associated substations are also potential EMF sources, but would have little or no impact on exposure to the general public because experience indicates that EMF levels from substations attenuate sharply with distance and will often be reduced to a general ambient level at the substation property lines. The exception is where transmission and distribution lines enter the substation.

Q. Has CL&P arranged for measurements of existing electric and magnetic field levels along the ROW from North Bloomfield Substation to the state line to be made?

A. Yes. Measurements of electric and magnetic fields were taken by Exponent in 2008 at several locations along the ROW in accordance with standard industry protocol. The measurements were focused on sections where groups of residences are adjacent to the ROW or statutory facilities are nearby, as described in the Council's Application Guidelines. The measurement results are provided in Table O-4 of the Application.

Q. What type of information do these measurements provide?

A. These measurements are only a snapshot of conditions at a single moment in time. MF levels at any given location can vary significantly, even from minute to minute, based on the current flow in the transmission lines. A measurement taken at any given moment may or may not be representative of a MF level that is typical or average at that location.

Q. Did CL&P provide calculated estimates of EF and MF along the ROW before and after the proposed construction, as required by the Council's BMP?

A. Yes.

Q. How were EF and MF calculated?

A. As described more fully in Section O at O-12, CL&P estimated (1) annual peak load (APL) conservatively from ISO – NE's projected 90/10 system peak loads, (2) peak-day average loads (PDAL) over 24 hours based on the 90/10 peak-load days and (3) annual average loads (AAL)_based on 61% annual load factor of the New England Transmission system. EF and MF were calculated using computer algorithms developed by the Bonneville Power Administration, an agency of the United States Department of Energy. The "pre-project" conditions included transmission system changes approved by ISO-NE and included in their system reliability models as of April 30, 2008, which have expected in-service dates before 2012, and system loads forecasted for 2012. The "post project" conditions for modeling the new and reconfigured lines assumed a 2017 system topology, including the construction of not just GSRP and MMP but also the other NEEWS projects. That assumption was made so as to reflect the higher line loadings – and thus higher levels of magnetic fields - that the completed NEEWS projects could enable.

The Application, Field Management Design Plan (FDMP) and supplemental FDMP present calculations of magnetic field levels at 25-foot intervals are also for the each base design, alternative design, and route variations at AAL, APL and PDAL, together with associated electric field levels. We consider the AAL case to be most useful reference for predicting field levels for any 'typical' day. Accordingly, we used these levels to develop the profiles and tables presented in the text of the Application, and the comparisons made in this testimony.

Q. How would you characterize the nature of the estimated calculations for MF?

A. As the result of the choice of load levels and the choice of import levels and generation dispatches, the MF calculations will yield conservatively high estimates.

Q. Please describe the estimated pre-project and post-project MF levels under the Average Annual Load case for the section of the ROW between North Bloomfield Substation and Granby Junction using the base line design:

A. These levels are set forth in Table O-3 in Volume 1 of CL&P's Application, which is reproduced below:

North Bloomfield to Granby Jct. (XS-1) (AAL)

	Magnetic Field (mG)		Electric Field (kV/m)	
Cross Section	West/North ROW	East/South ROW	West/North ROW	East/South ROW
XS-1 – Pre	16.0	0.5	0.46	0.00
XS-1 – Post	10.2	13.4	0.01	0.18

Q. How would you characterize the change in MF along this section of the ROW?

A. The MF environment is broadly similar both before and after the proposed line construction. The effect of the Project is to reduce MF on the west/north side of the ROW and to increase MF on the east/south side but to a level that is lower than the pre-existing level on the west/north side.

B. **Field Management Design Plan**

Q. What do the Council's BMP require with respect to transmission line design?

A. The BMP require an applicant for approval of an electric transmission line to submit a FDMP that begins from a design of a proposed overhead transmission line that incorporates standard utility practice to which "no-cost" magnetic field mitigation design features are added (the "base line design") and then examines modified overhead line designs that incorporate low-cost magnetic field mitigation design features in publicly accessible areas, and specifically at locations where the transmission line routes could be considered by the Council to be adjacent to residential areas, public or private schools, licensed child day-care facilities, licensed youth camps, or public playgrounds. The "low-cost" benchmark for this purpose is 4% of the base project cost, including not just the cost of the proposed line but substation costs as well. In order to be considered for adoption, proposed "reduced EMF' line designs should achieve at least a 15% reduction in edge of ROW MF levels, as compared to the levels that would be associated with the "base line" design.

(i) <u>FDMP for North Bloomfield to Agawam ROW</u>

Q. Did CL&P evaluate, in an FDMP, no-cost/low-cost measures to reduce MF associated with the new 345-kV line from North Bloomfield to the Connecticut / Massachusetts state border?

A. Yes, CL&P's FDMP is included in Appendix O-1 of the Application and was supplemented by CL&P's response to Q-CSC-049-BULK. The main FDMP relates to the proposed new 345-kV line from North Bloomfield Substation to the state border and to the MMP. The supplement relates to the Southern Route Alternative.

Q. What area for application of low-cost measures was identified for the Connecticut section of the North Bloomfield to Agawam 345-kV line?

A. Since there are no public or private schools, licensed child day-care facilities, public playgrounds or licensed youth camps along the route, the only area identified was a potential residential area comprising a 3.2-mile section of the new 345-kV line, from a starting point in East Granby approximately 1.3 miles north of Granby Junction to an end point in Suffield just north of the crossing of Phelps Road. This section of the ROW is more specifically defined as that between existing line structures 3191 and 3221. It is depicted in aerial-photograph-based Mapsheets 5-8 in Volume 9 of the Application (the 400 scale maps) and in Mapsheets for the Connecticut portion of the 345-kV line 23, 35 and 36 of 45 in Volume 11 of the Application (the 100 scale maps). A larger scale illustration of the focus area on a single sheet is attached to this testimony as <u>Exhibit CN-8.</u>

Q. Does CL&P have a recommendation for MF reductions on this 3.2-mile segment of the Connecticut portion of the North Bloomfield – Agawam ROW ?

A. Yes. CL&P recommends the delta line design, at its standard height, as the best compromise between minimizing the line visibility, vegetation removal on the ROW and achieving MF reductions well above 15%, within the target 4% spending cap.

Q. If the delta line configuration was built, how would the EMF levels at the ROW edges change?

A. The field levels at the ROW edges would be reduced from those associated with the base line design by well more than 15%. They would be higher than the pre-project levels, but toward the lower end of the range of edge-of-ROW levels for 345-kV lines. The following table, which appears as Table O-5 in CL&P's application, displays the calculated MF levels along the North Bloomfield – Agawam ROW under the AAL case before the NEEWS projects; after the NEEWS projects with the base line design; and after the NEEWS projects with the delta monopole design recommended for one segment of the ROW.

Granby Jct. to CT / MA Border
Pre- and Post- Project EMF at ROW Edges with AAL

	Magnetic Field (mG)		Electric Field (kV/m)	
Cross Section	West/North ROW	East/South ROW	West/North ROW	East/South ROW
XS-2 – Pre	8.7	0.1	0.09	0.00
XS-2 – Post	23.5	12.6	0.11	0.15
XS-2 BMP – Post	17.9	9.8	0.15	0.14

Q. Did CL&P evaluate other reduced-EMF designs for this focus area besides the delta design it is recommending?

A. Yes, as set forth in detail in the FDMP, CL&P evaluated a total of seven alternative designs. The results of that evaluation are set forth in summary form in the following table:

Granby Jct. to CT / MA Border
Comparison to Existing Conditions
Line Configuration and Magnetic Fields @ ROW Edges

X S2 Configuration	Typical Structure Height (ft.)		AAL Case	
	Existing To Remain	New	W/N ROW Edge (mG)	E/S ROW Edge (mG)
Existing Lattice Towers Pre- project	70		8.7	0.1
Base Line Design H-Frame	70	90	23.6	12.6
Alt 1 – H Frame + 20 feet	70	110	22.8	12.3
Alt 2 – Delta	70	110	15.1	9.7
Alt 3 – Delta + 20 ft.	70	130	15.1	9.1
Alt 4 – Vertical	70	130	15.8	9.6
Alt 5 – Vertical + 20 ft	70	150	13.4	9
Alt. 6 – Split Phase	70	130	2.6	1.9
Alt 7 345/115 Composite	N/A	130	19.1	8.3

Q. What is "split phasing" of a line?

A. A transmission circuit is usually comprised of three conductors (or conductor bundles), one for each "phase." This configuration employs six, rather than three, phases, thus reducing the current in each of them one by one-half. The phases of the two sets of conductors are then arranged on the support structures so that the magnetic fields associated with each set of three phase conductors acts to partially cancel the fields from the other. This combination of reduced currents and mutual cancellation dramatically reduces MF levels at the ROW edges.

Q. According to the table, the "split phase" line configuration would lower magnetic field levels along the ROW edges to 2.6 mG and 1.9 mG. These are very low levels, lower than or comparable to the pre-Project levels. Why isn't CL&P recommending use of the split-phase line configuration?

A. The additional cost for this line configuration is estimated at $9,348,000, which is more than double the cost of the presumptive BMP allowance of 4% of project cost. The support structures would also have to be 130 feet high, which is 60 feet higher than the existing structures and 20 feet higher than the proposed delta structures. In addition, the two sets of conductors required for split-phasing creates somewhat more visual impact than a single set of conductors on a delta structure. Accordingly, CL&P concluded that the delta design was more consistent with the guidance of the BMPs.

Q. Nevertheless, is CL&P prepared to build any of the BMP alternative designs for the Focus Area along the North Bloomfield – Agawam ROW identified in the FDMP if so ordered by the Council?

A. Yes.

(ii) <u>FDMP for Connecticut Portion of Southern Route Alternative</u>

Q. In the supplement to its FDMP entitled "Supplement to CL&P's Field Management Design Plan Specific to the Connecticut Portion of the Massachusetts Southern Route Alternative" dated March 20, 2009, and filed in response to Q-CSC-049, did CL&P identify a segment of the Southern Route in Connecticut for application of low-cost measures to reduce MF?

A. Yes. CL&P identified a 3.7-mile segment in Enfield as a possible residential area and determined that a low-cost measure was applicable. This section of ROW is between existing structures 22024 and 22052, beginning west of Interstate 91 and continuing east, past North Maple Street (State Route 192) to Mayfield Road. It is depicted in Mapsheets 2 to 5 in Volume 9 of the Application and in Mapsheets 7 and 19 of 22 for the Southern Route Alternative in Volume 11 of the Application. A larger scale illustration on a single sheet is attached to this testimony as <u>Exhibit CN-9</u>.

Q. What considerations caused CL&P to designate this 3.7-mile long segment as a BMP focus area?

A. There are three schools and several child day-care facilities in the general vicinity of the ROW. However, these facilities are not "adjacent to" the line and indeed are sufficiently distant from it that magnetic field levels at the facilities will not be appreciably changed by the new line. On the other hand, over these 3.7 miles, both sides of the ROW are bordered by residential development that may qualify as a "residential areas."

Q. What are the magnetic field levels that would be associated with each of the reduced MF strategies considered in the supplemental FDMP?

A. They are set forth in the following table, which also appears as FDMP Table 7:

FDMP Table 7: Magnetic Field Management Results for a 3.7-Mile Section of the GSRP – Massachusetts Southern Route Alternative ROW (Enfield) (AAL Case)

XS-S07 Cross Section Configuration	Typical Structure Height (ft)	Average Annual Load Case: Maximum Level on ROW (mG)	North ROW Edge: Level (mG)	North ROW Edge: Change (%)	South ROW Edge: Level (mG)	South ROW Edge: Change (%)	Cost: Section Amount ($)	Cost: Project Increase (%)
Base Line Design H-Frame	90	277.7	17.3		15.2		$11,714,000.00	-
Alt 1 - H-Frame +20 feet	110	134.9	10.3	- 40%	14.3	- 6%	$12,225,000.00	0.3%
Alt 2 - Delta Configuration	110	164.8	30.1	+ 74%	12.7	- 16%	$15,067,000.00	2.2%
Alt 3 - Delta +20 feet	130	81.5	27.5	+ 59%	11.8	- 22%	$16,908,000.00	3.4%
Alt 4 - Vertical Configuration	130	152.0	30.3	+ 75%	12.5	- 18%	$15,998,000.00	2.8%
Alt 5 - Vertical +20 feet	150	76.3	25.4	+ 47%	11.7	- 23%	$17,432,000.00	3.7%
Alt 6 - Split Phase	130	85.4	17.8	+ 3%	2	- 87%	$26,631,000.00	9.6%
Alt 7 - 345/115-kV Composite	130	159.0	28.9	+ 67%	12.5	- 18%	$27,527,000.00	10.2%

Q. How would the post-project fields and conditions compare to the pre-project fields and conditions, if overhead line construction were used for the entire Connecticut portion of the Southern Route?

A. The following table provides such a comparison:

Comparison to Existing Conditions
Structure Configuration and Magnetic Fields @ ROW Edges

XS2 Configuration	Typical Structure Height (ft.): Existing To Remain	Typical Structure Height (ft.): New	AAL Case: W/N ROW Edge (mG)	AAL Case: E/S ROW Edge (mG)
Existing H-Frame	60		7	0.3
Base Line Design H-Frame	60	90	17.3	15.2
Alt 1 – H Frame + 20 feet	60	110	10.3	14.3
Alt 2 – Delta	60	110	12.1	11.9
Alt 3 – Delta + 20 ft.	60	130	10	10.9
Alt 4 – Vertical	60	130	22.5	12.5
Alt 5 – Vertical + 20 ft	60	150	24	10.8
Alt. 6 – Split Phase	60	130	15.4	2.5
Alt 7 345/115 Composite		130	17.2	9.4

Q. As a result of the analysis in the supplement to its FDMP, what is CL&P's recommendation?

A. CL&P recommends a delta line design over the 3.7 miles in Enfield. That design results in a MF decrease of over 5 mG on the north ROW edge and over 3 mG on the south ROW edge. If the delta line height was increased by 20 feet, then MF would decrease further by 2 mG on the north edge and 1 mG on the south edge.

Q. Would the extra cost of a delta line, coupled with the MF management recommendation for the GSRP route in Connecticut, exceed the 4% spending limit in the BMPs?

A. No.

Q. If CL&P's recommendations in the FDMP are adopted by the Council, would the GSRP ROWs provide an adequate buffer zone between any new or modified lines and any adjacent residential areas or other "statutory facilities?"

A. Yes.

C. <u>Analysis of Rebuttable Presumption for Statutory Facilities</u>

(i) <u>345-kV Line Construction on ROW from North Bloomfield to State Border</u>

Q. Section 16-50p(i) of the General Statutes establishes a rebuttable presumption that construction of an overhead 345-kV line "adjacent to" any of certain specified land uses, sometimes referred to by the convenient term "statutory facilities" would be inconsistent with the purposes of the Public Utilities Environmental Standards Act. These statutory facilities include public or private schools, licensed child day-care facilities, licensed youth camps and public playgrounds. Will the new 345-kV line in the Connecticut section of the North Bloomfield – Agawam ROW be adjacent to any of these statutory facilities?

A. No.

Q. The final category of statutory facilities is "residential areas." Will the new 345-kV line from North Bloomfield to the state border be adjacent to any residential area, as the Council has applied that term?

A. It is possible that the Council may consider a group of homes along the existing ROW between the points where Country Club Lane in East Granby comes closest to the ROW and where Phelps Road in Suffield intersects with the ROW to be sufficiently dense and integral to be considered a residential area. This is the segment of ROW that was treated as a BMP focus area, described in the preceding section of this testimony and is shown on <u>Exhibit CN-8</u>.

Q. Did CL&P evaluate if overhead line construction on this section of the ROW could be avoided by re-routing the line as an overhead line to a new ROW?

A. Yes. We did not find any feasible alternate location where that section of line could be re-routed as an overhead line without being adjacent to a residential area or other statutory facility or without traversing environmentally sensitive areas, but we did consider several different underground construction alternatives– which we called underground variations.

Q. Please describe these underground variations.

A. We identified four underground variations, which are all alternatives to the section of overhead line in the BMP Focus Area, and alternatives to one another. Their locations are shown generally in dashed blue lines in Exhibit CN-1, and in detail on the aerial-photography-based alignment maps in Volumes 9 and 11 of the Application. Two of the variations would be constructed within or alongside public roads and two would be constructed within CL&P's existing ROW. The four variations are called the Newgate Road, State Route 168/187, 3.6 Mile In-ROW, and 4.6 Mile In-ROW variations.

Q. What would be the purpose of each of these variations?

A. Each would replace a portion of the proposed overhead line with an underground cable segment, in order to avoid building an overhead 345-kV line on the existing ROW in the vicinity of nearby residences, should the Council determine that the residences constitute a statutory "residential area," and that the cost of underground construction would not be unreasonable.

Q. What facilities would be required for the underground line variations?

A. All variations would require the installation of a 345-kV cable system consisting of power and other cables within conduits in a trench and within splice vaults (one per set of three XLPE cables) and two line transition stations.

Q. When did CL&P develop the underground line-route variations?

A. Initially, before making its Municipal Consultation filing in October, 2008. CL&P developed the underground line variations in roads, which is typically the better location for underground cables due to the constraints of an existing transmission line ROW. Then, in consultations with affected landowners during the municipal consultation process, CL&P was asked to explore in-ROW underground variations and did so.

Q. Does CL&P have rights for the two in-ROW underground line variations?

A. With the exception of four properties in East Granby and four in Suffield, for which CL&P would have to negotiate additional rights, CL&P has the required easement rights for the in-ROW underground variations.

Q. Please describe the "Newgate Road" underground line-route variation.

A. The Newgate Road variation would extend for about 6 miles from Granby Junction in East Granby to the intersection of the ROW and Phelps Road in Suffield, replacing 4.6 miles of the overhead line. The underground cables would be installed within the existing CL&P ROW for 1,000 feet and then within or along public roads. Two line transition stations would be required, one at Granby Junction (CL&P property available) and one near Phelps Road

(CL&P property available plus 1 acre of private land). Additional temporary and permanent easements may be required from landowners along segments of the route where cables and/or splice vaults could not be placed within public road ROW, due to conflicts with existing utility facilities or requirements of the Connecticut Department of Transportation. The route would pass by Newgate Prison (listed on the National Register of Historic Places and designated a National Historic Landmark). Underground construction could affect underground mining tunnels as well as the above-ground stone walls within 10 feet of Newgate Road.

Q. Please describe the State Route 168/187 underground line-route variation.

A. The State Route 168/187 variation would extend for 8 miles starting at Granby Junction to the intersection with Mountain Road, replacing 5 miles of the overhead line. The cables in this variation would be located in the existing CL&P ROW for 1,000 feet and then within and along public roads, with similar construction and ROW requirements as the Newgate Road variation.

Q. Please describe the 4.6 Mile In-ROW underground line-route variation.

A. This variation would begin and end at two line transition stations in the same manner as the Newgate Road variation, except that it would follow CL&P's existing ROW.

Q. Please describe the 3.6 Mile In-ROW underground line-route variation.

A. This variation is a shorter version of the 4.6 Mile In-ROW variation that would reduce impacts to wetlands and water resources. However, a line transition station on State land in a protected wildlife preserve would be required.

Q. Has CL&P estimated the cost of each of the potential underground variations, as compared to the cost of the section of overhead line that each would replace?

A. Yes, we have prepared planning grade estimates of the initial capital cost of each of the variations, including required transition stations, in comparison to the cost of the segment of overhead line that each would replace. These costs have been provided previously in response to DR-OCC-01, Q-OCC-005 and DR-CSC-02, Q-CSC-031, and are set forth in the following table:

Estimated Initial Capital Costs of Underground Variations Compared to That of Section of Overhead Line Each Variation Would Replace

1	2	3	4	5	6	7
UG Variation	Length of OH Line Replaced by UG Variation	Cost of UG Variation	Cost of OH Segment Replaced	Excess UG Cost (3) - (4)	UG Cost Multiple (3) ÷ (4)	OH Section To Be Replaced (Existing Structures)
3.6 Miles in-ROW	3.6	$166,000,000	$12,400,000	$153,600,000	13.4	Str 3187 to Str [illegible]
4.6 miles in-ROW	4.6	$200,300,000	$15,500,000	$184,800,000	12.9	Str 3177 to Str 3219
Newgate Road	4.6	$262,800,000	$15,500,000	$247,300,000	17.0	Str 3177 to Str 3219
RT 167/187	5.0	$337,500,000	$15,500,000	$322,000,000	21.8	Str 3177 to Str 3224

Q. Mr. Scarfone has explained that the incremental costs associated with underground line construction in these locations, above those of overhead line construction, would be accorded "localized" rate treatment by ISO-New England. Have you considered what the comparative costs shown in the preceding table would be for Connecticut ratepayers after adjusting for the localization of the incremental underground costs?

A. Yes. Approximately 27% of costs for transmission improvements that qualify for regional rate support are allocated to Connecticut based on its New England load share. "Localized" costs are allocated 100% to Connecticut. The cost to Connecticut ratepayers for each underground variation would accordingly be equal to 27% of the overhead line cost, plus 100% of the difference between the cost of underground line construction (including the transition stations) and the cost of the overhead line segment each underground variation would replace. Using the same planning grade estimates, we have calculated the following comparison, which has previously been provided in the data responses referenced in the preceding answer:

Estimated Connecticut Share of Initial Capital Costs of Underground Variations Compared to That of Section of Overhead Line Each Variation Would Replace, Assuming Localization of Excess Underground Costs

1	2	3	4	5	6	7
UG Variation	Cost of UG Variation	Cost of OH Segment Replaced	Excess UG Cost (2) - (3)	Cost to CT of OH Section (3) x 27%	Total Cost to CT of UG After Localization (4) + (5)	Multiple UG Cost to CT After Localization (6) ÷ (5)
3.6 Miles in-ROW	$166,000,00 0	$12,400,000	$153,600,000	$3,348,000	$156,948,000	46.9
4.6 miles in-ROW	$200,300,00 0	$15,500,000	$184,800,000	$4,185,000	$188,985,000	45.2
Newgate Road	$262,800,00 0	$15,500,000	$247,300,000	$4,185,000	$251,485,000	60.1
RT 167/187	$337,500,00 0	$15,500,000	$322,000,000	$4,185,000	$326,185,000	77.9

Q. Is CL&P recommending that the Council order any of the underground line variations?

A. No.

Q. Why not?

A. The primary reason why CL&P is not proposing to construct any of the underground line variations is that the high cost of that construction, particularly after "localization" of the incremental cost of undergrounding which would pose an unreasonable burden on Connecticut ratepayers. In addition, in-ROW variations would have greater environmental effects, and the previously described increased operating complexity of the underground cables makes them less desirable from a reliability perspective. Finally, the in-road variations would have greater temporary construction impacts. Table H-4 on p. H-52 of the Application contains a useful comparison of the overhead line as compared with each of the underground line-route variations and demonstrates that the overhead line is superior.

Q. Please explain generally the types of effects on magnetic field levels when an underground variation is selected, rather than building a new line overhead on an existing ROW.

A. An underground line variation, constructed off the ROW in streets avoids the creation of a new source of MF along the ROW, and may lower fields associated with the existing line because it may share load with those lines. However, the underground line will create a second linear source of MF in another location. Directly over and near to the cables, magnetic fields will tend to be elevated, but they fall off quickly to background levels over rather short distances.

Q. Did CL&P evaluate the MF exposure levels that would be associated with the adoption of any of the in-road underground variations?

A. Yes. The MF along the existing ROW would be reduced, because the new 345-kV underground cables would take over most of the load from the 115-kV overhead line. Because magnetic fields fall off quickly at lateral distances from underground lines, the post-project MF values at the ROW edges would be the approximately the same, whether the underground line was built within the ROW or under streets, and they would be as follows:

Post-NEEWS (2017) magnetic field levels at annual average loading (AAL) for part of Granby Junction to CT/MA State Border ROW (XS-2), with new line UG

	Magnetic Field (mG)	
Cross Section	West/North ROW*	East/South ROW*
XS-2 Post: New 345-kV line UG	3.2	0.5

However, assuming the underground line was constructed in streets, as it would probably have to be because of environmental permitting constraints, there would then be a second source of magnetic fields, although the fields would fall off sharply at lateral distances from the cables. Exponent calculated the post-project magnetic fields at 25 feet from the centerline of the underground cable installation, as follows:

Post-NEEWS (2017) magnetic field levels at annual average loading (AAL) with new line UG in streets; at 25 feet from centerline for underground construction

	Magnetic Field (mG)	
Cross Section	25 ft.West/North	25 ft. East/South
Post: New 345-kV line UG	2.6	5.6

Q. What was the outcome of CL&P's evaluation of MF for underground line variations both in the existing ROW and under roads?

A. An underground variation would result in a reduction of magnetic fields along the ROW edges, as compared to building the new line overhead on the ROW, and in comparison to pre-project conditions. On the other hand, if the underground variation was constructed in streets, as it would probably have to be for environmental reasons, it would provide a new source of magnetic fields, possibly in the streets in front of the same houses that have the ROW to the rear of their properties. An enormous extra expense would be required to attain this result.

Q. If the homes in the BMP Focus area on the ROW from North Bloomfield to the state border are considered to constitute a "residential area," so that the underground presumption applies, does CL&P consider that the presumption has been rebutted?

A. Yes. The presumption may be rebutted by showing that the costs of underground line construction would impose an unreasonable burden on ratepayers. The cost estimates provided above show that the cost of underground construction, particularly for Connecticut consumers, would be severe. Moreover, such an investment would be particularly unreasonable in light of the effectiveness of other overhead line designs in lowering magnetic field levels along the edge of the ROW in the area of interest. The recommended delta line configuration produces edge-of-ROW magnetic fields which are at the low end of the range of levels commonly encountered along ROWs that have 345-kV lines on them. Moreover, even though the cost of a split-phase line configuration would be more than double the Council's 4% "low-cost" guideline, it would still be a fraction of the underground cost – and it would actually produce lower fields at the ROW edges than underground construction. In addition, it would not create a second source of magnetic fields in the streets. Consider the following comparison:

BMP Focus Area	West/North ROW*	East/South ROW*
Pre-project	8.7	0.1
Post-project BMP Delta Design	15.1	9.7
Post Project Split-Phase	2.6	1.9
Post-project, UG variation (in streets)		
Edge of ROW (existing lines, new loads)	3.2	0.5
25' from cables in streets	2.6	5.6

Therefore, if the primary objective in siting the line was to minimize magnetic field exposures, the choice would be a split-phase overhead line configuration, rather than an in-road underground line installation.

(ii) <u>Connecticut Portion of Southern Route Alternative</u>

Q. Now let us turn briefly to the application of the presumption of section 16-50p(i) to the FDMP for the Connecticut Portion of the Southern Route Alternative. Has CL&P evaluated an underground variation that would avoid the 37 mile BMP focus area along this route that you described earlier?

A. Yes, initially we looked at both in-row and street variations, but it is likely that only the latter could qualify for environmental permitting. This would be an XLPE cable system installed in streets for a distance of 4.3 miles. The planning grade comparative cost estimate is as follows:

Comparison of Cost of Underground Variation As Compared to Overhead Segment It Would Replace

UG Variation	Length of OH Line Replaced by UG Variation	Cost of UG Variation (including 2 transition stations)	Cost of OH Segment Replaced	Excess UG Cost	UG Cost Multiple	UG Cost Multiple to CT Consumers After Localization of Excess UG Cost
4.3 miles in-ROW & streets	3.7 miles	$184,000,000	$15,000,000	$169,000,000	12.3	42.7

Q. How has CL&P evaluated the MF field reduction options along the Southern Route Alternative?

A. CL&P recommends overhead line construction for the entire route, using the base H frame line design and further recommends consideration of a 110-foot-high delta line design in the BMP focus area. The BMP configuration can be built within the Council's cost guidelines, but achieves a reduction on only one side of the ROW. On the other side, levels increase. The Council may want to consider retaining the base line configuration here. In any case, the cost of the underground variation is unreasonable. The cost of this 4.3-mile underground section would exceed the estimated cost of the entire overhead line segment from North Bloomfield Substation to the state border (not including substation costs).

6.0 THE MANCHESTER SUBSTATION TO MEEKVILLE JUNCTION CIRCUIT SEPARATION PROJECT

Q. What does the Manchester Substation to Meekville Junction Circuit Separation Project (MMP) involve?

A. This project includes the physical separation of an existing 345-kV circuit segment and a 115-kV circuit segment now sharing towers between Manchester Substation and

Meekville Junction in Manchester, over a distance of approximately 2.2 miles. The route is illustrated in Figure E-4 of the Application, a copy of which is provided as Exhibit CN-10 to this testimony. The existing conditions and proposed future conditions are illustrated in Figure O-19 in the Application, a copy of which have been attached to this testimony as Exhibit CN 11.

Q. What work will be done as part of MMP?

A. Currently, a 345-kV circuit segment and a 115-kV circuit segment share a line of structures over approximately 2.2 miles. The 115-kV circuit segment will be reconstructed on a new line of structures to separate these two circuits.

Q. How long will the MMP work take?

A. CL&P anticipates starting construction on MMP in the third quarter of 2010 and completing construction in 2011.

Q. What is the estimated cost of the MMP?

A. The estimated cost of the MMP is $14 million. Like all cost estimates, this one is subject to modification as detailed design work is done.

Q. Is new ROW required for MMP?

A. Yes. Although most work would take place within CL&P's existing 350-foot-wide ROW in Manchester, a 20-foot-wide ROW expansion will be required for approximately 120 feet, starting at Tolland Turnpike and heading north. This will require the acquisition of additional easement rights over one commercial parcel.

Q. Please describe the MMP scope of work.

A. Currently, there are two double-circuit lines and a distribution line on the ROW. Along the western portion of the ROW there is an existing line of lattice steel towers, typically 105 feet high, which supports two 115-kV circuits. Toward the easterly side of the ROW, there is a line of lattice-steel towers that support a 115-kV circuit and a 345-kV circuit, which range between 120 and 195 feet in height, with an average height of 155 feet. In between these two lines of double-circuit towers there is a line of wood poles supporting a distribution circuit. The scope of the MMP work will include erecting a new line of steel monopoles, approximately 155 feet high, to support bundled 1,590-kcmil ACSR conductors that will be used to replace a 2.2-mile section of the 115-kV circuit on the common 115-kV / 345-kV structures, and making other adjustments to the facilities on the ROW necessary to enable that construction.

Q. Where will the new monopoles be placed?

A. To minimize clearing and other environmental effects, the new monopoles will be placed between the existing line that supports 115-kV and 345-kV circuits and the existing line that supports two 115-kV circuits.

Q. What work will be done on the other facilities on the ROW to enable the construction of the new monopoles in this interior location?

A. The distribution line will be relocated within the ROW, primarily to a location between the proposed line and the line of existing double 115-kV circuit towers that is on the westerly side of the ROW. Most likely three of the 115-kV double-circuit towers will also have to be relocated within the ROW, in the vicinity of their current locations, to make room for the new transmission line; and some of the conductors and insulators on the existing structures will be replaced in so doing. In addition, assuming that the existing 345-kV line is converted to a split-phase line in accordance with CL&P's BMP recommendation, some of the conductors and insulators on that line, at each end of the 2.2-mile MMP segment, will be replaced and upgraded for 345-kV operation.

Q. Please describe CL&P's BMP recommendation, which would entail split-phasing of the existing 345-kV line.

A. CL&P proposes to treat the entire 2.2-mile long segment of ROW where the line separation will be done as a BMP focus area. Although there are no youth camps, child day-care facilities, or residential areas along this ROW, there is one school and one playground on the east side of the ROW. The most practical approach to reconfiguring the line with the recommended reduced EMF design where it is near these facilities is to extend the reconfiguration for the entire 2.2 mile length of the project. This area is depicted in the Mapsheets for this project in Volumes 9 and 11, and in the larger scale illustration attached as Exhibit CN-12 to this testimony. We recommend that the existing 345-kV line be reconfigured as a split-phase line. This can be done using the conductors of the existing 115-kV circuit now on the structures, since over most of the 2.2-mile route of the MMP they were pre-designed to operate at 345kV if necessary. Accordingly, in this instance, the split phasing can be accomplished within the Council's 4% cost guideline.

Q. If the existing 345-kV line is configured as a split-phase line, how will the EMF levels change?

A. The magnetic field levels will be dramatically reduced, not only as compared to those associated with the base line design, but even as compared to pre-project conditions, as shown in the following table:

Summary of pre-NEEWS (2012) and post-NEEWS (2017) EMF Levels at the edge of the ROW at annual average loading (AAL) - Manchester to Meekville Junction

Manchester Substation to Meekville Junction				
	Magnetic Field (mG)		Electric Field (kV/m)	
Cross Section	**West/North ROW**	**East/South ROW**	**West/North ROW**	**East/South ROW**
XS-21 – Pre	**4.8**	**27.4**	**0.06**	**0.15**
XS-21 – Post	**3.2**	**12.2**	**0.07**	**0.15**
XS-21 BMP – Post	**2.2**	**4.9**	**0.05**	**0.14**

Note that even the base line design would achieve a substantial reduction from pre-project levels. The BMP design achieves an even greater reduction in MF levels.

Q. Does the underground presumption apply to this construction?

A. No, we believe that it does not.

Q. Why not?

A. Although there is a school and a playground adjacent to the east side of the ROW, neither of them would be "adjacent to" the proposed new overhead line. As shown in <u>Exhibit CN-11</u>, the new line is proposed to be constructed in a vacant position to the east of an existing transmission line and an existing double-circuit line and to the west of another transmission line.

Accordingly, facilities along the ROW, although adjacent to existing lines, will not be adjacent to the new line, but will be separated from it by one or more existing lines.

Q. If CL&P's recommendations in the FDMP are adopted by the Council, would the GSRP and MMP ROWs provide an adequate buffer zone as required by the BMP between any new or modified lines and any adjacent residential areas, public or private school, licensed child day-care facilities, licensed youth camps or public playgrounds?

A. Yes.

7.0. COMPLIANCE WITH STATUTORY AND BMP REQUIREMENTS

Q. Please summarize CL&P's efforts to comply with the statutory and BMP requirements regarding EMF.

A. CL&P has complied with statutory and the BMP requirements regarding EMF, as follows:

- CL&P has provided an update of scientific research and group positions re: MF;
- CL&P has provided measurements and calculations that were developed in accordance with the BMP;
- CL&P has prepared an FDMP with a base design that incorporates standard utility practice with no-cost MF mitigation design features, and with modified line designs that incorporate low-cost MF reduction designs;
- CL&P's FDMP designs, if adopted by the Council, would reduce post-Project MF levels at the edges of the GSRP and MMP ROWs by more than the 15% goal of

the BMP; would produce MF levels at the ROW edges that are below the low end of the range of magnetic fields commonly encountered along ROWs with 345-kV lines; and in some cases could reduce MFs at the ROW edges to levels lower than the pre-project levels.

- CL&P's ROW would provide an adequate buffer zone between any new or modified lines and any adjacent statutory facilities.

Q. Has the Company complied with other MF standards?

A. Yes, the IEEE International Committee for Electromagnetic Safety (ICES) and the International Commission on Non-Ionizing Radiation Protection (ICNIRP) have issued guidelines for long-term public exposures to MF. The ICES reference level is 9,040 mG; the ICNIRP reference level is 833 mG. Projected MF for the Projects and the Southern Route are well below these guidelines.

8.0 SAFETY

Q. Would the proposed transmission line facilities and North Bloomfield Substation additions pose any safety risk to the public?

A. No. The construction of proposed transmission line facilities and North Bloomfield Substation additions would not pose a safety threat or create any undue hazard to the general public. All work would be designed and constructed in accordance with all applicable national, electric utility industry, state and, to the extent practical, local codes.

Q. What would happen if an outage or fault occurred on the transmission or substation equipment?

A. High speed protective relaying equipment would automatically detect abnormal system conditions (e.g., a faulted overhead transmission line) and would send a protective trip signal to circuit breakers to isolate the faulted section of the transmission system. Protection will also be provided by a Supervisory Control and Data Acquisition system ("SCADA"). The SCADA system allows for remote control and equipment monitoring by the Connecticut Valley Electric Exchange System ("CONVEX") Operator and would be housed in a weatherproof, environmentally-controlled electrical enclosure.

Q. What fire protection systems will be maintained at the North Bloomfield Substation?

A. Fire/smoke detection would automatically activate an alarm at CONVEX and the system operators would then take appropriate action.

9.0 MUNICIPAL CONSULTATIONS

Q. Did you consult with officials in the towns affected or potentially affected by the Projects?

A. Yes, including the towns within 2,500 feet of any portion of the Projects, we served municipal consultation packages on a total of nine towns. However, most of our consultation activities have been with town officials in Bloomfield, East Granby, Enfield, Manchester and Suffield. They have been on-going since 2007.

Q. Please explain the nature of such consultations.

A. As the Projects evolved, chief elected officials and staff were provided periodic updates, drawings and information on the Projects.

Q. When was the municipal consultation filing distributed to the affected towns?

A. June 16, 2008.

Q. Did the town land-use agencies review the North Bloomfield Substation additions pursuant to the statutory location approval process?

A. Yes. CL&P filed location review submissions with the Bloomfield Inland Wetlands and Watercourses Commission ("IWWC") and the Town Plan & Zoning Commission ("P&Z").

Q. What was the nature of and outcome of the Bloomfield P&Z location review process?

A. CL&P provided a presentation to the Bloomfield P&Z at its regular meeting on August 28, 2008. No one from the public spoke at that meeting. On September 2, 2008, the Bloomfield Director of Planning provided CL&P with comments from the P&Z indicating that the expansion was necessary and would not be detrimental to the surrounding residential neighbors. These comments are included in the Application in Volume 4 of 11, Exhibit 4, Item 8 and discussed in the testimony of Louise Mango.

Q. What was the nature of and outcome of the Bloomfield IWWC location review process?

A. Comments were provided to CL&P by the IWWC's agent on August 14, 2008. CL&P provided a presentation to the IWWC on August 18, 2008 and addressed those comments. No one from the public spoke at that meeting. On August 28, 2008, CL&P provided a written response to the IWWC agent's comments of August 14th and comments from the IWWC members at their August 18th meeting. Those comments and response are included in the Application in Volume 4 of 11, Exhibit 4, Item 7 and discussed in the testimony of Louise Mango.

Q. Was the Suffield Conservation Commission consulted?

A. Yes.

Q. What was the nature and outcome of such consultation?

A. On July 22, 2008, CL&P provided a presentation to the Suffield Conservation Commission and answered questions from Commission members. Two members of the public addressed the Commission.

10.0 PUBLIC NOTICES, OUTREACH AND COMMENTS

Q. What measures were undertaken by CL&P to inform the public and property owners along the routes of the Projects?

A. The following measures were undertaken:

- Open Houses
- Public Meetings
- Neighborhood Meetings
- Meetings with individual landowners
- Bill Inserts
- Notices to Community Organizations and Water Companies
- Notices to Abutters of the North Bloomfield Substation
- Legal Notices of filing of Application

Q. When and where were open houses held?

A. Open houses were held in Suffield: Tuesday, June 24, 2008, 6:00 to 8:00 PM, Suffield High School (1060 Sheldon Street); East Granby: Wednesday, June 25, 2008, 6:00 PM to 8:00 PM, East Granby High School (95 South Main Street); Enfield: Thursday, June 26, 2008, 7:00 to 9:00 PM, The Enfield Street School (1318 Enfield Street).

Q. How was information presented at the open houses?

A. The open houses were organized into four clusters of information stations, staffed by knowledgeable representatives from CL&P, including (1) a "Welcome" station with information kit (including a graphic explaining how to participate in the siting process) and a route locator station to respond to the question where?, (2) a "Why?" station, which provided materials including the need for the Projects, electric industry information and collateral material on energy and congestion, (3) a "How?" station providing materials including photo simulations, structure designs and samples of conductors and insulators, and (4) a "What About?" station providing materials on topics including environmental management, EMF and specific property information.

Q. What community organizations and water companies were notified of the Projects?

A. As set forth in the Affidavit submitted with the Application, notice was given to the community organizations and water companies included in the listing attached to such affidavit.

Q. Who received the bill inserts and when?

A. As set forth in the Affidavit submitted with the Application, bill inserts were provided during the August and September billing cycles of 2008 to all CL&P customers in the Towns of Bloomfield, East Granby, Enfield, Manchester and Suffield.

Q. How were abutters to the North Bloomfield Substation notified?

A. As set forth in the Affidavit submitted with the Application, those abutters were notified by certified mail, return receipt requested.

Q. Please describe your contacts with Connecticut stakeholders, including government entities, interested organizations, landowners and other individuals, interested in or concerned about the Projects, since you began your public outreach efforts?

A. The project team has performed extensive outreach efforts to all interested stakeholders, using many different means of communication. The three Open Houses we described earlier were attended by 88 community members. If we could not answer their questions on the spot, we followed up with a written response afterwards. So far, we have prepared a total of 124 written responses to inquiries that have come through the open houses or other outreach efforts. In addition to the Open Houses, we have also made presentations to at least 15 meetings of community organizations and public entities, and many presentations to individual representatives of such organizations and entities. Some of the organizations whose meetings we have addressed, whose representatives we have met with, or with whom we have corresponded, include: the Hockanum River Group, the East Granby Land Trust, the Enfield Senior Center, Farmington Watershed Council, the American Association of Retired Persons, the Connecticut Forest and Park Association, the Hartford-Springfield Economic Partnership, Environment Northeast and Environment Connecticut, the No Power Towers Group (Mr. Richard Legere), the Windsor Civitan Club, the Connecticut Audubon Society, the Connecticut River Watershed Council, the Farmington Watershed Association, the Urban League of Greater Hartford, the Connecticut Chapter of the NAACP, and the Spanish American Merchants Association.

We have also met with all of the Chambers of Commerce in the GSRP and MMP project areas, trade associations such as the Manufacturing Alliance of Connecticut and the Connecticut Technology Council, and labor organizations. We have met with all of the Councils of

Governments covering the GSRP and MMP project areas. We have also conducted many meetings with representatives of potentially affected municipalities, including the Bloomfield Inland Wetlands and Watercourse Commission, and the Suffield Conservation Commission.

We have approximately 150 stakeholders along the route on a direct mail list, which we use to keep them updated on project issues. We hand deliver messages, using door hangers, to make sure that word gets through to landowners when we are planning to perform geotechnical work on the ROW.

We provide conveniently accessible information about the project in a frequently updated website, (www.NEEWSprojects.com); and we provide an e-mail address (NEEWS@nu.com) and a project telephone hotline (1-866-99NEEWS) that interested or concerned stakeholders – and project opponents – can use to communicate with us easily. We have responded to all inquiries, except in a few instances where the communications directed to us have become more argumentative than inquisitive.

Q. In the course of your public outreach activities, have you gathered information of value to designing and executing the Projects?

A. Yes, and we intend to make good use of this information. To cite one example, we received inquiries and statements of concern from the residents along Newgate Road adjacent to Suffield Mountain regarding erosion and sediment control during construction. They described an existing erosion problem related to storm water flowing down the mountain, which they are concerned will be exacerbated by the construction related vegetation removal and other construction activities. These communications alerted us that this area is going to require special attention. Accordingly, we will engage a consultant and a contractor with specialized expertise in erosion control to help us develop a sediment control plan for the ROW adjacent to Suffield Mountain that will take existing problems into account, and we will accomplish the construction in compliance with that plan, rather than simply adhering to applicable federal and state erosion control standards. We will, of course, include that special erosion control plan in the D&M Plan that the Council will require before construction may begin.

12.0 CONCLUSION

Q. Please conclude and summarize your testimony.

A. CL&P proposes to construct the Connecticut portion of the GSRP and the MMP in compliance with all statutory requirements, the Council's regulations and applicable industry codes, standards.. The new 345-kV line will be constructed almost entirely within existing ROW, using best construction practices. For the EMF focus areas, CL&P evaluated both the base line design and alternative line designs for magnetic field reductions in the FDMP to specifically address the Council's policies reflected in its BMP. CL&P is prepared to build any of the alternative line designs if so ordered by the Council. Underground line construction should not be ordered because of its unreasonable impact on Connecticut ratepayers, particularly in light of the relatively low EMF levels that can be achieved by construction in accordance with the Council's BMP.

Exhibits to Carberry – Newland Testimony

No.		Description
CN-1		GSRP Potential Project Routes
CN-2		Connecticut Portion of North Bloomfield to Agawam 345-kV Line Route
CN-3		Cross Section XS-1: North Bloomfield to Granby Junction
CN-4		Cross Section XS-2: Granby Junction to CT/MA State Border
CN-5		Cross Section XS-2: BMP – Existing Str. 3191 to existing Str. 3221
CN-6		Example of Photosimulations of ROW; Typical Cross Section XS-1
CN-7	A	Animations and Photosimulations – Newgate & Phelps Road Area – 90' High H-frame construction
	B	Animations and Photosimulations – Newgate & Phelps Road Area – 110' BMP delta steel monopole construction
CN-8		3.2-mile BMP focus area in East Granby and Suffield on North Bloomfield – State Border ROW
CN-9		3.7-mile BMP focus area in Enfield on Alternate Southern Route ROW
CN-10		Manchester to Meekville Junction Circuit Separation Project
CN-11		Cross section XS-21BMP: Manchester Substation to Meekville Junction
CN-12		Manchester to Meekville Junction BMP Focus Area