Docket F-2010
Draft Report
February 8, 2011

INTRODUCTION

Connecticut's electric system provides service to approximately 3.5 million residents and approximately 78 thousand businesses and impacts our lives in many ways. The system's infrastructure includes 108 generating units whose output is dispatched onto the regional supply grid, over 1,800 circuit-miles of high-voltage conductors that form the transmission portion of the grid, and more than 130 substations that finally direct electricity to individual users via the distribution system.

This network of electric connections must be highly reliable, reflecting its importance not only for our state, but for our region. Reliability is a special challenge, given current global circumstances, with its volatile fuel prices, new energy technologies, and climate change concerns. Daily operations of the grid, including both power flows and transactions within the wholesale market for electricity, are managed by the Independent Systems Operator for New England, ISO New England Inc. (ISO-NE), a public-private organization run jointly by a board of regional stakeholders (generation, transmission, and distribution companies, state utility regulators, and others), but ultimately responsible to the Federal Energy Regulatory Commission (FERC). Reliability standards set or approved by FERC are carried out by ISO-NE. This centralized regional authority for management helps to ensure that the system functions reliably and efficiently. With the same aim, ISO-NE also directs annual forward planning for electric transmission needs in our region. Nonetheless, since each state regulates the power facilities within its borders, and affects future electric reliability by establishing energy policies and electric rates for in-state businesses and citizens, the wise state must carefully review forecasts of anticipated electric supply and demand within its borders.

Since 1972, the Connecticut General Assembly has mandated the Connecticut Siting Council (Council) to provide an annual review of our state's electricity needs and resources, looking ahead ten years. Other agencies, such as the Connecticut Energy Advisory Board (CEAB), the Energy Conservation Management Board (ECMB), the Connecticut Clean Energy Fund (CCEF), and the Office of Policy and Management, not only contribute to the annual Council forecast, but regulate, coordinate and conduct certain planning processes of their own, each addressed to particular aspects of the electric system. As is to be expected, the utilities companies themselves provide projections. Most of Connecticut's electric system data is used in common by all the state and regional planners and is supplied by Connecticut generators and by our state's two largest transmission and distribution companies, The Connecticut Light and Power Company (CL&P) and The United Illuminating Company (UI). These data have been developed for their own corporate planning. Other planning groups model these data to emphasize fuel characteristics, cost issues, efficiency, and so forth. As more and more forecasting has been undertaken by different parties to make sure, in different ways, that the electric system will remain reliable, the more the Council has tried, in its annual forecast review, to emphasize openness, to clarify differences in approach, and to assess consistency.

CL&P and UI were mandated by the Public Act 07-242 to create an Integrated Resource Plan (IRP) that they could agree to jointly and present as a planning tool for the state. The IRP focuses on resource procurement. Its most important features, to be discussed below in more detail, are its coordinated approach to procurement and its emphasis on energy efficiency. In the end, all of Connecticut's and New England's plans for the future of the electric system are designed to make changes in the system happen more smoothly, so electric service will not be disrupted, and more efficiently, so electric service will be worth its price.

ELECTRIC DEMAND

Load and Load Forecasting

The principal term for describing electric load is "demand," which can be thought of as the rate at which electric energy is consumed. (This is not to be confused with "energy", which is the total work done by the electricity and will be discussed later.) The most familiar unit of load or demand is a "Watt"; however, since utility companies serve loads on a much larger scale, forecasts typically use the unit of a megawatt (MW), or one million watts[1].

Loads increase with any increase in the number of electrical devices being used at the same time. The demand also depends on the type of loads and how much work is being performed by those devices. Generally, the higher the loads, the more the stress on the electrical infrastructure. Higher loads result in more generators having to run, and run at higher outputs. Transmission lines must carry more current to transformers located at the various substations. The transformers in turn must carry more load, and supply it to the distribution feeders, which must carry more current to feed the end users. In order to maintain reliability and predict when infrastructure must be added, upgraded, and replaced to serve customers adequately, utilities must have a meaningful and reasonably accurate estimate or projection of future loads. The process of calculating future loads is called "load forecasting."

Load forecasting by Connecticut utilities is broken down by service area. Each of the three transmission/distribution companies in Connecticut has a particular service area. UI serves 17 municipalities in the New Haven area near the coast from Fairfield to North Branford and north to Hamden. The Connecticut Municipal Electric Energy Cooperative (CMEEC) collectively serves all of the municipal utilities in Connecticut, namely the cities of Groton and Norwich; the Borough of Jewett City; the Second (South Norwalk) and Third (East Norwalk) Taxing Districts of the City of Norwalk; the towns of Wallingford and Groton; and the Mohegan Tribal Utility Authority. The largest transmission/distribution company is CL&P. CL&P serves all of the remaining municipalities in Connecticut. Collectively, at a given time, the sum of CL&P, UI, and

CMEEC loads is equal to the Connecticut load. The Council is mandated by statute to review the three forecasts for the Connecticut load.

ISO-New England Inc. (ISO-NE) is charged by the federal government with operating the grid in New England and overseeing the wholesale electric market and planning in this region. ISO-NE produces a regional forecast for New England, as well as individual forecasts for each of the New England states, including Connecticut. In order to provide a thorough review and analysis, even though it is not specifically required by statute to do so, the Council also reviews the load forecast of ISO-NE because this is the tool used for planning regional electric facilities, not the individual company forecasts. Therefore, ISO-NE's forecast is reviewed in parallel with the sum of the CL&P, UI, and CMEEC forecasts.

Peak Load Forecasting

In utility forecasting, it is the peak load or highest load experience during the year that is the most important to consider because it usually represents a clearly defined worst-case stress on the electric system. Connecticut experiences its peak load during a summer day. This is because air conditioning generally creates one of the largest components of demand for power.

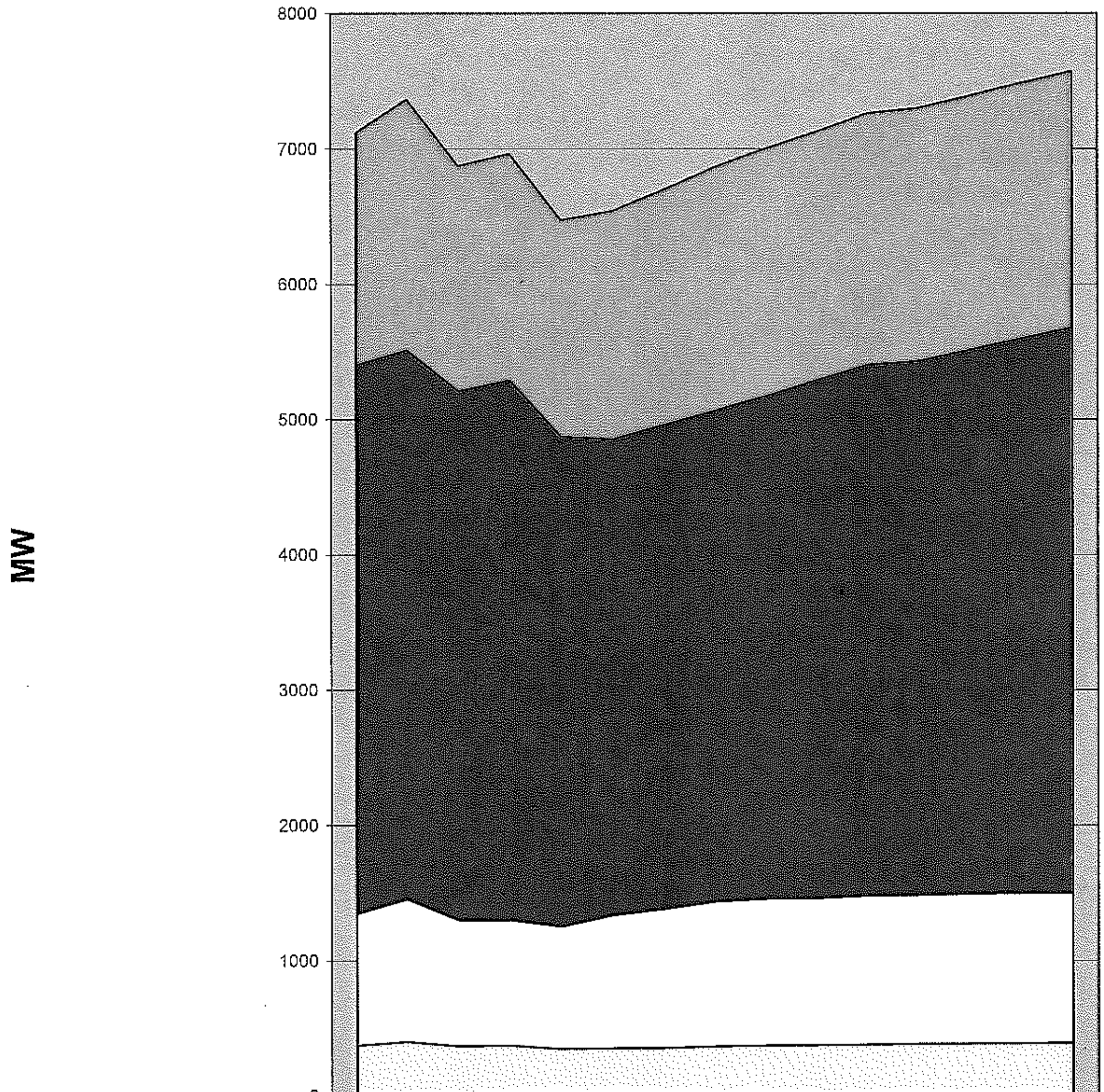
While winter months in Connecticut do have periods of significant loads, these are generally less than summer peaks because the significant air conditioning load is not present. Furthermore, many residents and businesses use natural gas or oil rather than electricity for heat. Thus, most of the energy for heating is supplied directly by the fossil fuel, not electricity. While natural gas or oil furnaces typically require electricity for blowers/fans, pumps, and control systems, this electrical load is small compared with the load from air conditioning. This is because most air conditioning systems run entirely on electricity without being assisted by another fuel. (Notwithstanding, there are some natural gas-fueled air conditioning systems, but it is less common.) Conversely, in areas where electric heat is common and there is less demand for air conditioning, such as the Canadian province of Quebec, a winter peak load can result.

While a detailed discussion of peak loads would have to include additional factors such as customer usage, demographics, conservation efforts, economic conditions, and others, the most important factor is weather—specifically the temperature and humidity. Higher temperatures result in more frequent use of air conditioning, and the units work harder, consuming more electricity. Also, higher humidity can exacerbate the situation, as it can make the temperature feel hotter than it actually is (raising what is sometimes called the "heat index") and further encourage air conditioning use.

In consideration of these weather effects, the Connecticut transmission/distribution companies provide a forecast based on "normal weather" or assumed temperatures consistent with approximately the past 30 years of meteorological data. This is also referred to as the "50/50" forecast, which means that, in a given year, the probability of the projected peak load being exceeded is 50 percent, while the probability that the actual peak load would be less than predicted is also 50 percent. Another way of considering this 50/50 forecast would be to say that it has the probability of being exceeded, on average, once every two years. The Council cautions that the 50/50 forecast is used more for internal financial planning of the utilities rather than for infrastructure planning.

In its normal weather (50/50) forecast, CL&P predicted a peak load of 4,853 MW for its service area during 2010. This load is expected to grow during the forecast period at an annual compound growth rate (ACGR) of 1.76 percent, reaching 5,678 MW in 2019. UI predicted, in its normal weather (50/50) forecast, a peak load of 1,335 MW for its service area during 2010. This load is expected to grow during the forecast period at an ACGR of 1.31 percent, reaching 1,501 MW in 2019. CMEEC predicted, in its normal weather (50/50) forecast, a peak load of 352 MW for its service area during 2010. This load is expected to grow during the forecast period at an ACGR of 1.23 percent, reaching 393 MW in 2019[2]. All three of the state utilities' 50/50 summer peak loads are depicted in Figure 1a.

Figure 1a: Utility Peak Loads in MW



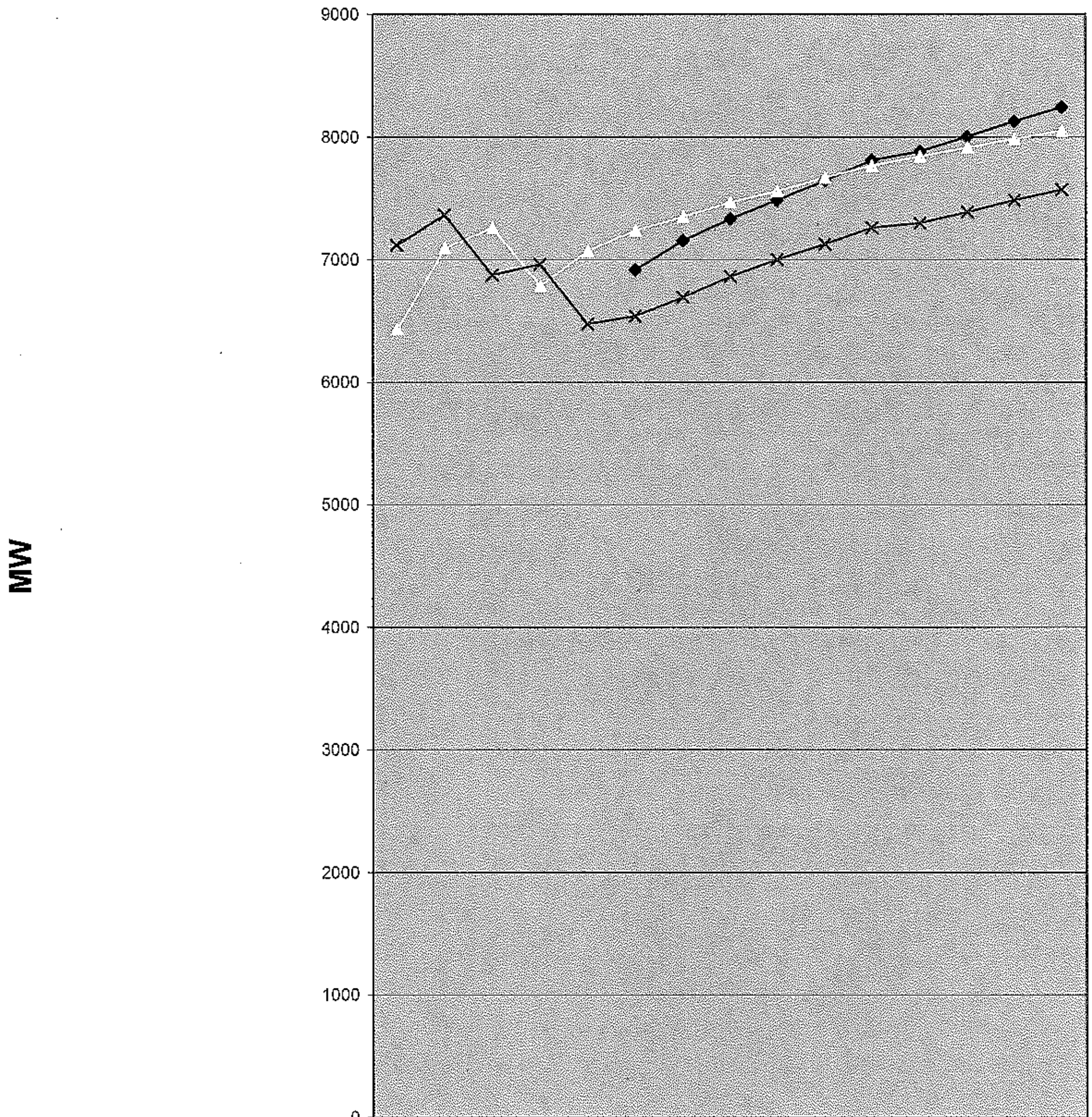
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
CT Utilities' Peak w/C&LM & DG	7120	7366	6874	6964	6474	6540	6696	6865	7002	7127	7261	7299	7390	7484	7572
CL&P Peak	5402	5512	5209	5289	4873	4853	4959	5064	5173	5290	5401	5430	5511	5596	5678
UI Peak	1346	1456	1298	1301	1253	1335	1383	1435	1457	1461	1480	1486	1493	1499	1501
CMEEC Peak	372	398	367	374	348	352	354	366	372	376	380	383	386	389	393

Megawatts

The sum of the three utilities' forecasts resulted in a projected statewide peak load of 6,540 MW during 2010. This load is expected to grow at an ACGR of 1.64 percent and reach 7,572 MW by year 2019. The statewide ACGR is a weighed average of three utilities' ACGRs. Since CL&P has the largest service area in Connecticut, and its customers are the dominant source of load in the state, it is not surprising that the statewide ACGR of 1.64 percent is comparable to CL&P's ACGR of 1.76 percent. The statewide ACGR is lower than CL&P's due to the effect of slower projected growth rates in UI and CMEEC territories. (See Figure 1b.) The Council notes that the sum of three utilities' forecasts can only approximate the Connecticut peak load. Because temperatures and customer usage patterns vary across the state, the three utilities do not necessarily experience their peaks on the same hour and/or same day. Indeed, adding the three utilities' forecasts may slightly overstate the peak load in the state, but the error is generally considered quite small.

ISO-NE predicted, in its 50/50 forecast for Connecticut, a peak load of 7,240 MW during 2010. This peak load is expected to grow at an ACGR of 1.19 percent and reach 8,050 MW by year 2019. Note that the ISO-NE 50/50 forecast exceeds the sum of the utilities' forecasts each year by an average of 562 MW. This is due to a difference in how conservation and load management (C&LM) and distributed generation (DG) are treated. (These topics will be discussed in later sections.) Generally, ISO-NE considers C&LM and DG to be capacity resources (i.e. sources similar to generation) while the Connecticut utilities consider them to be reductions in load. Thus, the forecasts differ by approximately the sum of the C&LM and DG effects. See ISO-NE and the state utilities' forecasts in Figure 1b.

Figure 1b: 50/50 Forecasts in MW



	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
CT Utilities' Peak w/o C&LM & DG						6919	7159	7333	7488	7646	7813	7884	8005	8129	8246
ISO-NE 50/50 CT Forecast Peak	6435	7097	7261	6788	7073	7240	7350	7470	7560	7670	7770	7845	7915	7985	8050
CT Utilities' Peak w/C&LM & DG	7120	7366	6874	6964	6474	6540	6696	6865	7002	7127	7261	7299	7390	7484	7572

Megawatts

The ISO-NE 50/50 forecast is depicted in yellow in Figure 1b. The Connecticut utilities peak including the effects of C&LM and DG is depicted in red. The Connecticut utilities peak excluding the effects of C&LM and DG are depicted in blue. This more closely matches the ISO-NE projections and provides an approximately "apples to apples" comparison. This is evident as the curves intersect at approximately year 2014.

The more significant forecast to be discussed in this review, is the one produced by ISO-NE. Called the "90/10" forecast, it is separate from the normal weather (50/50) forecasts offered by the Connecticut utilities. However, it is the one used by both ISO-NE and by the Connecticut utilities for utility infrastructure planning, including transmission and generation.

A 90/10 forecast is a plausible worst-case hot weather scenario. It means there is only a 10 percent chance that the projected peak load would be exceeded in a given year, while the odds are 90 percent that it would not be exceeded in a given year. Put another way, the forecast would be exceeded, on average, only once every ten years. While this projection is quite conservative, it is reasonable for facility planning because of the potentially severe disruptive consequences of inadequate facilities: brownouts, blackouts, damage to equipment, and other failures.

State utility planners must be conservative in estimating risk because they cannot afford the alternative. Just as bank planners should ensure the health of the financial system by maintaining sufficient collateral to meet worst-case liquidity risks, so load forecasters must ensure the reliability of the electric system by maintaining adequate facilities to meet peak loads in worst-case weather conditions. While over-forecasting can have economic penalties due to excessive and/or unnecessary expenditures on infrastructure, the consequences of under-forecasting can be much more serious. Accordingly, the Council will base its analysis in this review on the ISO-NE 90/10 forecast.

Specifically, ISO-NE's 90/10 forecast has a projected (worst-case) peak load of 7,865 MW in 2010. This load is expected to grow at an ACGR of 1.20 percent and reach 8,760 by 2019. See Figure 1c.

Forecasting Electric Energy Consumption

Energy is the product of the average load and time. As an analogy, load (or rate of energy consumption) can be thought of as the gallons per minute running out of a water faucet to fill a sink. Energy can be thought of as the total number of gallons of water that accumulate in the sink or gallons per minute times the number of minutes.

Accordingly, energy consumption is represented in units of load multiplied by time or Watt-hours. On a household scale and for most electric sales, a unit of kilowatt-hours is used (kWh, or one thousand watt-hours) for energy. On a larger statewide scale, the units used are megawatt-hours (MWh or one million watt-hours), or gigawatt-hours (GWh, or one billion watt-hours).

While load or demand represents a snapshot of time (usually recorded hourly by utilities) and provides an instantaneous measurement of electric load, energy is the total work done by the electricity over time. For example, a 23-Watt compact fluorescent light bulb consumes electricity at a rate of 23 Watts. If the bulb were on for ten hours, the total energy consumed would be 230 Watt-hours or 0.23 kWh. A much larger load, for example, a 1,500 Watt electric heater, would only have to run for approximately 9.2

minutes (0.153 hours) to consume 0.23 kWh of energy. A household or business electric meter essentially records the sum of the kilowatt-hours of all loads that have operated on the premises during the billing period. For larger accounts, meters also record the instantaneous load (i.e. demand).

The three transmission/distribution utilities maintain records of total energy consumption in their service area. It is generally the sum of the customers' consumption, the utilities' internal consumption, and losses in the system. The sum of the three utilities' energy consumption, like the sum of their loads, only approximates the electric energy consumption in Connecticut.

CL&P predicted that the total electric energy consumption[3] in its service area would be 24,150 GWh during 2010. The calculated ACGR is -0.38 percent. This means the energy consumption is forecast to slowly decline over time. Thus, energy consumption is expected to decline to 23,338 GWh by 2019.

UI predicted that the total electric energy consumption in its service area would be 5,740 GWh during 2010. UI's projections also result in an ACGR of 0.027 percent. That is, UI's electric energy consumption is expected to remain essentially flat, yet very slowly increase over the forecast period to reach 5,754 GWh by 2019.

CMEEC predicted that the total electric energy consumption in its service area would be 1,803 GWh during 2010. This number is expected to grow at an ACGR of 1.27 percent, reaching 2,020 GWh by 2019.

Taken together, these data result in a projected statewide electric energy consumption of approximately 31,693 GWh for 2010. This number is expected to decline at a (weighted) ACGR of 0.21 percent and reach 31,112 GWh by 2019.

On the surface, this slowly declining energy consumption may seem counterintuitive and even inconsistent, given the 1.64 percent ACGR of peak electric load growth in the state. Actually, it is not. It is the result of changing customer behavior in response to higher electric rates, to technological change, and to various efficiency efforts encouraged by the utilities and the state.

It appears that customers are conserving electricity wherever possible to reduce their electric bills, resulting in essentially flat or even declining (in the case of CL&P's territory) electric energy consumption. On the other hand, demand for air conditioning during the hottest days (and hours) of the year appears to remain strong, and energy consumption during peak periods continues to grow. However, since the short peak periods, when people tend not to conserve, are offset by the much longer periods when people do conserve, the overall trend for electric energy consumption stays steady.

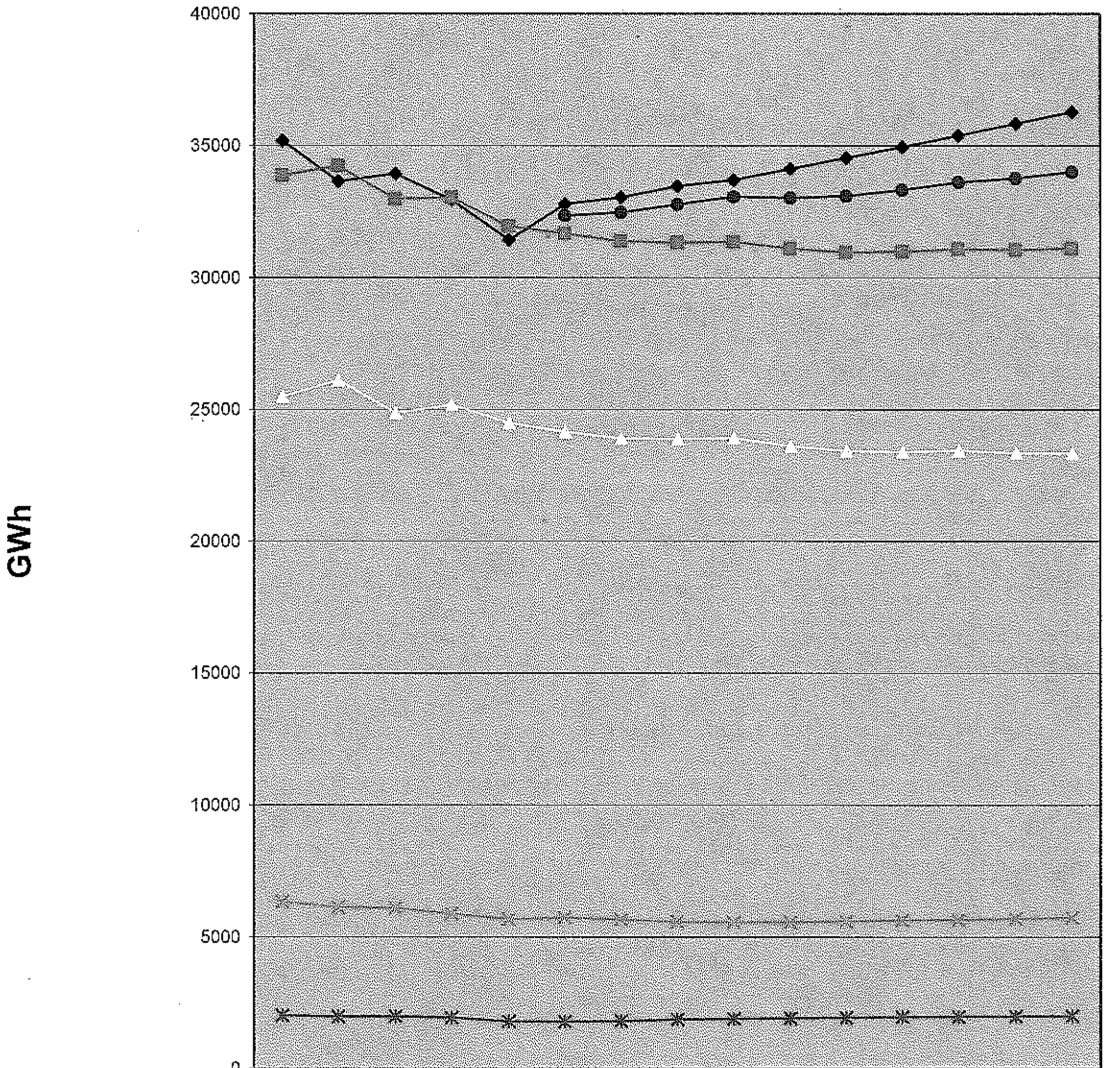
As is the case with electric load, ISO-NE also provides electric energy consumption data for Connecticut. Specifically, ISO-NE predicts electric energy consumption in

Connecticut to be 34,050 GWh in 2008. This number is expected to grow at a ACGR of 0.85 percent and reach 36,755 GWh. Figure 2 depicts the energy requirement forecasts.

ISO-NE's projections differ from the sum of the utilities' projections because of the different forecasting models used. Furthermore, the ISO-NE forecast differs from the sum of the utilities' forecasts because ISO-NE excludes the impact of C&LM and DG. Accordingly, Figure 2 includes the CT utilities energy consumption excluding the effects of C&LM and DG to provide a closer comparison to the ISO-NE energy forecast. Lastly, the Council notes that, of the C&LM and DG components, conservation has the greatest effect on net energy consumption because these effects operate more hours of the year.

Load management (or turning off certain loads during peak demand hours) tends to have a minimal effect on energy consumption because the savings are during a very limited number of hours. The DG included in such analysis has relatively small power outputs, so even with greater run time, the effect on net energy consumption is also quite small.

Figure 2: State and Utility Energy Requirements in GWh



	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
ISO-NE	35202	33656	33948	32964	31441	32800	33045	33475	33705	34135	34540	34950	35385	35835	36280
CT no C&LM and DG						32356	32487	32791	33069	33029	33104	33331	33618	33771	34005
CT w/C&LM and DG	33896	34253	33000	33055	31966	31693	31397	31348	31376	31116	30980	31002	31092	31059	31112
CL&P	25496	26119	24871	25185	24485	24150	23910	23883	23917	23605	23429	23383	23441	23350	23338
UI	6360	6149	6119	5912	5673	5740	5670	5585	5559	5576	5600	5646	5665	5706	5754
CMEEC	2040	1985	2010	1958	1808	1803	1817	1880	1900	1935	1951	1973	1986	2003	2020

Gigawatt-Hours (GWh)

CONSERVATION AND LOAD MANAGEMENT (C&LM)

Energy efficiency or conservation is the ability to reduce usage while still providing essential service to the end user. Energy efficiency can be considered a reduction in demand or an increase in supply. As mentioned earlier, the Connecticut utilities consider conservation a reduction in load, while ISO-NE considers it a supply resource. Either way, the net result is the same: less stress on the electric system, reduced need to construct additional generation and transmission, and greater ability to serve loads while reducing pollution and need for fuels, particularly fossil fuels. Energy conservation can also have economic benefits since the marginal cost per kW of conservation can be less than that of new generation depending on the method employed.

The Connecticut Energy Conservation Management Board (ECMB) was created by the Legislature in 1998 to advise and assist the state's utility companies in developing and implementing cost-effective conservation programs to meet Connecticut's changing and growing energy needs. With the approval of the Department of Public Utility Control (DPUC), the ECMB also guides the distribution of the Connecticut Energy Efficiency Fund (CEEF). The CEEF is a fund that finances energy efficiency and load management programs and initiatives. Its money comes from a surcharge on customer electric bills.

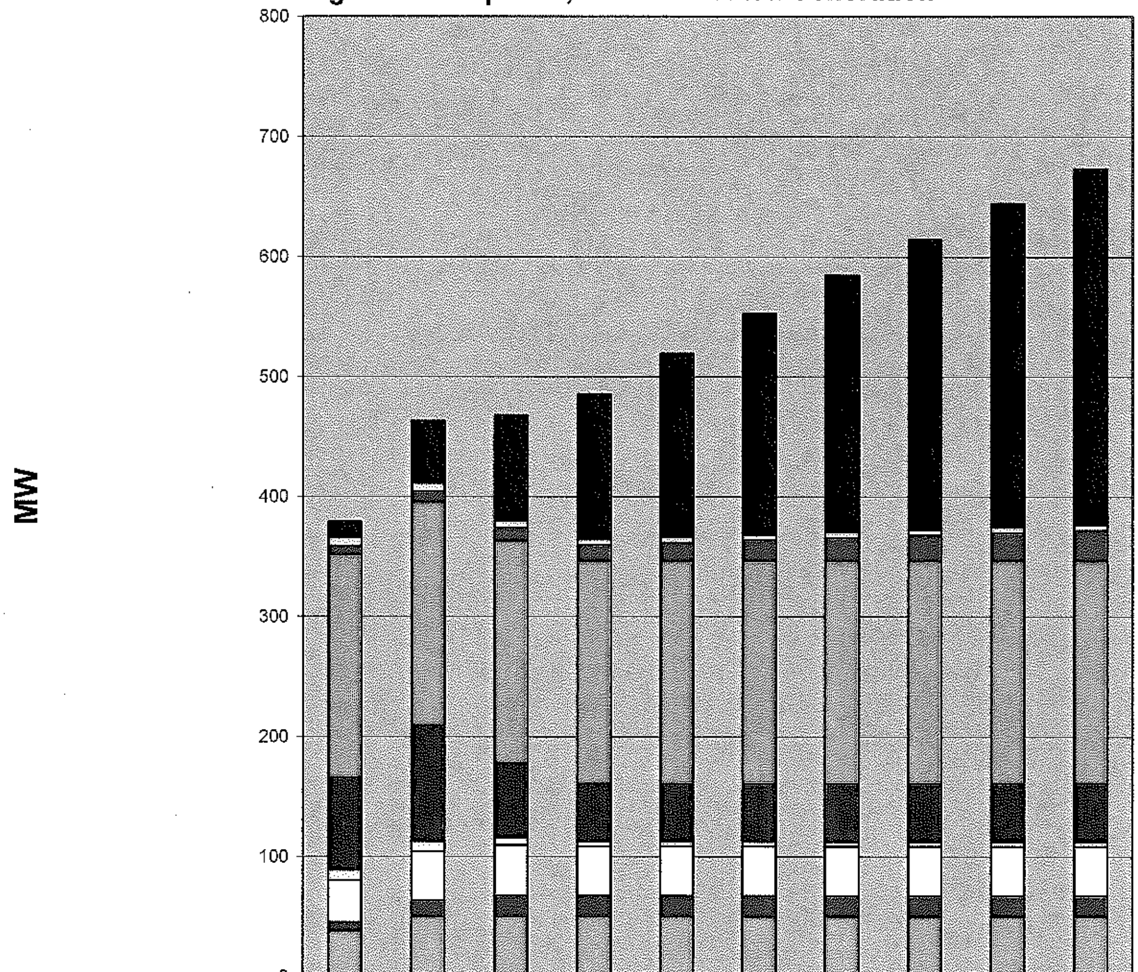
These programs are implemented and administered by CL&P and UI, who are also accountable for attaining performance goals approved by the DPUC and ECMB—goals that include reducing both energy consumption and peak load. CMEEC has a separate program for energy efficiency, but with the same goals.

The ECMB submits an annual report to the legislature regarding energy efficiency programs in Connecticut. In the ECMB report dated March 1, 2010, the ECMB notes that the CEEF programs (for CL&P and UI) resulted in annual energy savings of 237 million kWh or 237 GWh and lifetime savings of 2.634 billion kilowatt-hours or 2,634 GWh.

CL&P projected a load reduction (excluding DG) of 199 MW in 2010 due to C&LM. This number is expected to grow to 483 MW by 2019. UI projected a load reduction (excluding DG) of 84.5 MW in 2010. This number is expected to decline to 53 MW by 2019. CMEEC reported a projected load reduction of 15.44 MW for 2010. This number is expected to grow to 29 MW by 2019.

Collectively, the statewide peak load reduction due to C&LM (and excluding DG) was projected to be 298.94 MW in 2010[4]. This cumulative load reduction is projected to increase annually with a ACGR of 7.3 percent and reach 565 MW by 2019, the end of the forecast period. The magnitude of this reduction in load is nearly on the order of the output of the (620 MW nominal) Kleen Energy facility in Middletown. Figure 3 depicts the projected annual peak load reduction by utility throughout the forecast period.

Figure 3: Load Reductions Due to Conservation, Load Management/Response, and Distributed Generation



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
CL&P Conservation	13	52	88	121	153	184	214	242	270	297
UI Conservation	7.4	6.9	5.5	4.8	4.7	4.7	4.8	4.8	4.8	4.8
CMEEC Conservation	7	9	11	13	15	17	19	21	23	25
CL&P Load Management	186	186	186	186	186	186	186	186	186	186
UI Load Management	77.1	96.4	61.4	48.2	48.2	48.2	48.2	48.2	48.2	48.2
CMEEC Load Management	8.44	8.44	6.5	4	4	4	4	4	4	4
CL&P DG	35	41	42	41	41	41	41	41	41	41
UI DG	7.2	13.4	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5
CMEEC DG	38	50	50	50	50	50	50	50	50	50

Megawatts

The Council believes that energy efficiency and programs like CEEF are an extremely important part of Connecticut's electric energy strategy. Increased efficiency allows the state's electric needs to be met, in part, without incurring the incremental pollution that would be caused by dispatching generation to serve the additional load. Reductions in peak load due to increased efficiency can also impact the schedule of necessary changes to existing utility infrastructure, such as transmission lines and substation equipment (transformers, distribution feeders, etc.) and hence tends to hold down utility costs. Electric energy efficiency also reduces federal congestion costs and the costs of new generation.

ELECTRIC SUPPLY

Even taking into account the most conservative forecast, the ISO-NE 90/10 forecast, the Council anticipates that electric generation supply during the forecast period will be adequate to meet demand. Neglecting retirements, going forward, Connecticut has a surplus of generation during the forecast period. When retirements are taken into account, the New England East West Solution (NEEWS) projects (if approved), would provide additional import capacity to largely offset such losses. The magnitudes of remaining deficits in Table 2 are small enough to be met by reserves and demand response.

New Generation

The largest addition to Connecticut's generation resources is the Kleen Energy facility. The 620 MW Kleen Energy facility in Middletown is a natural gas-fired (with oil backup) combined-cycle generating facility. The plant was approved by the Council in Docket No. 225. This plant was later selected in a request for proposal (RFP) by DPUC as a project that would significantly reduce federally mandated congestion charges and the plant is currently under construction. Due to a tragic accident on February 7, 2010, the in-service date of the plant has been delayed. Accordingly, the Council granted an extension of time to until June 30, 2011 to complete construction. It is anticipated that the plant will go into service approximately April 2011. Accordingly, the Kleen Energy plant is reflected in the load/resource balance table (Table 2) based on an estimated in-service date of 2011.

Public Act 07-242, An Act Concerning Electricity and Energy Efficiency, created an expedited Council review and approval process to facilitate the siting of certain new power plants. The Council is mandated to approve by declaratory ruling:

- the construction of a facility solely for the purpose of generating electricity, other than an electric generating facility that uses nuclear materials or coal as a fuel, at a site where an electric generating facility operated prior to July 1, 2004;
- the construction or location of any fuel cell—unless the Council finds a substantial environmental effect—or of any customer-side distributed resources project or facility or grid-side distributed resources project or facility with a capacity of not more than 65 megawatts, so long as such the project meets the air quality standards of the Department of Environmental Protection;
- the siting of temporary generation solicited by DPUC pursuant to section 16-19ss of this act.

Many projects, instead of being submitted to the Council as applications for Certificates of Environmental Compatibility and Public Need, were submitted as petitions for declaratory ruling under the new provision. Several Project 150 proposals (see below) were in this category.

Project 150

Project 150 is a program funded by the CEEF. The aim of this program is to stimulate Class I renewable energy generation. Applicants that are approved by the Council receive secure funding via long-term power purchase agreements with CL&P and UI. Table 1 reports each applicant's status before the Council, and estimated in-service dates for those already approved. (See also later sections on renewable generation projects.)

Table 1: Renewable Generation Projects Selected in Project 150

Project	*Location*	*Project MW*	*Contract MW*	*Est. In-service Date*	*Council Review Status*
Watertown Renewable Power, LLC	Watertown	27.3	15	2013	Approved
DFC-ERG Milford Project	Milford	9	9	2010	Approved
South Norwalk Renewable Generation	South Norwalk	35.5	30	2011	Not Rec'd
Plainfield Renewable Energy	Plainfield	37.5	30	2012	Approved
Clearview Renewable Energy, LLC	Bozrah	30	30	2011	Withdrawn
Stamford Hospital Fuel Cell CHP	Stamford	4.8	4.8	2011	Not Rec'd
Clearview East Canaan Energy, LLC	North Canaan	3	3	2010	Not Rec'd
Waterbury Hospital Fuel Cell CHP	Waterbury	2.4	2.4	2011	Not Rec'd
Cube Fuel Cell	Danbury	3.36	3.36	2011	Not Rec'd
DFC-ERG Glastonbury	Glastonbury	3.4	3.4	2011	Approved
DFC-ERG Trumbull	Trumbull	3.4	3.4	2011	Not Rec'd
DFC-ERG Bloomfield	Bloomfield	3.65	3.65	2011	Approved
Bridgeport Fuel Cell Park	Bridgeport	14.93	14.93	2011	Approved

Source: CL&P Forecast dated March 1, 2010

Bridgeport Energy II LLC - Bridgeport

On June 5, 2008, the Council approved another large generation project: the Bridgeport Energy II (BEII) facility. This is a 350 MW single cycle natural gas-fired generating plant with ultra low sulfur fuel oil as the backup fuel. It was the subject of Petition No. 841. The plant would be located at the site of the existing 442 MW (summer rating) Bridgeport Energy facility. The BEII project was also selected by the DPUC as a peaking facility. However, it is unclear as when this project will go forward due to the economic conditions. Accordingly, it is not included in the load/resource balance in Table 2 to be conservative.

<u>Montville Power LLC – Montville</u>

On June 22, 2009, Montville Power LLC (MP) submitted a petition (Petition No. 907) for a declaratory ruling that Certificate is required for the proposed construction, maintenance, and operation of a 40 MW wood biomass-fueled generating facility. Such a facility would replace Montville Unit 5 which is an 81 MW (summer rating) oil and natural gas-fired steam electric generator. The repowered facility could generate up to 40 MW of electricity using wood fuel and up to 82 MW using natural gas or ultra-low sulfur distillate fuel during high demand periods. The project was approved by the Council on February 25, 2010 and has all its permits. With a power purchase contract, the project could be commercially available in 2012. Since this is a repowering of nearly equal peak megawatts, such project is not reflected in Table 2.

<u>PSEG Power LLC – New Haven</u>

On November 23, 2009, PSEG Power Connecticut LLC (PSEG) submitted a petition (Petition No. 925) for a declaratory ruling that no Certificate is required for the proposed construction, maintenance, and operation of three 48.4 MW electric generating peaking units. The units would be dual-fuel (natural gas/oil) and would be able commence operations within ten minutes of being dispatched by ISO-NE. Black start capability or the ability to start without outside grid power is also included to improve the reliability of Connecticut's power system.

While the original petition included a overhead electrical connection, PSEG subsequently filed another petition (Petition No. 976) on November 2, 2010 for an underground connection after it was found to be feasible and of comparable cost to the overhead connection. Petition Nos. 925 and 976 were approved on January 7, 2010 and December 16, 2010, respectively. This project is expected to go into service approximately June 2012.

Demand/Supply Balance

Table 2 contains a tabulation of generation capacity vs. peak loads. The ISO-NE 90/10 forecast is applied in this table because it is the forecast used for utility facility planning purposes. The largest reserve requirement is 1,225 MW, which is approximately the current summer output of the state's largest generating unit, Millstone 3. In the event that Millstone 3 or any significantly sized smaller unit trips off-line, reserves must be available to rapidly compensate for that loss of capacity.

Assumed unavailable generation estimates a typical amount of power plants off-line for maintenance purposes. Existing generation supply resources are based on the total existing generation in Connecticut listed in Appendix A. Appendix A contains data from the December 2010 Seasonal Claimed Capability report from ISO-NE. Approved generation projects (not yet constructed and/or complete) are also included in Table 2. In-service dates for these facilities are estimates and may be subject to change.

The retirement of older generating units is difficult to predict because it is the result of many factors such as market conditions, environmental regulations and the generating companies' business plans. While NRG Energy Inc. (the owner of several older fossil-fueled steam facilities) testified at the Council's 2010 hearing that there are no plans at this time to retire facilities during the forecast period, the 2010 IRP has several retirement assumptions in its base case. To maintain consistency, the Council adopts these retirement assumptions, but cautions that they are hypothetical and subject to change.

Specifically, the 2010 IRP assumes that Bridgeport Harbor (130 MW summer), Middletown No. 3 (236 MW summer), Norwalk Harbor No. 1 (162 MW summer), and Norwalk Harbor 2 (168 MW summer) would retire in 2013. Accordingly, Table 2 includes the loss of 696 MW (total) beginning in 2013. The 2010 IRP also assumes that the following facilities would retire in approximately 2016: Middletown No. 4 (400 MW summer), Montville 6 (407 MW summer). Thus, Table 2 also includes the incremental loss of 807 MW beginning in 2016.

Table 2: MW Balance

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	201
90/10 Load	7865	7985	8105	8220	8330	8450	8530	8610	8680	876
Reserve (Equiv. Millstone 3)	1225	1225	1225	1225	1225	1225	1225	1225	1225	122
Load + Reserve	9090	9210	9330	9445	9555	9675	9755	9835	9905	998
Existing Generation	7345	7345	7345	7345	7345	7345	7345	7345	7345	734
Est.Unavail. Generation	576	576	576	576	576	576	576	576	576	57
Available Generation	6769	6769	6769	6769	6769	6769	6769	6769	6769	676
Normal Import[1]	2000	2000	2000	2000	2000	2000	2000	2000	2000	200
Energy Efficiency[2] per Fig. 3	27	68	95	139	173	206	238	268	298	32
Total Avail. Resources	8796	8837	8864	8908	8942	8975	9007	9037	9067	909
Surplus/Deficiency[3]	**-294**	**-373**	**-466**	**-537**	**-613**	**-700**	**-748**	**-798**	**-838**	**-88**
Approved Generation Projects										
Ameresco	5	5	5	5	5	5	5	5	5	[illegible]
Project 150[4]		0	9	54	54	54	54	54	54	5
PSEG Power New Haven			130	130	130	130	130	130	130	13
Kleen Energy Middletown		620	620	620	620	620	620	620	620	62
CMEEC DG	38	38	38	38	38	38	38	38	38	3
Ansonia		58	58	58	58	58	58	58	58	5
NRG Middletown #12-15		200	200	200	200	200	200	200	200	20
Surplus/Deficiency	**-251**	**548**	**594**	**568**	**492**	**405**	**357**	**307**	**267**	**21**
Possible Generation Retirements Per 2010 IRP[5]				-696	-696	-696	-1503	-1503	-1503	-150
Surplus/Deficiency	**-251**	**548**	**594**	**-128**	**-204**	**-291**	**-1146**	**-1196**	**-1236**	**-128**
Future Projects Under Council Review										
NEEWS[6,7,8]	0	0	0	0	300	700	1100	1100	1100	110
Future Projects Not Yet Filed[9]										
South Norwalk Renewable Generation (Proj. 150)			35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.
Stamford Hospital Fuel Cell CHP (Proj. 150)		5	5	5	5	5	5	5	5	[illegible]
Clearview East Canaan Energy, LLC (Proj. 150)		3	3	3	3	3	3	3	3	[illegible]
Waterbury Hospital Fuel Cell CHP (Proj. 150)		2	2	2	2	2	2	2	2	[illegible]
CMEEC DG			12	12	12	12	12	12	12	1

Total Net Surplus/Deficiency	**-251**	**558**	**651.5**	**-70.5**	**153.5**	**467**	**11.5**	**-38.5**	**-78.5**	**-13**

[1]This is an average value. The actual import capacity can range between 1,500 MW to 2,500 MW.
[2]This takes into account only passive (non-dispatched) demand reductions such as energy efficiency, to be conservative.
[3]This is based on a one-in-ten years event and assumes conservative import capacity, no load response, and no newly-approved generation.
[4]Only the Council approved-projects associated with Project 150 are listed in this row.
[5]Such retirements are hypothetical based on certain conditions, and are difficult to predict with certainty at this time, especially since they require ISO-NE approval.
[6]NEEWS is a group of transmission projects, three of which are in Connecticut. The Council already approved the Greater Springfield Reliability Project.
[7]The other NEEWS applications are expected to be received in the future.
[8]NEEWS' effect on import capacity will ultimately depend on which of the projects are approved.
[9]It is not known when these projects will be filed with the Council or whether they would be approved.

Existing Generation

Nuclear Powered Generation

Nuclear plants use nuclear fission (a reaction in which uranium atoms split apart) to produce heat, which in turn generates steam, and the steam pressure operates the turbines that spin the generators. Since no step in the process involves combustion (burning), nuclear plants produce electricity with zero air emissions. Pollutants emitted by fossil-fueled plants are avoided, such as sulfur dioxide (SOx), nitrogen oxides (NOx), mercury, and carbon monoxide. (SOx and NOx contribute acid rain.) Nuclear plants also do not emit carbon dioxide, which is a significant advantage in the effort to curb greenhouse gas emissions. However, issues remain with regard to security, the short and long-term storage of nuclear waste, and cost of new plants.

Connecticut currently has two operational nuclear electric generating units (Millstone Unit 2 and Unit 3) contributing a total of 2,101 MW of summer capacity, approximately 29.4 percent of the state's generating capacity. (The Millstone facility is the largest generating facility in Connecticut by power output.) Previously, nuclear power supplied approximately 45 percent of Connecticut's electricity. However, this capacity has been reduced to 29 percent by the retirement of the Connecticut Yankee plant in Haddam Neck (December 1996) and Millstone Unit 1 (July 1998).

The former Millstone 1 reactor has been decommissioned in place. Dominion Nuclear Connecticut Inc. (Dominion), owner of the Millstone units, has no plans at this time to construct another nuclear power generating unit at the site.

Dominion submitted license renewal applications to the United States Nuclear Regulatory Commission (NRC) on January 22, 2004. On November 28, 2005, the NRC announced that it had renewed the operating licenses of Unit 2 and Unit 3 for an additional 20 years. With this renewal, the operating license for Unit 2 is extended to July 31, 2035 and the operating license for Unit 3 is extended to November 25, 2045.

The 2,101 MW summer rating includes the most recent power upgrades, including a 80 megawatt power upgrade to Millstone Unit 3. The reserve requirement in Table 2 has been increased accordingly.

<u>Coal Powered Generation</u>

Connecticut has two coal-fired electric generating facilities contributing 566 MW, or approximately 7.9 percent of the state's current capacity. The AES Thames facility, located in Montville, burns domestic coal and generates approximately 181 MW. The AES Thames facility is technically a cogeneration facility because, besides generating electricity for the grid, it also provides process steam to the Jefferson Smurfit-Stone Container Corporation.

The other coal-fired generating facility in Connecticut is the Bridgeport Harbor #3 facility located in Bridgeport. This facility burns imported coal and has a summer power output of approximately 383 MW.

While both of these facilities are listed as coal/oil in Appendix A, the Council notes that these are not dual-fuel facilities and cannot operate on oil alone. Oil is only used to help ignite the coal initially to start the plant.

In general, using coal as fuel has the advantages of an abundant domestic supply (US reserves are projected to last more than 250 years), and an existing rail infrastructure to transport the coal. However, despite the advantages of domestic coal, generators sometimes find imported coal more economical to use. With very low sulfur content, imported coal does not require as much cost for emissions control.

In conventional coal-fired plants, coal is pulverized into a dust and burned to heat steam for operating the turbines. However, burning coal to make electricity causes air pollution. Pollutants emitted include sulfur dioxide, carbon dioxide, and mercury. Coal-fired power plants have high carbon dioxide emissions relative to plants using other fuels; thus, they are considered particularly significant contributors to global warming. (See later section on the Regional Greenhouse Gas Initiative.)

One alternative to conventional coal-fired generation is "clean coal technology." This is a complex process in which gaseous fuel (such as carbon monoxide) is extracted from coal and then burned in a gas turbine engine. The result is higher efficiency and significantly lower air pollution than conventional coal-fired power plants.

Petroleum Powered Generation

Connecticut currently has 34 oil-fired electric generating facilities contributing 2,994 MW, or 39.2 percent of the state's current capacity.

Devon 7 and 8 units were replaced by Devon 15 through 18. This repowering project resulted in higher efficiency, lower emissions, and the replacement of approximately 200 MW of capacity lost when Devon 7 and 8 were taken out of service.

Additional oil-fired generation is not likely in the near future, due to market volatility and mounting oil prices. (However, replacement and/or repowering of existing aging units may occur.) In particular, the price of crude oil has recently exceeded $90 per barrel.

Moreover, oil-fired generation presents environmental problems, particularly related to the sulfur content of the oil, and may face tighter air-emissions standards in the near-term, such as regulation of carbon dioxide emissions. Some of the oil-fired generating facilities in Connecticut are dual-fueled, meaning that they can switch to natural gas if necessary. Currently, four active plants in Connecticut (Middletown #2 and #3; Montville #5; and New Haven Harbor #1), totaling approximately 882 MW, have the ability to change from oil to gas. The Council believes that dual-fuel capability is an important part of diversifying the fuel mix for electric generation, with the benefit of avoiding overdependence on a particular fuel.

Natural Gas Powered Generation

Connecticut currently has 14 natural gas-fired generating units (not including Lake Road[5] which is electrically more part of Rhode Island than Connecticut) contributing a total of 1,384 MW, or 19.3 percent of the state's generating capacity. This includes additions such as Waterbury Generation, with a summer rating of 98 MW.

Natural gas-fired electric generating facilities are preferred over those burning coal or oil primarily because of higher efficiency, lower initial cost per MW, and lower air pollution. Natural gas generating facilities also have the advantage of being linked directly to their fuel source via a pipeline.

Some natural gas generating plants, such as Bridgeport Energy, Milford Power, Lake Road, and the upcoming Kleen Energy plant are combined-cycle. Added to the primary cycle, in which gas turbines turn the generators to make electricity, is a second cycle, in which waste heat from the first process is used to generate steam: steam pressure then drives another turbine that generates even more electricity. Thus, a combined-cycle plant is highly efficient, with an efficiency on the order of 60 percent. However, the tradeoffs are higher initial costs and increased space requirements for the extra generating unit.

The Towantic power plant in Oxford and the NRG facility in Meriden were approved by the Council, but have been subject to delays due to market conditions. The estimated completion dates are not known at this time. Accordingly, to be conservative, they are not included in Table 2.

Hydroelectric Power Generation

Connecticut's hydroelectric generation consists of 28 facilities contributing approximately 118 MW, or 1.6 percent of the state's current generating capacity. Hydroelectric generating facilities use a largely renewable energy source, emit zero air pollutants, and have a long operating life. Also, some hydro units have black start capability. However, hydroelectric units can divert river flows from worthwhile public uses, such as recreation and irrigation, and can disrupt fish and wildlife. The main obstacle to the development of additional hydroelectric generation in Connecticut is a lack of suitable sites.

FirstLight Hydro Generating Company (FLHGC) formerly known as Northeast Generation Company, Connecticut's largest provider of hydroelectric power, owns the following hydroelectric facilities: Bantam, Bulls Bridge, Falls Village, Robertsville, Scotland, Stevenson, Taftville, Tunnel 1-2, Rocky River, and Tunnel 10. Table 3 shows the status of the FERC licenses for FLHGC's facilities.

Table 3

Generating Facility	MW (Summer)	Status of FERC License[6]
Bantam 1	0.07	License not required
Bulls Bridge 1-6	4.72	40 year license issued on June 23, 2004
Falls Village 1-3	4.32	40 year license issued on June 23, 2004
Robertsville 1-2	0.33	License not required
Scotland 1	1.82	License expires August 31, 2012. Re-licensing to begin in 2007.
Shepaug 1	41.51	40 year license issued on June 23, 2004
Stevenson 1-4	28.31	40 year license issued on June 23, 2004
Taftville 1-5	2.03	License not required
Tunnel 1-2	1.48	License not required
Rocky River	29.35	40 year license issued on June 23, 2004

Solid Waste Power Generation

Connecticut currently has approximately 180 MW of solid waste-fueled generation, approximately 2.5 percent of the state's generation capacity. The Exeter generating plant in Sterling burns used tires, and has a summer rating of approximately 24 MW. The remaining 160 MW of solid waste-fueled generation includes: Bridgeport Resco; Bristol Resource Recovery Facility (RRF); Lisbon RRF; Preston RRF; Wallingford RRF; and the Connecticut Resource Recovery Agency South Meadows facility. See Table 4.

Table 4

Solid Waste-fueled Generation	**MW**
Bridgeport Resco	58.52
Bristol Resource Recovery Facility	13.2
Lisbon Resource Recovery Facility	12.96
Preston Resource Recovery Facility	16.01
Wallingford Resource Recovery Facility	6.35
Connecticut Resource Recovery Agency - South Meadows Unit #5	25.6
Connecticut Resource Recovery Agency - South Meadows Unit #6	27.11
Exeter Tire-burning Facility	24.17
Total	183.92

Solid waste has the advantage of being a renewable, locally supplied fuel and it contributes to Connecticut's fuel diversity. It is not affected by market price volatility, nor supply disruptions—significant advantages over fossil fuels. In addition, the combustion of solid waste produces relatively low levels of greenhouse gases, and reduces the amount of space needed for landfills.

Recently passed energy legislation encourages the development and expansion of waste-to-energy facilities. Trash-to-energy plants are considered a Class II renewable resource, which could count toward the Renewable Portfolio Standards. (See later section titled "Renewable Portfolio Standards.")

Miscellaneous Small Generation

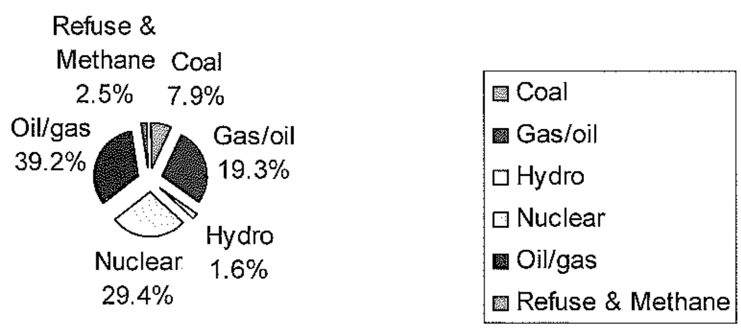
Approximately 134 MW of electricity is generated by 67 independent entities in Connecticut such as schools, businesses, homes, etc. This portion of generation is not credited to the state's capability to meet demand because ISO-NE does not control its dispatch. However, these privately-owned units do serve to reduce the net load on the grid, particularly during periods of peak demand. They range from 5 kW to 32.5 MW in size and are fueled primarily by natural gas, with several others using oil, solid waste, hydro, solar, wind, landfill gas (essentially methane), and propane. The newest significant addition to this category is the 24.9 MW cogeneration facility at the University of Connecticut. This unit was put into service in August 2005.

Under Public Act 05-01, An Act Concerning Energy Independence, financial and other incentive mechanisms were put in place to encourage the amount of installed distributed generation and combined heat and power in Connecticut. The DPUC has approved numerous grant applications for distributed generation projects. So while more small distributed generation is expected, it is not clear at this time how many of these projects will actually be constructed. In addition, several unreported units may be in service in Connecticut. Therefore, the total amount of miscellaneous small generation is an approximation at best.

Fuel Mix

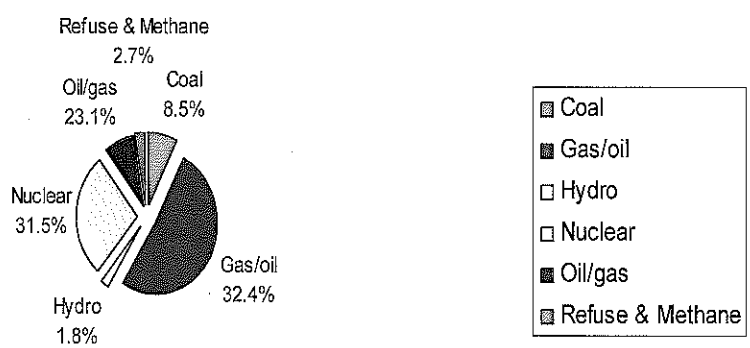
Based on existing generation and future (approved) generation projected in Table 1, the estimated fuel mix (by MW) is provided below for 2010 and also 2019, the end of the forecast period. The retirement assumptions of the 2010 IRP are included in the 2019 Fuel Mix chart. See Figure 4a and 4b below.

Figure 4a: 2010 Fuel Mix



*Lake Road plant (~700 MW) is not included in the fuel mix charts because it is electrically more a part of Rhode Island than Connecticut.

Figure 4b: 2019 Fuel Mix



Import Capacity

The ability to import electricity plays a significant role in Connecticut's electric supply. It is essential for maximizing reliability and for allowing economic interchange of electric energy. Connecticut can reliably import approximately 1,500 MW to 2,500 MW of power from the neighboring states of New York, Rhode Island, and Massachusetts. 2,500 MW is considered the maximum and best-case scenario at this time.

Connecticut has one 345-kV tie with each bordering state. The 345-kV tie from New York can carry 18 percent of our import capacity. The 345-kV tie from Rhode Island can carry 31 percent. The 345-kV tie from Massachusetts can carry about 32 percent. This results in 81 percent of our imports being carried on high-capacity lines. The remaining power is carried via 115-kV interstate connections.

While the previous imports mentioned have all been on the alternating current (AC) transmission system, there is one direct current (DC) tie between New Haven and Long Island called the Cross Sound Cable. The Cross Sound Cable is 450-kV DC and has a capacity of approximately 330 MW in either direction.

The twenty-five hundred MW import capability only represents about 30 percent of the state's peak demand. Looking ahead, CL&P is developing a transmission upgrade plan that would increase the state's import capacity to approximately 45 percent of peak demand. This plan would significantly increase the reliability of Connecticut's supply system and allow for greater import of economical supply. This plan is known as NEEWS. (See Transmission section.)

Market Rules Affecting Supply

Forward Capacity Market

Pursuant to a settlement agreement filed with FERC on March 6, 2006, ISO-NE has introduced a new Forward Capacity Market (FCM) under which ISO-NE projects the needs of the power system three years in advance, then holds an annual auction to purchase power resources to satisfy those needs. New generating plants are allowed to bid in on the same basis as existing ones, a rule that should favor alternative fuels, and, for the first time, demand response resources can bid in a form of capacity supply. Various supplemental rules provide penalties for generators who fail to fulfill their auction commitments, and also ensure that large and small generators are treated on par.

The ISO-NE FCM rules needed to conduct the first forward capacity auction (FCA) were approved by the FERC during 2007. In the first auction, 39,155 MW of new and existing demand and supply resources competed to provide the 32,305 MW needed for New England reliability for the twelve month period: June 2010 through May 2011. The auction consisted of eight rounds over a three-day period.

Since, as mentioned above, the FCA invited demand response resources to bid in as a source of supply, the result is particularly notable. Six hundred MW of new supply was procured, an unexpectedly high number. ISO-NE officials are not sure whether this level of new supply resulted from a "first-time" surge, or will continue.

An important function of the FCM is to compensate resources for providing capacity in advance, which should provide additional financial support beyond what is obtained through the (actual) wholesale electricity market. However, there appears to be some concern, by at least some market participants, that revenues from the FCM may be inadequate: if so, some units will be retired during the forecast period.

Other ISO-NE Markets

In addition to the FCM, ISO-NE also runs other electricity supply markets: one for Forward Reserves, and the other for Ancillary Services. Without going into the details, suffice to say that rewards to suppliers are higher on these markets than on the FCM. Just as demand response resources are now making the FCM more competitive, they also could make the other markets more competitive—if they were permitted to bid in. ISO-NE has stated they are willing to open these doors, in principle, but have not yet developed the precise terms. It is unclear how long it will take before demand resource responses will be introduced into these markets.

Legislation Affecting Supply

An Act Concerning Electricity and Energy Efficiency

On June 4, 2007, Public Act 07-242, An Act Concerning Electricity and Energy Efficiency (PA 07-242) became effective. This is one of the most sweeping pieces of state energy legislation since electric deregulation. In general, it requires coordinated electric utility planning for procuring energy efficiency and other clean energy resources such as renewables. While PA 07-242 cannot be described thoroughly here, some of its main provisions affecting electric supply will be noted below.

Appliance Standards

Efficiency standards for certain appliances are ratcheted up so that all new appliances of these kinds sold in Connecticut will use less electricity.

Regional Greenhouse Gas Initiative (RGGI)

Seven years ago, then-Governor Rowland signed a compact with other New England states and eastern Canadian provinces to reduce greenhouse gas emissions. Through a series of legislative steps in Connecticut since then, this initial pledge has been translated into mandatory timelines and rules governing CO_2 emissions statewide, with particular emphasis on the electricity sector, since greenhouse gas emissions from power plants contribute about a quarter (11 million tons) of Connecticut's estimated 40-45 million tons. Most notably, an auction program—the first in the US—has been established through which electricity generators can buy and sell CO_2 allowances to comply with

RGGI's regional cap of 188 million tons of CO_2 emissions annually. PA 07-242 dictates that Connecticut's share of the proceeds from this auction mostly be used to fund energy efficiency, demand response, and renewables, with a small percentage of the proceeds being used to support administration of the program and climate policy development. A preliminary "test" auction offering allowances from six of the ten RGGI states was held on September 25, 2008 (see below), and another will be held in December, with more states participating. A regular slate of auctions will continue beyond January 1, 2009, when the RGGI cap officially takes effect, so that all regional power producers will be able to meet the emissions limit. Per legislated schedule, the cap holds steady until 2014, then declines by 2.5 percent per year through 2018. The specific level of the cap was set during 2004, and is regarded now as generous, since regional emissions currently are 15-20 million tons below it, on account of mild weather, the economic slowdown, and New England's continued shift from fuels that are high in CO_2 emissions, such as coal and oil, to ones that are low, such as natural gas. Thus, initially, the supply of CO_2 allowances available to electricity generators in Connecticut will be larger than the demand, and the RGGI targets will not have a significant effect on electric supply. By 2014, however, when the cap starts ratcheting down, RGGI could have a greater effect, particularly in accelerating plant retirements.

The results of the September auction showed that a cap-and-trade system can work well to price carbon emissions, according to RGGI Inc., which manages the initiative[7]. Six states offered a total of 12,565,387 allowances for sale: Connecticut, Maine, Maryland, Massachusetts, Rhode Island and Vermont. Fifty-nine bidders took part, representing the energy, financial and environmental sectors. The number of allowances they asked for was four times the available supply. Thus, the market proved to be open and competitive. With a floor of $1.86 for each allowance, and a ceiling at $10, the final clearing price was $3.07. The $38,575,783 in proceeds will be distributed to the six states per the number of allowances each one offered into the auction. Connecticut's share will be approximately $4 million.

Renewable Portfolio Standards

Connecticut's Renewable Portfolio Standards (RPS) were first legislated by Public Act 03-135. In general, these standards require retail electric suppliers (including, most notably, CL&P and UI) to ensure that a certain minimum percentage of their electricity comes from renewable energy sources. Legislation has divided renewable fuels into two classes, depending roughly how much pollution they cause, and their sustainability. Under PA 07-242, these percentages have been revised, with a target of 20 percent renewable energy sources by 2020.

Table 5 depicts the required percentages for Class I and Class II renewable energy sources through 2020.

Table 5	Renewable Portfolio Standards	
Effective Date	*Minimum Class I Percentage*	*Addt'l Percentage of Class I or II*
1/1/2006	2 percent	3 percent
1/1/2007	3.5 percent	3 percent
1/1/2008	5 percent	3 percent
1/1/2009	6 percent	3 percent
1/1/2010	7 percent	3 percent
1/1/2011	8 percent	3 percent
1/1/2012	9 percent	3 percent
1/1/2013	10 percent	3 percent
1/1/2014	11 percent	3 percent
1/1/2015	12.5 percent	3 percent
1/1/2016	14 percent	3 percent
1/1/2017	15.5 percent	3 percent
1/1/2018	17 percent	3 percent
1/1/2019	19.5 percent	3 percent
1/1/2020	20 percent	3 percent
Source: PA 07-242		

According to PA 07-242, Section 40, an electric supplier or electric distribution company may satisfy the RPS requirements by purchasing certificates issued by the New England Power Pool Generation Information System, provided the certificates are for Class I or Class II renewables generated within ISO-NE's territory (i.e. New England) or energy imported into ISO-NE's territory. For those renewable energy certificates under contract to serve end-use customers in the state on or before October 1, 2006, the electric supplier or distribution company may participate in a renewable trading program within said jurisdictions by the Department of Public Utility Control, or purchase eligible renewable electricity and associated attributes from residential customers who are net producers.

PA 07-242 also requires electric distribution companies and electric suppliers, on or after January 1, 2007, to demonstrate that no less than one percent of the total output of the suppliers or the standard service of an electric distribution company is obtained from Class III sources, a newly-defined group of resources focusing on combined heat and power systems, and C&LM. On January 1, 2008, this percentage increases to 2 percent. For January 1 of years 2009 and 2010, the percentages are 3 and 4 percent, respectively.

Connecticut Advisory Board (CEAB) and the Integrated Resource Plan (IRP)

PA 07-242 restructures the CEAB, and requires that it conduct studies on how to integrate and coordinate the state's energy entities to achieve the state's greenhouse gas goals, as well as evaluate the efficacy of the state's efficiency program delivery. Under this broad mandate, one of the CEAB's most important new duties is to review and approve an electric resource assessment and procurement plan—a plan to be submitted for approval by UI and CL&P. While this was originally an annual plan, in 2009 the statute was revised to require an IRP every even number year.

On January 1, 2010, as required, the two utilities, along with their consultant, The Brattle Group, submitted their integrated resource plan (IRP). It included seven primary findings which are listed below:

- Assuming the New England states are successful in building enough renewable generation and associated transmission to meet RPS requirements, there should be no need for any additional generating resources for resource adequacy purposes over the next ten years under a wide range of demand uncertainty;

- Predicated on reasonable assumptions regarding supply and demand and transmission, Connecticut has sufficient generation installed or under contract to assure locational resource adequacy requirements for reliability over the next 10 years, even if significant uneconomic, high-emissions generating plants retire;

- Due primarily to the effects of RPS and climate legislation, power supply-related costs are expected to increase from 11 cents per kWh today and in 2013 to nearly 14 cents per kWh in 2020 (in 2010 dollars) under expected supply and demand and moderate fuel and emissions costs;

- A targeted expansion of DSM programs beyond those currently planned can lead to significant reductions in emissions and costs. It is anticipated that the additional program costs would be more than offset by a reduction in generation service costs and rates;

- For New England to meet each respective state's 2020 Class I renewable portfolio requirements, New England news to add about 4,800 MW (nameplate) of new renewable generation, primarily wind, that will be located in areas distant from load centers that would require investments of approximately $20 billion in new renewable generation and about $10 billion of investment in transmission resources to access this new renewable generation;

- Assuming the Class I renewable generation buildout and continuation of the Connecticut DSM measures, New England's carbon dioxide emissions, NOx emissions, and S02 emissions in 2020 will be substantially below 2007 actual levels; and

- New England electric energy prices are highly dependent on the price of natural gas. It is expected that the large supply of economically recoverable shale gas, which can be found as close to New England as New York and Pennsylvania, may allow natural gas prices to remain moderate and may thereby help to moderate energy prices.

Per mandate, the IRP was reviewed and modified by the CEAB, and then re-drafted in the form of the CEAB's 2010 *Comprehensive Plan for the Procurement of Energy Resources*. The document was then submitted to the DPUC for final review and approval.

Finally, PA 07-242 is expected to benefit Connecticut by resulting in increased energy efficiency, reduced pollution, and additional electric generation powered by renewable energy sources. However, it is not clear at this time how many megawatts of this renewable-fueled electricity required by the RPS will be generated in Connecticut and how many will be imported.

TRANSMISSION SYSTEM

Transmission is often referred to as the "backbone" of the electric system, since it transports large amounts of electricity over long distances efficiently by using high voltage. High voltages maximize efficiency. This is because higher voltages result in less current. Since losses are proportional to the square of the current, higher voltages result in less losses. Also, for a given line current, since power is proportional to the voltage, higher voltages allow more power to be carried via a given line.

In Connecticut, electric lines with a voltage of 69 kilovolts (kV) or more are considered transmission lines. The highest transmission line voltage in Connecticut is 345 kV.

Distribution lines are those below 69-kV. They are the lines that come down our streets to connect (via a transformer) with even lower-voltage lines supplying each residence or business.

The state's electric transmission system contains approximately: 413.1 circuit miles of 345-kV transmission; 1,300 circuit miles of 115-kV transmission; 5.8 miles of 138-kV transmission; and 99.5 circuit miles of 69-kV transmission. (These figures refer to AC transmission. The Cross Sound Cable is not counted because it is DC.) Appendix B shows planned new transmission, reconductoring, or upgrading of existing lines to meet load growth and/or system operability needs.

Connections with other systems outside the state are critical to overall reliability and economic efficiency. There are 11 such AC connections or ties: one at 69-kV; one at 138-kV (the underwater cable from Norwalk to Long Island); six at 115-kV; and three at 345-kV. In addition, the Cross Sound Cable, at 450-kV, is a DC tie between New Haven and Long Island.

Of these interstate connections, one 345-kV tie is with National Grid in Rhode Island; one 345-kV tie is with Central Hudson in New York state; and five ties (one 345-kV and four 115-kV) are with the Western Massachusetts Electric Company (WMECO) in Massachusetts.

The CL&P 345-kV transmission system transmits power from large central generating stations such as Millstone, Lake Road, and Middletown via four 345-kV transmission ties with neighboring utilities. Large generating units are typically connected to the 345-kV transmission system because they are higher capacity lines[9].

Electric Transmission in Southwest Connecticut

Dockets 217 and 272

After the turn of the century, it became evident that the 115-kV lines serving Southwest Connecticut (SWCT) were reaching the limit of their ability to support the area's current and projected loads reliably and economically. ISO-NE, CL&P, and UI devised a plan to supplement the existing 115-kV transmission lines with a new 345-kV "loop" though SWCT that would integrate the area better with the 345-kV system in the rest of the state and New England, and provide electricity more efficiently.

The first phase of this proposed upgrade (known as "Phase One"), involved the construction of a 345-kV transmission line from Plumtree Substation in Bethel to the Norwalk Substation in Norwalk. The Phase One proposal was the subject of Council Docket No. 217, approved by the Council on July 14, 2003. Construction is complete, and the line was activated in October 2006.

The second phase of the upgrade (known as "Phase Two") was the subject of Council Docket No. 272. This proposal includes the construction of a 345-kV transmission line from Middletown to Norwalk Substation. This project was approved by the Council on April 7, 2005. Construction began in 2006. The project went into service in late 2009.

Glenbrook-Norwalk Cable Project

Within SWCT, a critical sub-area is called the Norwalk-Stamford Sub-Area. Historically, Norwalk and Stamford have relied on local generation. Since generation has become less economical, given electric restructuring, and given the age of generating plants around Norwalk and Stamford, the Norwalk-Stamford Sub-Area had to look at an additional 115-kV transmission line, rather than generation, to meet its increasing needs.

To address these needs, the Council reviewed and approved the construction of two new 115-kV underground transmission cables between the Norwalk Substation in Norwalk and the Glenbrook Substation in Stamford. This project, proposed by CL&P, will effectively bring the reliability benefits of the new 345-kV transmission loop to the large load center in Stamford. The project is also currently in service.

While the Phase I, Phase II, and Glenbrook-Norwalk projects relieved transmission congestion in SWCT for the near term, as part of prudent planning, ISO-NE is continually reviewing the New England grid to determine future needs. SWCT is currently being reviewed again by ISO-NE to determine if any further upgrades would be needed to ensure continued reliability going forward.

New England East – West Solution (NEEWS)

In 2006, National Grid, a utility company that provides service in various parts of New England, CL&P, and ISO-NE began planning a major tri-state transmission upgrade to improve electricity transfers between Connecticut, Massachusetts, and Rhode Island. Known as NEEWS, the large-scale upgrade is comprised of four separate projects, described below.

The Interstate Reliability Project is the most comprehensive. It would build a new 345-kV transmission line to tie National Grid's Millbury Substation in Massachusetts with CL&P's Card Street Substation in Lebanon, thus connecting electric service more efficiently from Massachusetts to eastern Connecticut, offering an existing connection point with Rhode Island. When combined with the three other projects within NEEWS, this one would increase the east-west power transfer capability across New England in general.

The Greater Springfield Reliability Project improves connections between Connecticut and Massachusetts to address particular problems in the Springfield, Massachusetts area. New 345-kv facilities would be built to tie the Western Massachusetts Electric Company's (WMECO) Ludlow Substation with Agawam Substation and also connect Agawam Substation with CL&P's North Bloomfield Substation in Bloomfield. New and modified 115-kV facilities for the area would be integrated into this project.

The Central Connecticut Reliability Project would increase the reliability of power transfers from eastern Connecticut to western and southwest Connecticut. A new 345-kV transmission line would connect the North Bloomfield Substation in Bloomfield and Frost Bridge Substation in Watertown. Associated upgrades to the 115-kV facilities in the area would also be necessary.

The Rhode Island Reliability Project principally would affect Rhode Island. New 115-kV and 345-kV facilities would be built to improve Rhode Island's access to the regional 345-kV grid and decrease its dependence on local generation. National Grid would construct the facilities. Connecticut would be only minimally involved in this project.

Overall, the aggregate of the southern New England transmission reinforcements provided by NEEWS is expected to increase Connecticut's import capacity significantly. Eleven hundred MW will be added, possibly more. The Council has already reviewed and approved The Greater Springfield Reliability Project (GSRP). The other applications are expected to be filed with the Council in the future.

Substations and Switching Stations

A substation is a grouping of electrical equipment including switches, circuit breakers, buses, transformers and controls for switching power circuits and transforming electricity from one voltage to another.

Another common type of substation connects the transmission system to the distribution system. For example, the input might be 115-kV transmission and the output might be 13.8-kV distribution.

Another type of substation connects a generator to the grid. A generator's output voltage is much less than the transmission voltage. Thus, the generator's voltage has to be raised before the power generated can be fed into the grid.

Lastly, a switching station is a facility where transmission lines are interconnected at the same voltage.

As depicted in Appendix C, as many as 8 new substations are planned for the next eight years to address high load areas within the state. Other new substations and/or upgrades to existing substations are also being considered, with the estimated in-service dates to be determined.

New Transmission Technologies

Although the amount of investment in R&D for transmission technology has historically been small, the next decade should increase that investment. For instance, during the recent 345kV transmission upgrade running from Middletown to Norwalk, helicopters were used to install overhead conductors in Connecticut for the first time. Transmission towers fabricated with new materials are being installed. Conductors designed with special-purpose metals and ceramics—so-called "superconductors"—are being tested in other parts of the country and could be applied at certain sites in Connecticut. Also, the spread of distributed generation, particularly units using renewable fuels, such as solar panels, wind microturbines, advanced batteries, fuel cells, and even plug-in electric vehicles, may demand a variety of new methods for integrating these innovative power sources onto the grid.

RESOURCE PLANNING

Since 1972, when, by statute, the Council began its annual forecast reviews, the practice of resource planning in Connecticut has changed in two major and largely unexpected ways.

The first change resulted from Connecticut's electric restructuring. It caused an inexorable shift in the relationship between the electric system in our state and the regional electric system. Prior to restructuring, the state's utility industry was fully accountable for all planning decisions. Since that change, utilities are no longer in a position to perform such rigorous planning. Decisions on generation are entirely out of their hands and scattered among many participants. ISO-NE has now assumed the role of principal planner, since it makes the forecasts associated with facility planning. Connecticut utilities now make their forecasts only for financial planning. Hence, the Council's emphasis in its forecast review must of necessity shift more and more away from the state's utilities and toward ISO-NE.

The second major change in the Council's task of resource planning has to do with the nature of planning itself. Forecasting electric loads and resources is an inherently difficult process even in the best of times, because the electric system is so complex. But the United States (US) is going through a period of game-changing instability. Energy prices are not simply rising but becoming increasingly volatile. Technological change, geopolitics, the US and world economies, and climate affect the US electric system daily. Studies have shown that forecasters are weak at estimating uncertainties especially in the long range: indeed, they try to delay plans until more variables are known. The period of this forecast review, however, seems to promise only extraordinary uncertainties, and it cannot be waited out. Nonetheless, forecasting can be effective, within limits, if it acknowledges that human behavior can change, if it discusses major variables openly, if it is modest, and if it incorporates data sets from several different sources. The Council has tried to follow these maxims.

As depicted in Appendix B, the Council continues to assess the existing electric system to maintain and improve reliability. Rate pressures, congestion management, targeted demand-side programs, regional transfers, likely retirements, and scarce locations for siting facilities are the main issues making the Council's decisions difficult and critical. Further, the Council notes the legislated mandate of its sister agency, the CEAB, for stimulating alternatives to certain proposed electric facilities that come before the Council. Such alternatives may include new transmission technologies, generation using renewable fuels, distributed generation, wholesale and retail market strategies, CEEF, and combinations thereof. The Council encourages innovation. In order for regulators to work well, they must look at multiple scenarios, and consider diverse solutions.

CONCLUSION

This Council has considered Connecticut's electric energy future and finds that even taking into account the most conservative forecast, the ISO-NE 90/10 forecast, the electric generation supply during the forecast period will be adequate to meet demand. Neglecting retirements, going forward, Connecticut has a surplus of generation during the forecast period. When retirements are taken into account, the NEEWS projects (if approved), would provide additional import capacity to largely offset such losses. The magnitudes of remaining deficits in Table 2 are small enough to be met by reserves and demand response.

The most significant gains in generating capacity will be associated with the upcoming 620 MW Kleen Energy power plant in Middletown. These, along with other smaller projects, will result in additional megawatts of new capacity for the state. Furthermore, additional generation fueled by renewable resources as well as increased efficiency in homes and businesses are expected to result from the Act Concerning Electricity and Energy Efficiency.

In addition to generating capacity and demand side management, the Council cannot overstate the importance of having adequate transmission to transport the electricity from generators (both in-state and out of state) to our substations to serve the local loads. In particular, the Council is pleased to note the significant improvements to our transmission system that are complete and/or underway. The Phases I, II, and III transmission projects of SWCT are up and running. One NEEWS project has been reviewed and approved by the Council. Applications for the remaining projects are anticipated in the future. The utilities and ISO-NE are continually reviewing the future needs of the system.

Issues that warrant attention in the future include:

- consider additional interstate transmission resources that will allow greater transfer capability into Connecticut, increasing reliability and helping meet the state's renewable portfolio standards requirements, as well as the growing load in the New England region;

- promote clarity, transparency and a longer forecast period in relation to ISO-NE's operating reserve requirements for Connecticut;

- consider a uniform forecasting methodology for the transmission/distribution companies consistent with the ISO-NE 90/10 forecast, which is considered the lead forecast;

- be proactive regarding the deactivation/retirement of older generating facilities in the context of electric system needs and consider replacement/repowering of such facilities where feasible;

- encourage additional energy efficiency and demand response as recommended in the Integrated Resource Plan;

- increase fuel diversity to avoid excessive reliance on any one fossil fuel for generation; and

- encourage innovations that conserve energy and/or generate electricity through diverse fuel sources.

End Notes

1. A one MW load would be the equivalent of operating 10,000 light bulbs of 100 Watts each simultaneously. Put another way, 1 MW could serve between 300 and 1,000 homes, with 500 being a typical number.

2. A very small amount of CMEEC load is the result of providing service to Fisher's Island, New York via a connection to a substation in Groton, Connecticut. The peak load is on the order of 1 MW and thus considered negligible.

3. Electric energy consumption, as used in this report, includes losses. See "Losses" in Glossary.

4. Peak load reduction due to C&LM includes Energy Independence Act initiatives, excluding third party contracts.

5. While the Lake Road power plant does provide electricity to Connecticut under normal operating conditions, it is not considered a Connecticut resource by ISO-NE due to the existing transmission configuration. As such, it is not included in this forecast.

6. Hydroelectric units under 5 MW do not require licensing from the Federal Energy Regulatory Commission.

7. RGGI Inc. Press Release dated September 29, 2008.

8. Interestingly, no mention was made of the use of oil as a fuel both for electric generation and space heating. Yet oil is the fuel that has historically driven energy costs and availability.

9. Since power is directly proportional to voltage, all else being equal, a 345-kV line can carry three times as much power as a 115-kV line. A typical 345-kV line has two conductors per phase, whereas a typical 115-kV line has one, thus turning the three times power-carrying advantage of a 345-kV line to six times.

Glossary

50/50 forecast: A projection of peak electric load assuming normal weather conditions. The 50/50 projected peak load has a 50 percent chance of being exceeded in a given year.

90/10 forecast: A projection of peak electric load assuming extreme (hot) weather conditions. The 90/10 forecast has a 10 percent chance of being exceeded in a given year.

Ampere (amp): A unit measure for the flow (current) of electricity. As load increases, so does the amperage at any given voltage.

AC (Alternating Current): An electric current that reverses (alternates) its direction of flow periodically. In the United States, this occurs 60 times per second (60 cycles or 60 Hz).

Baseload generator: A generator that operates nearly 24/7 regardless of the system load.

Blackout: A total disruption of the power system, usually involving a substantial or total loss of load and generation over a large region.

Black start capability: Having the ability to return to service without the need for an outside power source. Usually applies to generators.

C&LM (Conservation and load management): Any measures to reduce electric usage and provide savings. See Conservation. See Demand response.

Cable: A fully insulated conductor usually installed underground, especially at voltages of 69-kV and above.

CEAB (Connecticut Energy Advisory Board): The CEAB is a 15-member body responsible for representing the state in regional energy planning, participating in the Council's annual load forecast proceeding, and reviewing the procurement plans submitted by electric distribution companies.

CELT (Capacity, Energy, Load and Transmission Report): An annual ISO-NE report including data and projections for New England's electric system over the next ten years.

CHP (Combined heat and power): Term used interchangeably with cogeneration. See Cogen.

Circuit: A system of conductors (three conductors or three bundles of conductors) through which electrical energy flows between substations. Circuits can be supported above ground by transmission structures or placed underground.

Class I renewable energy sources: "(A) energy derived from solar power, wind power, a fuel cell, methane gas from landfills, ocean thermal power, wave or tidal power, low emission advanced renewable energy conversion technologies, a run-of-the-river hydropower facility provided such facility has a generating capacity of not more than five megawatts, does not cause an appreciable change in the river flow, and began operation after the effective date of this section, or a biomass facility, including, but not limited to, a biomass gasification plant that utilizes land clearing debris, tree stumps or other biomass that regenerates or the use of which will not result in a depletion of resources, provided such biomass is cultivated and harvested in a sustainable manner and the average emission rate for such facility is equal to or less than .075 pounds of nitrogen oxides per million BTU of heat input for the previous calendar quarter except that energy derived from a biomass facility with a capacity of less than five hundred kilowatts that began construction before July 1, 2003, may be considered a Class I renewable energy source, provided such biomass is cultivated and harvested in a sustainable manner, or (B) any electrical generation, including distributed generation, generated from a Class I renewable energy source." (Public Act 03-135)

Class II renewable energy source: "Energy derived from a trash-to-energy facility, a biomass facility that began operation before July 1, 1998, provided the average emission rate for such facility is equal to or less than 0.2 pounds of nitrogen oxides per million BTU of heat input for the previous calendar quarter, or a run-of-the-river hydropower facility provided such facility has a generating capacity of not more than five megawatts, does not cause an appreciable change in the riverflow, and began operation prior to the effective date of this section." (Public Act 03-135)

Class III source: "The electricity output from combined heat and power systems with an operating efficiency level of no less than fifty percent that are part of customer-side distributed resources developed at commercial and industrial facilities in this state on or after January 1, 2006, a waste heat recovery system installed on or after April 1, 2007, that produces electrical or thermal energy by capturing preexisting waste heat or pressure from industrial or commercial processes, or the electricity savings created in this state from conservation and load management programs begun on or after January 1, 2006." (Public Act 07-242)

CL&P (The Connecticut Light and Power Company): CL&P is the largest transmission/distribution company in Connecticut.

CMEEC (The Connecticut Municipal Electric Energy Cooperative): An "umbrella" group comprised of all of the municipal electric utilities in Connecticut. It manages coordinated generation and transmission/distribution services on their behalf.

Combined-cycle: A power plant that uses its waste heat from a gas turbine to generate even more electricity for a higher overall efficiency (on the order of 60 percent).

Conductor: A metallic wire, busbar, rod, tube or cable, usually made of copper or aluminum, that serves as a path for electric flow.

Cogen (Cogeneration plant): A power plant that produces electricity and uses its waste heat for a useful purpose. For example, some cogeneration plants heat buildings, provide domestic hot water, or provide heat or steam for industrial processes.

Conservation: The act of using less electricity. Conservation can be achieved by cutting out certain activities that use electricity, or by adopting energy efficiencies: thus, conservation is virtually the same as energy efficiency.

Customer-side distributed resource: "The generation of electricity from a unit with a rating of not more than sixty-five megawatts on the premises of a retail end user within the transmission and distribution system including, but not limited to, fuel cells, photovoltaic systems or small wind turbines, or a reduction in demand for electricity on the premises of a retail end user in the distribution system through methods of conservation and load management, including, but not limited to, peak reduction systems and demand response systems." (Public Act 05-01)

DC (Direct Current): An electric current that flows continuously in one direction.

Dual-fuel: The ability of a generator to operate on two different fuels, typically oil and natural gas. Economics, the availability of fuels and environmental (e.g. air emission) restrictions are factors that generating companies consider when deciding which fuel to burn.

Demand: The total amount of electricity required at any given instant by an electric customers. "Demand" can be used interchangeably with the term "load". See Load.

Demand response: The ability to reduce load during peak hours, by turning down/off air conditioning units, industrial equipment, etc.

Distribution: The part of the electric delivery system that operates at less than 69,000 volts. Generally, the distribution system connects a substation to an end user.

Distributed generation: Generating units (usually on the customer's premises) that connect to the electric distribution system, not to the transmission system. These units are generally smaller than their counterparts.

DPUC (Department of Public Utility Control): The state agency charged with regulating utilities in Connecticut.

Energy (electric): The total work done by electricity. Energy is the product of the average load and time. The unit is kilowatt hours (kWh).

Energy efficiency: Using less energy to perform the same function (that is, doing the same with less). Energy efficiency activities are distinguished from demand-side management (DSM) in that DSM generally refers to electric utility-sponsored and -

financed programs and may also include load management measures, while energy efficiency is a broader term, not limited to any particular sponsor, energy type or sector.

Feeder: Conductors (forming a circuit) that is part of the distribution system. See Distribution. See Circuit.

Fuel cell: Fuel cells are devices that produce electricity and heat by combining fuel and oxygen in an electrochemical reaction. Fuel cells can operate on a variety of fuels, including natural gas, propane, landfill gas, and hydrogen. Unlike traditional generating technologies, fuel cells do not use a combustion process that converts fuel into heat and mechanical energy. Rather, a fuel cell converts chemical energy into heat and electrical energy. This process results in quiet operation, low emissions, and high efficiencies. Nearly all commercially installed fuel cells operate in a cogeneration mode. See Cogen. In addition, fuel cells provide very reliable electricity and are therefore potentially attractive to customers operating sensitive electronic equipment.

Generator: A device that produces electricity. See Baseload generator, Intermediate generator, and Peaking generator.

Grid: A system of interconnected power lines and generators that is managed so that the generators are dispatched as needed to meet the requirements of the customers connected to the grid at various points. The term "gridco" is sometimes used to identify an independent company responsible for the operation of the grid.

Grid-side distributed resource: "The generation of electricity from a unit with a rating of not more than sixty-five megawatts that is connected to the transmission or distribution system, which units may include, but are not limited to, units used primarily to generate electricity to meet peak demand." (Public Act 05-01)

ISO-NE: (ISO New England): An entity charged by the federal government to oversee the bulk power system and the electric energy market in the New England region.

Intermediate generator: A generator that operates approximately 50 to 60 percent of the time, depending on the system load.

kV (kilovolt): One thousand volts (i.e. 345 kV = 345,000 volts). See Volt.

Line: A series of overhead transmission structures that support one or more circuits; or, in the case of underground construction, a single electric circuit.

Load: Amount of power delivered, as required, at any point or points in the system. Load is created by the aggregate load (demand) of customers' equipment (residential, commercial, and industrial).

Load management: Steps taken to reduce demand for electricity at peak load times or to shift some of the demand to off-peak times. The reduction may be made with reference to peak hours, peak days or peak seasons. Electric peaks are mainly caused by high air-conditioning use, so air-conditioners are the prime targets for load management efforts. Utilities or businesses that provide load management services pay customers to reduce load through a variety of manual or remotely-controlled methods.

Loss or losses: Electric energy that is lost as heat and cannot be used to serve end users. There are losses in both the transmission and the distribution system. Higher voltages help reduce losses.

Megawatt (MW): One million Watts. A measure of the rate at which useful work is done by electricity.

Normal weather: Weather that includes typical temperatures and humidity consistent with past meteorological data.

Peak load: The highest electric load experienced during a given time period. See Load.

Peaking unit: A generator that can start under short notice (e.g. 10 to 30 minutes) and operates approximately less than 10 percent of the hours in a year.

Quick-start unit: A generator that can start and provide electricity within 30 minutes of being dispatched.

Substation: Electric facilities that use equipment to switch, control and change voltages for the transmission and distribution of electrical energy.

Switching station: A type of substation where no change in voltage occurs.

Terminal structure: A structure typically within a substation that physically ends a section of transmission line.

Transformer: A device used to change voltage levels to facilitate the efficient transfer of electrical energy from the generating plant to the ultimate customer.

Transmission line: Any electric line operating at 69,000 or more volts.

Transmission tie-line or tie: A transmission line that connects two separate transmission systems. In the context of this report, a tie is a transmission line that crosses state boundaries and connects the transmission systems of two states.

UI (The United Illuminating Company): A transmission/distribution company that serves customers in the New Haven – Bridgeport area and its vicinity.

Voltage or volts: A measure of electric force.

Wire: See Conductor.

Appendix A
Existing Electric Generation Facilities
as of December 2010

Facility	Owner	Town	Fuel	Summer Rating	Winter Rating	In-Service Date
AES Thames	AES Thames, Inc.	Montville	Coal	182.65	182.06	12/1/1989
Aetna Capitol District (CDECCA)	Capitol District Energy Ctr.	Hartford	Gas	55.25	61.33	11/1/1988
Bantam #1	FirstLight Hydro Generating Co.	Litchfield	Hydro (Run of River)	0.00	0.14	1/1/1905
Branford #10	NRG	Branford	Oil (Jet Fuel)	15.84	20.95	1/1/1969
Bridgeport Energy	Bridgeport Energy LLC	Bridgeport	Gas	460.95	540.19	8/1/1998
Bridgeport Harbor #2	PSEG Power, LLC	Bridgeport	Oil	130.50	136.82	8/1/1961
Bridgeport Harbor #3	PSEG Power, LLC	Bridgeport	Coal/Oil	383.43	384.98	8/1/1968
Bridgeport Harbor #4	PSEG Power, LLC	Bridgeport	Oil (Jet Fuel)	17.11	20.44	10/1/1967
Bridgeport Resco	CRRA	Bridgeport	Wood/Refuse	58.52	58.74	4/1/1988
Bristol Refuse	Ogden Martin Systems-CT	Bristol	Wood/Refuse	12.86	13.05	5/1/1988
Bulls Bridge #1- #6	FirstLight Hydro Generating Co.	New Milford	Hydro (Pondage)	0.00	6.61	1/1/1903
Colebrook	MDC	Colebrook	Hydro (Pondage)	0.00	1.03	3/1/1988
Cos Cob #10	NRG	Greenwich	Oil (Jet Fuel)	19.03	23.00	9/1/1969
Cos Cob #11	NRG	Greenwich	Oil (Jet Fuel)	18.72	23.00	1/1/1969
Cos Cob #12	NRG	Greenwich	Oil (Jet Fuel)	19.08	23.00	1/1/1969
Cos Cob #13	NRG	Greenwich	Oil (Jet Fuel)	19.20	24.20	unknown
Cos Cob #14	NRG	Greenwich	Oil (Jet Fuel)	19.61	23.48	unknown
Cytec #1	CMEEC	Wallingford	Oil (Diesel)	1.93	1.92	5/15/2008
Cytec #2	CMEEC	Wallingford	Oil (Diesel)	1.94	1.91	5/15/2008
Cytec #3	CMEEC	Wallingford	Oil (Diesel)	1.94	1.93	5/15/2008
Dayville Pond	Summit Hydro Power	Killingly	Hydro (Run of River)	0.00	0.06	3/1/1995
Derby Dam	McCallum Enterprises	Shelton	Hydro (Run of River)	7.05	7.05	3/1/1989
Devon #10 (reactivated)	NRG	Milford	Oil (Jet Fuel)	14.41	19.19	4/1/1988
Devon #11	NRG	Milford	Gas	29.30	38.82	10/1/1996
Devon #12	NRG	Milford	Gas	29.23	38.44	10/1/1996
Devon #13	NRG	Milford	Gas	29.23	38.97	10/1/1996
Devon #14	NRG	Milford	Gas	29.97	40.27	10/1/1996
Devon #15	NRG	Milford	Oil (Jet Fuel)	46.85	49.15	
Devon #16	NRG	Milford	Oil (Jet Fuel)	46.90	49.20	
Devon #17	NRG	Milford	Oil (Jet Fuel)	46.90	49.20	
Devon #18	NRG	Milford	Oil (Jet Fuel)	46.90	49.20	
Dexter	Alstom	Windsor Locks	Gas	20.64	39.33	5/1/1990
East Windsor NORCAP LFG	East Windsor NORCAP	East Windsor	Landfill Gas (Methane)	0.98	1.00	
Exeter	Oxford Energy, Inc.	Sterling	Refuse (Tires)	24.01	20.28	12/1/1991
Falls Village #1- #3	FirstLight Hydro Generating Co.	Canaan	Hydro (Pondage)	0.00	5.59	1/1/1914
Franklin Drive #10	NRG	Torrington	Oil (Jet Fuel)	15.42	20.53	11/1/1968
Glen Falls	Summit Hydro Power	Plainfield	Hydro (Run of River)	0.00	0.00	3/1/1998

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as of December 2010

Facility	Owner	Town	Fuel	Summer Rating	Winter Rating	In-Service Date
Goodwin Dam	MDC	Hartland	Hydro (Run of River)	3.00	3.00	2/1/1986
Hartford Landfill	CRRA	Hartford	Landfill Gas (Methane)	1.74	1.76	8/1/1998
John Street #1	CMEEC	Wallingford	Oil (Diesel)	1.95	2.00	unknown
John Street #3	CMEEC	Wallingford	Oil (Diesel)	2.00	2.00	9/26/2007
John Street #4	CMEEC	Wallingford	Oil (Diesel)	2.00	2.00	9/26/2007
John Street #5	CMEEC	Wallingford	Oil (Diesel)	2.01	2.00	11/1/2007
Kimb Rocky River	Kimberly Clark Corporation	New Milford	Gas	14.00	21.50	unknown
Kinneytown A	Kinneytown Hydro Co.	Ansonia	Hydro (Run of River)	0.00	0.00	3/1/1988
Kinneytown B	Kinneytown Hydro Co.	Seymour	Hydro (Run of River)	0.00	0.44	11/1/1986
Lake Road #1	Lake Road Generating Co., L.P.	Killingly	Gas/Oil	232.75	268.37	7/1/2001
Lake Road #2	Lake Road Generating Co., L.P.	Killingly	Gas/Oil	251.33	286.95	11/1/2001
Lake Road #3	Lake Road Generating Co., L.P.	Killingly	Gas/Oil	254.90	283.67	5/1/2002
Lisbon Resource Recovery	Riley Energy Systems	Lisbon	Wood/Refuse	13.73	13.84	1/1/1996
Mechanicsville	Saywatt Hydro Associates	Thompson	Hydro (Run of River)	0.00	0.15	9/1/1995
Middletown #2	NRG	Middletown	Oil/Gas	117.00	120.00	1/1/1958
Middletown #3	NRG	Middletown	Oil/Gas	236.00	245.00	1/1/1964
Middletown #4	NRG	Middletown	Oil	400.00	402.00	6/1/1973
Middletown #10	NRG	Middletown	Oil (Jet Fuel)	17.12	22.02	1/1/1966
Milford Power #1	Milford Power Company, LLC	Milford	Gas/Oil	253.61	281.85	2/12/2004
Milford Power #2	Milford Power Company, LLC	Milford	Gas/Oil	253.09	287.63	6/1/2004
Millstone #2	Dominion Nuclear CT, Inc.	Waterford	Nuclear	875.82	879.31	12/1/1975
Millstone #3	Dominion Nuclear CT, Inc.	Waterford	Nuclear	1225.00	1235.00	4/1/1986
Montville #5	NRG	Montville	Oil/Gas	81.00	81.59	1/1/1954
Montville #6	NRG	Montville	Oil	407.40	409.91	7/1/1971
Montville #10 & #11	NRG	Montville	Oil (Diesel)	5.30	5.35	1/1/1967
New Haven Harbor #1	PSEG Power, LLC	New Haven	Oil/Gas	447.89	453.38	8/1/1975
New Milford Landfill	Vermont Electric Power Co.	New Milford	Landfill Gas (Methane)	1.52	1.75	8/1/1991
Norden #1	CMEEC	East Norwalk	Oil	1.96	1.96	unknown
Norden #2	CMEEC	East Norwalk	Oil	1.95	1.95	unknown
Norden #3	CMEEC	East Norwalk	Oil	1.94	1.94	unknown
Norwalk Harbor #1	NRG	Norwalk	Oil	162.00	164.00	1/1/1960
Norwalk Harbor #2	NRG	Norwalk	Oil	168.00	172.00	1/1/1963
Norwalk Harbor #10 (3)	NRG	Norwalk	Oil (Diesel)	11.93	17.06	10/1/1996
Norwich 2nd St./Greenville Dam	CMEEC	Norwich	Hydro	0.00	0.00	10/1/1998
Norwich 10th St.	CMEEC	Norwich	Hydro	0.00	0.00	1/1/1966
Norwich Jet	CMEEC	Norwich	Oil	15.26	18.80	9/1/1972
Norwich Wasterwater Treatment	CMEEC	Norwich	Oil (Diesel)	2.00	2.00	unknown

Appendix A
Existing Electric Generation Facilities
as of December 2010

Facility	Owner	Town	Fuel	Summer Rating	Winter Rating	In-Service Date
Pierce	CMEEC	Wallingford	Oil/Gas	76.13	96.63	10/1/2007
Pinchbeck	William Pinchbeck, Inc.	Guilford	Wood/Refuse	0.00	0.00	7/1/1987
PPL Wallingford Unit #1	PPL EnergyPlus, LLC	Wallingford	Gas	42.30	48.41	8/1/2001
PPL Wallingford Unit #2	PPL EnergyPlus, LLC	Wallingford	Gas	41.37	49.00	8/1/2001
PPL Wallingford Unit #3	PPL EnergyPlus, LLC	Wallingford	Gas	42.30	47.84	8/1/2001
PPL Wallingford Unit #4	PPL EnergyPlus, LLC	Wallingford	Gas	41.91	47.19	8/1/2001
PPL Wallingford Unit #5	PPL EnergyPlus, LLC	Wallingford	Gas	40.72	49.00	8/1/2001
Preston RRF	SCRRF	Preston	Wood/Refuse	16.45	16.75	1/1/1992
Putnam	Putnam Hydropower, Inc.	Putnam	Hydro (Run of River)	0.00	0.48	10/1/1987
Quinebaug	Quinebaug Associates LLC	Killingly	Hydro (Run of River)	0.04	1.10	9/1/1990
Rainbow Dam	Farmington River Power Co.	Windsor	Hydro (Run of River)	8.20	8.20	1/1/1980
Robertsville #1- #2	FirstLight Hydro Generating Co.	Colebrook	Hydro (Run of River)	0.00	0.00	1/1/1924
Rocky Glen/Sandy Hook Hydro	Rocky Glen Hydro LP	Newtown	Hydro (Run of River)	0.04	0.09	4/1/1989
Rocky River	FirstLight Hydro Generating Co.	New Milford	Hydro (Pump Storage)	29.35	29.00	1/1/1928
Scotland #1	FirstLight Hydro Generating Co.	Windham	Hydro (Run of River)	0.00	1.96	1/1/1937
Shepaug #1	FirstLight Hydro Generating Co.	Southbury	Hydro (Reservoir)	41.51	42.56	1/1/1955
South Meadow #5	CRRA	Hartford	Refuse	24.26	26.22	11/1/1987
South Meadow #6	CRRA	Hartford	Refuse	24.43	24.56	11/1/1987
South Meadow #11	CRRA	Hartford	Oil (Jet Fuel)	35.78	46.92	8/1/1970
South Meadow #12	CRRA	Hartford	Oil (Jet Fuel)	37.70	47.87	8/1/1970
South Meadow #13	CRRA	Hartford	Oil (Jet Fuel)	38.32	47.92	8/1/1970
South Meadow #14	CRRA	Hartford	Oil (Jet Fuel)	36.75	46.35	8/1/1970
Stevenson #1- #4	FirstLight Hydro Generating Co.	Monroe	Hydro (Reservoir)	28.31	28.90	1/1/1919
Taftville #1- #5	FirstLight Hydro Generating Co.	Norwich	Hydro (Run of River)	0.00	0.78	1/1/1906
Torrington Terminal #10	NRG	Torrington	Oil (Jet Fuel)	15.64	20.75	8/1/1967
Toutant	Toutant Hydro Power, Inc.	Putnam	Hydro (Run of River)	0.40	0.40	2/1/1994
Tunnel #1- #2	FirstLight Hydro Generating Co.	Preston	Hydro (Run of River)	0.00	1.41	1/1/1919
Tunnel #10	FirstLight Hydro Generating Co.	Preston	Oil (Jet Fuel)	17.00	22.10	1/1/1969
Wallingford Refuse	CRRA	Wallingford	Refuse/Oil	4.40	7.29	3/1/1989
Waterbury Generation	Waterbury Generation	Waterbury	Oil/Gas	97.52	99.92	unknown
Waterside Power	Waterside Power	Stamford	Oil	71.70	73.24	10/1/2006
Willimantic #1	Willimantic Power Corp.	Willimantic	Hydro (Run of River)	0.00	0.36	6/1/1990
Willimantic #2	Willimantic Power Corp.	Willimantic	Hydro (Run of River)	0.00	0.30	6/1/1990
Wyre Wynd	Summit Hydro Power	Griswold	Hydro (Run of River)	0.02	1.72	4/1/1997

Appendix A
Existing Electric Generation Facilities
as of December 2010

	Seasonal Claimed Capability of coal fired plants			566.08	567.04	
	Seasonal Claimed Capability of natural gas fired plants			1383.87	1629.77	
	Seasonal Claimed Capability of oil fired plants			2805.98	2969.04	
	Seasonal Claimed Capability of hydroelectric plants			117.92	141.33	
	Seasonal Claimed Capability of methane fired plants			1.74	1.74	
	Seasonal Claimed Capability of nuclear plants			2100.82	2114.31	
	Seasonal Claimed Capability of refuse-fueled plants (inc. wood and tires)			180.18	182.48	
	Total Seasonal Claimed Capability available for dispatch to the grid.			7345.12	7803.48	
	(Lake Road is excluded from the total.)					
Facility (self generation)	**Owner**	**Town**	**Fuel**	**Summer Rating**	**Winter Rating**	**In-Service Date**
Connecticut Valley Hospital	State of Connecticut	Middletown	Oil	2.05	2.05	5/9/1999
Fairfield Hills Hospital	Fairfield Hills Hospital	Newtown	Oil	3.95	3.95	5/9/1999
Federal Paper Board	Federal Paper Board	Sprague	Oil	9.00	9.00	5/9/1999
Groton Sub Base	U.S. Navy	Groton	Oil/Gas	18.50	18.50	1/1/1966
Loctite	Loctite	Rocky Hill	Gas	1.18	1.18	4/1/1994
Norwalk Hospital	Norwalk Hospital	Norwalk	Gas	2.36	2.36	1/1/1992
Norwich State Hospital	Norwich State Hospital	Norwich	Oil	2.00	2.00	5/9/1999
Pfizer #1	Pfizer	Groton	Oil	32.50	32.50	1/1/1948
Pratt & Whitney	UTC	E. Hartford	Gas	23.80	23.80	4/1/1992
Pratt & Whitney	UTC	Middletown	Oil	1.00	1.00	5/9/1999
Smurfit-Stone Container Co.	Smurfit-Stone Container Co.	Montville	Refuse	2.00	2.00	9/1/1989
Southbury Training School	State of Connecticut	Southbury	Oil	1.50	1.50	5/9/1999
University of Conn. COGEN	State of Connecticut	Mansfield	Gas/Oil	24.90	24.90	8/1/2005
	Total Natural Gas Fired Generation less than 1 MW each			4.42	4.42	
	Total Propane Fired Generation less than 1 MW each			0.03	0.03	
	Total Hydroelectric Generation less than 1 MW each			3.33	3.33	
	Total Methane Fueled Generation less than 1 MW each			0.13	0.13	
	Total Solar (photovoltaic) Generation less than 1 MW each			0.15	0.15	
	Total Wind Powered Generation less than 1 MW each			0.04	0.04	
	Total Oil Fired Generation less than 1 MW each			0.01	0.01	
	Generation retained by facility			132.85	132.85	
	Total MWs of generation in Connecticut			7477.97	7936.33	

Appendix A
Existing Generation
(listed by fuel type)

Facility	Owner	Town	Fuel	Summer Rating	Winter Rating	In-Service Date
AES Thames	AES Thames, Inc.	Montville	Coal	182.65	182.06	12/1/1989
Bridgeport Harbor #3	PSEG Power, LLC	Bridgeport	Coal/Oil	383.43	384.98	8/1/1968
Aetna Capitol District	Capitol District Energy Ctr.	Hartford	Gas	55.25	61.33	11/1/1988
Bridgeport Energy	Bridgeport Energy LLC	Bridgeport	Gas	460.95	540.19	8/1/1998
Devon #11	NRG	Milford	Gas/Oil	29.30	38.82	10/1/1996
Devon #12	NRG	Milford	Gas/Oil	29.23	38.44	10/1/1996
Devon #13	NRG	Milford	Gas/Oil	29.23	38.97	10/1/1996
Devon #14	NRG	Milford	Gas/Oil	29.97	40.27	10/1/1996
Dexter	Alstom	Windsor Locks	Gas	20.64	39.33	5/1/1990
Kimb Rocky River	Kimberly Clark Corporation	New Milford	Gas	14.00	21.50	unknown
PPL Wallingford Unit #1	PPL EnergyPlus, LLC	Wallingford	Gas	42.30	48.41	8/1/2001
PPL Wallingford Unit #2	PPL EnergyPlus, LLC	Wallingford	Gas	41.37	49.00	8/1/2001
PPL Wallingford Unit #3	PPL EnergyPlus, LLC	Wallingford	Gas	42.30	47.84	8/1/2001
PPL Wallingford Unit #4	PPL EnergyPlus, LLC	Wallingford	Gas	41.91	47.19	8/1/2001
PPL Wallingford Unit #5	PPL EnergyPlus, LLC	Wallingford	Gas	40.72	49.00	8/1/2001
Lake Road #1	Lake Road Generating Co., L.P.	Killingly	Gas/Oil	232.75	268.37	7/1/2001
Lake Road #2	Lake Road Generating Co., L.P.	Killingly	Gas/Oil	251.33	286.95	11/1/2001
Lake Road #3	Lake Road Generating Co., L.P.	Killingly	Gas/Oil	254.90	283.67	5/1/2002
Milford Power #1	Milford Power Company, LLC	Milford	Gas/Oil	253.61	281.85	2/12/2004
Milford Power #2	Milford Power Company, LLC	Milford	Gas/Oil	253.09	287.63	6/1/2004
Bantam #1	FirstLight Hydro Generating Co.	Litchfield	Hydro (Run of River)	0.00	0.14	1/1/1905
Bulls Bridge #1- #6	FirstLight Hydro Generating Co.	New Milford	Hydro (Pondage)	0.00	6.61	1/1/1903
Colebrook	MDC	Colebrook	Hydro (Pondage)	0.00	1.03	3/1/1988
Dayville Pond	Summit Hydro Power	Killingly	Hydro (Run of River)	0.00	0.06	3/1/1995
Derby Dam	McCallum Enterprises	Shelton	Hydro (Run of River)	7.05	7.05	3/1/1989
Falls Village #1- #3	FirstLight Hydro Generating Co.	Canaan	Hydro (Pondage)	0.00	5.59	1/1/1914
Glen Falls	Summit Hydro Power	Plainfield	Hydro (Run of River)	0.00	0.00	3/1/1998
Goodwin Dam	MDC	Hartland	Hydro (Run of River)	3.00	3.00	2/1/1986
Kinneytown A	Kinneytown Hydro Co.	Ansonia	Hydro (Run of River)	0.00	0.00	3/1/1988
Kinneytown B	Kinneytown Hydro Co.	Seymour	Hydro (Run of River)	0.00	0.44	11/1/1986
Mechanicsville	Saywatt Hydro Associates	Thompson	Hydro (Run of River)	0.00	0.15	9/1/1995
Norwich 2nd St./Greenville Dam	CMEEC	Norwich	Hydro	0.00	0.00	10/1/1998
Norwich 10th St.	CMEEC	Norwich	Hydro	0.00	0.00	1/1/1966
Putnam	Putnam Hydropower, Inc.	Putnam	Hydro (Run of River)	0.00	0.48	10/1/1987
Quinebaug	Quinebaug Associates LLC	Killingly	Hydro (Run of River)	0.04	1.10	9/1/1990

Appendix A
Existing Generation
(listed by fuel type)

Facility	Owner	Town	Fuel	Summer Rating	Winter Rating	In-Service Date
Rainbow Dam	Farmington River Power Co.	Windsor	Hydro (Run of River)	8.20	8.20	1/1/1980
Robertsville #1- #2	FirstLight Hydro Generating Co.	Colebrook	Hydro (Run of River)	0.00	0.00	1/1/1924
Rocky Glen/Sandy Hook Hydro	Rocky Glen Hydro LP	Newtown	Hydro (Run of River)	0.04	0.09	4/1/1989
Rocky River	FirstLight Hydro Generating Co.	New Milford	Hydro (Pump Storage)	29.35	29.00	1/1/1928
Scotland #1	FirstLight Hydro Generating Co.	Windham	Hydro (Run of River)	0.00	1.96	1/1/1937
Shepaug #1	FirstLight Hydro Generating Co.	Southbury	Hydro (Reservoir)	41.51	42.56	1/1/1955
Stevenson #1- #4	FirstLight Hydro Generating Co.	Monroe	Hydro (Reservoir)	28.31	28.90	1/1/1919
Taftville #1- #5	FirstLight Hydro Generating Co.	Norwich	Hydro (Run of River)	0.00	0.78	1/1/1906
Toutant	Toutant Hydro Power, Inc.	Putnam	Hydro	0.40	0.40	2/1/1994
Tunnel #1- #2	FirstLight Hydro Generating Co.	Preston	Hydro	0.00	1.41	1/1/1919
Willimantic #1	Willimantic Power Corp.	Willimantic	Hydro	0.00	0.36	6/1/1990
Willimantic #2	Willimantic Power Corp.	Willimantic	Hydro	0.00	0.30	6/1/1990
Wyre Wynd	Summit Hydro Power	Griswold	Hydro	0.02	1.72	4/1/1997
Hartford Landfill	CRRA	Hartford	Landfill Gas (Methane)	1.74	1.76	8/1/1998
East Windsor NORCAP LFG	East Windsor NORCAP	East Windsor	Landfill Gas (Methane)	0.98	1.00	
Millstone #2	Dominion Nuclear CT, Inc.	Waterford	Nuclear	875.82	879.31	12/1/1975
Millstone #3	Dominion Nuclear CT, Inc.	Waterford	Nuclear	1225.00	1235.00	4/1/1986
Branford #10	NRG	Branford	Oil (Jet Fuel)	15.84	20.95	1/1/1969
Bridgeport Harbor #2	PSEG Power, LLC	Bridgeport	Oil	130.50	136.82	8/1/1961
Bridgeport Harbor #4	PSEG Power, LLC	Bridgeport	Oil (Jet Fuel)	17.11	20.44	10/1/1967
Cos Cob #10	NRG	Greenwich	Oil (Jet Fuel)	19.03	23.00	9/1/1969
Cos Cob #11	NRG	Greenwich	Oil (Jet Fuel)	18.72	23.00	1/1/1969
Cos Cob #12	NRG	Greenwich	Oil (Jet Fuel)	19.08	23.00	1/1/1969
Cos Cob #13	NRG	Greenwich	Oil (Jet Fuel)	19.20	24.20	unknown
Cos Cob #14	NRG	Greenwich	Oil (Jet Fuel)	19.61	23.48	unknown
Cytec #1	CMEEC	Wallingford	Oil (Diesel)	1.93	1.92	5/15/2008
Cytec #2	CMEEC	Wallingford	Oil (Diesel)	1.94	1.91	5/15/2008
Cytec #3	CMEEC	Wallingford	Oil (Diesel)	1.94	1.93	5/15/2008
Devon #10 (reactivated)	NRG	Milford	Oil (Jet Fuel)	14.41	19.19	4/1/1988
Devon #15	NRG	Milford	Oil (Jet Fuel)	46.85	49.15	
Devon #16	NRG	Milford	Oil (Jet Fuel)	46.90	49.20	
Devon #17	NRG	Milford	Oil (Jet Fuel)	46.90	49.20	
Devon #18	NRG	Milford	Oil (Jet Fuel)	46.90	49.20	
Franklin Drive #10	NRG	Torrington	Oil (Jet Fuel)	15.42	20.53	1/1/1968
John Street #1	CMEEC	Wallingford	Oil (Diesel)	1.95	2.00	unknown

Appendix A
Existing Generation
(listed by fuel type)

Facility	Owner	Town	Fuel	Summer Rating	Winter Rating	In-Service Date
John Street #3	CMEEC	Wallingford	Oil (Diesel)	2.00	2.00	9/26/2007
John Street #4	CMEEC	Wallingford	Oil (Diesel)	2.00	2.00	9/26/2007
John Street #5	CMEEC	Wallingford	Oil (Diesel)	2.01	2.00	11/1/2007
Middletown #4	NRG	Middletown	Oil	400.00	402.00	6/1/1973
Middletown #10	NRG	Middletown	Oil (Jet Fuel)	17.12	22.02	1/1/1966
Montville #6	NRG	Montville	Oil	407.40	409.91	7/1/1971
Montville #10 & #11	NRG	Montville	Oil (Diesel)	5.30	5.35	1/1/1967
Norden #1	CMEEC	East Norwalk	Oil	1.96	1.96	unknown
Norden #2	CMEEC	East Norwalk	Oil	1.95	1.95	unknown
Norden #3	CMEEC	East Norwalk	Oil	1.94	1.94	unknown
Norwalk Harbor #1	NRG	Norwalk	Oil	162.00	164.00	1/1/1960
Norwalk Harbor #2	NRG	Norwalk	Oil	168.00	172.00	1/1/1963
Norwalk Harbor #10 (3)	NRG	Norwalk	Oil (Diesel)	11.93	17.06	10/1/1996
Norwich Jet	CMEEC	Norwich	Oil	15.26	18.80	9/1/1972
Norwich Wastewater Treatment	CMEEC	Norwich	Oil (Diesel)	2.00	2.00	unknown
South Meadow #11	CRRA	Hartford	Oil (Jet Fuel)	35.78	46.92	8/1/1970
South Meadow #12	CRRA	Hartford	Oil (Jet Fuel)	37.70	47.87	8/1/1970
South Meadow #13	CRRA	Hartford	Oil (Jet Fuel)	38.32	47.92	8/1/1970
South Meadow #14	CRRA	Hartford	Oil (Jet Fuel)	36.75	46.35	8/1/1970
Torrington Terminal #10	NRG	Torrington	Oil (Jet Fuel)	15.64	20.75	8/1/1967
Tunnel #10	FirstLight Hydro Generating Co.	Preston	Oil (Jet Fuel)	17.00	22.10	1/1/1969
Waterside Power	Waterside Power	Stamford	Oil	71.70	73.24	10/1/2006
Middletown #2	NRG	Middletown	Oil/Gas	117.00	120.00	1/1/1958
Middletown #3	NRG	Middletown	Oil/Gas	236.00	245.00	1/1/1964
Montville #5	NRG	Montville	Oil/Gas	81.00	81.59	1/1/1954
New Haven Harbor #1	PSEG Power, LLC	New Haven	Oil/Gas	447.89	453.38	8/1/1975
Pierce	CMEEC	Wallingford	Oil/Gas	76.13	96.63	unknown
Waterbury Generation	Waterbury Generation	Waterbury	Oil/Gas	97.52	99.92	unknown
Bridgeport Resco	CRRA	Bridgeport	Refuse	58.52	58.74	4/1/1988
New Milford Landfill	Vermont Electric Power Co.	New Milford	Refuse	1.52	1.75	8/1/1991
South Meadow #5	CRRA	Hartford	Refuse	24.26	26.22	11/1/1987
South Meadow #6	CRRA	Hartford	Refuse	24.43	24.56	11/1/1987
Bristol RRF	Ogden Martin Systems-CT	Bristol	Refuse/Oil	12.86	13.05	5/1/1988
Wallingford RRF	CRRA	Wallingford	Refuse/Oil	4.40	7.29	3/1/1989
Exeter	Oxford Energy, Inc.	Sterling	Refuse (Tires)	24.01	20.28	12/1/1991

Appendix A
Existing Generation
(listed by fuel type)

Facility	Owner	Town	Fuel	Summer Rating	Winter Rating	In-Service Date
Lisbon Resource Recovery	Riley Energy Systems	Lisbon	Wood/Refuse	13.73	13.84	1/1/1996
Preston RRF	SCRRF	Preston	Wood/Refuse	16.45	16.75	1/1/1992
Pinchbeck	William Pinchbeck, Inc.	Guilford	Wood/Refuse	0.00	0.00	7/1/1987
	Seasonal Claimed Capability of coal fired plants			566.08	567.04	
	Seasonal Claimed Capability of natural gas fired plants			1383.87	1629.77	
	Seasonal Claimed Capability of oil fired plants			2993.53	3165.79	
	Seasonal Claimed Capability of hydroelectric plants			117.92	141.33	
	Seasonal Claimed Capability of methane fired plants			1.74	1.76	
	Seasonal Claimed Capability of nuclear plants			2100.82	2114.31	
	Seasonal Claimed Capability of refuse-fueled plants (inc. wood and tires)			180.18	182.48	
	Total Seasonal Claimed Capability available for dispatch to the grid.			7344.14	7802.48	
	(Lake Road is excluded from the total.)					
Facility (self generation)	**Owner**	**Town**	**Fuel**	**Summer Rating**	**Winter Rating**	**In-Service Date**
Loctite	Loctite	Rocky Hill	Gas	1.18	1.18	4/1/1994
Norwalk Hospital	Norwalk Hospital	Norwalk	Gas	2.36	2.36	1/1/1992
Pratt & Whitney	UTC	E. Hartford	Gas	23.80	23.80	4/1/1992
Connecticut Valley Hospital	State of Connecticut	Middletown	Oil	2.05	2.05	5/9/1999
Fairfield Hills Hospital	Fairfield Hills Hospital	Newtown	Oil	3.95	3.95	5/9/1999
Federal Paper Board	Federal Paper Board	Sprague	Oil	9.00	9.00	5/9/1999
Norwich State Hospital	Norwich State Hospital	Norwich	Oil	2.00	2.00	5/9/1999
Pfizer #1	Pfizer	Groton	Oil	32.50	32.50	1/1/1948
Pratt & Whitney	UTC	Middletown	Oil	1.00	1.00	5/9/1999
Southbury Training School	State of Connecticut	Southbury	Oil	1.50	1.50	5/9/1999
Groton Sub Base	U.S. Navy	Groton	Oil/Gas	18.50	18.50	1/1/1966
Smurfit-Stone Container Co.	Smurfit-Stone Container Co.	Montville	Refuse	2.00	2.00	9/1/1989
University of Conn. COGEN	State of Connecticut	Mansfield	Gas/Oil	24.90	24.90	8/1/2005
	Total Natural Gas Fired Generation less than 1 MW each			4.42	4.42	
	Total Propane Fired Generation less than 1 MW each			0.03	0.03	
	Total Hydroelectric Generation less than 1 MW each			3.33	3.33	
	Total Methane Fueled Generation less than 1 MW each			0.13	0.13	
	Total Solar (photovoltaic) Generation less than 1 MW each			0.15	0.15	
	Total Wind Powered Generation less than 1 MW each			0.04	0.04	
	Total Oil Powered Generation less than 1 MW each			0.01	0.01	
	Generation retained by facility			132.85	132.85	
	Total MWs of generation in Connecticut.			7476.99	7935.33	

Appendix B
Planned Transmission Lines in Connecticut

Planned/Proposed Transmission Lines in Connecticut	Utility	Length (miles)	Voltage (kV)	Estimated In Service Date
Rebuild 318 and 324 Lines from PoquonnockRiver Substaton in Groton to Groton Long Point Substation	CMEEC			2009
Rebuild underground 308 Line from Poquonnock Substation in Groton to Eastern Point Road Substation in Groton	CMEEC			2009
Manchester S/S, Manchester - Millstone S/S, Waterford (circuit separation)	CL&P	1.8	345	2010
Manchester S/S, Manchester - Card S/S, Lebanon (circuit separation)	CL&P	1.8	345	2010
Manchester S/S, Manchester - Hopewell S/S, Glastonbury (circuit reconstruction)	CL&P	1.8	115	2010
Manchester S/S, Manchester - Millstone S/S, Waterford (new)	CL&P	1.0	345	2010
Manchester S/S, Manchester - Card S/S, Lebanon (new)	CL&P	1.0	345	2010
Manchester S/S, Manchester - Meekville Jct., Manchester (circuit separation)	CL&P	2.0	345	2013
Manchester S/S, Manchester - Meekville Jct., Manchester (circuit separation)	CL&P	2.0	115	2013
Card S/S, Lebanon - Lake Road S/S, Killingly (2)	CL&P	29.3	345	2013
Lake Road S/S, Killingly - CT/RI Border, Thompson (2)	CL&P	7.6	345	2013
North Bloomfield S/S, Bloomfield - CT/MA Border, Suffield (1)	CL&P	11.5	345	2013
North Bloomfield S/S, Bloomfield - CT/MA Border, Suffield (1)	CL&P	11.9	115	2013
North Bloomfield S/S, Bloomfield - CT/MA Border, Suffield (1)	CL&P	11.9	115	2013
North Bloomfield S/S, Bloomfield - CT/MA Border, Granby (1)	CL&P	8.7	115	2013
Frost Bridge S/S, Watertown - North Bloomfield, Bloomfield (3)	CL&P	35.4	345	2013
Naugatuck Valley 115 dV Reliability Improvement Project (Shelton and Derby)	UI		115	2014
Pequonnock 115 kV Fault Duty Mitigation Project (Bridgeport)	UI		115	2015
Manchester S/S, Manchester - Scovill Rock S/S, Middletown (rebuild portion of line)	CL&P	0.9	345	TBD
Manchester S/S, Manchester - East Hartford S/S, East Hartford (new)	CL&P	3.2	115	TBD
(1) Related to Greater Springfield Reliability NEEWS Project				
(2) Related to Insterstate Reliability NEEWS project				
(3) Related to Central Connecticut Reliability NEEWS project				

Appendix C
Planned Substations

Appendix C: Planned Substation Projects	Est. In-Service Date	Company
Modify the existing 115 kV Cos Cob Substation in Greenwich	2011	CL&P
Modify the existing 115 kV Flax Hill Substation in Norwalk	2009	CL&P
Install the new 115 kV Waterford Substation in Waterford	2010	CL&P
Modify the existing 115 kV Mystic Substation in Stonington	2010	CL&P
Install the new 115 kV Stepstone Substation in Guilford	2009	CL&P
Modify the existing 115 kV North Bloomfield Substation in Bloomfield	2015	CL&P
Install the new 115 kV Rood Avenue Substation in Windsor	2009	CL&P
Modify the existing 115 kV North Wallingford Substation in Wallingford	2009	CMEEC
Modify the existing Stockhouse Road Substation in Bozrah	2009	CMEEC
Modify the existing Buddington Substation in Groton		CMEEC
Modify the existing 115 kV Waterside Substation in Stamford	2010	CL&P
Install the new 345 kV Kleen Energy Substation in Middletown	2011	CL&P
Expand the existing Broadway 115 kV Substation in New Haven	2010	UI
Modify the existing Union Avenue-Metro North 115 kV Substation in New Haven	2011	UI
Install the new 115 kV Sherwood Substation in Westport	2011	CL&P
Modify the existing Grand Avenue 115 kV Switching Station in New Haven	2012	UI
Modify the existing 115 kV South End Substation in Stamford	2012	CL&P
Modify the existing 345 kV Frost Bridge Substation in Watertown (2)	2013	CL&P
Modify the existing 345 kV Montville Substation in Montville (1)	2013	CL&P
Modify the existing 345 kV Card Substation in Lebanon (1)	2013	CL&P
Modify the existing 345 kV Lake Road Substation in Killingly (1)	2013	CL&P
Modify the existing 345 kV North Bloomfield Substation in Bloomfield (1) & (2)	2013	CL&P
Install a new 115 kV Substation in Shelton	2016	UI
Install a new 115 kV Substation in North Branford	2016	UI
Install a new 115 kV Substation in New Haven	2019	UI
Modify the existing 115 kV Pequonnock Substation in Bridgeport	2013	UI
Rebuild existing 115/13.8 kV Baird Substation in Stratford	2013	UI
Rebuild existing 115/13.8 kV Sackett Substation in North Haven	2014	UI
(1) Related to Interstate Reliability NEEWS project (2) Related to Central Connecticut Reliability NEEWS project		