Docket F-2009
Draft Report
July 13, 2009

INTRODUCTION

Connecticut's electric system is the lifeblood for approximately 1.3 million households, 78 thousand businesses, and, more generally, every aspect of personal or economic life in the state. The system's infrastructure includes 100 generators whose output is dispatched onto the regional supply grid, 1,818 circuit-miles of high-voltage conductors that form the transmission portion of the grid, and 130 substations or switching stations 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 overview 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 energy experts within the Office of Planning 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 utility 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). The Connecticut Municipal Electric Energy Cooperative (CMEEC) also provides its forecast report to the Council. CMEEC is comprised of the municipal electric distribution companies in Connecticut and also has some electric generation capacity.

The data in these forecast reports are typically developed for the companies' internal 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 new kind of 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. The most familiar unit of load 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.

Loads increase with any increase in the number of electrical devices being used at the same time. 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 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. 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, 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 now used for planning regional generation and transmission 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, the peak load is the highest load experienced during the year. It generally occurs on a summer day in Connecticut. This is because air conditioning generally creates one of the largest components of demand for power. While loads can be significant during the winter, many Connecticut residents and businesses heat with oil or natural gas. Thus, the electric loads resulting from operating their heating systems are typically less than that of air conditioning.

Furthermore, many fossil-fueled power plants have a lower power output during the summer. See Summer and Winter Ratings in Appendix A. Thus, from a supply and demand perspective, the highest load combined with (typically lower) summer power outputs for many generators results in the worst-case scenario for the electric system. Thus, the analysis contained in this report will focus on such a scenario.

Developing such load forecasts is a complex process which includes considerations of weather, customer usage patterns, demographics, conservation efforts, and economic conditions. Weather is generally the dominant factor since higher temperatures and humidity result in greater air conditioning use.

However, perhaps more now than in recent years, the economy is also a key consideration in such analysis. Since 2008, the country has been experiencing its worst economic decline in decades, fueled by a near collapse in the financial markets. At the time of this writing, according to the United States Bureau of Labor Statistics, official unemployment in the U.S. has reached 9.5 percent. (The actual numbers are likely considerably higher since discouraged workers, part-time workers seeking full-time work, etc., are excluded.)

Accordingly, families and businesses are cutting costs in this economic climate. The result is lower overall electric usage. However, during the hottest days of the year, many will still use their air conditioning and simply reduce consumption on other cooler days to compensate.

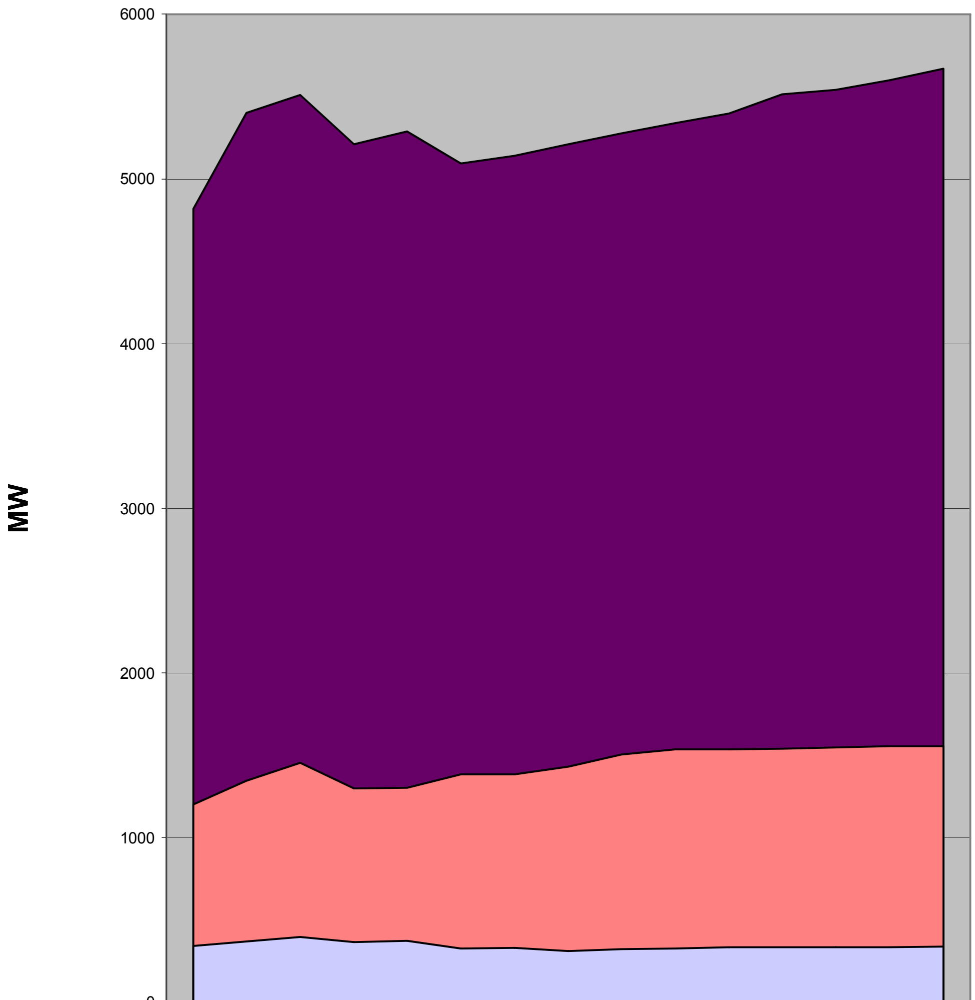
While the Federal Reserve predicts the economy may begin to improve in 2010, a full recovery will certainly take time, perhaps several years. Given that prudent utility planning is often performed years in advance, the utilities must consider the impact of a possible economic recovery to ensure that they are prepared for the growth in loads that would accompany such recovery. Specifically, in its 2009 forecast report, CL&P notes:

> "Connecticut needs the electric system infrastructure necessary to hit the ground running once the economy begins to turn itself around. A lack of investment or delay in investment in the state's transmission system can hamper operation of a reliable electric system needed to support the state's economy."

Taking into account the economy, demographics, and other factors noted above, the Connecticut transmission/distribution companies provide forecasts assuming "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.

In its normal weather (50/50) forecast, CL&P predicts a peak load of 5,094 MW for its service area during 2009. This load is expected to grow during the forecast period at an annual compound growth rate (ACGR) of 1.20 percent, reaching 5,669 MW in 2018. UI predicts, in its normal weather (50/50) forecast, a peak load of 1,383 MW for its service area during 2009. This load is expected to grow during the forecast period at an ACGR of 1.32 percent, reaching 1,556 MW in 2018. CMEEC predicts, in its normal weather (50/50) forecast, a peak load of 328 MW for its service area during 2009. This load is expected to grow during the forecast period at an ACGR of 0.30 percent, reaching 337 MW in 2018. All three of the state utilities' 50/50 summer peak loads are depicted in Figure 1a.

Figure 1a: Utility Peak Loads in MW



	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
CL&P Peak	4818	5402	5512	5209	5289	5094	5139	5210	5278	5337	5397	5514	5541	5598	5669
UI Peak	1201	1346	1456	1298	1301	1383	1386	1431	1506	1535	1538	1541	1548	1555	1556
CMEEC Peak	345	372	398	367	374	328	330	312	323	328	336	335	335	336	337

Megawatts

[Graph does not add up to peak loads for each utility. For example, in 2018, the sum of CL&P, UI and CMEEC should 7,562 MW. The graph shows roughly 5,700 MW.]

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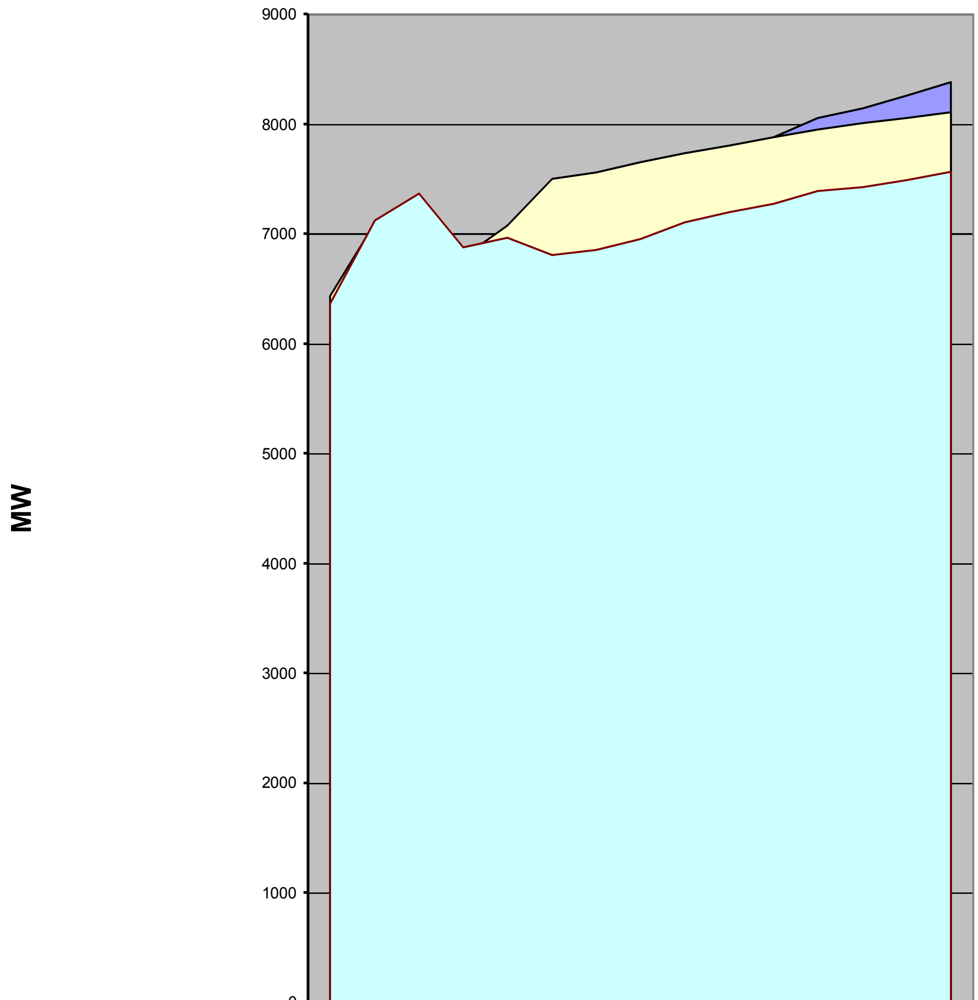
The sum of the three utilities' forecasts results in a predicted statewide peak load of 6,805 MW during 2009. This load is expected to grow at an ACGR of 1.18 percent and reach 7562 MW by year 2018. The statewide ACGR is a weighed average of three utilities' ACGRs. Since CL&P has the largest service area in Connecticut, and its customers are the dominant source of load in the state, it is not surprising that the statewide ACGR of 1.18 percent is comparable to CL&P's ACGR of 1.20 percent. (See Figure 1b.)

The CL&P and UI forecasts take into account load reductions due to conservation and load management (C&LM), load response (LR), and distributed generation (DG). The CMEEC forecast, as filed, does not reflect these reductions. Thus, for an "apples to apples" comparison, the CMEEC forecast loads have been reduced accordingly in Figure 1a to take into account these load reductions. CMEEC's total projected load reductions range from 43 MW in 2009 to 76 MW in 2018.

Since the three utilities' service areas cover the entire state of Connecticut, the sum of the three load reduction-adjusted peaks may be taken to approximate the Connecticut load. However, the Council cautions that temperatures and customer usage patterns vary across the state, the three utilities do not necessarily experience their peaks at 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.

Next, the regional grid operator, ISO-NE, predicts in its 50/50 forecast for Connecticut, a peak load of 7,500 MW during 2009. This peak load is expected to grow at an ACGR of 0.87 percent and reach 8,105 MW by year 2018. Note that the ISO-NE 50/50 forecast exceeds the sum of the utilities' forecasts each year by an average of 619 MW. This is because C&LM, LR, and DG load reductions are not included in the ISO-NE forecast. Generally, ISO-NE considers these load reductions to be capacity resources (i.e. sources similar to generation) while the Connecticut utilities consider them to be reductions in load. The average annual sum of C&LM, LR, and DG reductions are 566 MW for the forecast period. Thus, the forecasts differ by approximately the sum of the C&LM, LR, and DG effects. The remaining discrepancy (~53 MW on average) is likely attributable to differences in forecast methodology between ISO-NE and the state utilities. See ISO-NE and the state utilities' forecasts in Figure 1b. Such discrepancy is less than one percent of peak load, which is not a significant difference.

Figure 1b: 50/50 Forecasts in MW



	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
CT Utilities' Peak w/o C&LM & DG						7078	7192	7383	7594	7749	7878	8055	8143	8259	8381
ISO-NE 50/50 CT Forecast Peak	6435	7097	7261	6788	7073	7500	7560	7650	7735	7805	7880	7950	8005	8055	8105
CT Utilities' Peak w/C&LM & DG	6364	7120	7366	6874	6964	6805	6855	6953	7107	7200	7271	7390	7424	7489	7562

Megawatts

[Reformat into a line chart so “CT Utilities Peak w/o C&LM & DG'” prior to 2014 can be seen.]

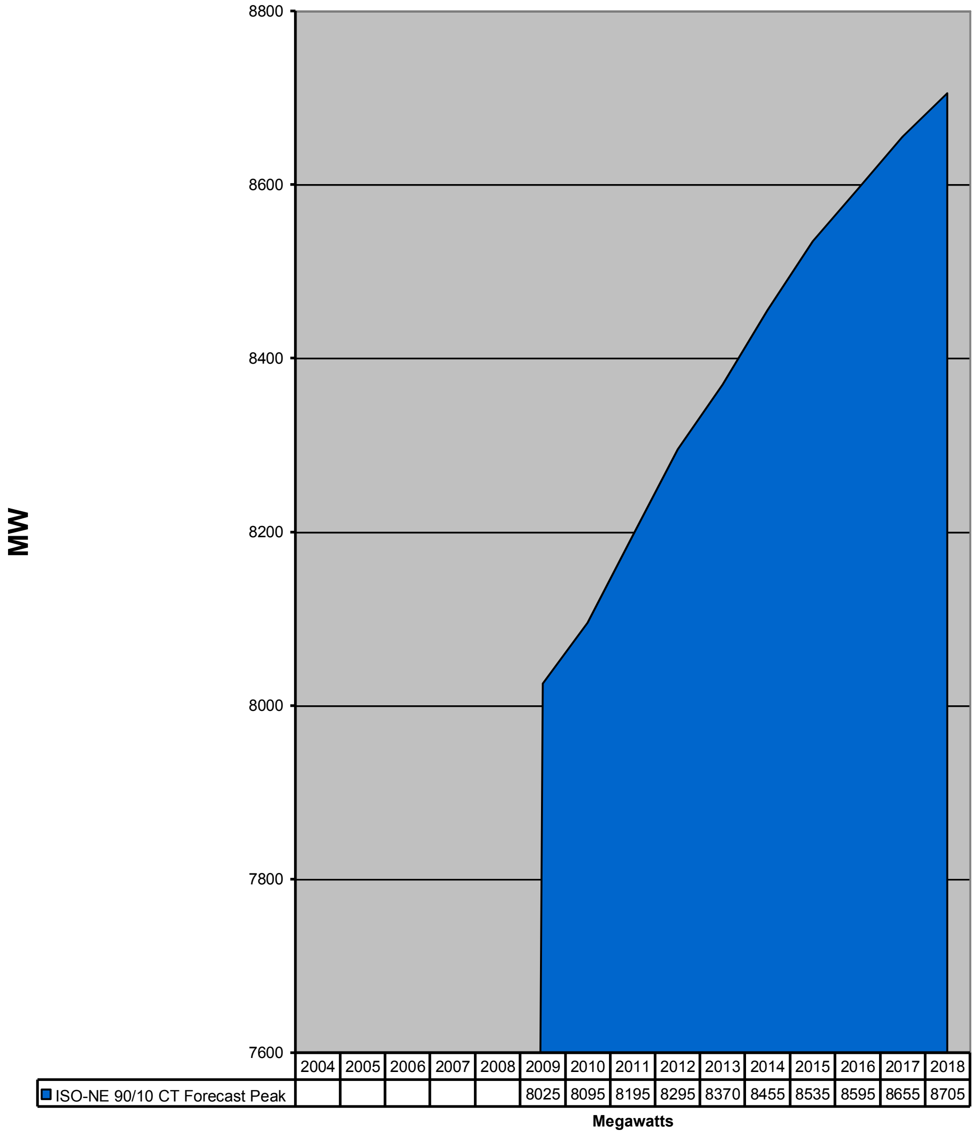
The more important forecast to be discussed in this review, is the one produced by ISO-NE. Called the “90/10” forecast, it is separate from the normal weather (50/50) forecasts offered by the Connecticut utilities. However, it is the one used by both ISO-NE and by the Connecticut utilities for utility 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 extremely 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 8,025 MW in 2009. This load is expected to grow at an ACGR of 0.91 percent and reach 8,705 by 2018. See Figure 1c.

Figure 1c: Extreme Weather and 90/10 Forecasts in MW



	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
ISO-NE 90/10 CT Forecast Peak						8025	8095	8195	8295	8370	8455	8535	8595	8655	8705

Forecasting Electric Energy Consumption

Another term for describing electric demand is "energy consumption." Electric energy consumption is (average) load multiplied by time. Accordingly, energy consumption is represented in Watt-hours. On a household scale, a unit of kilowatt-hours is used (kWh, or one thousand watt-hours). On a statewide scale, the units used are megawatt-hours (MWh or one million watt-hours), or gigawatt-hours (GWh, or one billion watt-hours).

While 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 100-Watt light bulb consumes electricity at a rate of 100 Watts. If the bulb were on for ten hours, the total energy consumed would be 1,000 Watt-hours or 1 kWh. A larger load, for example, a 1,500 Watt electric heater, would only have to run for 40 minutes (2/3 of an hour) to consume 1 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 predicts that the total electric energy consumption in its service area will be 24,150 GWh during 2009. This number is expected to <u>decline</u> at an ACGR of 0.38 percent and reach 23,338 GWh by 2018.

UI predicts that the total electric energy consumption in its service area will be 5,883 GWh during 2009. This number is expected to grow at a modest ACGR of 0.16 percent and reach 5,968 GWh by 2018.

CMEEC predicts that the total electric energy consumption in its service area will be 1,947 GWh during 2009. This number is expected to grow at an ACGR of 0.78 percent and reach 2,088 GWh by 2018.

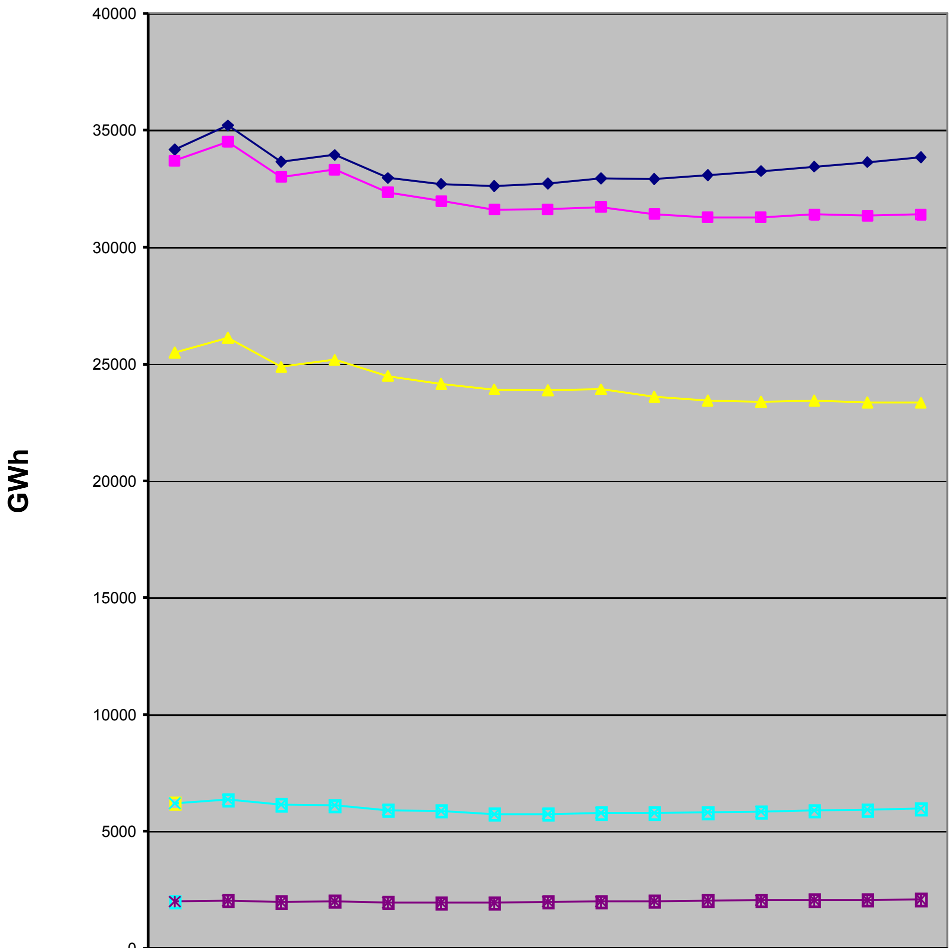
Taken together, these data result in a statewide electric energy consumption of approximately 31,980 GWh in 2009. This number is expected to <u>decline</u> at a (weighted) ACGR of 0.21 percent and reach 33,394 GWh by 2017.

On the surface, this decline in energy consumption may seem counterintuitive and even inconsistent, given the 1.18 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 concerns about the economy, electric rates, and also due to various efficiency efforts encouraged by the utilities and the state. So while the peak loads may increase, the net energy usage, on a statewide basis, is projected to decline during the forecast period. This is due to conservation.

As is the case with electric load, ISO-NE also provides electric energy consumption data for Connecticut. 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 effects. DR is not expected to significantly affect the energy consumption since demand response only operates for a limited number of peak hours per year.

Specifically, ISO-NE predicts electric energy consumption in Connecticut to be 32,710 GWh in 2008. This number is expected to grow at a ACGR of 0.38 percent and reach 33,850 GWh. Figure 2 depicts the energy requirement forecasts.

Figure 2: State and Utility Energy Requirements in GWh



	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
ISO-NE	34171	35202	33656	33948	32958	32710	32620	32730	32955	32910	33080	33260	33450	33645	33850
CT Utilities	33706	34519	33005	33314	32355	31980	31607	31622	31712	31414	31279	31275	31399	31345	31394
CL&P	25496	26119	24871	25185	24485	24150	23910	23883	23917	23605	23429	23383	23441	23350	23338
UI	6205	6360	6149	6119	5912	5883	5742	5748	5794	5785	5809	5840	5894	5919	5968
CMEEC	2005	2040	1985	2010	1958	1947	1955	1991	2001	2024	2041	2052	2064	2076	2088

Gigawatt-Hours (GWh)

CONSERVATION AND LOAD MANAGEMENT (C&LM)

"Energy conservation"—"doing without"—has largely been replaced in the common parlance by "energy efficiency"—"doing more with less." Energy efficiency has the advantage of being extraordinarily flexible: it can switch-hit. It can function either as a negative for demand, or as a positive for supply. Forecasters can and do account for energy efficiency differently, making it hard to evaluate the results of efficiency on a consistent basis. At the same time, everyone involved in making energy projections for the future agrees that energy efficiency is either the key player on the team or the only game in town. As the section below and others in this review will show, consistent with history, energy-efficiency efforts significantly affect the growth of the Connecticut electric system, and will continue to do so.

The Connecticut Energy Conservation Management Board 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, 2009, the ECMB notes that the 2008 CEEF programs (for CL&P and UI) resulted in annual energy savings of 368 million kWh or 368 GWh and lifetime energy savings of 4,290 million kWh or 4,290 GWh.

Assuming an average electric price of 17.46 cents per kWh per the United States Department of Energy - Energy Information Association data, this is equal to a savings of $64.3 million annually and a lifetime savings of $749 million for businesses and residences throughout Connecticut.

The conservation piece of C&LM is generally sponsored by the utility itself. Such conservation measures are obtained through retrofitting existing equipment with higher efficiency equipment. This can include the replacement of incandescent light bulbs with new compact fluorescent bulbs, the replacement of existing air conditioning units with high efficiency units, etc.

The load management / load response piece of C&LM is typically sponsored by ISO-NE. This can include emergency generation, cycling off certain commercial and industrial loads, as well as air conditioning units during periods of high peak demand.

Combining these two types of load reduction, CL&P reports a projected load reduction of 192 MW in 2009 due to conservation and load management. This number is expected to grow to 600 MW by 2018. UI reports a projected load reduction of 5.1 MW in 2009. This number is expected to grow to 92.1 MW by 2018. CMEEC reports a projected load reduction of 53 MW in 2009. This number is expected to decline to 26 MW by 2018 due to a reduction in load management / load response. However, this decline will be more than offset by nearly 50 MW of new distributed generation in the CMEEC service area expected in the near future.

Collectively, the statewide peak load reduction due to C&LM is projected to be 250 MW in 2009. This cumulative load reduction is projected to increase annually with an ACGR of 12.4 percent and reach 718 MW by 2018, the end of the forecast period. The magnitude of this reduction in load is on the order of the output of the (739 MW summer output) Lake Road Generating facility in Killingly.

The last type of load reduction is not considered part of C&LM. This is the load reduction associated with distributed generation or DG. Distributed generation units are small generators typically under 65 MW. 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.

This grant program was continued until October 14, 2008 when such program was suspended. Accordingly, the utilities have made projections based on the number and size of the projects approved and their estimates of the probability that such projects would be completed.

CL&P's distributed generation is projected to reach 20 MW in 2009 and grow to 32 MW by 2018. UI expects that 2.5 MW of distributed generation will be added in 2009 and 19.2 MW will be added by 2018 (see UI's Response to CEAB Interrogatory 8). CMEEC's distributed generation is expected to grow from 0 MW in 2009 to 50 MW in 2018. Thus, the total statewide DG output is expected to grow from 22.5 MW in 2009 to 101 MW in 2018. This results in an ACGR of 18.2 percent. Accordingly, Figure 3 depicts total load reductions by utility and type of reduction, i.e. conservation, load management / load response, and distributed generation.

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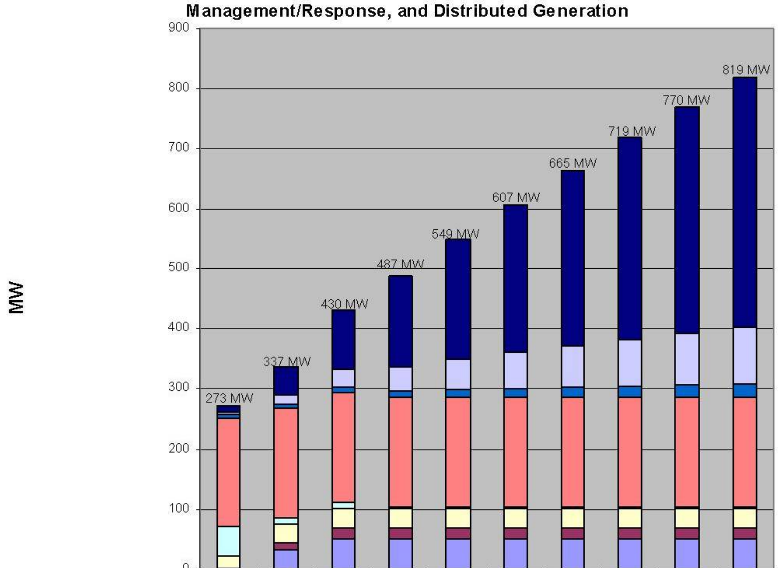
Figure 3: Load Reductions Due to Conservation, Load Management/Response, and Distributed Generation



	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
CL&P Conservation	10	46	98	150	199	246	292	336	378	418
UI Conservation	5.1	16.6	29	40.1	50.5	60.1	69.4	77.6	84.7	92.1
CMEEC Conservation	5	7	9	11	13	15	17	19	21	23
CL&P Load Management	182	182	182	182	182	182	182	182	182	182
UI Load Management	0	0	0	0	0	0	0	0	0	0
CMEEC Load Management	48	11	11	3	3	3	3	3	3	3
CL&P DG	20	29	32	32	32	32	32	32	32	32
UI DG	2.5	13.2	19.2	19.2	19.2	19.2	19.2	19.2	19.2	19.2
CMEEC DG	0	32	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

The Balance Table (Table 2) indicates a shortage of electric generation supply early in the forecast period (2009 through 2010). However, the assumptions are quite conservative with respect to unavailable generation and the reserve requirement taking into account the loss of the largest resource: Millstone 3. Thus, given that magnitude of the deficit is less than 300 MW (i.e. ~4 percent of the peak load), and assuming most generation is available for dispatch, it is likely that supplies will meet demand, taking into account the most conservative forecast (ISO-NE's 90/10 estimate).

According to the 2009 Integrated Resources Plan, approximately 1,267 MW of oil-fired generation could retire beginning in 2013 per more strict environmental standards. This results in a shortage in the Balance Table during 2013 and 2014. Likewise, the assumptions are conservative enough where the magnitude of the shortage is such that it likely will be met with available generation.

Going forward, the hypothetical loss of generation due to retirements could largely be cancelled out by the increase in import capacity should the New England East – West (NEEWS) project, in several components, be approved.

New Generation

Notwithstanding, several significant generation projects have been approved by the Council and are expected to be brought online within the next few years.

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. It is reflected in the load/resource balance table based on an estimated in-service date of mid-2010. Thus, the table entry for the Middletown project begins on 2011, since that would be the first full estimated year of service.

On June 5, 2008, the Council approved the Bridgeport Energy II (BEII) project. 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 will 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. This project is currently on hold. It is not clear when such project would be constructed. Accordingly, to be conservative, this project has been omitted from the Balance Table pending an update on the project's status.

With regard to Council review of such generating projects, 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	30	15	2011	Approved
DFC-ERG Milford Project	Milford	9	9	2010	Approved
South Norwalk Renewable Generation	South Norwalk	32.5	30	2010	Not Rec'd
Plainfield Renewable Energy	Plainfield	37.5	30	2011	Approved
Clearview Renewable Energy, LLC	Bozrah	30	30	2011	Under Review
Stamford Hospital Fuel Cell CHP	Stamford	4.8	4.8	2009	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	2009	Not Rec'd

Source: CL&P Forecast dated March 2, 2009

Waterside Power

On June 20, 2006, Waterside Power, LLC (Waterside) submitted a petition (Petition No. 772) to the Council for a declaratory ruling that no Certificate of Environmental Compatibility and Public Need is required for the proposed modifications to the existing temporary 69.2 MW oil-fired peaking project located at 17 Amelia Place in Stamford, CT. Waterside was also selected as part of an RFP issued by the DPUC. (See the section titled "An Act Concerning Energy Independence.") On May 8, 2008, the Council approved Waterside as a permanent, rather than temporary, generating facility. Waterside's power output is included in Appendix A.

Plainfield Renewable Energy

On August 14, 2006, Plainfield Renewable Energy LLC submitted a petition (Petition No. 784) to the Council for a declaratory ruling that no Certificate of Environmental Compatibility and Public Need (Certificate) is required for the proposed construction, maintenance, and operation of a 37.5 MW wood biomass fueled electric generating facility in the Town of Plainfield. This project was approved on June 7, 2007. It will be a Class I renewable resource, will provide additional generation to Connecticut, and will help meet part of the statutory requirement that a certain percentage of the state's power come from renewable resources. (See the later section titled "Renewable Portfolio Standards.")

Kimberly Clark Corporation – New Milford

On May 15, 2007, the Kimberly Clark Corporation (KCC) submitted a petition (Petition No. 813) to the Council for a declaratory ruling that no Certificate is required for the proposed construction, maintenance, and operation of a 34 MW natural gas-fired generating facility in New Milford. Approximately 17 MW output would be consumed by KCC, and the remaining 17 MW would be fed into the electric grid. This project was approved by the Council on June 12, 2007.

Ansonia Generation LLC – Ansonia

On May 13, 2007, Ansonia Generation LLC submitted a petition (Petition No. 805) to the Council for a declaratory ruling that no Certificate is required for the proposed construction, maintenance, and operation of a 58.4 MW combined heat and power natural gas-fired generating facility. The project is eligible for a customer-side distributed generation capital grant pursuant to a DPUC determination that the project would help minimize federally mandated congestion charges. This project was approved by the Council on July 26, 2007.

Connecticut Jet Power, LLC – Cos Cob, Greenwich

On May 15, 2007, Connecticut Jet Power, LLC submitted a petition (Petition No. 812) to the Council for a declaratory ruling that no Certificate is required for the proposed construction, maintenance, and operation of two 20 MW oil-fired combustion turbines in Greenwich. Initially, 60 MW of existing generation capacity was available at this site. With this project, an additional 40 MW became available for use by the electric grid. This project was approved by the Council on July 26, 2007. This facility is complete and in service.

DFC-ERG Milford, LLC – Milford

On September 4, 2007, DFC-ERG Milford, LLC (DFC-ERG) submitted a petition (Petition No. 828) for a declaratory ruling that no Certificate is required for the proposed installation of a 9 MW fuel cell. This project includes three 2.4 MW fuel cell units and a turbo-expander generator powered by the waste heat that would generate an additional 1.8 MW of electricity. This project is part of Project 150 and perhaps the largest fuel cell project in the state. The Council approved this project on October 4, 2007.

Waterbury Generation, LLC – Waterbury

On October 5, 2007, Waterbury Generation, LLC (WatGen), submitted a petition (Petition No. 831) for a declaratory ruling that no Certificate is required for the proposed construction, maintenance, and operation of a 96 MW combustion turbine peaking facility. This facility would be fueled by natural gas, with ultra-low sulfur fuel oil as the backup fuel. This project was selected by the DPUC because it would improve the reliability of the electric system and reduce federally mandated congestion charges. This project was approved by the Council on April 10, 2008.

Watertown Renewable Power, LLC – Watertown

On November 14, 2007, Watertown Renewable Power, LLC (WRP) submitted a petition (Petition No. 834) for a declaratory ruling that no Certificate is required for the proposed construction, maintenance, and operation of a 30 MW biomass gasification-fueled electric generating facility. The facility would burn clean chipped wood waste, and would operate as a baseload facility. This project was approved by the Council on April 24, 2008. The Council is awaiting a Development and Management Plan (D&M Plan), which contains the final construction details and site plans. This project is part of Project 150. See Table 1.

Devon Power LLC – Milford

On December 21, 2007, Devon Power LLC (DPLLC) submitted a petition (Petition No. 843) for a declaratory ruling that no Certificate is required for the proposed construction, maintenance, and operation of four 50 MW electric generating facilities at the existing Devon Station. These units would replace the decommissioned Devon 7 and 8 units. These new units would be considered Devon 15 through 18 and would be capable of operating on natural gas or ultra-low sulfur fuel oil. This project was approved by the Council on January 24, 2008.

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 transmission planning purposes. The largest reserve requirement is 1,233 MW, which is approximately the size of Connecticut's largest generator, 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.

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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 July 2009 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. However, assumptions per the utilities' 2009 Integrated Resources Plan regarding retirements were included in the Balance Table.

C&LM and DG are also included in the Balance Table as such resources are not included in the ISO-NE forecast, and they would likely be in effect during a peak load situation as depicted on the next page.

Table 2: MW Balance

Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
90/10 Load	8025	8095	8195	8295	8370	8455	8535	8595	8655	8705
Reserve (Equiv. Millstone 3)	1233	1233	1233	1233	1233	1233	1233	1233	1233	1233
Load + Reserve	9258	9328	9428	9528	9603	9688	9768	9828	9888	9938
Existing Generation	7100	7100	7100	7100	7100	7100	7100	7100	7100	7100
Est.Unavail. Generation	576	576	576	576	576	576	576	576	576	576
Available Generation	6524	6524	6524	6524	6524	6524	6524	6524	6524	6524
Normal Import	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
C&LM and DG per Fig. 3	273	337	430	487	549	607	665	719	770	819
Total Avail. Resources	8797	8861	8954	9011	9073	9131	9189	9243	9294	9343
Surplus/Deficiency	**-461**	**-467**	**-474**	**-517**	**-530**	**-557**	**-579**	**-585**	**-594**	**-595**
Ameresco	5	5	5	5	5	5	5	5	5	5
Project 150 (see comment below)		150	150	150	150	150	150	150	150	150
Cos Cob	40	40	40	40	40	40	40	40	40	40
Middletown			620	620	620	620	620	620	620	620
Waterbury	96	96	96	96	96	96	96	96	96	96
Ansonia (see comment below)	58	58	58	58	58	58	58	58	58	58
NRG Devon #15-18			200	200	200	200	200	200	200	200
NRG Middletown #12-15				200	200	200	200	200	200	200
Surplus/Deficiency	**-262**	**-118**	**695**	**852**	**839**	**812**	**790**	**784**	**775**	**774**
NEEWS	0	0	0	0	0	300	700	1100	1100	1100
PSEG Power New Haven			130	130	130	130	130	130	130	130
Surplus/Deficiency	**-262**	**-118**	**825**	**982**	**969**	**1242**	**1620**	**2014**	**2005**	**2004**
Possible Retirements of Existing Generation										
per 2009 IRP					(1267)	(1267)	(1267)	(1267)	(1267)	(1267)
Total Net Surplus/Deficiency	-262	-118	825	982	-298	-25	353	747	738	737

[Some of the Project 150 units are forecast to come on-line in 2011 (reference Table 1 on page 17) so the entire 150 MW should not be shown in 2010.]

[Ansonia Generation is not projected to be in service until 2011 (see 7/15/09 Tr. at 75 (Bilcheck).]

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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. 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 2,103 MW of summer capacity, approximately 29.6 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.

Most recently, on July 16, 2007, Dominion filed an application with the NRC for a capacity up-rate of approximately 80 megawatts on Millstone Unit 3. This application was approved in 2008. This upgrade is complete and accounts for the increase in Millstone's summer of output from 2,014 MW reported in last year's forecast report to the current 2,103 MW.

Coal Powered Generation

Connecticut has two coal-fired electric generating facilities contributing 564 MW, or approximately 8.0 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 Bridgeport Harbor is listed as coal/oil in Appendix A, the Council notes that this is not a dual-fuel facility 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. However, this process has not yet been brought to Connecticut.

Petroleum Powered Generation

Connecticut currently has 38 oil-fired electric generating facilities contributing 2,702 MW, or 38.1 percent of the state’s current capacity. This takes into account the reactivation of Devon 10 (14 MW) on June 29, 2006.

Both Devon 7 and 8 are considered decommissioned. These units are expected to be replaced by Devon 15 through 18. (See earlier section titled Devon Power LLC – Milford.) This repowering project will result in higher efficiency, lower emissions, and will replace the 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 with regard to oil prices. (However, replacement and/or repowering of existing aging units may occur.) In particular, the price of crude oil has pulled back significantly from its peak of over $147 last year to a low of approximately $32. Crude oil prices then soared nearly 85 percent to a current price of nearly $60 per barrel. Concerning this increase in oil prices, CL&P notes that, "[E]ven the current run-up in crude oil prices lacks substantive support from demand and supply fundamentals."

Fuel costs aside, oil-fired generation presents environmental challenges, 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 18 natural gas-fired generating units (not including Lake Road which is electrically more part of Rhode Island than Connecticut) contributing a total of 1,405 MW, or 19.8 percent of the state's generating capacity. This includes additions such as the Milford Power facility, with a total summer rating of 510 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. In particular, natural gas has a lower carbon footprint than oil. This will become even more important under proposed federal cap and trade. See later section. Finally, natural gas generating facilities also have the advantage of being linked directly to their fuel source via a pipeline.

More recently, the price of natural gas has dropped significantly and made such a fuel source even more attractive. While natural gas reached a peak of $13.61 per thousand cubic feet (or roughly one million Btus), with the recession, such prices are currently as low as $3.37 per thousand cubic feet. This is a nearly 75 percent reduction wholesale prices.

Historically, natural gas prices have followed oil prices, so this begs the question, will natural gas prices surge in the near future in a delayed response to oil prices? According to CL&P, "[T]he linkage between oil and gas prices has weakened dramatically. Over the next few years there is little in the way of market fundamentals to justify a significant run-up in natural gas prices as seen recently in crude oil prices."

Further weakening the market fundamentals for natural gas prices is that the amount of gas available for production has soared 58 percent in the past four years per a June 18, 2009 Wall Street Journal article. At current consumption rates, the U.S. still has nearly a century's worth of natural gas available.

With regard to generation technologies to make efficient use of this gas, 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 project-specific delays. The completion dates are unclear at this time. Accordingly, they are not included in Table 2 to be conservative pending any updates on the status of the projects.

Hydroelectric Power Generation

Connecticut's hydroelectric generation consists of 27 facilities contributing approximately 138 MW, or 1.9 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 Federal Energy Regulatory Commission (FERC) licenses for FLHGC's facilities.

Table 3

Generating Facility	MW (Summer)	Status of FERC License
Bantam 1	0.20	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 and Methane Power Generation

Connecticut currently has approximately 186 MW of solid waste-fueled generation, approximately 2.6 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 162 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.

Some landfills harvest the landfill gas, which is largely methane, and use it in a similar manner to natural gas to fuel electric generation. One such facility is noted in Appendix A. It is the Hartford Landfill facility with a summer power output of 1.89 MW. See Table 4.

Table 4

Solid Waste and Methane-fueled Generation	**MW**
Bridgeport Resco	58.52
Bristol Resource Recovery Facility	13.20
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	25.60
Connecticut Resource Recovery Agency - South Meadows Unit #6	27.11
Exeter Tire-burning Facility	24.17
Hartford Landfill	1.89
Total	185.87

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 133 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.

While more of this units are expected in the future, even if approved, 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 2009 and also 2018, the end of the forecast period. In this proceeding, NRG recommended that the Council assume for planning purposes that the Norwalk Harbor, Middletown, and Montville generating stations are retired. See Figure 4a and 4b below.

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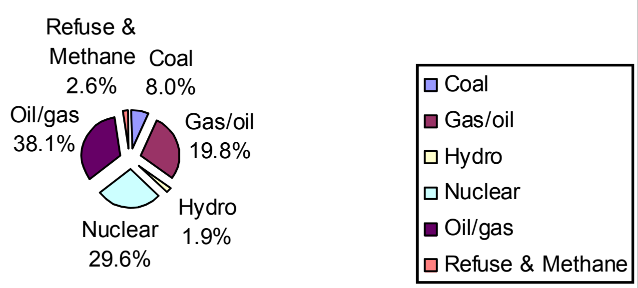
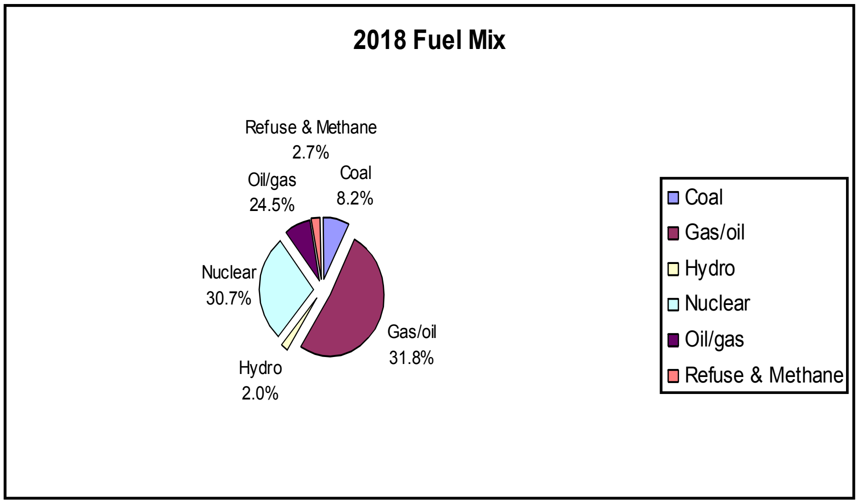
2009 Fuel Mix



*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.



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. It is called the New England East – West Solution (NEEWS). (See Transmission section.)

Market Rules Affecting Supply

Forward Capacity Market

ISO-NE conducted its second Forward Capacity Auction (FCA) in December 2008 which resulted in 42,777 MW of new and existing demand-side and supply-side resources competing to provide 32,528 MW needed for reliability between June 2011 and May 2012. The FCA consisted of eight rounds, starting at a price of $12.00/kW-mo. Bidding in the final round reached the minimum price established for this auction at $3.60/kW-mo., with 4,755 MW of excess internal New England resources remaining. This excess does not include 158 MW of real-time emergency generation that cleared surplus to the 600 MW allotment real-time emergency generation under the capacity market rules.

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, so 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 Energy Independence

Ever since the beginning of this decade, public concern about the cost of electricity in Connecticut and about available supply has prompted state legislators to consider comprehensive action. On July 21, 2005, Connecticut Public Act 05-1 (PA 05-1), "An Act Concerning Energy Independence", was approved. Its purpose is to boost electric supply through a combination of innovative means, with the incentive being relief from congestion charges, that is, charges imposed by FERC on Connecticut rate-payers in locations where demand is especially high and supply is especially low. (These are the FMCC charges shown on all electric bills.) PA 05-1 provisions that are most relevant to the Council's forecast review are discussed below.

PA 05-1 requires the DPUC to solicit proposals for reducing congestion costs during 2006-2010. Proposals can be submitted for customer-side distributed resources, grid-side distributed resources, new generation facilities, including expanded or repowered generation, and conservation or energy efficiency agreements. Successful proposals will receive contracts for no more than 15 years for the purchase of electric capacity rights. DPUC is instructed to prefer proposals that cause the greatest aggregate reduction in federally mandated congestion charges; make efficient use of existing sites and supply infrastructure; and serve the long-term interests of ratepayers.

PA 05-1 also requires the DPUC to issue an RFP soliciting new or additional generation or conservation to mitigate electric demand and rates in the state. In response to this RFP (September 16, 2006), 80 project bid packages from 45 different entities were received, representing more than 8,000 MW of capacity from a full spectrum of resources, including generation, demand-side reduction, conservation and energy efficiency technologies. On April 23, 2007, the DPUC announced that it had selected four winning bidders whose projects total 787 MW. The portfolio of projects consists of: a 620 MW gas-fired combined-cycle baseload plant in Middletown offered by Kleen Energy; a 66 MW oil-fired peaking facility located in Stamford offered by Waterside Power; a 96 MW gas-fired peaking facility in Waterbury offered by Waterbury Power; and a 5 MW statewide energy efficiency project offered by Ameresco. These upcoming projects are reflected in Table 2.

PA 05-1 further requires the electric utilities to submit Time-of-Use (TOU) rate plans to the DPUC, by October 2005. These provide for a combination of mandatory and voluntary rates, including peak, shoulder, off-peak and seasonal rates, and, additionally, optional interruptible/ load response rates for certain commercial and industrial customers.

PA 05-1 also creates a new municipal conservation and load management program, to start in 2006, requiring municipal electric utilities to assess a 1.0 mill per kilowatt-hour sold, with the charge increasing to 2.5 mills by January 1, 2011. The money goes into a special non-lapsing fund held by CMEEC, which must develop an annual conservation plan for member utilities. (See Conservation and Load Management Section.)

The Connecticut Energy Efficiency Fund (CEEF)

CEEF, an agency that was legislatively mandated in 1998 as part of electric deregulation, offers financial incentives and technical support to customers for energy-efficiency improvements to their businesses and facilities. Incentives for peak demand reduction (kW) are a major focus of the programs. The Load Response programs provide additional incentives to customers who shed load or run emergency generators during peak demand events. Customers do not have to receive a monetary grant to be eligible for CEEF program incentives. There are also special incentives offered for customers in southwest Connecticut. CEEF has been quite successful in stimulating energy efficiency over the years, and some of its results are reflected in the earlier graphs and tables under the section on Electric Demand.

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 CO2 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 CO2 allowances to comply with RGGI's regional cap of 188 million tons of CO2 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 CO2 emissions, such as coal and oil, to ones that are low, such as natural gas. Thus, initially, the supply of CO2 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.

American Clean Energy and Security Act

This year the United States Congress is considering legislation that would address, on a national level, issues Connecticut and other northeast states have tackled by adopting the

Regional Greenhouse Gas Initiative and Renewable Portfolio Standards. Entitled the American Clean Energy and Security Act (ACES), this legislation would amend a number of existing Acts that pertain to the utility industry, including the Public Utility Regulatory Policies of Act of 1978, the Clean Air Act, the Energy Policy and Conservation Act, and the Federal Power Act.

ACES contains a far-ranging set of policy measures aimed at improving energy efficiency and conservation. For the purposes of this report, the bill's most important features are the adoption of federal standards for the use of renewable energy sources and energy efficiency in the production of electricity and a cap and trade system intended to reduce the amount of greenhouse gas emissions.

Like Connecticut's RPS, ACES would establish minimum percentages for the use of renewable energy or savings from energy efficiency that utilities would have to achieve. The ACES proposed percentages, however, are lower than the RPS Connecticut has already adopted. ACES would set a target of 6% of utility-provided electricity being produced from renewable energy sources or through energy efficiency measures by 2012 (versus Connecticut's 2012 target of 9%). The ACES target percentages would escalate to 9.5% in 2014 (versus Connecticut's target of 11%), 13% in 2016 (versus Connecticut's target of 14%), 16.5% in 2018 (versus Connecticut's target of 17%), and 20% in 2021 (Connecticut requires reaching 20% in 2020).

The ACES' emissions cap and trade program, which would apply to electricity generators as well as other stationary emission sources, would be similar to the program enacted under the Clean Air Act of 1990 that was aimed at sulfur emissions contributing to acid rain. It would be designed to reduce greenhouse gas emissions to 97% of 2005 levels by 2012. This percentage would be ratcheted down over the years to 83% of 2005 levels by 2020, 58% of 2005 levels by 2030, and 17% of 2005 levels by 2050. These percentages are much more restrictive than RGGI, which seeks to achieve a 10% reduction in 2009 emissions levels by 2018.

One of the provisions of ACES would be a prohibition against states implementing cap and trade programs covering capped emissions from 2012 to 2017. It is unclear at this time how this provision would affect existing state programs such as RGGI.

At the time this report was being written, the American Clean Energy and Security Act had been passed by the U.S. House of Representatives and was being considered by the U.S. Senate. As the final version of this bill has not been enacted, it is too early to know its exact ramifications for Connecticut's electricity providers and consumers.

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.

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.

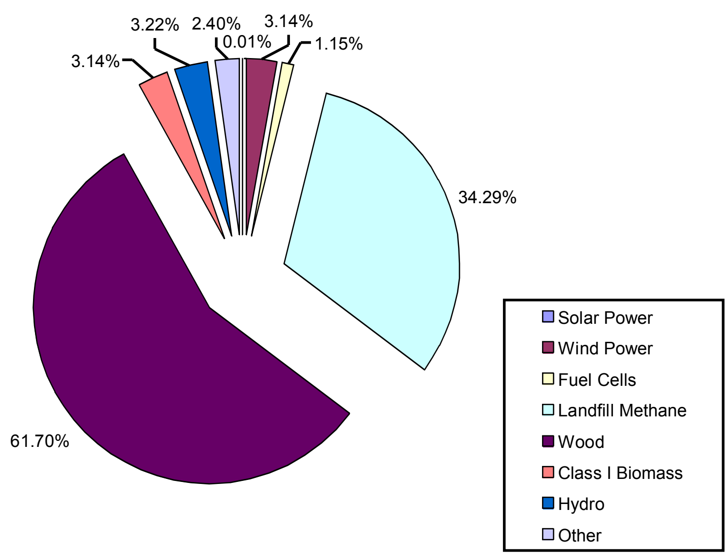
Table 5 depicts the required percentages for Class I and Class II renewable energy sources through 2020.

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		

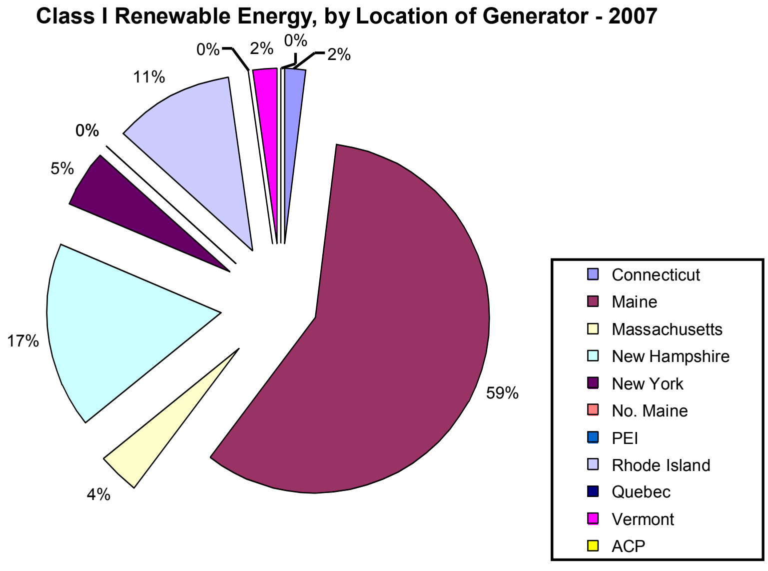
Renewable Portfolio Standards Attainment

Data available through the Department of Public Utility Control make it possible to determine how Connecticut's electricity providers met the state's RPS requirements for 2007, the latest year for which data can be obtained. In this year, approximately one million megawatt hours were generated from Class I renewable energy sources. The largest percentage of these hours, 53%, was generated using wood as a fuel. The next largest amount of hours was attributable to landfill methane (34%). Hydropower, wind power, and electricity generated from Class I biomass each contributed approximately three percent of total Class I renewable megawatt hours. The number of hours attributable to solar power was the equivalent of 0.01% of Class I megawatt hours.

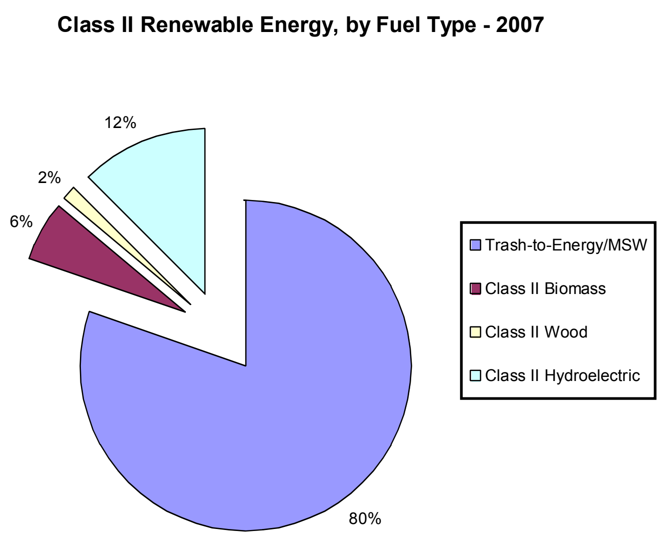
Class I Renewable Energy, by Fuel Type - 2007



By far the largest percentage of megawatt hours generated by Class I renewable fuels (58%) were generated in Maine. The next largest percentages were generated in New Hampshire (17%) and Rhode Island (11%). Connecticut contributed somewhat less than two percent of the Class I megawatt hours in 2007.

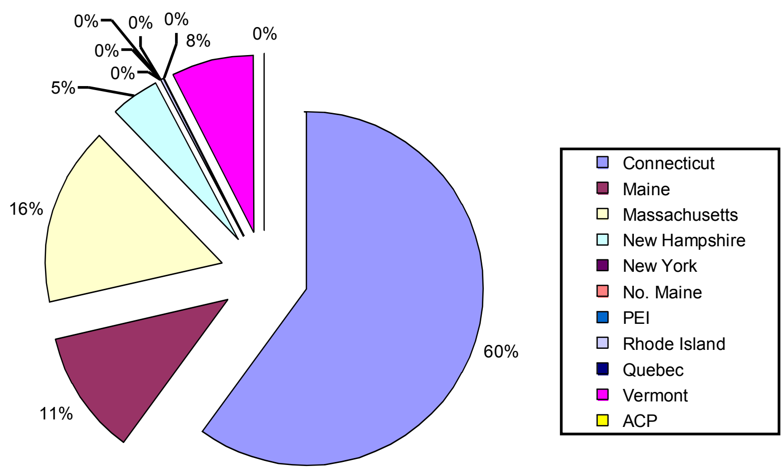


In 2007, Connecticut's electricity providers generated approximately 1,300,000 megawatt hours from Class II renewable energy fuels. The largest percentage of this total was generated from trash-to-energy, which accounted for 80% of the Class II megawatt hours. Hydroelectric was the second most-used Class II fuel, contributing approximately 12% of megawatt hours generated.



In contrast with the locations where Class I fuels generated the electricity supplied to Connecticut, most of the electricity generated by Class II fuels (approximately 60%) originated in our state. Massachusetts and Maine also supplied significant quantities of megawatt hours generated by Class II fuels (16% and 11% respectively).

Class II Renewable Energy, by Location of Generator - 2007



Connecticut Advisory Board (CEAB) and the Integrated Resource Plan

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. On January 1, 2009, as required, the two utilities, along with their consultant, The Brattle Group, submitted their integrated resource plan (IRP).

The primary findings of the IRP were as follows:

- Connecticut has sufficient generation installed or under contract to assure reliability to meet capacity requirements for the next 10 years, even if some uneconomic, high-emissions generating plants retire after transmission upgrades are completed;

- Although there is no immediate need from a resource adequacy perspective, there are policy-related needs that will drive new resource development. Those drivers include energy efficiency, environmental performance, renewable development, and diversity of supply to meet Connecticut's long-term energy policy objectives

- Connecticut has very limited in-state renewable resource potential other than fuel cells. Although qualified resources form outside Connecticut can help meet the state meet RPS, there is uncertainty whether there will be sufficient resources developed to meet region-wide demand for renewables. New transmission could enable the development and integration of out-of-state resources;

- Connecticut is a national leader in energy efficiency programs. These programs are a very cost-effective and environmentally responsible way to meet Connecticut's increasing energy needs, and expanding them would benefit Connecticut consumers;

- Current and proposed transmission projects (included in ISO-NE's Regional System Plan) will: mitigate reliability deficiencies; further integrate Connecticut into the regional grid; reduce congestion; and provide improved access to a more diverse pool of generation assets; and

- Transmission planning involves multiple regional and state processes which offer numerous opportunities for state participation and influence.

The IRP had seven recommendations:

- The electric distribution companies (EDC) should work with the CEAB to reach consensus on the structure and assumptions for the 2010 IRP, using the 2009 IRP as a starting point for the dialogue;

- Based on discussions held during December 2008 with the CEAB subcommittee, the EDCs will submit supplemental information for the 2010 IRP regarding nuclear power, energy efficiency, emerging technologies, Canadian imports, and energy security;

- The EDCs, DEP, and CEAB should collaborate on energy and environmental policy direction;

- Commit to funding expanded energy efficiency in Connecticut;

- Enhance transmission-related processes and outcomes through wider participation in regional planning processes and development of state-wide perspectives on transmission issues;

- Incorporate renewable generation and renewable energy certificates in contracting solicitations undertaken by the EDCs; and

- Use collaborative efforts of the DEP, CEAB, and the EDCs to inform decision-making regarding environmental regulations and relevant inputs for the 2010 IRP.

Per mandate, the IRP was reviewed and modified by the CEAB, and then re-drafted in the form of the CEAB's 2009 *Comprehensive Plan for the Procurement of Energy Resources*, dated May 1, 2009. 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. This will increase our fuel diversity.

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.

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.

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. 1,100 MW may be added, possibly more. The Greater Springfield Reliability Project is currently being reviewed by the Council. The other applications are expected to be filed with the Council in the near 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. An example is the Killingly 2G Substation, which is discussed below.

On May 11, 2005, the Council approved the Northeast Connecticut Reliability Project (Docket No. 302). This project includes the construction of a new 345-kV/115-kV substation (Killingly 2G) on CL&P property straddling the Killingly/Putnam town line. This substation connects to an existing overhead 345-kV transmission line, then uses that source to feed into two existing overhead 115-kV transmission lines. Killingly 2G was intended to alleviate transmission capacity constraints and improve electric system reliability in this region of the state. It was placed into service on December 16, 2006.

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. The Council recently approved a new substation of this type in the Town of Guilford (Docket No. 326).

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 6 new substations are planned for the next seven years to address high load areas within the state. Some of the substations are associated with the 345-kV transmission projects in SWCT. Others are associated with local load growth. Other additional 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 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 for the next ten years. While deficits in generation appear during the early (2009-2010) and middle portion (2013-2014) the forecast period when taking into account the most conservative weather prediction (ISO-NE's 90/10 estimate) and the possible retirement of several oil-fired generating facilities per the analysis in the 2010 IRP, the magnitude of the deficit is less than 300 MW. Assuming most generation is available for dispatch, and given the significant reserve requirement, it is likely that electric resources will meet demand during the forecast period. Furthermore, the NEEWS projects, if later approved, would significantly increase import capacity and essentially cancel out the loss of resources should oil-fired generation retire under more stringent environmental standards. One NEEWS project, the Greater Springfield Reliability Project, is currently under Council review. Other NEEWS project applications are expected to be filed with the Council in the near future.

The most significant gain in generating capacity will be associated with the upcoming 620 MW Kleen Energy power plant in Middletown. 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. This increases reliability, and the ability to import renewable power to help meet RPS.

Issues that warrant attention in the future include:

- continue to pursue 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 all Connecticut 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.

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.