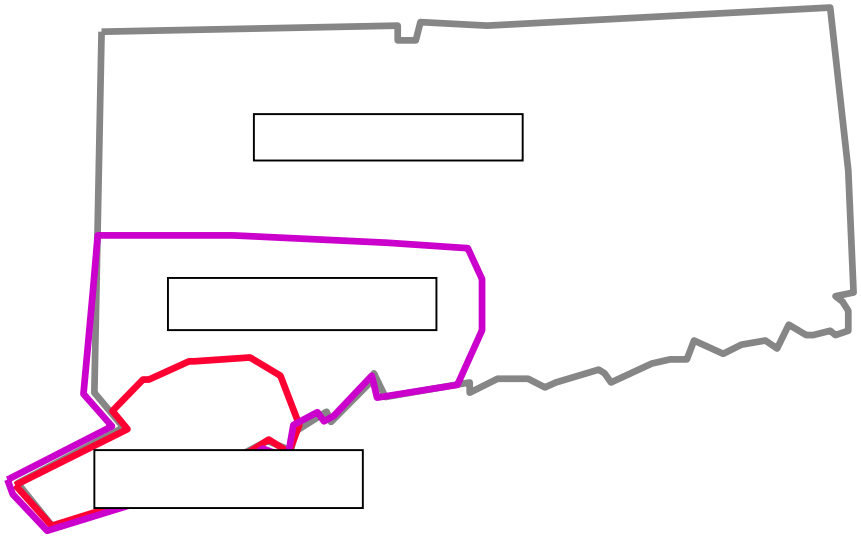
A Profile of the Electric System, Air Quality Issues and the Economic Situation in Southwestern Connecticut



Center for Energy & Climate Solutions

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Executive Summary

The Connecticut Department of Environmental Protection (CT DEP), the Connecticut Department of Public Utility Control (CT DPUC), and the Connecticut Office of Policy and Management (CT OPM) and the Connecticut Clean Energy Fund (CEF) are engaged in a project with support from the Ozone Transport Commission (OTC), the Global Environment and Technology Foundation (GETF), and the U.S. Department of Energy (DOE) to develop and implement demand response programs that encourage energy efficiency and reliability and are consistent with air quality and public health goals. One aim is to design a pilot program that can serve as a replicable model for implementation elsewhere in the country.

This profile details the current situation in southwestern Connecticut with respect to the area's economic picture, local electric system characteristics, and environmental/air quality regulations and policies. It provides information on the composition of recent demand response, energy efficiency, and clean distributed generation programs in the state. It also provides a future picture of the southwestern Connecticut load pocket, including the upcoming electricity, environmental, regulatory, and economic issues for 2002, 2003, and beyond in Connecticut and New England.

This profile also includes a summary of the outcome of a recent meeting conducted in Bridgeport, CT, on April 3, 2002. At this meeting, representatives of the Connecticut business community, utilities, state agencies, environmental groups, and the Independent System Operator provided input to help formulate a pilot project for southwestern Connecticut that would reconcile addressing the electric reliability concerns of the area with improved environmental quality. This project will be implemented during the summers of 2002 and 2003.

A. Background on Southwestern Connecticut

The geographic focus of this project is southwestern Connecticut (SWCT), an area that encompasses 52 towns in Fairfield and New Haven counties. Of these, the Norwalk-Stamford area includes 13 towns in Fairfield County that are at the intersection of high demand, constrained supply, and greatest air pollution problems[1].

Power quality and reliability are significant issues for the public and business communities. Many prominent U.S. and international companies have headquarters or major facilities in the area, including UBS Warburg, Purdue Pharma LP, Albert B. Ashforth Inc., People's Bank, Bristol Meyers Squibb, Stamford Hospital, Swiss Re, Pitney Bowes, Perkin Elmer, General Electric, BiC, and Bigelow (CT State Website, SACIA).

[1] The 13 towns in the Norwalk-Stamford area include: Bridgeport, Darien, Easton, Fairfield, Greenwich, New Canaan, Norwalk, Redding, Ridgefield, Stamford, Weston, Westport, and Wilton.
Other towns in the congested southwestern Connecticut load pocket include: Ansonia, Beacon Falls, Bethany, Bethel, Branford, Bridgewater, Brookfield, Cheshire, Danbury, Derby, East Haven, Hamden, Meriden, Middlebury, Milford, Monroe, Naugatuck, New Fairfield, New Haven, New Milford, Newtown, North Branford, North Haven, Orange, Oxford, Prospect, Roxbury, Seymour, Shelton, Sherman, Southbury, Stratford, Trumbull, Wallingford, Waterbury, Watertown, West Haven, Woodbridge, Woodbury.

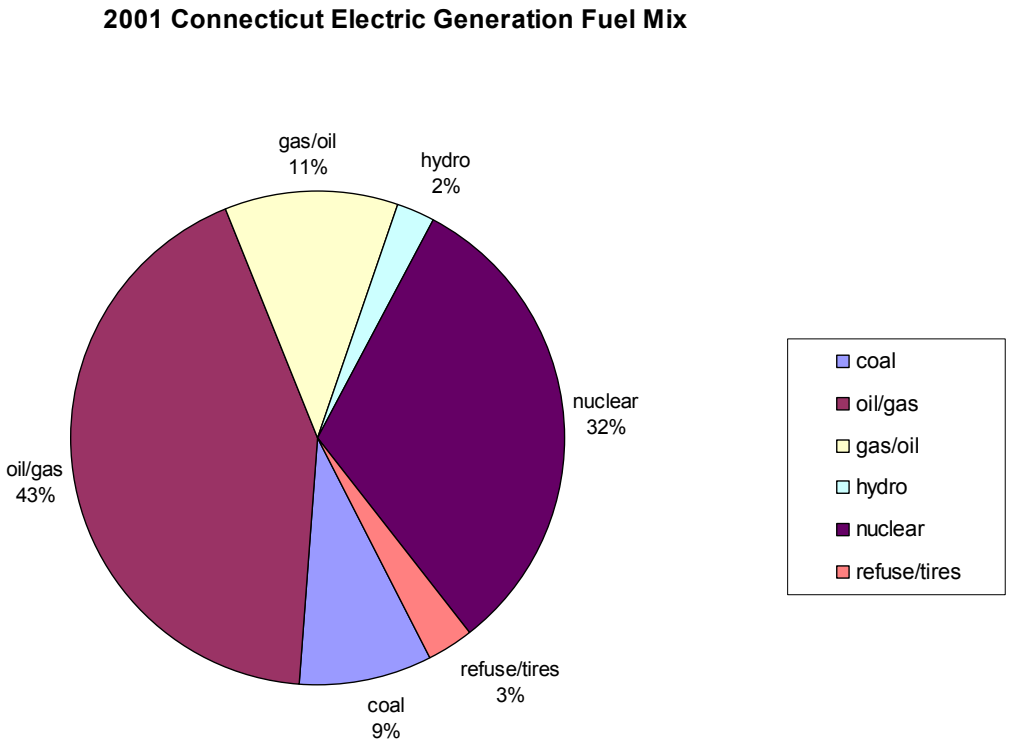
B. Energy Supply and Demand in Southwestern Connecticut

In 1999, Connecticut ranked 45th in the nation in per-capita energy consumption, and 33rd in total energy consumption (CGA Energy Availability Briefing, 2001). Electricity in Connecticut is more expensive than the national average: in 2000, the average cost of electricity was 9.5 cents per kilowatt hour for all end users, compared to 6.5 cents in the nation (EIA, 2001).

The SWCT load pocket is served by two electric utilities, United Illuminating (UI) and Connecticut Light & Power (CL&P), and by some municipal electric service. In 2000, CL&P had 22.4 GWh sales in Connecticut; UI had 5.7 GWh sales, with another 1.9 GWh sales in Connecticut by publicly owned generators.

Generation Capacity and Demand

As of 2001, Connecticut possessed a total installed generating capacity of over 6,400 MW, broken down as follows in the graph below (CSC 2001):



The current picture of electricity supply indicates that, with unforeseen outages and scheduled maintenance, Connecticut can expect to have an available peak summer 2002 capacity between 6,381 MW and 6,516 MW. Peak electricity demand was 6,369 MW in July 1999, 0.19% to 2.3% below installed generating capacity (DPUC 2000). In 2001, this peak was exceeded several times, finally setting the current record peak of 6,871 MW on August 9, 2001 (CONVEX, 2002).

In 2001, peak electricity demand in SWCT was 3,300 MW, about half the total for the state. Peak electricity demand during this period was 1,195 MW in the Norwalk-Stamford area alone, greater than the installed generation capacity of 449 MW in the immediate area (ISO-NE, 2002).

Because of plant retirements, in-state capacity and generation had been dropping since 1990 in Connecticut, although this trend reversed slightly in 2000 (EIA, 2002a). New generation has been approved and is either under construction or has recently begun operation, replacing some of the retirements. Only one of these new plants, the 540 MW combined cycle gas-fired plant at Bridgeport Harbor, is sited in SWCT (CT DEP, 2001).

Transmission Capacity

There are approximately 400 miles of 345-kV, 6 miles of 138-kV, 1,300 miles of 115-kV, and 100 miles of 69-kV transmission lines in the Connecticut transmission network. However, SWCT is not served by the 345-kV system, depending instead on multiple overhead 115-kV lines to bring power from the 345-kV-connected system into the SWCT load pocket. ISO-NE has identified the transmission system serving the Norwalk-Stamford area as one of the weakest parts of the Connecticut transmission system. This high load density area is at the extreme end of the Connecticut transmission system and relies entirely upon overextended 115-kV transmission lines emanating from the 345- kV bulk substations in northern and central Connecticut.

Three underwater transmission lines connect SWCT to Long Island. The first such project is the Cross Sound Cable project. This 330 MW cable, which is rated at 150 kV direct current (DC), transits from Brookhaven, NY to United Illuminating's East Shore substation in East Haven, and should be operational this year. Another transmission project significant to SWCT is the replacement of the Northport NY to Norwalk Harbor 138 kV DC cable, which is rated at 300 MW but is capable of providing up to 443 MW in an emergency. This cable provides essential transmission capacity to the heart of the Norwalk-Stamford sub-area, and is scheduled for replacement in 2003. A third cable crossing Long Island Sound is planned for 2004 by CL&P. This cable is rated at 300 kV and will transit from Oyster Bay, NY to Norwalk Harbor, and, if approved, will provide additional import capability to the critical Norwalk-Stamford sub-area. Construction related to these three transmission lines has not been delayed by a moratorium issued on April 12, 2002, by the Governor (Executive Order No. 26) or by subsequent legislative action that requires a complete review of the benefits and impacts of transmission lines (Public Act 02-95). These executive and legislative actions are described later in the paper. However these lines are capable of transmitting power from Connecticut to Long Island as well, and consequently the replacements will not relieve transmission constraints in many cases.

The existing transmission interconnection system can already carry between 1,100 MW and 1,500 MW of supply between New England and New York, and 2,100 MW to 2,900 MW between New England and Canada. Proposals have been submitted to the Independent System Operator of New England (ISO-NE) to increase transmission capacity with Canada by 2,000 MW. Most imports to Connecticut and to ISO-NE are from the New York Power Pool (NYPP), as imports from Canada are limited to emergency shortfalls of 500 MW to 1,000 MW. While the overall capacity of the transmission system to import power into Connecticut is normally

between 1,600 MW and 2,300 MW, due to operating constraints, imports into the southwestern part of the state are limited to 1850 MW (DPUC 2002).

Expected Growth in Generation and Transmission

Accounting for almost half the load in the state of Connecticut, the densely populated SWCT area is one of the fastest growing and economically vital regions in the state. The available reserve margin for the entire state, currently at 0.19% to 2.3% above peak load, is likely to increase in coming years, and ISO-NE predicts that natural gas additions and supply increases will outpace the increase in demand.

Transmission remains a problem. CL&P has plans for transmission capacity upgrades, including a 345 kV line supporting SWCT, but this is not expected to come online in the near future. As a result of the area's transmission constraints, there are concerns that older fossil fuel plants in SWCT may continue to operate even if lower-cost power were to come online elsewhere in state.

Future Demand Growth

Many factors contribute to growth in the demand for electricity. One of these factors is economic growth, but since predictions for economic growth are never certain, predicting the effect of the economy on electricity demand can be complicated. Most analysts expect moderate continued economic growth in the near future. The current control forecast by Regional Economic Model, Inc. (REMI) puts Connecticut's inflation-adjusted Gross State Product at $155 billion in 2001 and growing 2% to $158 billion in 2002. This could be a significant driver for increased demand for electricity.

Weather has a significant effect on demand growth, and is also unpredictable. Summer peak demand is heavily impacted by air conditioner use, and in the summer of 1999 a 1° rise in temperature corresponded to a demand increase of 85 MW. End-user characteristics also affect the load profile; in Connecticut, the industrial sector has declined (slowing overall demand growth) and the commercial sector has increased. As a result of increasing use of air conditioning in offices, stores, and residences, the peak summer demand has grown more rapidly than the overall demand. Commercial facilities are also less likely to be able to participate in certain types of load response programs such as shifting load to non-peak times (CSC 2001).

As a result of these and other factors, the Connecticut Siting Council (CSC) expects 1.3% annual electricity demand growth through 2018, both for demand (GWh) and for peak demand (MW), with up to a 6% annual growth in SWCT. The CT OPM expects 0.8% annual electricity demand growth over the period 1999-2015. This would accompany a 6% overall population increase, and 7.9% in per capita electricity use, for a 14.4% overall increase through 2015. Through 2015, CL&P (22.4 GWh sales in 2000) and Connecticut's cooperative of municipal generators (1.9 GWh sales in 2000) both predict 1.3% annual growth; UI (5.7 GWh sales in 2000) predicts 0.7% annual growth (CSC, 2001).

C. Environmental Issues and Regulations

Environmental/Air Quality Requirements

Like many states in the Northeast and around the country, Connecticut is subject to strict federal and state regulations governing a variety of airborne pollutants which affect environmental quality and human health. The federal Clean Air Act delegates authority to the states to develop and implement State Implementation Plans (SIPS) to achieve health-based air quality standards. SIPs are developed for each "criteria" air pollutant for which a state has recorded or expected violations. Once approved by the U.S. Environmental Protection Agency (EPA), a SIP has the force of federal law. States typically rely on a mix of national, regional, and state-specific programs, and incorporate them into their SIPs, to meet air quality goals.

Monitoring data, summarized in the CT DEP's 1999 Connecticut Annual Air Quality Summary (published in August 2001), indicates that the State has been in compliance with National Ambient Air Quality Standards (NAAQS) for most regulated air pollutants, except for ground-level ozone. Based on these data, the U.S. Environmental Protection Agency (EPA) classifies all of Connecticut as attaining the NAAQS for the criteria pollutants nitrogen dioxide (NO_2), sulfur dioxide (SO_2), carbon monoxide (CO), and lead (Pb). The CT DEP will soon be requesting similar attainment status from EPA for particulate matter with a diameter smaller than 10 microns (PM-10), based on data indicating that New Haven (the only area in the state currently classified as nonattainment) has reached compliance with the PM-10 NAAQS. The CT DEP has begun collecting monitoring data to assess compliance with the newer fine particulate matter (PM-2.5) NAAQS, with attainment status expected to be determined by EPA in 2004.

Although emission control programs in Connecticut and throughout the Northeast have resulted in a significant downward trend in ground-level ozone concentrations, Connecticut continues to experience periods during the hot summer months when measurements exceed the ozone NAAQS.

EPA has established ozone NAAQS measured over both 1-hour and 8-hour averaging periods. With regard to the one-hour ozone NAAQS of 0.12 parts per million (ppm), the SWCT area is classified by the EPA as a "severe" nonattainment area. Over the last five years, exceedances of the one-hour ozone NAAQS in Connecticut have occurred on 3 to 12 days per summer, with the number largely dependent on summer-to-summer meteorological variations. EPA expects to determine attainment status for the newer eight-hour ozone NAAQS by 2004. Measured values in Connecticut over the last five years have exceeded the eight-hour NAAQS of 0.08 ppm on 15 to 33 days, again depending on summertime meteorology. Future improvements in ozone levels are dependent on achieving significant additional reductions in emissions of nitrogen oxides (NOx) and volatile organic compounds (VOC), both within Connecticut and from upwind states along the Northeast Corridor and in the Midwest. Transported ozone and precursor emissions from sources in these areas are the dominant contributor to Connecticut's ozone problem.

Public Health Impacts of Ozone

Exposure to ground-level ozone can cause lung inflammation and irreversible lung damage, and aggravates asthma and other respiratory conditions and illness. Ozone reduces the immune system's ability to fight off bacterial infections in the respiratory system. Scientists have found

that approximately one in three people in the U.S. are at a higher risk of experiencing ozone-related health effects. These adverse effects are prevalent in children, healthy adults that work or are active outdoors, those with pre-existing respiratory ailments, and in some cases, the elderly.

One way to determine the impact of poor air quality on the public is through health statistics, particularly for asthmatic episodes, which can be triggered by elevated levels of air pollutants such as ozone and particulate matter. Nationally, people with asthma experience more than 100 million days of restricted activity, health care and societal costs for asthma exceed $4 billion per year, and about 4,000 premature deaths occur because of asthma annually. A recent study by the CT Department of Public Health (CT DPH) indicates that the asthma hospitalization rate for children in Connecticut is lower than that for children in the US overall, but that asthma hospitalization rates among children living in Connecticut's five largest cities (Hartford, New Haven, Bridgeport, Waterbury and Stamford) are much higher than the rate of the entire state and that in the US. Each year, there are approximately 6000 emergency room visits and 1400 hospitalizations for asthma among children under 14 in Connecticut. Over 20% of the state's children under 14 reside in the cities of Bridgeport, Hartford, New Haven, Stamford and Waterbury, whereas children in these cities accounted for 50% of all hospitalizations and emergency room visits for asthma in the CT DPH study. (CDC 2002; BBC, 2002; CT DPH, 2002).

Sources of Emissions

As noted above, Connecticut's ozone nonattainment status is dominated by contributions from sources located upwind. The chief local contributors to air pollution levels in SWCT are mobile sources, which in 1996 accounted for over half of NOx and VOC emissions, the primary ozone precursors. Two of the largest stationary sources in SWCT are electric generating facilities, the 352 MW oil-fired Norwalk Harbor Power plant and the 590 MW coal and oil-fired Wisvest plant in Bridgeport Harbor. While these sources are essential to the area's reliable supply of electricity due to local transmission line congestion, they also produce significant quantities of SO_2 and NOx, resulting in considerable controversy about the need for further emission reductions (CT DEP 2002). These plants, while exempt from certain requirements of the Clean Air Act, are still considerably cleaner than diesel backup generators in terms of emissions per kWh (CT DEP 2001, EIA 2001).

Recent data from the CT DEP indicated that there were over 1000 operators permitted for general emergency backup generation. However, the regulations under which those generators were permitted expired on March 15, 2002, and the Connecticut Distributed Energy Resources draft regulations intended to replace this permitting regime are currently being developed. Connecticut's general permits rule for distributed generation was signed on April 23, 2002, and is currently in effect. The permit allows units to participate in the ISO-NE demand response program for up to 300 hours per year. It is available to any unit located in the 51 SWCT towns identified by the February 27, 2002 ISO RFP and expires on December 31, 2003. The permit also requires use of ultra-low sulfur fuel. and annual emissions caps of no more than five tons per year. After that date, the CT DEP would either renew the permit with more specific emissions limits, or promulgate a distributed generation rule along the lines of the Regulatory Assistance Project (RAP) demand response model rule. Consequently, there are no current data characterizing the precise number of diesel backup generators in Connecticut that would be

subject to the new regulations, nor is there a concise assessment of their potential air quality impacts. The Northeast States for Coordinated Air Use Management (NESCAUM) is conducting an inventory of small generators in the Northeast, including their air quality impacts, which should be completed by September 2002. (CT DEP 2001; NESCAUM).

Current and Pending Regulations and Legislation

As described below, numerous federal and state regulations have been adopted, or are pending, to address ozone and other air quality concerns in Connecticut.

Connecticut's Ozone Attainment Plan

EPA recently issued final approval to Connecticut's SIP describing the control programs that have been adopted to provide for attainment of the one-hour ozone air quality standard by the end of 2007. The plan includes numerous controls on emissions from on-road mobile sources, new off-road engines, and various industrial source categories (e.g., municipal waste combustors, architectural coatings industry, gasoline marketing, consumer products industry, and the automotive refinishing industry). The plan also accounts for large industrial and power plant emission reductions required by EPA's NOx SIP Call, as implemented through Connecticut's NOx Budget Program (described below). Many of these control programs have already been fully implemented, while others are being phased-in to provide for attainment by the end of 2007.

Connecticut's NOx Budget Program

Since 1999, Connecticut has been implementing a NOx allowance cap and trading program with the Ozone Transport Commission (OTC) states. In September 1994, the Northeast and Mid-Atlantic states entered into a memorandum of understanding to reduce NOx emissions from large stationary sources to levels commensurate with standards of 0.20 lb/MMBTU by 1999 and 0.15 lb/MMBTU by 2003 (OLR Jul. 2000). This program will be merged with and extended into a larger, multi-state NOx cap and allowance trading program beginning in 2004 (known as EPA's Section 110 NOx SIP Call Program). Both programs apply to large electricity generating and industrial sources. The size of Connecticut's ozone season (May 1 through September 30) budget is 5,866 tons for years 1999-2002 and 4,477 tons for years 2003 and beyond. Small distributed generation (DG) sources are not subject to this program, but DG is covered by other, state-specific permitting requirements The NOx budget program is estimated to reduce NOx emissions in SWCT by 5.4 tons/day starting in 2003, which is 33% of the average summer day emissions of 16.6 tons/day in 1996.

Governor Rowland's Executive Order No. 19

On May 17, 2000, Governor Rowland issued Executive Order No. 19 directing DEP to further reduce emissions of NOx and SO_2 in Connecticut. For NOx, sources must meet a seven-month non-ozone season (October through April) cap based on an emission rate of 0.15 lb/MMBtu beginning in October 2003. Trading can be used to meet this cap. For SO_2, sources must meet two phases of reduction. Beginning January 1, 2002, all NOx Budget Program units must either: combust 0.5% sulfur (or less) fuel; meet an emissions rate of 0.55 lb/MMBtu for each unit on a quarterly basis; or meet a facility-wide (for NOx Budget Program sources) quarterly average emission rate of 0.50 lb/MMBtu.

Beginning January 1, 2003, all Title IV Acid Rain Program units (a subset of NOx Budget Program units) must either: combust 0.3% sulfur (or less) fuel; meet an emissions rate of 0.33 lb/MMBtu for each unit on a quarterly basis; meet a facility-wide (for Title IV sources) quarterly average emission rate of 0.30 lb/MMBtu; or use emissions reduction trading to meet a quarterly average emission rate of 0.30 lb/MMBtu, so long as the standards of the first phase (0.5 % sulfur/0.55 lb/MMBtu) are maintained.

Governor Rowland's Executive Order No. 26 and Public Act No. 02-95

Governor Rowland issued Executive Order No. 26 calling for a moratorium on permitting for any energy development, including gas pipelines and transmission lines, which could potentially have adverse environmental impacts on Long Island Sound, pending review by a task force working with the Institute for Sustainable Energy at Eastern Connecticut State University. This was reiterated in Public Act No. 02-95, which asked for a report from the task force evaluating alternatives including load response, distributed generation, and conservation.

Other Connecticut State Legislation

A number of new laws and pending bills also affect the power generation sector in Connecticut. Notably, Connecticut General Assembly Public Act PA 02-64, which was passed by the House of Representatives on April 25, 2002, proposes to eliminate the SO_2 trading provisions detailed above beginning January 1, 2005. Sources would be required to meet the 0.3% sulfur/0.33/0.30 limits on site. These limits could be met through emissions averaging and greater use of low-sulfur fuel for oil and coal plants (OLR 2000).

Other EPA Regulations and Proposals

EPA recently proposed more stringent emission standards for a number of non-road categories. A September 2001 Notice of Proposed Rulemaking would create new rules for large engines, affecting spark-ignition generators larger than 19 kW (though not diesel-cycle engines, which are covered under other rules). Other rules have been developed for compression-ignited (diesel cycle) engines greater than 50 kW, and for smaller engines (OLR 2001). These rules are relevant to the SWCT situation in the context of their applicability to diesel backup generators.

The EPA's "Section 126" rule requires reductions of interstate NOx emissions from Midwest power plants. While these emission reductions are considered essential for attainment of the ozone standard in the Northeast, the Section 126 rule will not require a specific ozone SIP revision for Connecticut or other states in the Northeast, as these states have already adopted strict NOx standards and are participating in the abovementioned NOx cap and allowance trading programs. In April 2002, EPA announced its plans to "harmonize" the Section 126 rule compliance date with the NOx SIP Call compliance date, thus delaying the effective compliance date for the Section126 program until May 31, 2004 (CT DEP, 2001).

EPA is currently developing implementation guidance for the new eight-hour ozone standard. As of this writing, EPA plans to designate areas as attainment or non-attainment of the eight-hour ozone standard in 2004, and SIPs that indicate what controls will be needed to meet the new standard will be due from the states in the 2007-8 timeframe.

In July 1999, EPA issued regulations to achieve national visibility goals in national and international parks and wilderness areas by 2064. The regional haze rule is designed to address

the combined visibility effects of many pollution sources over broad geographic regions, and requires all states to participate in the process. To this end, CT is part of the Mid-Atlantic/Northeast Visibility Union (MANE-VU), which is funded by EPA to coordinate regional haze planning activities for the region. MANE-VU will be assessing ways to address regional haze, and SIPs will be developed within the next several years. In January 2001, EPA proposed regulations regarding the implementation of "Best Available Retrofit Technology" (BART) within the context of the regional haze program. This and other proposals may lead to future regulations for large, older stationary sources to control haze-forming pollutants such as SO_2 and NOx.

D. Current Demand Management and Clean Energy Programs

Connecticut Restructuring Law

Citizens and businesses are generally strong supporters of environmental protection at the same time recognizing the benefits of market-based approaches. Connecticut passed electricity restructuring legislation in April 1998, which became effective in January 2000. Connecticut's restructuring law contained several environmentally forward-looking provisions, and the Union of Concerned Scientists considered the law to have the strongest environmental protection of any in the nation. These provisions include:

- A Renewable Portfolio Standard (RPS) with two classes of renewable energy. RPS requirements escalate over time. At the moment, most of the RPS can be met with Class II renewables, including municipal solid waste, but the fraction that must be met by Class I is increasing[2]. By 2009, a minimum of 6% of generation from new Class I renewables and an additional 7% from Class I and Class II are required.

- Electric ratepayer funds directed towards renewable energy development, and conservation and energy efficiency, including the Renewable Energy Investment Fund or CT Clean Energy Fund (CEF), and the Conservation & Load Management (C&LM) fund, each discussed in greater detail below.

- Customer disclosure and public reporting requirements for electric suppliers licensed in Connecticut.

- Public reporting requirements for electric utilities in the state (ECMB 2001, OLR June 2001).

ISO-NE's Demand Response Programs

ISO New England's Load Response Program (LRP), established in 2000, allows customers located anywhere in New England to participate in load response through curtailment, load-

[2] Class I renewables include energy sources derived from solar power; wind power, a fuel cell; methane gas from landfills; or a biomass facility, provided the facility begins operating on or after July 1, 1998, and the biomass is cultivated and harvested in a sustainable manner. Class II renewables are energy sources derived from waste-to-energy facilities, biomass facilities that do not meet the criteria for Class I renewable energy sources, or certain hydropower facilities.

shifting, or on-site generation. ISO-NE has also responded to the situation in SWCT with a program which specifically targets that area.

New England Load Response Program

The 2000 and 2001 programs incorporated two elements: Class 1 Demand Response, in which participants commit to mandatory energy reductions after 30 minutes' notice; and Class 2 Price Response, in which participants may choose to reduce consumption during periods of high wholesale energy prices. End-use customers in all of these programs must participate through load serving entities or aggregators, rather than being able to join directly (ISO-NE 2001).

The Class 1 Demand Response program compensates participants at the 30-minute operating reserve price for any mandatory curtailments it experiences; in this sense it is a typical emergency response program. The Class 2 Price Response program is available to participants only when the forecasted energy price is above $100/MW. Customers who reduce load are compensated based on the energy clearing price established during the hours during which the reduction occur (ISO-NE 2001).

In the summer of 2001, 5 participants reduced load during the 7 peak load events, totaling 70.5 peaking hours, which occurred during June and July. Three customers reduced their load using on-site diesel generation, and 2 curtailed their demand. Although the participants who curtailed load reduced it by 2,134 kWh, the participants who switched to on-site diesel power as part of the demand response program increased kWh consumed by 534,035 kWh, and program resulted in a net increase in total kWh consumed of 531,901 kWh (ISO-NE 2001).

Similar net increases in air emissions resulted from the use of on-site diesel generation. Despite reductions in emissions from the participants who reduced their load, the use of on-site diesel resulted in a net increase in NOx emissions of 1,058 lbs, net SO_2 emissions increased by 3,671 lbs, and net CO_2 emissions increased by 531,533 lbs (ISO-NE 2001).

ISO-NE has revised its market rules for 2002. Major enhancements include adding installed capacity credit for Class 1 participants, adding $100/MW floor price for Class 1 interruptions, adding a low-tech participation option for Class 2 participants, and adding a Congestion Cost Multiplier (CCM) for all Class 1 and Class 2 interruptions. This CCM will initially improve the incentive offered to potential participants in SWCT, Northeastern Massachusetts, and Vermont. Enrollment in the 2002 program has been automated (ISO-NE, 2002).

The goal of the 2002 ISO-NE load response program is to achieve a reduction in energy demand of 300-600 MW. This will be accomplished by improving market efficiency by giving large customers more control over their energy use and costs. If the program reaches full subscription, participants could save as much as $30 million annually. This could also help control wholesale market price fluctuations and cut air pollution by reducing use of older, less efficient plants. If the program becomes fully enrolled, the ISO expects annual emission reductions of 280 tons NOx, 200 tons SO_2, and 230,000 tons of CO_2 (ISO-NE, April 2002).

SWCT Emergency Capacity Supplement

The regional Load Response Program is being augmented by an emergency program targeting SWCT. On April 16, 2002, ISO-NE announced it had awarded contracts for approximately 84 MW of added supply and reduced demand to supplement grid power in SWCT during peak power usage periods. These measures include approximately 70 MW of new gas-fired peaking generation, 10 MW of emergency generation, and 4 MW of load response. Additional financial incentives, beyond those provided in the regional Load Response Program, are being provided to medium and large customers in SWCT as part of this emergency program (ISO-NE April 2002). The emergency capacity supplement program was designed to meet all applicable Connecticut air quality requirements; however the specific environmental impacts of this program have not been established.

The Connecticut Conservation and Load Management (C&LM) Program

This program is funded by a 3 mills/kWh Conservation and Load Management charge on electric customers' bills, established by the Electric Restructuring Act, which in effect almost tripled prior funding. The fund is administered by the utilities, with advice and oversight from the Energy Conservation Management Board (ECMB) and final approval by the CT DPUC. The Fund began operation on January 1, 2000 through the restructuring legislation and receives approximately $86 million per year. The overall goal of the C&LM program is to advance the efficient use of energy, reduce air pollution and negative environmental impacts, and promote economic development in Connecticut. The Board has agreed that C&LM funds for 2002 should be allocated to market development and refinement, technical assistance, education & outreach, system reliability, load management, and future research and development.

During 2000, CL&P spent $67.1 million on energy efficiency programs for over 300,000 residential and 1,400 commercial/industrial customers; over the lifetime of these investments, electricity consumers will save about 2,899 GWh and $234 million (ECMB 2001; CSC 2001). The Connecticut Siting Council (CSC) stated that, as of January 2001, potential savings from all current and previous CL&P demand management sources, considering only energy efficiency and not distributed generation, could reduce summer peaks by 456 MW and winter peaks by 339 MW. By 2006, programs in place by 2001 would reduce summer peak demand by 620 MW. For 2002, CL&P plans to spend almost $60 million on these programs with an estimated lifetime savings for customers of over $473 million.

United Illuminating's CL&M program expenditures in 2000 were $17.0 million (ECMB 2001) saving approximately 65 GWh, which equates to an 11 MW reduction in demand for electricity during peak hours (CSC 2001). Most successful demand-side management programs in 2000 were retail lighting, advanced design for new residential, commercial, and industrial construction, energy efficient residential washing machine sales, and custom on-site energy audits for commercial and industrial customers. Least successful were residential audits, heat pump water heater sales, and express services targeted to small load commercial and industrial customers for upgrading lighting, motors, and heating/cooling units (ECMB, OLR Jun. 2001). For 2002, UI plans to invest $14.6 million in its C&LM program.

The cumulative predicted impact of activities undertaken in 2002 is 219 million kWh for 2002, with lifetime savings of over 3 GWh (ECMB 2002).

The Connecticut Clean Energy Fund (CT CEF)
Managed by Connecticut Innovations, Inc., CT CEF was created by Public Act 98-28 in 1998 as part of legislation deregulating electric utilities. The Fund is capitalized by a surcharge on electric customers' bills, increasing from 0.5 mill/kWh in 2000 to 0.75 mill/kWh in 2002 and to 1 mill/kWh in 2004. For each 1 mill/kWh, the surcharge will generate roughly $30 million per year in CT, and the Fund is projected to grow to $120 million by 2005. The Fund invests in enterprises and other initiatives that promote and develop sustainable markets for energy from renewables and fuel cells that will benefit the ratepayers of Connecticut. CT CEF makes early stage capital investments in projects that either produce clean energy or build consumer demand for it, and makes venture capital investments in companies that are building clean energy products.

In 2000, the Fund received $15 million from the wires surcharge and invested about $900,000 (OLR 2001). Since then, CT CEF has made investments ranging from $150,000 to $2 million on wind, wave, fuel cell, and other renewable energy resources. The Fund has recently expanded its range of investments to include direct support of renewable energy projects as well as investment in the renewables industry.

In November 2001, the CT CEF received 31 responses to a request for proposals for fuel cell projects funded through CT CEF's RFP Program, which has a 2002 project budget of approximately $8 million. Of the proposals received, 17 are commercial application projects, 9 are demonstration projects, and 5 are research and development projects. Of these submissions, eight were accepted. These included two projects in SWCT:

- A fuel cell to be installed at the New Haven Water Pollution Control Authority.
- A 50 kW fuel cell power plant, to be located in Fairfield County, used to power a compressor station as well as provide excess Class One Renewable Power to the grid.

The other projects in Connecticut include:

- Fuel cell research and development at Allen Engineering in Southbury.
- Fuel cell research and development at Ionomen Corporation in Marlborough.
- A fuel cell demonstration project at Dinosaur State Park in Rocky Hill.
- A fuel cell to be installed at the State of Connecticut Department of Information Technology data center in East Hartford.
- A fuel cell to be installed at Saint Francis Hospital and Medical Center in Hartford.
- Two fuel cells to be installed at the Pepperidge Farm Bakery in Bloomfield.

Connecticut is the first of the nation's 14 deregulated states to launch a fuel cell initiative of this magnitude. It is hoped that some of these proposals and bidders will participate as part of demand response projects envisioned for the summer of 2003 (CT CEF 2002).

New Energy Technology Program
The New Energy Technology (NET) program is a state grant program that gives small startup grants to Connecticut companies once per year. Administered by the Energy Office in the CT OPM, its purpose is to develop the most innovative energy-saving and renewable energy

technologies and to provide assistance to Connecticut companies to get these technologies into the market. Each year, one or more companies whose proposals are approved by an outside panel receive a $10,000 grant. The intent of the program is to save energy, to improve air quality, and to help invigorate Connecticut's economy by creating employment opportunities. The program is in its ninth year (CT OPM 2002).

Rebuild America

Rebuild America is a federal program that facilitates the development of community-based partnerships to renovate commercial, institutional, and multi-family buildings to improve their energy efficiency. Rebuild America's Connecticut program, Rebuild Connecticut, partners with organizations to make communities stronger by stimulating economic growth, creating jobs, saving money, and improving environmental quality while saving energy and improving the community infrastructure. Since 1996, 25 towns have joined in the Rebuild Connecticut program, including Bridgeport, New Haven, Fairfield, West Haven, Oxford, and Stamford in SWCT.

Rebuild is a voluntary program. The program manager works with cities and towns to develop an action plan, which includes facilities partnerships. The program manager also provides technical assistance to each partnership in order to help implement energy efficiency measures. Rebuild Connecticut is administered by the Energy Office of the CT OPM.

Consortium for Advanced Residential Buildings (CARB)

As part of the Department of Energy's Building America program, CARB works with scores of professionals throughout the homebuilding industry to design, engineer, and test energy-efficient homes. CARB projects start with a thorough analysis of current standard building practices and local climate conditions. Results across the country range from a 30% improvement in energy efficiency with little or no cost to the builder, to truly "zero-net-electric" homes that consume virtually no electrical energy. CARB's research and development activities include new energy-saving technologies, such as an advanced geothermal heat pump and compact HVAC distribution systems. CARB also conducts training programs targeted to those on the front-line of residential construction, implemented through local homebuilder associations, CARB builder members, and subcontractor teams. In Connecticut, CARB is administered by Steven Winter Associates (DOE CARB 2002, SWA 2002).

Other Connecticut Energy Efficiency Regulations

As noted above, Connecticut's 1998 deregulation law included environmentally-related provisions such as the Renewable Portfolio Standard, the Renewable Energy Investment Charge, an increase in the Conservation and Load Management Charge, and disclosure and reporting requirements for electric suppliers and utilities, to be incorporated in 2000.

Three other laws in Connecticut are related to energy efficiency. The first (Connecticut General Statutes Title 8, Section 37kk) requires the Department of Economic and Community Development and the Housing Finance Authority to give preference to loans for energy efficient projects in all of its grant and loan programs. The second (Connecticut General Statutes Title 8, Section 44a) requires the Commissioner of Housing to establish a program of rehabilitation and major repair, including any repair, replacement or installation as may be necessary to keep

residences in sound, habitable and energy-efficient condition. This program applies to existing rental housing projects developed with state financial assistance. The third, (Connecticut General Statutes Title 32, Sections 315 et seq.,) allows the Commissioner of Economic and Community Development to establish an Energy Conservation Revolving Loan Account. This account can be used to make and guarantee loans or deferred loans to state residents for the purchase and installation of insulation, energy conservation materials, new furnaces and boilers, and similar equipment (EREN 2002).

E. Moving Forward With Clean Demand Response

A brainstorming session to address the complex issues involved in developing clean demand response was held in SWCT at the Governor's offices in Bridgeport, CT on April 3rd, 2002. It was hosted by the CT DEP, CT OPM, and CT DPUC, working with support from the OTC and GETF as part of an ongoing "Clean Demand Response" pilot project in SWCT for the summer of 2002. The objective of this session was to enlist input from stakeholders from diverse sectors to help develop and implement demand response programs that encourage energy efficiency, clean energy technologies, and reliability and are consistent with air quality and public health goals. Two dozen representatives from the business and environmental communities joined the utilities, the Independent System Operator, the Connecticut state agencies, and the Washington D.C.-based groups to explore opportunities and obstacles for energy efficiency and clean distributed generation technologies in an environmentally friendly demand response program in SWCT.

The meeting provided the participants with context on the electric reliability, environmental, regulatory, and economic issues facing the area. The participants discussed actions, approaches, and programs that could help ensure the success of clean demand response programs in southwestern Connecticut.

One perceived barrier identified was the difficulty of participating in ISO-NE's demand response programs. A number of participants also felt that they lacked information about their options for energy efficiency and demand-side management. Furthermore, some facility managers expressed the feeling that they had already exploited all the cost-effective energy efficiency improvements they could, and noted that for large businesses, energy costs were such a small proportion of total operating budgets that the savings generated by energy efficient upgrades seemed less significant. The priority for these end-users was on reliability and power quality, and the business sector participants stated that they would have a much easier time selling those issues to management than cost savings and environmental quality.

Some of the specific areas for action that the participants identified included air conditioner buyback programs, SIP credit for energy efficiency, heat island mitigation opportunities, education and marketing, expansion of the CT Smart Living Catalogue, smart metering and direct controls, green lighting, renewable energy, and water efficiency and conservation. State agencies, banks, the insurance industry, the big box retail sector, and residential and light commercial energy consumers were key stakeholders that would be most likely to benefit and be the most effective partners in these types of programs.

From these discussions, a preliminary list of short-term activity areas was developed that would be feasible for the summer of 2002, including:

- *Education, outreach, and marketing activities* – these activities will focus on the distribution of key messages to the proper stakeholders. Near-term activities will include identifying the messages to communicate, the mechanisms and channels that could serve to communicate the messages, and the actors responsible for each communication action.

- *Targeting the Conservation & Load Management Fund (C&LM) and the Clean Energy Fund (CEF) to maximize their effectiveness in reducing peak power demand* – this will include developing recommendations for the Energy Conservation and Management Board (ECMB) and CEF, and implementing projects in concert with these two funds. Near-term activities will include obtaining a current list of existing and planned projects and developing a list of recommendations for ECMB and CEF.

- *Developing a clean energy siting map / tool* – this effort will focus on identifying appropriate locations for clean energy, possibly including transmission-constrained areas, facilities with heavy energy usage, and other locations. Actions will include developing information by acquiring the highest possible resolution map of electricity density and a transmission / main distribution system map, and conducting a survey of high-level consumers of energy in areas where density lines up with distribution capacity.

- *Developing a leadership effort in Connecticut state government buildings for energy efficiency, renewable energy, and demand response* – this will focus on creating tools and providing technical assistance focusing on improving the energy performance of state buildings. Near-term actions will include identifying the communications mechanisms that we can leverage, developing communication materials and an action plan, and meeting with appropriate state personnel.

- *Corporate strategies for (1) banks and insurers, (2) big box retail (e.g., Wal-Mart, Home Depot, Target, etc), and (3) small and medium sized businesses* – efforts in this area will focus on assisting corporate partners in determining real value of clean, reliable distributed power sources. Near-term actions will include identifying opportunities and partners, determining sector-wide energy savings metrics, and entering into dialogue with appropriate parties to move forward in this key area.

Representatives from CT DEP, CT DPUC, CT OPM, GETF, NARUC, and OTC have subsequently reviewed and synthesized the information obtained from the meeting, and have begun developing specific action items to expand the role of energy efficiency and clean distributed generation in meeting peak power needs in SWCT. From the invaluable input provided at the meeting, potential efficiency, renewables, and demand response options were prioritized according to their feasibility for deployment this summer, their potential effectiveness at meeting reliability goals, and their potential effectiveness at meeting air quality goals.

Eight specific products and deliverables are envisioned for the summer of 2002. The CT OPM, CT DEP, CT DPUC, OTC, GETF, NARUC, and NASEO will continue to work with stakeholders in Connecticut on the following:

- Developing recommendations and lessons learned for CL&M and the Clean Energy Funds;
- Providing support to utility air conditioner rebate programs and other demand response initiatives;
- Creating a "Summer Savers Award" program to encourage and recognize peak demand reduction activity taking place in SWCT this summer;
- Developing a high-resolution siting resource for renewables and clean distributed generation in SWCT;
- Developing the first stages of a combined energy efficiency and renewables strategy for Big Box Retail;
- Providing support to outreach, partnership, and mentoring activities being undertaken by the Energy Star Small Business program in SWCT;
- Developing recommendations and lessons learned for environmental measurement and metrics in ISO-NE's Load Response Program; and
- Developing options for state buildings to demonstrate leadership in conservation, energy efficiency, and load response programs.

Options for 2003 and Beyond

Moving forward into 2003 and beyond, this project aims to capitalize on the momentum, successes, and lessons learned from the 2002 project, and prioritize and address issues as they arise. Successful projects from 2002 will be continued in and further developed in 2003. In no particular order, some of the medium and long-term actions which are under consideration for this project include:

- Recommending steps to improve communications between public / private sectors;
- Building on utility programs such as account bundling, air conditioner replacement rebates, and financing options;
- Developing strategies for small and medium-sized businesses such as mentoring, information-sharing, and technical assistance among businesses;
- Working with ISO-NE programs to create incentives for energy efficiency program participation in load response and to develop clean, low-tech load response program participation;
- Working with big-box retailers such as Ikea, Wal-Mart and Home Depot on energy efficiency and rooftop renewable energy siting; and
- Integrating water efficiency, renewable energy, and energy efficiency at water and wastewater treatment plants.

In the longer term, this project could also consider ways to encourage the implementation of projects with a greater scale or which will require longer-term development, such as heat island mitigation programs; working with banks, the insurance industry, socially responsible investment, and pension funds to determine the true value of energy efficiency and renewables for financing purposes; and establishing SIP credits for energy efficiency, renewable energy, and

pollution prevention. These programs could prove to be powerful solutions in the long-term effort to meet the electric reliability demands of southwestern Connecticut while improving local and regional air quality.

As the pilot project moves forward, the lead agencies will continue to provide periodic updates on progress to the stakeholders involved in the April 2002 meeting. In addition, they will solicit interested parties to become involved with the development and deployment of particular strategies. Outcomes will be documented in a summary report outlining a roadmap of the SWCT project for reference by other states and communities looking for ways to promote clean demand strategies.

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Appendix II: April 3 Bridgeport Meeting Participating Organizations:

Connecticut Business and Industry Association
Connecticut Clean Energy Fund
State of Connecticut Department of Environmental Protection
State of Connecticut Department of Public Utility Control
State of Connecticut Office of Consumer Council
State of Connecticut Office of Policy and Management
Environment Northeast
Environmental Energy Solutions
Global Environment & Technology Foundation
Institute for Sustainable Energy at Eastern Connecticut State University
ISO New England Inc.
National Association of Regulatory Utility Commissioners
Northeast Utilities Service Company
Ozone Transport Commission
Pace University Energy Project
Pitney Bowes Inc.
Purdue Frederick Company
Stamford Health System
The United Illuminating Company
Townsley Consulting Group
UBS AG, Stamford Branch