OLR RESEARCH REPORT

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INTEGRATED RESOURCES ENERGY PLAN

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You asked for a summary of the integrated resources plan (IRP) adopted by the Department of Energy and Environmental Protection (DEEP) in June 2012. The plan is available at DEEP's website, www.ct.gov/deep.

SUMMARY

The law requires DEEP to (1) review the state's energy and generating capacity resources every two years and (2) develop an IRP that identifies how best to meet projected demand and lower the cost of electricity, consistent with the state's environmental goals and standards.

The plan finds that:

1. over the next several years, electric consumption in the state is expected to grow at approximately 1% per year;

2. Connecticut and New England as a whole will have adequate resources and likely not need new generation until 2022, though depending on market conditions new generation may be needed in the region (although not Connecticut specifically) as early as 2018;

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3. the generation services charge (the cost of power for electric company customers, as distinct from transmission, distribution, and other charges) should remain at or below 8¢ per kilowatt-hour (kWh) through 2017 (in constant dollars) due largely to moderate natural gas prices caused by expanding shale gas supplies;

4. between 2017 and 2022, this charge may to rise by more than 3¢/kWh in real terms, due to rising costs for generating capacity (due to region-wide demand growth), wholesale electric prices (mostly due to expected natural gas price increases), and costs for complying with the renewable portfolio standard (RPS) (due to anticipated scarcity of renewable generation);

5. air emissions in Connecticut have decreased, as low-cost natural gas-fired generation is displacing coal and oil-fired generation; and

6. a gap between projected available renewable generation and demand mandated by the RPS in Connecticut and other New England states is expected to emerge in 2018.

The IRP also addresses requirements in PA 11-80 that direct DEEP to analyze (1) options for minimizing the cost to ratepayers of procuring resources under the RPS, which requires electric companies and competitive suppliers to get part of their power from renewable sources and (2) the feasibility of expanding what counts as Class I renewable sources under the RPS.

BACKGROUND

Statutory Requirements

CGS § 16a-3a requires DEEP to (1) review the state's energy and generating capacity resources every two years and (2) develop an IRP that identifies how best to meet projected demand using a mix of generating facilities and efficiency programs. DEEP must do this while (1) minimizing costs to consumers, (2) maximizing consumer benefits, and (3) advancing the state's environmental goals and standards. By law, the resource needs the IRP identifies must first be met through all available cost-effective conservation and load management measures.

How the Plan Was Developed

As required by law, DEEP consulted with the Connecticut Energy Advisory Board and the electric companies in developing the plan. The 2012 plan is the fourth IRP and the first prepared by DEEP; previously

the electric companies prepared the plan and submitted it to the former Department of Public Utility Control for approval. DEEP developed the IRP with assistance from The Brattle Group, an economic consulting firm. DEEP staff met with staff from other state agencies and the electric and gas companies to address issues such as resource adequacy and electricity market modeling, energy efficiency, renewables, natural gas, environmental issues, transmission, emerging technology, and macroeconomic analysis.

DEEP held meetings to obtain feedback on the scope of the IRP. A total of 14 presentations were given over the three-day period covering areas including energy efficiency, renewables, natural gas, electric transmission, environmental issues, and emerging technologies.

DEEP developed the plan after:

1. identifying base case assumptions and a three-, five-, and ten-year outlook for resource needs in Connecticut and New England;

2. analyzing the factors that will likely affect rates in Connecticut in order to identify improvement opportunities;

3. analyzing how outcomes could change under alternative futures regarding market conditions the state cannot directly control, including natural gas prices, broad economic growth, and generation supply;

4. evaluating several resource scenarios and policy options the state could pursue involving energy efficiency, renewable generation, and new conventional generation, to reduce costs and emissions while supporting in-state jobs;

5. testing the robustness of resource scenarios against the base case and alternative futures; and

6. considering how to enable emerging technologies.

DEEP issued a draft plan on January 20, 2012, together with a notice inviting written comments. It held a technical meeting on February 1, 2012 to present the draft plan and receive public comments. DEEP received 28 written comments on the draft plan from consumer, environmental, and producer groups. The comments focused on (1) the expanded efficiency proposal submitted by the electric companies and the Energy Efficiency Board in the conservation and load management plan, (2) the need for flexibility in regard to the RPS requirements; (3)

transmission; and (4) the need for increased generation, including cogeneration and repowering of certain generation assets. Some comments also addressed the forecast assumptions used in the IRP.

The adopted plan assesses:

1. the state's energy and capacity resource outlook for the next three, five, and ten years;

2. how best to eliminate growth in overall electric demand;

3. how best to reduce peak demand and shifting demand to off-peak periods;

4. the impact of current and projected environmental standards, including those related to greenhouse gas emissions and the federal Clean Air Act goals;

5. how different resources could help achieve those standards;

6. energy security and economic risks associated with potential energy resources; and

7. the estimated lifetime cost and availability of potential energy resources.

ENERGY ASSESSMENT

Supply and Demand for Electricity

The plan centers on a base case that projects electric demand and supply for the next 10 years. The base case projects that the supply of power plants and other capacity resources is greater than that needed to reliably meet peak electricity load over the next decade for Connecticut and New England as a whole. This is attributable to several factors:

1. the region has an existing capacity surplus of more than 5,000 megawatts (MW);

2. demand is likely to grow slowly, due to the current economic conditions, continued energy efficiency programs, and new codes and standards; and

3. new transmission into Connecticut is helping to meet local requirements.

Connecticut's electric energy consumption declined sharply after 2005 due to several factors, including the recession and continued implementation of energy efficiency measures. Looking forward, the plan anticipates that Connecticut's total electric consumption will grow at approximately 1% per year, not reaching 2005 levels again until 2022. The Independent System Operator-New England (ISO-NE), which administers the wholesale market, forecasts that peak electric demand in Connecticut will grow at an annual rate of 1.7% (125 MW/year) over the next few years, decreasing to 0.9% (75 MW/year) by 2020. It forecasts that the New England system peak load will grow at an annual rate of 2.0% initially (545 MW/year), decreasing to 1.1% growth (340 MW/year) by 2020. These projections do not deduct the effects of energy efficiency, most of which is counted separately as a supply-side resource.

ISO-NE has established a number of standards to ensure the reliability of the electric system for Connecticut and the region. To analyze compliance with these standards, the IRP first considers known generating and demand-side resources, i.e., those that already exist or new resources expected to be online, based on currently available information. Planned additions fall into two categories: capacity built to help meet the RPS and capacity built for other reasons. The latter include the 130 MW New Haven Harbor gas turbine plant, scheduled to come online on June 1, 2012, and an 88 MW expansion to Northfield Mountain pump-storage plant in Massachusetts, scheduled to be completed by summer 2015. Planned additions to satisfy RPS requirements are 46 MW in Connecticut and 170 MW region-wide (the latter are estimated to provide only 69 MW in usable capacity since they do not operate at all times). These include projects being developed for Project 150 in Connecticut under current law as well as additional onshore wind and solar photovoltaic facilities that are being developed or have announced plans to build. In addition, DEEP assumes that 343 MW (150 MW capacity value) of renewables that are not yet planned will be developed in Connecticut and 2,470 MW (766 MW capacity value) region-wide to help meet RPS requirements.

On the other hand, DEEP assumes that the AES Thames plant in Connecticut (183 MW) and 1,366 MW in the rest of New England will retire (be shut down). Generation retirement decisions are driven largely by prices in the generating capacity market (which is separate from the market for the energy produced by this capacity) and evolving environmental regulations, specifically those that control hazardous air pollutants such as mercury. The plan anticipates that these regulations may cause other changes. For example, an electrostatic precipitator would likely be needed on Middletown 4 and Montville 6 plants in

Connecticut to capture mercury emissions, thereby increasing their costs.

The plan projects that the current capacity surplus is large enough to cope with likely generation retirements resulting from new environmental rules and planned changes in the rules governing the wholesale electric market. These projections assume that the various components of the planned New England East-West Solution transmission project will be completed. DEEP assumes that the project will allow the 745-MW Lake Road plant (located in northeastern Connecticut but connected to the Rhode Island grid) to serve demand in Connecticut. DEEP also estimates that the project will increase Connecticut's import capability by 1,100 MW. If the Connecticut components of the project are not built, the plan anticipates that the state will still have more than enough resources to meet projected demand, but the margin will shrink.

The plan notes that while new generating resources will not be needed for reliability purposes, they may be needed to serve other policy objectives, including reducing costs and emissions and supporting in-state jobs.

Renewable Energy

While the plan projects that overall demand will grow slowly, it anticipates that demand for Class I renewable energy resources in New England will almost triple over the next decade based on current state RPS rules. Based on available information, the plan's base case projects that Class I renewable energy resources development in New England is likely to meet the regional demand through 2017, but may fall short thereafter.

Wholesale Prices

The plan notes that the price of electricity will depend on fuel prices, the types of generating resources that are developed or retired in the future, and transmission constraints. One of the most important inputs is natural gas prices, with the prices of coal, oil, and emissions allowances influencing electric markets to a lesser extent. Natural gas prices used in the plan are based on NYMEX Henry Hub futures through 2021. The 2012 IRP relied on futures traded between August 5 and September 16, 2011, while the plan was being developed. At that time, the wholesale price for gas was $4.10 per million British thermal units (MMBtu) for near-term delivery, rising to $5.92 per MMBtu by 2022 (in contrast, the current price for near-term delivery is $2.80 per MMBtu).

Using these and other inputs, the model used in the plan simulates ISO-NE's operation of the electrical system and its administration of the energy market. The resulting annual average wholesale energy prices paid by consumers in Connecticut are projected to be $54.6/MWh in 2015 (i.e., 5.46¢ per kilowatt-hour (kWh)), $56.3/MWh in 2017, and $61.5/MWh in 2022 in constant 2012 dollars. For comparison, annual average prices in 2008 were $87/MWh (when natural gas prices were much higher), then dropped to $45/MWh in 2009 before rising to $52/MWh in 2010 (all in 2012 dollars). About two-thirds of the expected increase over time is due to rising natural gas prices. The remaining one-third of the expected increase is due to less efficient generators setting market prices more frequently as the initial capacity surplus shrinks and demand grows. (OLR Report 2011-R-0135 explains how wholesale electric prices are set.)

Renewable Generation

Electric companies and competitive suppliers in New England rely on a regional market for Class I Renewable Energy Credits (RECs) to comply with RPS requirements. Under the base case, Class I renewable cost assumptions, and the simulated REC market, the plan projects that the price for Class I RECs would be approximately $23/MWh while the market is in relative surplus (2012 through 2017). Beyond 2017, however, the REC shortfall implies that REC prices would rise to the level of the penalty that electric companies and competitive suppliers must pay if they fall short of the RPS. After 2017, REC prices would clear the market at $55/MWh ($45/MWh in 2012 dollars), which is the level of this penalty. A consultant retained by DEEP estimates that the cost of complying with the Class I requirements will increase from $118 million in 2012 to $445 million in 2022. Under these conditions, Connecticut utilities would satisfy nearly half of their RPS obligations by paying the penalty. These payments could be avoided if the pace of renewable energy development accelerates in the New England region, for example, if transmission were built to access remote onshore wind resources, costs decline more than expected, or financing for renewable projects improves.

Retail Rates

The IRP projects the generation service charge for Connecticut customers, averaged across all rate classes. This charge currently accounts for approximately half of the total customer bill. Based on the capacity, energy, and REC market projections, DEEP anticipates that the charge should remain relatively constant in real terms, at approximately 8¢/ kWh from 2012 through 2017. That is substantially lower than rates

experienced over the past several years, primarily because Henry Hub natural gas prices are expected to remain below $6/MMBtu and capacity prices are expected to be flat. From 2017 to 2022, the plan projects the generation service costs are likely to increase by slightly more than 3¢/kWh, due to increasing capacity charges, REC prices, and fuel costs.

Emissions

DEEP projects that displacement of coal and oil generation by gas and renewable generation will continue to produce a dramatic reduction in regional nitrogen oxides (NO_x), sulfur dioxide (SO_2), and carbon dioxide (CO_2), emissions relative to historic levels.

Connecticut's NO_x emissions in 2010 were 36% lower than 2007 emissions; the plan projects 2015 emissions to be half of that. After 2015, the plans projects that emissions will grow slowly back to two-thirds of the 2010 level by 2022.

The plan anticipates that Connecticut's power sector SO_2 emissions will be a small fraction of past emissions. For example, 2010 emissions were 70% lower than in 2007; 2015 emissions are projected to be another 45% lower than 2010 emissions. By 2022, emissions are projected to grow back to 90% of 2010 levels, but still 73% below 2007 levels.

Connecticut CO_2 emissions have already decreased from 9.7 million tons in 2007, and are projected to decrease to 7.8 million tons by 2015 then slowly rise to 8.5 million tons by 2022. New England as a whole is expected to follow a similar curve, staying well below the targets established under the Regional Greenhouse Gas Initiative.

ALTERNATIVE FUTURES

As part of the plan, DEEP deals with uncertainty by constructing "futures" based on different natural gas prices and the relative amounts of supply and demand, while holding all other variables at their base case values.

With respect to supply and demand, the "tight supply" future incorporates ISO-NE's high economic growth forecast and does not allow efficiency to affect the price of generating capacity. In contrast, the "abundant supply" future uses ISO-NE's low economic growth forecast and assumes that the Vermont Yankee nuclear plant remains in service during the study period. The "high gas" future assumes that the cost of

gas is 60% above the level used in the base case, while the "low gas" future uses a cost that is 40% below that used in the base case.

As noted above, new generation is not needed in Connecticut or the region under the base case until 2022, and this is true for Connecticut in the alternative futures. However, at the regional level, new generation could be needed as soon as 2018 under the tight supply future and 2019 for the low gas future, since lower gas costs would reduce the costs of electricity and thus demand for it. The high gas future has higher rates and the low gas future has lower rates than the base case, primarily because of differences in wholesale electric prices.

RESOURCE SCENARIOS

The final part of the plan addresses opportunities for securing energy resources to minimize the cost to Connecticut consumers over time and maximize consumer benefits, consistent with the state's environmental goals and standards. It does so in four areas: promoting more energy efficiency, meeting or redefining the RPS standard, fostering the development of new transmission, and facilitating the entry of new generation facilities in the market.

While the base case assumes continuing energy efficiency programs at current spending levels, the plan evaluates a scenario that nearly triples that amount of energy savings over the next decade by increasing this spending. The opportunities for increased efficiency and the costs of achieving them are based on a 2010 study commissioned by the Energy Conservation Management Board. The plan also evaluates the effects of maintaining the existing Class I RPS requirements under three options. Finally, the plan looks at options to develop a new efficient 656 MW gas-fired generation plant in Connecticut in 2017, backed by power purchase agreements or other support from Connecticut consumers. The plan analyzes this scenario in order to asses the value to Connecticut customers of paying the full cost of new conventional generation and receiving its full market value, and doing so before such a resource would have been developed by private developers.

Energy Efficiency

The expanded energy efficiency scenario estimates that by expanding current efficiency savings to the maximum cost-effective level each year from 2012-2022 would result in net savings that would exceed those in the base case by $534 million annually by 2022. The implementation cost per kWh saved under this scenario is assumed to be similar to that in the base case. However, program participants are assumed to pay

more of total costs (i.e., receive lower incentives) than in the base case. This assumption would require expansion in the availability of financing over time, through the programs such as those being developed by the Clean Energy Finance and Investment Authority.

DEEP's analysis of the expanded energy efficiency scenario finds substantial benefits in terms of costs, in-state jobs, electric rates, and emissions relative to the base case. Although the net cost savings are modest or negative in the early years, they become very substantial over time. By 2022, DEEP projects that the scenario would save consumers $778 million per year in energy, capacity, and RPS costs compared to the base case. At an annual incremental cost of $105 million in program costs and $138 million in participant out-of-pocket costs, consumers' annual net savings would be $534 million.

When customers spend less money on energy, they can spend the savings on other goods and services, benefitting the Connecticut economy. Based on modeling conducted by the Department of Economic and Community Development for the IRP, each $100 million reduction in net customer energy costs can support or create 780 in-state jobs. Thus, the annual net savings of $534 million in 2022 would support 4,200 more in-state jobs than in the base case for as long as the savings persist. In addition, implementation of the scenario would add 1,500 direct, indirect, and induced jobs. The direct jobs are associated with implementing measures, and the indirect and induced jobs are created in the rest of the economy for each year the program endures. On the other hand, spending and jobs associated with in-state renewable investments would be reduced by 250, as load reductions would result in lower penalty payments. The net result is that the scenario would create 5,500 more in-state jobs per year than in the base case.

The plan concludes that the state can cost-effectively reduce energy consumption by about 2% annually by increasing the budget for conservation and load management programs from $105 million annually under a business-as-usual budget to $206 million annually, and by initiating complementary measures such as providing low-cost financing, implementing more aggressive codes and standards, and motivating behavioral changes through information and training.

Renewable Portfolio Standard

Class I renewable development in New England has grown sufficiently to meet the region's current RPS requirements. Looking forward, while the resource potential in the region remains high, particularly for wind power in northern New England, there are many uncertainties regarding

the pace of renewable development. First, substantial additional transmission would be needed to deliver large additional amounts of remote wind resources. Second, the recession has made it increasingly difficult for new renewable energy resources to secure funding. Third, federal budgetary issues have compounded the perennial uncertainty regarding the future of federal production tax credits, after the current ones are set to expire at the end of 2012.

Under the base case, DEEP projects that the region will be short of Class I requirements starting in 2018, with Connecticut paying high REC prices, penalty payments for REC shortfalls, and part of new regional transmission costs as a consequence. Under the base case, compliance with the Class I RPS would reach a cost of $445 million annually by 2022.

The plan analyzes making no changes to existing Class I RPS requirements versus expanding the definition of Class I resources to include savings from energy efficiency programs. It compares two alternative scenarios under the first option, one with a larger shortfall in RPS compliance combined with larger penalty payments and a second where the RPS is met by making multi-state investments in transmission to support the development of a significant amount of wind power in northern New England.

Alternatively, the plan considers modifying the definition of Class I resources to allow electric companies and competitive suppliers to meet up to one quarter of their RPS obligations by saving energy under expanded efficiency programs. The plan finds that doing this would save consumers $152 million annually by 2022 compared to the expanded energy efficiency scenario. These savings result from reducing the quantity of Class I RECs purchased and penalty payments made and by reducing the Class I REC price. The plan also suggests that Class I resources could be expanded to include large scale hydroelectric facilities, but does not analyze this option.

New Fossil Fuel Generation

Another scenario examines the value to Connecticut consumers of building a new generation plant before it would have been developed by private developers and having the electric companies buy the power the plant produces. To analyze this scenario, the plan analyzes the development of a new 656 MW gas-fired combined-cycle plant in Connecticut in 2017, at an "overnight" cost of $929/kilowatt (in 2012 dollars). This cost does not include the cost of interest during the plant's construction.

The plan finds that the plant's cost would exceed its benefits in most scenarios. It finds greater economic value in waiting to build the plant until 2020, closer to when New England (although not Connecticut in particular) is likely to need new generation.

EMERGING TECHNOLOGIES

The plan concludes with assessments of emerging technologies that may provide attractive options in the coming decade and beyond, even if they are not yet mature enough to play a major role in the current market. The technologies covered are: plug-in electric vehicles, advanced metering infrastructure, energy storage, advanced waste-to-energy, geothermal energy, and microgrids.

Among other things, the plan recommends that the state:

1. adopt a proactive approach to the deployment of plug-in electric vehicles and address near-term localized impacts,

2. monitor progress in establishing universal industry advanced metering standards and protocols, and

3. evaluate specific meter technology proposals.

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