Appendix 5.16-B

La Capra Need Analysis

MEMORANDUM

To: Mitchell Jacobs and Craig Olmstead, Cape Wind Associates/EMI
Cc: Terry Orr, ESS
From: Karlynn S. Cory and Douglas C. Smith
Re: La Capra Analysis of Cape Wind Project
Date: January 10, 2003

Cape Wind Associates, LLC ("Cape Wind") has asked La Capra Associates ("La Capra") to determine the impact of a 400+ MW wind project ("Cape Wind project") on the New England electricity market. This memo briefly introduces our firm, and summarizes our conclusions.

Summary
La Capra Associates is a Boston-based consulting firm specializing in energy planning, market analysis, and regulatory policy in the electricity and natural gas industries. We provide strategic planning advice to senior managers and policy makers along with expert, technical analysis to support policy, investment, and operational decisions. La Capra also has extensive experience evaluating the New England electricity market. Since our founding in 1980, we have earned a reputation for practical and objective advice and for timely, accurate, and innovative analysis.

La Capra believes that the Cape Wind project will:

1) Reduce market clearing prices, resulting in savings to the market on the order of $25 million annually;

2) Displace emissions from approximately one percent of present NEPOOL fossil fuel generation;

3) Improve reliability of the regional electricity system by increasing the total electricity supply;

4) Help meet requirements for significant new renewable generation in New England, particularly in Massachusetts and Connecticut; and

5) Diversify the region's electricity mix in terms of fuel supply and generating technology.

I) Estimated Savings Due to the Cape Wind Project

<u>The Mechanism for Savings: Bid Stack Displacement</u>

The New England Independent System Operator ("NE-ISO") dispatches generating resources according to a bid stack. New England generators offer the output of their units at bid prices that tend to equal or exceed their variable costs. All units are stacked and units are dispatched from lowest to highest bids; all units receive a spot price equal to the highest priced unit dispatched.

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The Cape Wind project has a marginal operating cost of zero. Therefore, when Cape Wind generates, it will displace one or several more expensive fossil-fuel units whose bids are, at a minimum, their cost of fuel. By displacing these unit(s) on the margin, Cape Wind will lower the ISO-New England spot price for all consumers. Attachment 1 is a simplified illustration of the energy displacement dynamic.

Methodology and Assumptions

La Capra developed a model of the Northeast Power Coordinating Council and Mid-Atlantic Area Council[1] regional energy markets using PROSYM.[2] PROSYM is a well-established utility dispatch program that simulates an hourly chronological dispatch of the various thermal, hydro, contract and pumped storage sources in an electric system. Depending on the resources available each hour, the PROSYM dispatch algorithm selects the lowest cost combination of bids from generating sources and available imports to meet electricity demand. This method closely approximates the functioning of the NEPOOL ISO market, and it includes wheeling charges (from one region to another) and congestion charges (into sub-regions with limited transmission connections to other regions, like New York City).

LaCapra has adapted the PROSYM model to include the effects of future loads, unit retirements and additions of new units. La Capra uses this proprietary model to support the commercial decisions of Northeast clients such as project developers and utilities.

We assumed that the Cape Wind project will start production on January 1, 2005. In March, 2002, La Capra projected the impact of the Cape Wind project on the New England-ISO spot market using the modified PROSYM model and a monthly energy output projection for each hour in the month, based on the anticipated wind regime. We assumed that the 468 MW project had a capacity factor of 36 percent, yielding about 1,486 GWh of annual production of an average of about 170 MW across all hours of the year.

We conducted two simulation cases of the regional electricity market for the years 2005-2009: a “base case” reflecting current long term planning assumptions regarding regional electricity demand, supply and generating costs; and a companion case in which the Cape Wind project was added to the New England supply. To estimate the effect of the Cape Wind project we compared the results from our two simulations, and judged how the results fit in the range of potential alternative outcomes.

Estimated Savings due to Cape Wind

The savings in the New England electricity market were estimated to be approximately $25 million annually for the first five years of Cape Wind’s operation.

Several trends in the electricity markets may affect this analysis:

First, during substantial portions of the past several years, electricity has traded in spot and bilateral markets at prices higher than the prices predicted by our model. The difference is because the marginal cost of power is based on the price of fossil fuels in New England. The fuels market has experienced

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[1] The NPCC region includes the electricity systems controlled by the Independent System Operators of New England, New York, New Brunswick, Quebec and Ontario. The MAAC region includes the electricity system controlled by the Pennsylvania/New Jersey/Maryland Interconnection.

[2] La Capra Associates has licensed the PROSYM model from Henwood Energy Resources, Inc.

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spikes in the price of natural gas in late 2000, early 2001, and late 2002, while the simulation analysis bases the cost of fuel on the long term, natural gas and oil prices forecast in the Energy Information Administration's (EIA) "Annual Energy Outlook 2002" (developed in late 2001).[3] For example, current Nymex future prices for natural gas at Henry Hub, Louisiana for 2005 are about $4/mmBTU (before transportation to New England), significantly above the assumptions used in our analysis. If fuel prices turn out higher than the prices assumed in our analysis (which is fairly likely in the short-term), Cape Wind will generate greater savings for the market than estimated above.

Second, our analysis assumed a significant increase in new generation coming on line in 2002 and 2003, but only a gradual retirement of New England's current fleet of older fossil plants. Our analysis indicates that the new capacity, including Cape Wind, will have a downward effect on prices. However, the economic conditions in the power industry could limit the development of new facilities, and may accelerate the retirement of older facilities, especially where the older facilities are subject to pressure to conform to tighter environmental rules. Any reduction in capacity during a time of tight supply will put upward pressure on marginal prices, and will also increase the potential savings from the wind project.

Third, our simulation does not project many instances of tight supply and associated price spikes in the near term. The slope of the New England bid stack can be very steep at the top. Peaking plants may bid prices in the hundreds of dollars per MWh in hopes of recovering their fixed costs during their limited hours of operation. Displacing even a few hundred MW during peak hours can – during some hours – dramatically reduce the regional clearing price. For example, a La Capra ex-post review of the actual NEPOOL bid stack and loads from 1999 found that a 200 MW displacement during peak summer conditions could have, in an extreme case, reduced spot market expenditures by several million dollars in a single hour. If tighter regional supply conditions were to materialize on a sustained basis (e.g., robust demand growth, significant retirements of existing plants) or on a temporary basis (e.g., extreme summer weather, unusually high generating unit outages), the savings from Cape Wind could turn out much higher than indicated by our simulation.

II) Emissions, Market and Operational Benefits

Resulting Emissions Reductions

A wind power plant does not emit any pollutants. Therefore, every time the Cape Wind project displaces fossil-fired generation, it reduces the overall air emissions in the region and improves the overall environmental performance of the regional power system.

ISO-NE developed a report for the NEPOOL Environmental Planning Committee that examined the impact of 500 MW of demand-side management programs in the region in the year 2000. In doing so, ISO-NE developed a marginal emission rate for SO_2, NO_X and CO_2 for the year 2000. Using these rates as a proxy, if the Cape Wind Project had displaced the marginal emission rates determined from the ISO-NE study, the following emissions would not have been produced:

- 1,180 tons of nitrogen oxides (NO_X)
- 4,000 tons of sulfur dioxide (SO_2); and
- 949,000 tons of carbon dioxide (CO_2).

[3] Our use of the EIA fuel forecast therefore provides a conservative, but reasonable basis for estimating the savings.

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Cape Wind could also have displaced significant amounts of particulates and mercury that would have been emitted by the marginal NEPOOL unit, depending on the type of unit(s) displaced. NEPOOL did not project these emissions.

Supply Adequacy Benefits

The ISO New England ("ISO-NE") will need new generating sources soon after Cape Wind is operational to meet its threshold requirement for supply adequacy. This need will result from anticipated demand growth including appropriate capacity reserve margins, and retirements of existing generation due to aging and increasing environmental restrictions.

Because of the recent addition of more than 4,000 MW of new generation[4,5] the region's power supply is now considered adequate to meet short-term needs. However, this balance can be fragile. New England's power supply adequacy was challenged when several new peak load records were set this summer by an extended heat wave, and by drought conditions that threatened the supply from hydroelectric resources. The new ISO-NE peak hourly demand record of 25,715 MW[6] was set on August 14, 2002, and exceeded the forecasted peak load by more than 6 percent, illustrating the extent to which actual demand can depart from forecast levels due to the inherent uncertainty in peak load.

In fall 2002 La Capra prepared an analysis of the regional need for new power supply sources to maintain regional reliability. La Capra tested several supply and demand scenarios to assess the need for additional capacity in the region, above and beyond that which is assumed to be provided by existing facilities. The capacity supply cases consider all currently operational generation plus projects that have achieved significant development milestones. Other planned, proposed, or potential sources of new capacity are excluded from these cases specifically because this analysis is designed to determine how much of such new capacity is needed in the New England power market for reliability purposes. Attachment 2 presents the results for La Capra Base Case analysis for the 2002 to 2011 period, for the two supply sensitivity cases, and includes the 2002 CELT Report supply and demand case for reference. Attachment 3 presents the La Capra Base Case along with three load sensitivity cases.

These results illustrate that New England will need significant additional generating capacity, above and beyond existing supplies, to meet minimum reserve margin requirements. The Base Case analysis of regional capacity need indicates need by 2008 and thereafter. Just as important, the sensitivity cases demonstrate that additional supplies are needed as early as 2005 to meet common contingencies, such as spikes in demand due to extreme heat and cold, increases in the peak load due to economic and demographic factors, or the loss of capacity from existing sources. Under nearly all scenarios, there is a substantial need for new capacity by the end of the decade and thereafter.

Starting in 2005, the Cape Wind project will provide a valuable supply of power to New England to meet the need for new capacity in the future.

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4 *New England Summer Power Supply Outlook Positive*, ISO-NE Press Release, April 29, 2002.

5 *2002 Summer Assessment, Reliability of the Bulk Electricity Supply in North America*, North American Electric Reliability Council, May 2002.

6 This record peak demand was set during a period when an ISO-NE "Power Watch" was in effect, ISO-NE Press Release, August 14, 2002. This public appeal for conservation is likely to have caused the actual demand to be somewhat lower than would have resulted otherwise.

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III) Benefits of a Large, New Renewable Resource

Renewable Energy Need Due to Renewable Portfolio Standards

The renewable attributes of the Cape Wind project are needed to satisfy the requirements for renewable attributes in New England. Massachusetts and Connecticut have renewable portfolio standards ("RPS") requiring parties supplying retail load in each state to purchase a percentage of that load from new renewable suppliers. Wind is an eligible "new" renewable technology in both states.

Massachusetts' RPS is the most significant market for Cape Wind. Attachment 4 shows the percentages of electricity sold to consumers required from renewable resources (225 CMR 14.07(2)) and estimates the energy requirements. We estimate that in order to meet the Massachusetts requirement, energy production of at least 1,394 GWh per year will be needed from qualifying new renewable facilities by 2006, and about 2,386 GWh per year will be needed by 2009. These energy requirements translate to all-hours, average new renewable production of about 159 MW in 2006 and about 272 MW in 2009. At present, the amount of qualified, new renewable energy projects in operation or in construction is clearly insufficient to meet this requirement.

The Connecticut RPS includes a "Class I" requirement for new renewable supply that, like the Massachusetts RPS, requires significant and increasing amounts of newly constructed renewable facilities over time. The generating technologies that are considered eligible new renewables in the Connecticut and Massachusetts RPS programs are similar, although not identical. Neither state requires that the new renewables be developed in state, so the two states will effectively compete for the same pool of potential new renewable projects.

To date, Connecticut has applied its RPS only to load served by competitive retail electricity suppliers, and not to the substantial Default Service Offer load. If the Connecticut RPS is ultimately applied to all Connecticut load, or if most Connecticut customers switch to competitive suppliers, the resulting demand for new renewable energy will be almost as large as the requirements under the Massachusetts RPS.

Maine also has an RPS requirement, but as presently configured it is not likely to add materially to the level of renewables in the region. However, there are proposals to alter the Maine requirement to require additional new renewables.

Finally, earlier this month New York's Governor Pataki announced that he is "directing the Public Service Commission to implement a Renewable Portfolio Standard - a program which will guarantee that within the next 10 years at least 25 percent of the electricity bought in New York will come from renewable energy resources like solar power, wind power, or fuel cells."[7] To the extent that this turns into a law that stimulates new renewables, the New York RPS should increase demand for new renewables significantly.

[7] Governor George E. Pataki's State of the State Address, New York State, January 8, 2003. http://www.state.ny.us/03sosaddress/sos2003.pdf

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Retail Customer Demand for Renewables

The RPS standards are designed to motivate load serving entitles to purchase renewables for their customers. However, we believe that customers will demand renewables requiring purchases above the respective states' mandated percentages.

Nationwide research shows that residential customers support the increased use of renewable energy. Further, this research indicates that most customers would be willing to pay higher electricity bills to get renewable energy. In addition, some large commercial customers and wholesale power users such as municipalities and cooperatives will demand new renewables.

La Capra anticipates that some customers in New England states with retail choice will begin to sign up for green power products in the next few years. While there are currently only a few suppliers of renewable products in New England, more are expected to enter the market as the price of standard offer and default service increase over time (which will make green power products more economically competitive). La Capra projects that electricity customers in Massachusetts and Connecticut would be able to purchase green power products starting in 2004, and that Rhode Island and Maine customers would be able to sign up for green products starting in 2005. La Capra also estimates that products offered would contain 50 percent "new" renewables (commercially available after 1997), increasing by 5 percent a year to 75 percent new renewables in year 6. Finally, La Capra estimates that customers demanding renewables would be a combination of mostly residential and some commercial or industrial customers.

Range of Total New England Renewable Energy Need

In order to quantify the potential level of demand for additional renewables in New England, three scenarios were developed:

1) **The Massachusetts Only Case** reflects the statutory requirements associated with the Massachusetts RPS only.
2) **The Low Bound Renewable Demand Case** is intended to reflect the lowest reasonable level of demand for new renewables. The demand includes Massachusetts RPS demand, along with an estimate of Connecticut RPS demand, assuming that the RPS will apply to only 20 percent of load in Connecticut. This would approximate an outcome in which the Connecticut RPS is not applied to Standard Offer load (or to future generation service provided by utilities to customers that do not choose an alternative supplier), and only 20 percent of Connecticut load chooses to take service from non-utility suppliers over the planning horizon. This case does not include any customer-driven demand for new renewables.
3) **The Most Reasonable Renewable Demand Case** represents a very plausible scenario for which there are substantial probabilities of higher or lower outcomes. This case is considered to be the appropriate scenario to use when assessing the need for new renewables. This case assumes that the Connecticut RPS requirement applies to all retail load in that state (including Standard Offer service), or in which all customers switch to non-utility generation suppliers. In this scenario, a modest level of customer-driven demand for new renewables was included, increasing from less than 100 GWh per year in 2004 to about 750 GWh per year by 2009.

Generating facilities that have come online since December 31, 1997 will be eligible to provide "new renewable" power under the Massachusetts RPS. La Capra reviewed the Massachusetts Division of Energy Resources' ("DOER") website to identify projects for which the Massachusetts DOER has

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certified eligibility as a new renewable resource for the purposes of the Massachusetts RPS. La Capra also reviewed press reports and the NEPOOL CELT report to identify other renewable projects (consisting primarily of landfill gas and biomass) that have not applied to DOER but appear likely to be eligible for the Massachusetts RPS.

Attachment 5 illustrates the supply/demand outlook for new renewable energy in New England. The most significant results of the renewable energy supply/demand analysis include:

- The existing supply of new renewables is limited, and is not sufficient to meet even the Massachusetts RPS statutory requirements in any year from 2004 forward;

- By 2005, additional new renewable supplies will be needed to meet each of the renewable demand cases. For example, the estimated need for additional renewable generation in 2005 is between 561 GWh and 1,331 GWh per year, which translates to round-the-clock average output of between 64 MW and 153 MW;

- By 2010, the need for new renewables is even more substantial. The estimated need for additional renewable generation in 2010 is between roughly 2,800 GWh and 5,200 GWh per year, which translates to round-the-clock average output of between 300 and 600 MW.

Attachment 5 depicts the estimated supply and demand for new renewables through 2010. Thereafter, demand growth, along with further increases in the Massachusetts RPS requirement, will increase the need for new renewables. By contributing to the supply of new renewables, the Cape Wind project will limit the cost of compliance with the Massachusetts RPS.

Note that Attachment 5 illustrates the estimated minimum amounts of new renewables required by the Massachusetts and Connecticut RPS programs. In practice, La Capra anticipates that the need for renewables will go beyond the bare minimum levels mandated by statute, because additional capacity and energy will be needed to account for the annual variability of intermittent technologies. In addition, to the extent that other states implement RPS requirements, the regional need for new renewables could turn out much greater than shown in the Most Reasonable case.

In view of these substantial demands for new renewables, the Cape Wind project will diversify the renewables supply mix, and most importantly, help ensure that the RPS requirements in the region are met at a competitive cost.

<u>Increasing the Diversity of the Region's Electricity Mix</u>

Wind power in Massachusetts will also increase the diversity of the region's electricity mix in terms of fuel supply and generating technology. New England is now heavily reliant on natural gas for power generation, which is projected to increase from 16 percent of generation in 1999 to over 40 percent by 2005. This increasing dependency on natural gas - particularly for marginal generating units that tend to set the market clearing price – greatly increases the influence of natural gas price variations on electricity prices. Inclusion of a non-fossil-fueled resource like wind decreases the region's exposure to these fluctuating fossil fuel prices. In addition, as fossil fuel use continues to grow, the infrastructure for transporting those fuels to the region must increase as well. Reducing fossil-fuel requirements means that some amount of fuel delivery infrastructure investment can potentially be delayed or cancelled.

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Diversity of generating sources also tends to improve system reliability. An analysis conducted for ISO-NE by Levitan Associates showed that an interruption to any one of several pipelines serving New England on a winter peak day would require some amount of electric generating plants to switch to backup fuels. To the extent that the gas units are unable to switch or obtain supplies, grid reliability would be compromised. The report also observes that for an outage of significant duration, the surge in oil demand would likely overwhelm the delivery capability of regional oil distributors. Reducing oil and gas consumption would also put downward pressure on prices for those fuels, and could reduce the infrastructure (e.g., pipelines) required for fuel delivery.

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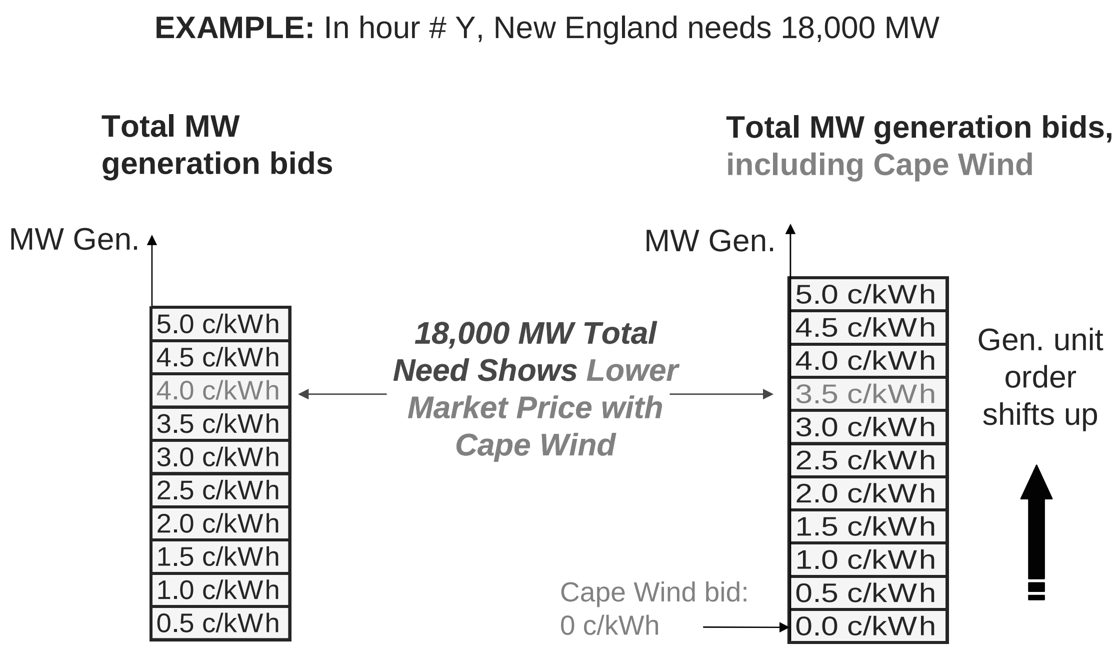
Attachment 1

Wind Park Displacement Illustration



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Attachment 2

New England Need for Capacity - Supply Sensitivity Analysis

Summer Capacity (MW)

La Capra Base Case	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Peak Demand	24,700	25,272	25,642	25,969	26,350	26,699	27,051	27,444	27,832	28,332
Minimum Reserve Margin	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%
Required Capacity	28,405	29,062	29,488	29,864	30,303	30,704	31,108	31,560	32,007	32,581
LCA Base Supply	27,440	31,723	31,592	31,429	31,271	31,172	30,846	30,393	30,295	30,125
Surplus / (Need)	**(965)**	**2,661**	**2,103**	**1,565**	**968**	**467**	**(262)**	**(1,167)**	**(1,712)**	**(2,456)**

Peak demand is adjusted down to account for contracts for interruptible load and peak conservation measures

High Supply Case	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Peak Demand	24,700	25,272	25,642	25,969	26,350	26,699	27,051	27,444	27,832	28,332
Minimum Reserve Margin	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%
Required Capacity	28,405	29,062	29,488	29,864	30,303	30,704	31,108	31,560	32,007	32,581
LCA High Supply	28,420	32,703	32,695	32,663	32,561	32,528	32,397	32,310	32,212	32,147
Surplus / (Need)	**15**	**3,641**	**3,207**	**2,799**	**2,258**	**1,824**	**1,289**	**750**	**205**	**(434)**

Low Supply Case	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Peak Demand	24,700	25,272	25,642	25,969	26,350	26,699	27,051	27,444	27,832	28,332
Minimum Reserve Margin	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%
Required Capacity	28,405	29,062	29,488	29,864	30,303	30,704	31,108	31,560	32,007	32,581
LCA Low Supply	26,813	31,096	30,842	30,548	30,334	30,169	29,649	28,829	28,731	28,456
Surplus / (Need)	**(1,592)**	**2,034**	**1,354**	**684**	**31**	**(535)**	**(1,460)**	**(2,731)**	**(3,276)**	**(4,125)**

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Attachment 3

New England Need for Capacity - Load Sensitivity Analysis

Summer Capacity (MW)

La Capra Base Case	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Peak Demand	24,700	25,272	25,642	25,969	26,350	26,699	27,051	27,444	27,832	28,332
Minimum Reserve Margin	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%
Required Capacity	28,405	29,062	29,488	29,864	30,303	30,704	31,108	31,560	32,007	32,581
LCA Base Supply	27,440	31,723	31,592	31,429	31,271	31,172	30,846	30,393	30,295	30,125
Surplus / (Need)	**(965)**	**2,661**	**2,103**	**1,565**	**968**	**467**	**(262)**	**(1,167)**	**(1,712)**	**(2,456)**

Peak demand is adjusted down to account for contracts for interruptible load and peak conservation measures

High Load Growth Case	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Peak Demand	25,200	25,868	26,555	27,259	27,982	28,724	29,486	30,268	31,071	31,895
Minimum Reserve Margin	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%
Required Capacity	28,980	29,749	30,538	31,348	32,179	33,033	33,909	34,808	35,731	36,679
LCA Base Supply	27,440	31,723	31,592	31,429	31,271	31,172	30,846	30,393	30,295	30,125
Surplus / (Need)	**(1,540)**	**1,974**	**1,054**	**81**	**(908)**	**(1,861)**	**(3,063)**	**(4,415)**	**(5,437)**	**(6,554)**

Peak demand forecast as projected by La Capra, adjusted for the effect of high load growth as estimated in the 1999 Triennial Review of Resource Adequacy

Hot Weather Case	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Peak Demand	25,700	26,660	27,051	27,396	27,799	28,167	28,537	28,952	29,362	29,889
Minimum Reserve Margin	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%
Required Capacity	29,555	30,660	31,109	31,505	31,968	32,392	32,818	33,295	33,766	34,372
LCA Base Supply	27,440	31,723	31,592	31,429	31,271	31,172	30,846	30,393	30,295	30,125
Surplus / (Need)	**(2,115)**	**1,063**	**483**	**(76)**	**(697)**	**(1,220)**	**(1,972)**	**(2,902)**	**(3,472)**	**(4,247)**

Peak demand forecast as projected by La Capra, adjusted for the effect of hot weather as estimated in the 2002 CELT

Mild Weather Case	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Peak Demand	24,200	24,373	24,731	25,046	25,414	25,751	26,089	26,468	26,843	27,325
Minimum Reserve Margin	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%
Required Capacity	27,830	28,030	28,440	28,803	29,226	29,613	30,003	30,439	30,870	31,423
LCA Base Supply	27,440	31,723	31,592	31,429	31,271	31,172	30,846	30,393	30,295	30,125
Surplus / (Need)	**(390)**	**3,693**	**3,151**	**2,626**	**2,045**	**1,558**	**843**	**(46)**	**(575)**	**(1,298)**

Peak demand forecast as projected by La Capra, adjusted for the effect of mild weather as estimated in the 2002 CELT

LCA Supply is 2002 CELT figures adjusted for La Capra Associates retirement and addition assumptions

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Attachment 4

Annual Massachusetts
Renewable Portfolio Standard Requirement

Year	Minimum Percentage Requirement	Estimated Requirement (GWh/yr)	Equivalent All Hours MW*
2003	1.0%	480	55
2004	1.5%	732	84
2005	2.0%	993	113
2006	2.5%	1,262	144
2007	3.0%	1,534	175
2008	3.5%	1,819	208
2009	4.0%	2,109	241
2010**	5.0%	2,676	305

* This is the equivalent capacity to meet the estimated energy requirement, if the capacity were to operate during all hours during the year.
**Starting in 2010, the requirement increases by 1.0 percent each year.

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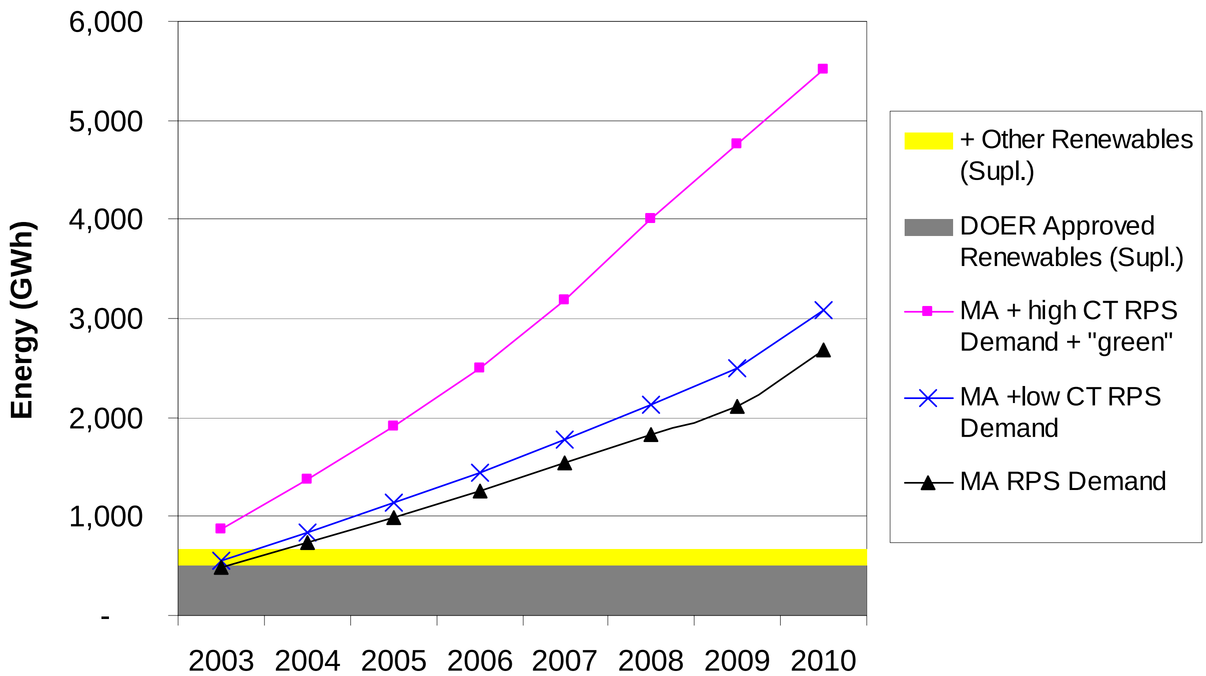
Attachment 5

New Renewable Energy Need



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