EXHIBIT B

ANALYSIS GROUP
ECONOMIC, FINANCIAL and STRATEGY CONSULTANTS

Proposed Senate Bill No. 1965: An Act Relative to Energy Sector Compliance with the Global Warming Solutions Act

Potential costs and other implications for Massachusetts consumers and the state's and region's electric system

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Executive Summary

On July 9, 2015, Massachusetts Governor Charles Baker submitted Senate Bill No. 1965 to the Senate and House of Representatives. If enacted, the bill would require the state's electric utility companies to solicit long-term contracts for large quantities of 'clean energy resources' and proposals for transmission. 'Clean energy resources' are defined as either stand-alone hydroelectric power from existing or new hydropower facilities, and new "Class 1" renewable resources firmed up by hydroelectric power resources. The solicitations, which would occur by April 2016 and could be done in conjunctions with other New England states, would provide for an amount of power equaling one third of Massachusetts' total electricity use (and one sixth of New England's power requirements) each year for a 15-25 year contract period.

Senate Bill 1965 is one of the most recent steps that Massachusetts executive branch officials have taken with other New England states over the past few years to address concerns about the environmental impact, cost and reliability of electricity supply in the region. Governor Baker has stated that without the procurement of significant quantities of hydroelectric power delivered into New England, Massachusetts will be at risk of not meeting its goal to reduce greenhouse gas emissions by 25 percent below 1990 levels by the year 2020.

I wish I could agree with the proposed policy, because it is so important to move toward an electric system with lower carbon emissions. In fact, I recognize that hydro power from Eastern Canada may have value for Massachusetts under some circumstances. But unfortunately, the approach authorized by Senate Bill 1965 is too risky and not a sound basis for accomplishing its intended goals.

If enacted into law, Senate Bill 1965 – however well-intentioned and seemingly appealing on first blush – will likely lead to predictable negative impacts for Massachusetts consumers and the state's economy. Its hoped-for outcomes will be undermined by second-order impacts that will raise costs and in turn challenge the state's accomplishment of its climate goals and significantly harm the markets on which Massachusetts depends for its electricity supply.

CO_2 emissions from Massachusetts power plants are declining.

First, the trends in carbon-dioxide ("CO_2") emissions from power plants in Massachusetts and New England are already heading toward the emission-reduction targets under the Global Warming Solutions Act. Although significant reductions in CO_2 emissions across the economy will be required to meet the state's statutory targets of 80 percent reduction by the year 2050, emissions trends are heading down, consistent with the state's 2010 Clean Energy and Climate Action Plan. Power plants in Massachusetts have already met the 2020 target to reduce emissions by a quarter of the total statewide reductions. And more is being done. Even absent SB 1965, Massachusetts continues to reduce power-sector emissions with several factors helping to lower emissions in the future: energy efficiency investments leading to flat demand; renewable energy investments; retirements of existing fossil-fuel power plants; addition of relatively efficient gas-fired generation; a declining cap on emissions under the 9-state Regional Greenhouse Gas Initiative ("RGGI"); and upcoming federal requirements (under the U.S. Environmental Protection Agency's ("EPA") new Clean Power Plan) to reduce CO_2 emissions from power plants.

Buying and delivering hydropower from Canada will not be cheap.

Second, long-term contracts for large-scale hydropower from Canada will not be cheap and will not have the hoped for result of lowering consumers' electric rates. New England will not be able to access large quantities of such power on a baseload basis for 15-25 years without construction of high-voltage transmission facilities which will render the purchase of power (including cost of transmission) above market prices. There's no reason to believe that power from provincially owned Canadian utilities will be low cost. Understandably, Hydro Quebec and Nalcor will need to take into account the economic interests of their provincial governments (Quebec and Newfoundland/Labrador), and it would be bad business for their provincial shareholders and electricity consumers to sell the firm power into New England at below the going price of electricity. Plus, committing to provide at least one third of Massachusetts's electricity needs for several decades will likely require investment in new hydroelectric dams, whose costs will be significant. The price offered to Massachusetts and in turn paid for by its ratepayers would have to recover such costs. When considered in total, the costs of the power and the transmission delivery facilities are likely to be well above market prices if procured in the manner anticipated by Senate Bill 1965.

The Bill would flood and erode the power market in the region.

Third, the amount of power authorized under Senate Bill 1965 would flood the New England market and lead to unintended consequences for carbon emissions and other outcomes. The enormous size and long length of the contracts is unprecedented. This amount of power is not needed in the region at this time, and 'out-of-market' contracts would serve to artificially suppress wholesale energy prices and undermine the financial viability of other, more cost-effective generating assets (e.g., existing nuclear plants) that are otherwise important for a low-carbon electricity supply.

Large, out-of-market power contracts whose risks are shifted to wires charges in electricity customers' bills is not consistent with the structure of the state's electric industry.

Fourth, Senate Bill 1965 is not consistent with the competitive structure of the state's electric industry. It would lead to risky obligations borne by Massachusetts electricity consumers rather than market actors better positioned to manage the risks. If enacted and implemented, Senate Bill 1965 would send the signal to private investors that Massachusetts is willing to adopt public policies that fundamentally change the rules of the game that other power suppliers have depended upon and had to live by. Local power plant owners – some of whom also provide significant quantities of power with no or little carbon pollution – have invested tens of billions of dollars here for the right to compete to serve consumer electricity demand reliably and efficiently, while driving dramatic reductions in emissions. New power generators are also just now starting to reenter the marketplace in response to price signals and investing in substantial new capacity to meet reliability at a competitively determined price. Those power generators would be right to protest that this bill would undermine the overall investment climate to the detriment of consumers, as well as their own companies. The local impact of plant closures representing significant jobs and tax payments should also raise concerns among policy makers in the state.

Instead of this Bill, the state should use non-discriminatory, market-based policies to accomplish the state's low-carbon goals.

The most cost-effective way to meet continued goals for carbon emission reductions – even beyond the already-met 2020 goals – is through non-discriminatory policies to reduce carbon emissions that allow any resource that can qualify to compete. There are opportunities in 2015 and 2016 for policy makers to support the design and implementation of market-based policies that focus strategically on reducing carbon emissions from the power sector. These include: development of Massachusetts' State Plan to comply with the EPA's Clean Power Plan regulations affecting existing power plants; reviewing and revising the RGGI program to address post-2020 carbon-reduction goals; the adoption of a technology-neutral Clean Energy Standard; and allowing many of the reforms in New England's wholesale market to have a chance to accomplish the reliability and cost-reduction outcomes they have been designed to induce. Notably, forward prices in New England's energy market are at relative historic lows and already reflecting the impact of such policies in the market.

Relying upon market-based approaches – rather than out-of-market contracts that impose undue (and unnecessary) risk on electric consumers in Massachusetts – is a practical and effective long-term model. This is the hallmark model that has been used in virtually every successful emissions market in the world, including the RGGI program in which all New England states participate today. Senate Bill 1965 would be a giant step in the other direction, and is not the right path forward.

Proposed Senate Bill No. 1965: An Act Relative to Energy Sector Compliance with the Global Warming Solutions Act

Potential costs and other implications for Massachusetts consumers and the state's and region's electric system

Susan F. Tierney, Ph.D.[1]
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Background

On July 9, 2015, Massachusetts Governor Charles Baker submitted Senate Bill No. 1965 to the Commonwealth's Senate and House of Representatives.[2] If enacted, the bill would require the state's electric utility companies to solicit long-term contracts for large quantities of 'clean energy resources,' and establish new authorities for various state agencies.[3]

Specifically, the bill would direct the state's Department of Energy Resources ("DOER") and the state's investor-owned electric distribution utilities ("electric utilities") to solicit proposals from suppliers of certain types of power supply: either stand-alone hydroelectric power from existing; or new hydropower facilities, and new "Class 1" renewable resources[4] firmed up by hydroelectric power resources. The solicitations could include proposals for transmission to connect the source of the clean energy generating resources to New England, with such transmission either being in a separate proposal or bundled together with the hydroelectric/renewable power supply. The solicitations, which could be conducted with other New England states and which would have to occur before April 1, 2016, would provide for an amount of power equaling one third of the state's total annual electricity use for a 15-25 year contract period.

Calling Senate Bill 1965 "an act relative to energy sector compliance with the Global Warming Solutions Act," Governor Baker has stated that without the procurement of significant quantities of hydroelectric power delivered into New England, Massachusetts will be at risk of not meeting its goal to reduce greenhouse gas ("GHG") emissions by 25 percent below 1990 levels by the year 2020.[5]

Senate Bill 1965 comes as one of the most recent steps Massachusetts executive branch officials have taken with other New England states over the past few years to address concerns about the environmental impact, cost and reliability of electricity supply in the region, and to lessen its reliance on natural gas.[6] In April 2015, the New England Governors issued a joint statement to cooperate and take "coordinated action on regional energy infrastructure" to address the "significant energy system challenges with serious economic consequences for the region's consumers. These challenges require cost-effective solutions to reduce consumer energy costs, strengthen grid reliability and enhance regional economic competitiveness."[7] As of late August,

2015, state agencies and electric utilities in Massachusetts, Connecticut and Rhode Island have been preparing for the potential issuance of a joint request for proposals for "clean energy projects based on each state's current authority."[8] The purpose of that solicitation is to "explore whether a multi-state procurement might attract larger-scale projects and transmission than single state procurements and achieve individual states' clean energy goals more cost effectively than if each state proceeded on its own."[9]

In the last session of the Massachusetts House and Senate, a bill similar to Senate Bill 1965 was considered but not enacted.[10] In early 2014, I prepared a report and testified on that bill, House Bill 2968, describing that "although I strongly support the stated intentions of the bill to assist the state in reducing GHG emissions from energy production and use, I want to point out the potential for unintended and negative consequences of this bill, if it were enacted in Massachusetts."[11]

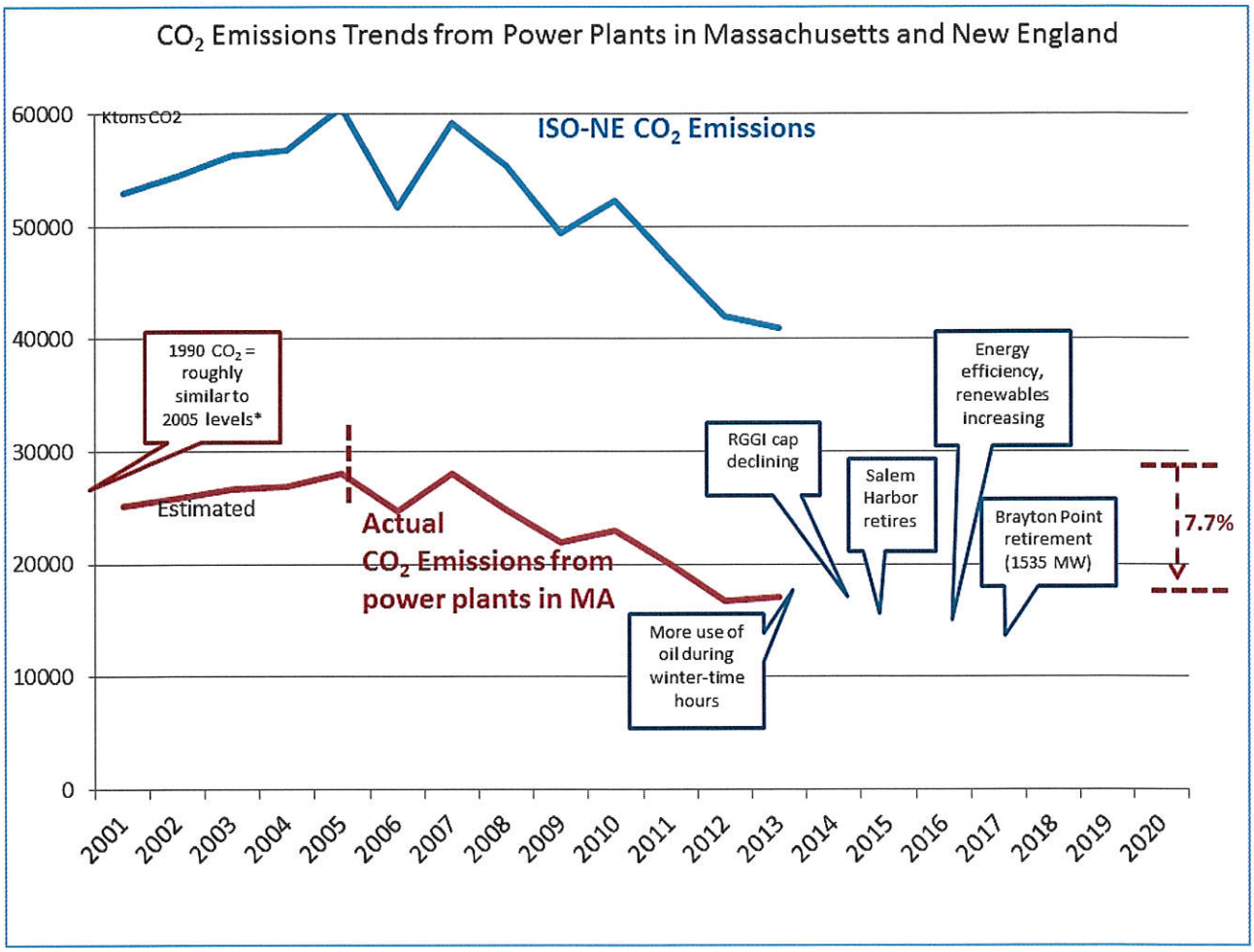
For the reasons I describe below in this updated and revised report, I believe that if enacted into law, Senate Bill 1965 – however well-intentioned and seemingly appealing on first blush – would likely cause predictable and negative impacts for Massachusetts consumers and the state's economy. Its hoped-for outcomes will be undermined by second-order impacts that will raise costs and challenge the state's accomplishment of its GHG reduction targets and significantly harm the markets on which Massachusetts depends for its electricity supply.

CO2 emissions from power plants are declining as called for in the Global Warming Solutions Act

Although there are still significant reductions in CO_2 emissions necessary across the entire Massachusetts economy to meet the statutory targets of 80 percent reduction by the year 2050, emissions trends are declining as anticipated under the state's Clean Energy and Climate Action Plan. That plan called for power-sector emissions to make up 7.7 percentage points (or roughly one fourth) of the total 25-percent emissions-reductions from 1990s levels by the year 2020.[12] That amount for the power sector is roughly 7.2-7.5 million metric tons ("MMT) of CO_2 (relative to total 1990 levels of 91 tons of CO_2).[13] In the Commonwealth's Five-Year Progress Report (January 2014) on meeting the targets set under the Global Warming Solutions Act, charts indicate that energy generation and distribution would likely account for roughly 10 MMT of CO_2 reduction.[14]

The figure below shows the trends in emissions from power production in Massachusetts and in New England. As of 2013, power plant emissions are already set to accomplish the original goal of approximately one fourth of the total state target for 2020.[15] In fact, this also highlights that beyond the 2020 target for power production, additional factors will lead to lower power production emissions than were even contemplated under the Clean Energy and Climate Action Plan. As noted in the 2014 Progress Report and elsewhere, the contributing factors include: the declining cap of emissions under the RGGI program; the continued investments in energy efficiency, which will

continue to lower demand for electricity; the increased amount of renewables that is required under the Massachusetts Renewable Portfolio Standard; actions that will be required under the U.S. EPA's Clean Power Plan; and recent and upcoming retirements of fossil-fuel power plants in Massachusetts (and in other New England states). There may be some offsetting impacts associated with the additions of dual-fuel capacity at some existing peaking-power plants in the state, but there are also proposals for new and highly efficient power plants to come on line before 2020, as well.



The bottom line is clear – Massachusetts is on pace for power plants to far exceed their 2020 emissions goal under the Global Warming Solutions Act. Senate Bill 1965 is simply not necessary to meet these goals, especially at the direct and indirect costs it would introduce into the region's energy system.

Why Senate Bill 1965 is unsound public policy: It introduces many risks and is unlikely to accomplish its hoped-for goals

Long-term contracts for large-scale firm hydropower will not be cheap

It is not sensible to assume that long-term contracts for Canadian hydroelectric power delivered and supplied on a firm basis into New England will be low cost. There are several reasons why.

First, the most recent example of the costs of a long-term contract for such hydroelectric supply is the one signed in early 2011 between the Vermont electric utilities and Hydro Quebec. This contract provides for between 218-225 MW of electric energy supply between November 2012 through 2038, starting at a price of approximately $58.07/MWh[16] plus the cost of the transmission line to get the electricity to Vermont. Although the price may have started out at roughly the market price of energy in New England, actual wholesale prices in New England in the past year are already below this level, as are forward power prices for at least the upcoming five years.[17] And that does not even take into account the cost of the Highgate transmission line (let alone what may be reflected in the $1.2-1.4 billion price tag for the new transmission currently being proposed to Canada).

Although this 2012 Vermont/Hydro-Quebec contract is not likely to have the same prices as any proposed contracts offered in the future for much-larger supplies of hydropower power (e.g., ranging from 9.45 million MWh per year to 18.5 million MWh per year, which the latter roughly equal to 10 times the size of the capacity of the Vermont/Hydro-Quebec deal[18]), it does suggest that Hydro Quebec has offered long-term contract prices into the New England market at no less than the long-term wholesale price. Even if the Canadian suppliers were to offer a commodity power price at close to the forward wholesale price in New England, that cost would have to be boosted to reflect the cost of transmission (e.g., another $30+/MWh), making this resource far from cheap relative to other supplies in New England's power market.[19]

Second, deliveries of up to 18.5 million MWh per year of hydroelectric power from Canada on a baseload basis will require construction of one or more new high-voltage transmission lines. Several proposed 1,000-MW transmission projects are already competing for regulatory approvals, and all of them have construction price tags ranging from $1.2-$1.4 billion dollars (and above) for the cost of the New England side of the line.[20] Although they have been proposed to date as "merchant" transmission lines with the sponsor (and/or its partner) intending to absorb the cost to construct and finance the lines,[21] that sponsor will need to be able to recover those investment costs through payments from New England's wholesale energy and capacity markets. The order-of-magnitude cost of the U.S. portion of such facilities has been estimated several years ago to be roughly $28.50/MWh (with another $14.00/MWh for upgrades to transmission facilities on the Canadian side of the border).[22] Therefore, to recover just the costs of these facilities alone – and without providing supply of hydropower over the lines on a baseload basis every year of the contract – the sponsor of

the line would need wholesale energy prices above ~$42/MWh and perhaps much higher to cover just the costs of transmission service from the Canadian border to a delivery point inside of New England. The electricity commodity cost would be added on top of the ~$42/MWh. By comparison, this represents a significant share of wholesale power prices in New England, which averaged around $55/MWh between July 2012 and June 2015 and which currently are around the same price (~$55/MWh) in forward power markets in New England.[23]

Third, the likely suppliers of firm hydroelectric power over these potential facilities are Hydro Quebec and Nalcor, the two provincially owned Canadian utilities with significant hydroelectric energy resources. Their economic interests are to provide value to their customers and their parents, the Provinces of Quebec, Newfoundland and Labrador. It is not reasonable to assume that they would sell power to New England buyers at anything but the market price of electricity – and it would be bad business for their provincial shareholders if they did. They will not want to sell power below the market price. And they will need to ask for a higher price if their costs to supply firm power over a 15-25 year period require something more than the going rate in New England.

Providing a commitment to provide at least one third of Massachusetts' electricity needs for 15-25 years will likely require that new hydroelectric dams be built to ensure the capacity and energy are available for export over that entire period on a baseload-power basis. The price offered to Massachusetts would have to reflect such investment costs (which are not likely to be supported by the $1 billion annual energy cost mentioned above, especially when the costs of the transmission facilities also need to be covered by those payments). Moving that much power into the New England grid would also require substantial investment in electric infrastructure within the region, adding further to the price tag (even if it is procured separately and directly paid for by consumers through higher transmission rates, rather than bundled together with hydropower supply).

Looked at from another angle, if the Canadian suppliers were to offer a price that was equal to the anticipated forward price curve in New England without a premium to cover their costs for the transmission line, then it is unlikely that the suppliers would have sufficient contract revenues to cover the cost to construct both the transmission and generation facilities needed to supply a contract for 9.45 million MWh to 18.5 million MWh per year on a baseload basis for 15-25 years. In such a case, the project would not be economical for the Canadians to pursue. If the Canadians did pursue such a project, the Canadian government would effectively be subsidizing electricity producers at the cost of Canadian citizens, and it is unclear why a government-owned utility would ever agree to such a contract.

The only reasonable assumption then is that, like the example of the Vermont/Hydro-Quebec contract, the electric energy will be priced at or above New England market prices when transmission costs are included. Using the transmission-cost figure highlighted above would bring the cost of the Hydro Quebec/Nalcor power to ~$97/MWh, compared to average New England

prices for delivered power of ~$55/MWh. This represents $777 million in above-market costs that Massachusetts consumers would be paying every year. Such an exorbitant cost does not appear to be justified even with the other policy considerations weighed.

The amount of power authorized under Senate Bill 1965 would flood the New England market with more electric supply than is needed, and lead to unintended negative consequences for CO_2 emissions and other outcomes

As I described in my report last year, the scale and pace of the procurement is unprecedented, at least in my memory of the last 30 years in New England's electric industry.[24] It is entirely misaligned with the amount of new capacity or energy needed in the market at this time. Notwithstanding the valuable goal of having low-carbon energy resources into the mix, the act of introducing into New England a new increment of resources equivalent to one sixth of the total electricity production in New England),[25] will introduce significant dislocations into the industry.

Although not stated in the language of Senate Bill 1965 itself, it is nonetheless clear from prior statements by the New England Governors (as recently as April 2015) that one of the principal goals of long-term contracts with suppliers of hydroelectric power is to introduce significant quantities of electricity with low operating costs into New England's wholesale market. The result of introducing such a supply (i.e., a 'price taker') into the market is to lower day-ahead and real-time energy prices.

The amount of price distortion that would occur with a new injection of 18.9 million MWh of price-taking supply would be significant. This amount of power is not needed for reliability. Nor can it be low cost in light of the full investments (including transmission and new generating assets) needed to supply firm power into New England for so many years, as I described previously. Whether stated as a goal in the bill, this "price suppression" through the use of an out-of-market contract (as opposed to having it be an outcome of a market-based contract) is likely to undermine the financial viability of other relatively efficient, low-cost existing power-generation resources currently in the market.

Moreover, it may hasten the retirement of existing nuclear power plants that produce power with no carbon emissions, thus undermining the stated objective of Senate Bill 1965 to help Massachusetts meet its goal to reduce GHG emissions by 25 percent below 1990 levels by the year 2020.

To illustrate the point: When Vermont Yankee retired at the end of 2014 (due to anticipated prices in New England's energy markets[26]), the region lost roughly 5 million MWh of zero-carbon electric energy per year, with most of it replaced in the near term, at least, by fossil-fired generation.[27] If a long-term contract for hydroelectric power were to suppress prices in New England's wholesale market and lead to the retirement of Pilgrim Nuclear Station, for example, it would mean another ~5 million MWh of zero-carbon supply per year would be retired in New England.[28] Were this to

occur, then such a retirement of an existing nuclear plant (before the end of its operating license and the second to have occurred in recent years) would lead to higher emissions – in effect offsetting more than half of the carbon emissions intended to be avoided a contract for 9.45 million MWh of hydroelectric power from Canada being procured by Massachusetts and would end up bumping up prices in the region's wholesale energy markets, without reducing any of the above-market costs borne by Massachusetts electricity consumers for the contract for Canadian hydroelectric supply.

If significant quantities of imported hydroelectric power ended up contributing to the premature retirement of plants in Massachusetts and New England, then jobs would be exported to Canada as well. At present there are at least 1,500 jobs associated with operating power plants in Massachusetts alone.[29] Pilgrim makes up approximately 650 of those jobs. National data indicate that the average annual pay for a non-nuclear power-plant operator in Massachusetts is $72,840 (as of 2014) and higher at nuclear plants. It is difficult, if not impossible, to predict exactly which plants may close as a consequence of an out-of-market action taken by the state. It is safe to say, however, that hundreds of Massachusetts jobs at power plants would be put at risk by this proposal.

The New England State energy officials (through their regional organization, the New England States Committee on Electricity ("NESCOE")) seem to understand this kind of negative unintended consequence:

> *Some Potential Risks*: A significant change to New England's resource mix [through significant quantities of new hydropower imports] is not without risk. One category of risk relates to the potential implications on New England's current generation fleet. Specifically, increasing in any substantial way the level of hydro imports could have the effect of displacing existing generation units that provide service in New England today and that are needed, whether by operating characteristic or geographic location, to reliably operate the regional power system. Increasing hydro imports has the potential to depress the current New England generating fleet's energy margins, placing the continued operation of those units at risk.[30]

When examined through the narrow carbon-emission-reduction lens of the Commonwealth's Global Warming Solutions Act, Senate Bill 1965 is a relatively costly manner of achieving GHG reductions, in light of these risks. If the goal of this legislation is to reduce GHG emissions, that goal can most cost-effectively and efficiently be met through non-discriminatory regulations that allow any resource that can meet the emissions criteria to compete to serve consumer demand and that do not introduce the same types of market-distorting effects that Senate Bill 1965 would produce. (See the concluding section of this report.)

If enacted and implemented, Senate Bill 1965 would send a clear message to the investment community that Massachusetts is willing to use certain policies to undermine the viability of other

energy investments. This could backfire, in the sense of helping to lead to an investment climate unsupportive of modernizing and further cleaning up the electric system in the state and region.

Senate Bill 1965 is not consistent with the competitive structure of the state's electric industry.

Senate Bill 1965 would authorize long-term, large-scale contracts underwritten by the state's electricity consumers, shifting the risk of power supply to them even though the state previously declared such risks to be borne by power suppliers and not ratepayers, as part of the reasoning for the state's restructuring of its electric industry a decade and a half ago.[31] This would reverse that policy – something that seems ill-conceived at a time when: electric consumers are already finding it attractive to generate power locally on their own premises;[32] wholesale power prices are at historic lows in recent memory; and new investment is taking place through the marketplace without state-sponsored contracts or subsidies. The risk-shifting that underpins this bill's approach would create powerful incentives for additional customers to go off grid through distributed generation and thereby avoid the costs of the expensive hydro contracts, leaving the rest to pick up the tab.[33]

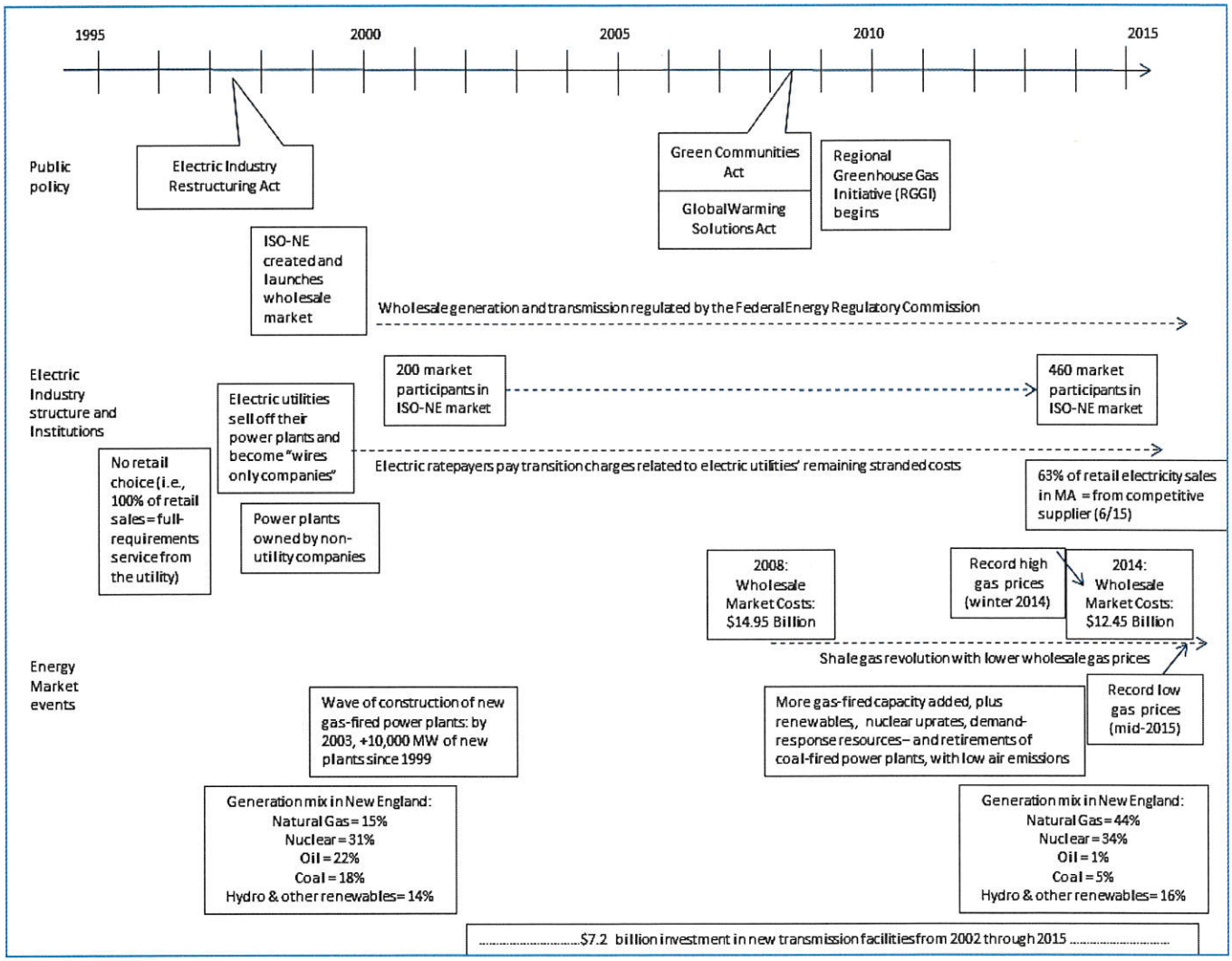
Massachusetts experienced this type of dynamic two decades ago when conditions – such as a prior decade of cost overruns associated with utility investments, changing technology and fuel costs, and signing of long-term contracts whose costs eventually became higher than prevailing prices – led Massachusetts officials to restructure the electric industry and to introduce competition in retail and wholesale markets. This "electric industry restructuring" took place over the course of a decade, leading to the development of systems and institutions designed to give customers the option to choose their electricity supplier, enabling non-utility companies (rather than utilities and their retail customers) to make at-risk investment in generation, and establishing a regional market to drive efficiencies in power production.

As shown in the figure below, various changes that have taken place since the mid-1990s and the enactment of the 1997 Massachusetts Electric Restructuring Act. Key elements that have changed include:

- Electric utilities providing wires (i.e., transmission and distribution) services, with those utilities having sold virtually all of the power plants they owned in 1997 to non-utility companies.
- The vast majority of generation supply in New England coming from non-utility competitive power suppliers, whose owners bear the various risks (e.g., financial, regulatory, market) associated with owning and operating power plants.
- Retail electricity customers now having the right to purchase 'generation service' from competitive suppliers rather than being required to purchase all supply from the local utility,

as was the case in 1997. Now, 29 percent of customers and 63 percent of total retail sales in Massachusetts are supplied by competitive electricity companies (i.e., not the utility), compared to zero percent in 1997.[34]

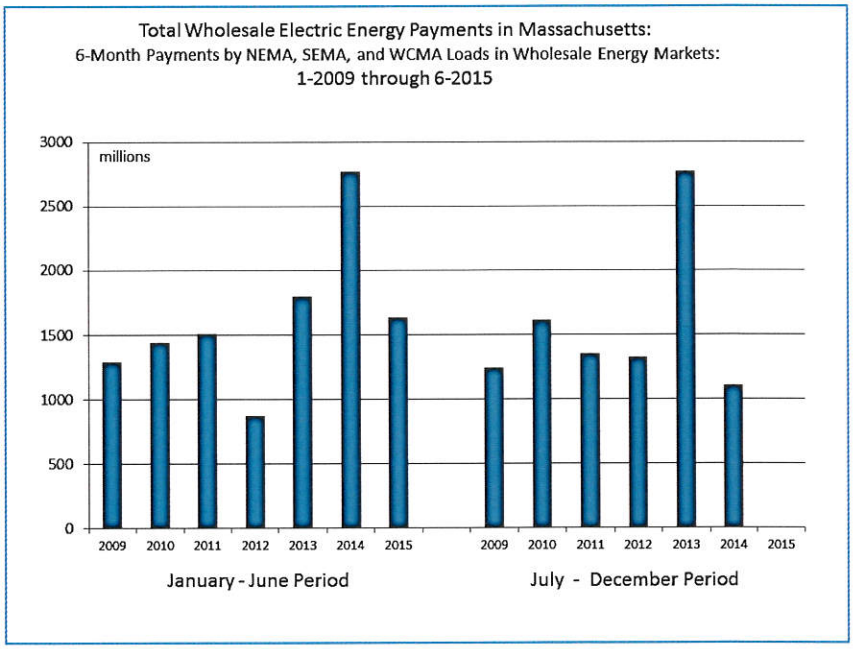
Two Decades of Changing Elements of the Massachusetts / New England Electric Industry and Power Market



- Significant investment in new generating assets since 2000, with most of the new supply being natural-gas-fired power plants and renewable energy projects (e.g., wind, solar, biomass), leading to large changes in the region's supply mix and much-greater dependence on natural gas for power generation.

- A new role for the grid operator (ISO-NE) to administer both reliability and market functions, under the regulatory supervision of the Federal Energy Regulatory Commission ("FERC"), rather than the states.

- A growing number of market participants (including not only electric utilities and power generators but also marketers, customers, and other resource suppliers).
- Significant electric resources coming from the customer's side of the electric meter, including new demand-response, energy efficiency and distributed generation (e.g., rooftop solar).
- Relatively flat demand, greater investment in energy efficiency, and reduction in air emissions, in part resulting from the operations of the nine-state RGGI program to limit CO_2 emissions from the power sector.
- Total cost of wholesale supply varying across the years, as the region experienced new investment in transmission (paid for by consumers), improved efficiency of the fleet of power plants (paid for by power plant owners), changing mix of power resources (with significant swings in fuel prices since 2000), changes in demand and the availability of tools (like demand-response as a resource). Notably the total cost of wholesale generation and transmission costs to consumers amounted to $12.45 billion in 2014 (the year in which natural-gas prices spiked and raised costs in the power market in New England), compared to $14.95 billion in 2008. And the costs to Massachusetts consumers for electric energy have gone down relative to the spike that occurred in 2014, and do not suggest a crisis in electricity prices. (The figure at the right shows prices from January 2009 through June 2015, with prices broken down into the first six months of each year versus the prices in the second six months of each year.[35] Prices in the second half of 2013 and the first half of 2014 were outliers.)



This rear-view-mirror look at the state's and region's electric industry might seem like ancient history. But looking back provides context for the kinds of changes that may occur over the period of time during which a new 15-year or 25-year power purchase agreement signed with suppliers of hydroelectric power would still in place and being paid for by Massachusetts electricity consumers.

The lessons from 15-20 years ago thus still seem relevant. And they are why I encourage the legislature not to authorize and direct the signing of major new contracts for such a large quantity of generating resources all to take place within a relatively short period of time.

Senate Bill 1965 is a risky obligation that will be borne by Massachusetts electricity consumers rather than market actors better positioned to manage the risks

There are other financial risks and unintended economic consequences of a procurement strategy that would displace one third of the state's power supply through long-term contracts in very large increments of supply. These other economic impacts and risks include: the cost implications of having ratepayers pay directly for transmission facilities to enable electric-energy imports without looking at the combined energy and delivery costs to determine whether there are net benefits of the latter; [36] the potential costs associated with mitigating the reliability impacts of such a large import of power on the operations of New England's system;[37] the challenges of using electricity imports from very-distant locations to integrate renewables in New England;[38] the potentially expensive way to achieve carbon emission reductions; and the macroeconomic implications of sending Massachusetts' dollars out of region to pay for power from Canadian government-owned sources, rather than keeping them in the state.

The energy system in Massachusetts, like almost every other part of the U.S., depends heavily on private companies and private capital markets to provide the investment and other resources needed to keep electricity as affordable and reliable as possible while also becoming increasingly clean. A healthy and sustainable investment climate is an essential ingredient for achievement of our economic, environmental and other goals for the power system. Enactment and implementation of this bill runs counter to that investment environment.

Despite the appearance that Senate Bill 1965 would rely on a market-based solicitation to procure new renewable or hydroelectric resources as one third of the state's electricity supply, this bill is not market friendly. It would solicit contracts for significant surplus power at a time when such quantities are not needed and when the addition of such will adversely affect the proper functioning of the region's electricity market. Local power plant owners – some of whom also provide significant quantities of power with no or little carbon pollution – have invested tens of billions of dollars here for the right to compete to serve consumer electricity demand reliably and efficiently. Those power generators would be right to object to a bill that would undermine the overall investment climate to the detriment of consumers, as well as their own companies.

Additionally, the existing suppliers in New England's market are subject to rules that Senate Bill 1965 anticipates hydropower suppliers being able to evade. The bill would allow suppliers of "firm service hydroelectric generation" to sign contracts with electric utilities that incorporate "reasonable force majeure interruptions that may be negotiated under the contract." This would allow such so-called "firm" supply to be interrupted without penalty. By contrast, under the new "pay-for-

performance" ("PFP") rules of ISO-NE's "forward capacity market" ("FCM"), suppliers of capacity resources (i.e., those suppliers that receive capacity payments in the FCM periods after 2018), there are no excuses (force majeure or otherwise) for a supplier of 'firm' capacity resources that fail to perform when called upon during periods of stressed system conditions.[39] Allowing a supplier of hydroelectric power to incorporate force-majeure elements into a supply contract would create an undue market advantage relative to other suppliers in New England's market and shift risks to the Massachusetts electric-distribution customers.[40]

Additionally, this out-of-market contract might run afoul of legal considerations arising from federal pre-emption over prices in wholesale power markets, which are the regulatory domain of the FERC. In the past year, there have been two federal appeals-court decisions that found state-mandated out-of-market power sales agreements with non-utility power suppliers to be pre-empted by the Federal Power Act (which is implemented by FERC).[41] Currently under consideration on appeal to the U.S. Supreme Court,[42] these holdings raise questions about whether the contracts authorized and directed by Senate Bill 1965, if enacted, would be found to affect prices in FERC-regulated markets and set aside as unconstitutional.

Conclusions and recommendations

For these reasons, I think that Senate Bill 1965 (like others that are similar to it) is ill-conceived. I do not reach that conclusion lightly. Like many others, I have long supported state and federal policies that move our energy systems toward a much-lower carbon profile. As a former environmental cabinet officer and utility regulator in Massachusetts, I have a healthy respect for the ability of states to fashion policies that fit the particular economic, environmental, social, and other conditions and aspirations of their leaders and citizens. I recognize that Massachusetts' adoption of the Global Warming Solutions Act in 2008 signaled an important and welcome step in addressing the costs of climate change. With the Green Communities Act, the state sought to pursue the potential benefits that can arise with investment in clean energy.[43]

I recognize that Massachusetts still has work to do in a number of sectors to accomplish its overall 2020 target for GHG reductions from the state's entire economy by 25 percent below 1990 levels. But the power sector is already at its 2020 targets and is on a good trajectory to exceed its carbon emissions goals. Senate Bill 1965 would be a potentially near-term disruptive element in the pathway toward continuing to reduce emissions, and would not accomplish its hoped-for goals of moving toward a cleaner electricity sector at a reasonable cost or reasonable way.

Indeed, I have previously testified on behalf and in support of Massachusetts electric utilities that have entered into long-term (10-15 year) contracts under Section 83A of the Green Communities,[44] at a time when the competitive solicitations were for an amount of power equal to no more than 3 percent of their total customer loads.[45] Those contracts similarly shifted risk to consumers, with any

above-market costs being paid through the distribution rates charged to all consumers by the utilities. Under Section 83A, electric utilities were allowed to charge ratepayers for the negative impacts of the contracts on the utility balance sheets. In my view, however, it is one thing to add a long-term commitment equaling 4 percent of total demand (as now provided for under Section 83A), with compensation to utilities for their role in signing 10-15 year contracts, and another thing altogether to add an amount of power equivalent to over 8 times the amount authorized under Section 83A. I respectfully suggest that this goes too far in shifting risk and costs to today's and tomorrow's electricity consumers.

And I previously testified against the prior "Clean Energy Resources" bill that was under consideration in 2014.[46] Senate Bill 1965 would similarly trade off the one set of goals (adoption of significant quantities of imported hydroelectric energy with zero carbon emissions associated with such power generation) for another (support for a healthy investment climate and robust electric industry in the state and in the New England region, to which Massachusetts electricity consumers' power supply is inextricably tied). Together, the enormous size and long length of the contract would have been unprecedented, and was misaligned with the amount of new capacity and energy needed in the market. The provisions of this bill are neither sensible nor efficient.

I know that Massachusetts is looking for ways to reduce reliance on natural gas to generate electricity, and to lower carbon pollution from power plants in the state and region. This bill is not the way to do so. The bill would introduce many unintended and negative costs and financial risks for Massachusetts consumers and its utilities, and would wreak havoc on the state's and region's electric industry. That electric system is surely in transition. This is well known to many in the industry, and I and others have written about the elements of the changes that are underway.[47] Unfortunately, this bill would not move it forward in a sustainable way.

Massachusetts energy/environmental policy makers should take advantage of the low-carbon energy options *and* market-based principles that Massachusetts and other New England states have been at the forefront of pursuing, and provide transitional approaches that respect both of those approaches, rather than supporting one at the peril of the other.

There are better policy designs to move toward a lower-carbon electricity supply in a manner consistent with the structure of the state's electricity market, its reliance on private investment for providing power supply, and its goals for reliable supply at efficient prices to consumers.

In fact, there are several upcoming opportunities for Massachusetts – either alone or in conjunction with other states – to implement carbon-reduction policies that are much-better aligned with the structure of this region's electric industry. Examples of such opportunities are as follows:

- **RGGI Program Update and Clean Power Plan Compliance**: As part of its planning to comply with the U.S. EPA's new "Clean Power Plan" final rules, Massachusetts may submit

a plan for how it will accomplish its CO_2-emission-reduction targets for 2022 and beyond. Like other states, Massachusetts may submit its State Plan by September 2016, or seek an extension that would mean the plan would be due in 2018.[48] Also during 2016, Massachusetts will be participating in a review of what changes might be needed in the RGGI program for the period beyond 2020.[49] Together, these provide means by which Massachusetts may consider how to tighten its program rules to deepen the power-sector's CO_2 emissions, consistent with federal law and with the state's own Global Warming Solutions Act. Novel things that Massachusetts might consider would be to use the proceeds to Massachusetts from future auctions of RGGI allowances to make deeper investments in low-carbon supply (e.g., continued investment in energy efficiency; the purchasing and retirement of CO_2 allowances; etc.).

- **Clean Energy Standard:** As part of the Massachusetts Clean Energy and Climate Plan for 2020 issued in 2010, the state identified the role that a new market-based "Cleaner Energy Performance Standard" might play in helping to reduce CO_2 emissions from power production in the Commonwealth.[50] At the end of 2014, a Clean Energy Standard was proposed by the Massachusetts Department of Environmental Protection ("DEP"), but further consideration of the proposal has been postponed during the agency's review of regulatory actions pursuant to Governor Baker's Executive Order 562.[51] (Senate Bill 1760, sponsored by Senators Benjamin Downing and Marjorie Decker, would further require DEP to issue a clean energy standard.) An improved proposed Clean Energy Standard regulation – designed to be competitively neutral to different zero- or low-carbon generating technologies and designed to retain existing low-carbon resources and well as induce new ones – could contribute substantially toward Massachusetts' compliance with the Global Warming Solutions Act. Such improvements in a revised and newly re-issued Clean Energy Standard would be a clear example of a carbon-reduction strategy well aligned with competitive markets in the state and region.[52]

- **Regional Wholesale Markets:** Third, the region's wholesale power market has introduced changes designed to provide much-stronger incentives for reliable power supply during winter months when deliveries of natural gas are constrained by gas pipeline delivery infrastructure. These should be allowed to do their intended work. Forward prices for power in New England are already taking into consideration the many changes that have been occurring in the past few years to mitigate the potential for natural gas prices – and wholesale electric energy prices in turn – to spike during the winter months. These changes include: incremental pipeline expansion projects in New England, which will provide new capacity to deliver gas during winter months;[53] making use of underutilized capacity for importing relatively attractively priced liquefied natural gas ("LNG") into Massachusetts; the addition of dual-fuel capacity and greater on-site storage of oil at many of New

England's existing and newly proposed gas-fired peaking power plants; demand-response and energy efficiency investments; and other new power projects in the region.[54] Furthermore, public officials in Massachusetts can continue to engage with other key stakeholders in New England, including the ISO-NE, to understand the implications for the region's energy and capacity markets as the region integrates increasing supplies of renewable energy. In June, 2015, ISO-NE published a "discussion paper on New England's capacity markets and a renewable energy future," which described the implications for an increasing role for the forward capacity market (and increased prices in it) as the region continues to encourage renewable resources with no or very-low fuel costs.[55] There is considerable work needed to further integrate renewable energy and the entry of technology (e.g., storage) to ensure a reliable, efficient and low-carbon supply of energy.

- **Cost-effective energy efficiency**: Compared to the costs associated with Senate Bill 1965, pursuing continued and even-more aggressive energy efficiency and other demand-side measures will not only support the goals of managing consumers' energy costs and reducing regional CO_2 emissions, but such measures may also be the most cost-effective way to accomplish that. Experience has shown that investing in energy efficiency (e.g., through use of RGGI auction proceeds) not only reduces consumers' energy bills but also keeps more dollars within the local economy.[56]

As policy makers consider adding new policies that affect features and performance of the electric system, they need to ask whether the elements of the overall markets and public policy add up to a system capable of producing a sustainable outcome. To attract and sustain the interest of private investors in the region's electric system, we need to make sure that the dollars and cents add up, as we hope for a system that evolves with the needs of the 21st century. If the numbers don't add up and therefore prevent key actors from remaining financially viable, then we should work to design reforms that will keep the goal of maintaining a sustainable electricity market in mind.

Fortunately, the New England states' energy officials have expressed caution about the potential risks and unintended consequences of executing a competitive procurement – outside of wholesale electric markets – that results in long-term contracts for power (such as those anticipated by Senate Bill 1965). Borrowing from NESCOE's own listing of such risks, I encourage Massachusetts policy makers to take actions that:

- Allow markets to efficiently allocate society's resources, identify economic opportunities, and satisfy consumer needs
- Avoid material distortions to New England's wholesale markets, which as ISO-NE cautions in other contexts, may present significant unintended consequences and reliability challenges;

- Insulate New England's ratepayers from generation and transmission costs and risks that investors have indicated an intent to fund and undertake....[57]

Consistency with these principles would lead logically to the conclusion that Senate Bill 1965 would undermine an economically as well as environmentally sustainable environment for the electric industry in Massachusetts. I respectfully encourage policy makers to reject it.

ENDNOTES

[1] Susan Tierney is a senior advisor at Analysis Group in Boston, and formerly assistant secretary for policy at the U.S. Department of Energy, Massachusetts' Secretary of Environmental Affairs and a commissioner at the Massachusetts Department of Public Utilities. For over two decades, she has worked for a wide variety of clients, including customers, environmental groups, state agencies, transmission companies, grid operators, electric and natural gas utilities, competitive suppliers, power generators, and others. She previously wrote a report on the "Clean Energy Resources Bill"(House Bill 3968, https://malegislature.gov/Bills/188/House/H3968) proposed in 2014, with her report called: "Clean Energy Resources Bill: Potential costs and other implications for Massachusetts consumers and the state's and region's electric system," April 1, 2014 (hereafter, "Tierney 2014 Report"). Knowing that she is a supporter of efforts to both lower the carbon emissions from the power sector as well as support competitive markets, the New England Power Generators Association approached her to assess and write a report analyzing the potential implications for Massachusetts of Senate Bill 1965.

[2] My summary of the bill is in the Appendix. The actual bill can be found at: https://malegislature.gov/Bills/189/Senate/S1965.

[3] There are other bills in the legislature that would similarly provide new authorities to state agencies for approving long-term contracts with renewable resources (e.g., offshore wind) and/or large-scale hydroelectric power. See, for example: House Bill 2881 sponsored by Representative Patricia Haddad, supporting procurements and contracting for offshore wind in an amount up to 8.5 million MWh per year by 2030; and Senate Bill 1757, sponsored by Senators Benjamin Downing and Marjorie Decker, supporting expansion of existing requirements that electric utilities solicit proposals for and contract with renewable projects in order to facilitate the financing of such projects, and providing new authorities to require electric utilities to jointly solicit and enter into long-term contracts for up to 9.45 million MWh of power from renewable energy projects built after 2003 and with those contracts paid for through a "diversity benefit allocator" applicable to all electric customers in the service territories of the state's electric utilities.

[4] Chapter 25A, Section 11F (b)-(c) https://malegislature.gov/Laws/GeneralLaws/PartI/TitleII/Chapter25A/Section11F.

[5] Massachusetts Governor Charles D. Baker, letter to the Senate and House and Representatives, "Senate Bill No. 1965: Message from His Excellency the Governor recommending legislation to require electric utility companies to solicit long-term contracts for clean energy generation," July 9, 2015. Governor Baker states that "In 2010, when the first Climate Change Plan was proposed to meet these goals, one significant assumption included the procurement of approximately 1,200 megawatts ("MWs") of hydroelectric power to be delivered to Massachusetts to meet the 2020 goal. The 2020 Plan assumed that delivery of this hydroelectric power would account for a full 5.3% of the targeted 25% reduction."

[6] See, for example: "New England Energy Update: Actions for a Cleaner, More Reliable and More Affordable Energy Future. (Actions Through July 2015)," http://www.nescoe.com/uploads/6_State_Action_Plan_FINAL_4-22-15_1-5.40_pf.pdf. See also: Northeast States Committee on Electricity ("NESCOE"), "2014 Annual Report to the New England Governors," http://www.nescoe.com/uploads/Annual_Report_2014.pdf. See more generally: http://www.nescoe.com/Home_Page.html.

[7] "New England Governors' Statement: Regional Cooperation on Energy Infrastructure," April 23, 2015. http://www.nescoe.com/uploads/6_State_Joint_Statement_FINAL_4-22-15_12-3.36pm_w-sealsf.pdf. See also: "New England Energy Update: Actions for a Cleaner, More Reliable and More Affordable Energy Future. (Actions Through July 2015)." http://www.nescoe.com/uploads/6_State_Action_Plan_FINAL_4-22-15_1-5.40_pf.pdf.

[8] NESCOE, "Presentation to the Consumer Liaison Group, Order 1000 in New England," June 18, 2015. http://www.nescoe.com/uploads/CLG_O_1000_6-18-15.pdf. The timeline for such joint solicitations has anticipated that the RFP would be issued in late summer of 2015, subject to approvals by state regulatory agencies. http://cleanenergyrfp.com/.

[9] NESCOE, "Presentation to the Consumer Liaison Group, Order 1000 in New England," June 18, 2015. http://www.nescoe.com/uploads/CLG_O_1000_6-18-15.pdf. The timeline for such joint solicitations has anticipated that the RFP would be issued in late summer of 2015, subject to approvals by state regulatory agencies. http://cleanenergyrfp.com/.

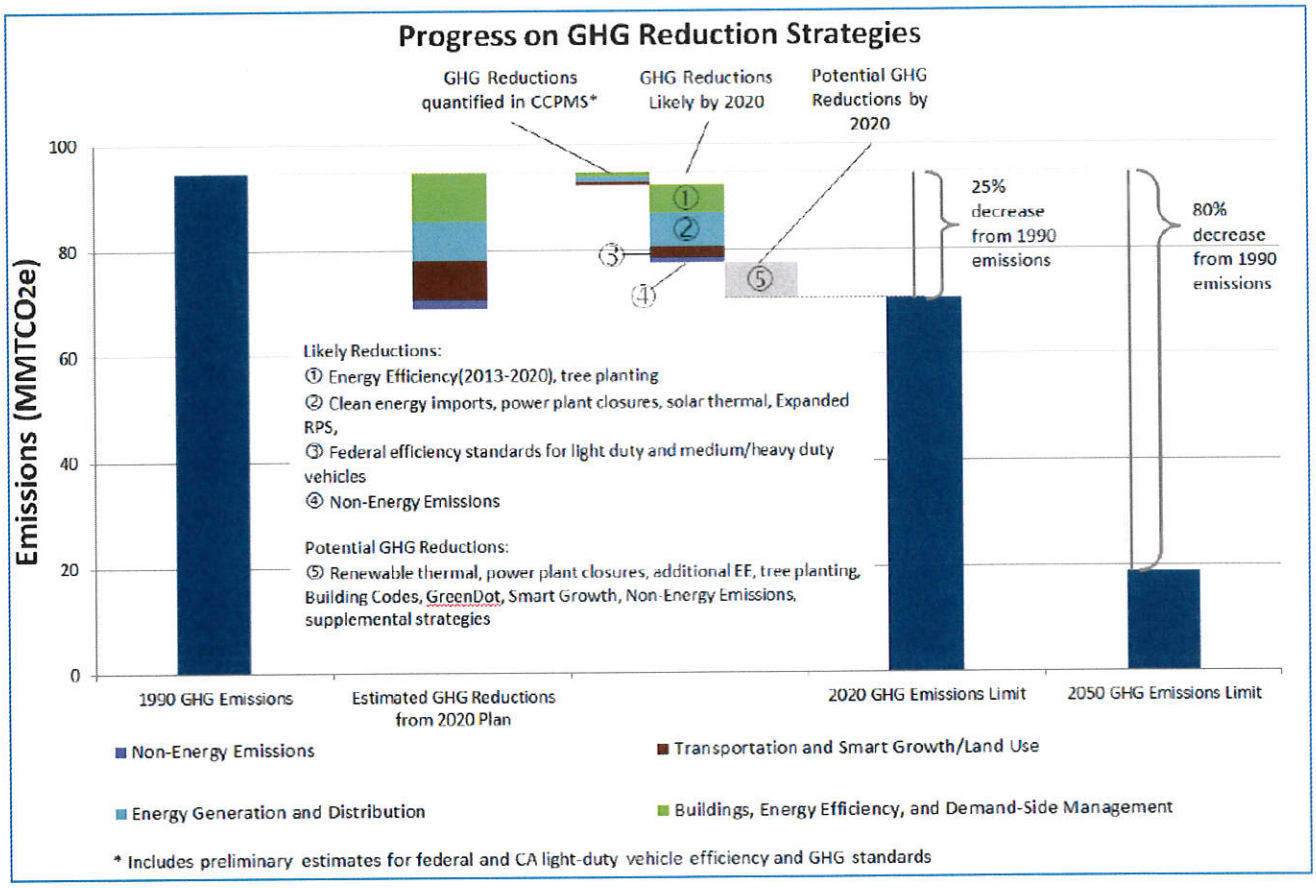
[10] Jon Chesto, "Patrick makes a push to help hydropower: As time runs out, governor makes last drive for rules," *Boston Globe*, December 9, 2014. https://www.bostonglobe.com/business/2014/12/09/time-runs-out-for-patrick-one-last-push-help-hydropower/Qf2OKhoEmcKzC8IKUknRaN/story.html.

[11] Tierney 2014 Report. See also: Testimony of Susan Tierney before the Massachusetts Joint Committee on Telecommunications, Utilities and Energy on An Act Relative to Clean Energy Resources – H. 3968, Hearing, April 8, 2014.

[12] "Massachusetts Clean Energy and Climate Plan for 2020," December 20, 2010, Figure ES-5.

[13] Massachusetts Clean Energy and Climate Plan, Figure ES-5 (indicating the 7.7 percent target for reductions in GHG emissions from the power sector, relative to the state-wide emissions-reduction target of 25 percent below 1990 levels by the year 2020). One-fourth of the 91 million metric tons of emissions in 1990 is approximately 23 million metric tons (reducing statewide emissions to 71 million metric tons. The 7.7 percent of total reductions intended to come from the power sector would be 7.2 million metric tons (or 7.7 percentage points out of the total 25-percentage point reduction by 2020.

[14] Figure 6 (below) from the Commonwealth's Global Warming Solutions Act: 5-Year Progress Report shows the components of progress on progress on GHG emission-reduction strategies relative to the 2020 target reduction:



[15] Here are the data depicted in that figure shown in my report:

CO_2 Emissions from Power Generation (ktons of CO_2)		
year	ISO-NE	Massachusetts
2001	52,991	25,092
2002	54,497	25,805
2003	56,278	26,648
2004	56,723	26,859
2005	60,580	28063
2006	51,649	24708
2007	59,169	28017
2008	55,427	24,767
2009	49,380	21,920
2010	52,321	22,960
2011	46,959	19,890
2012	41,975	16,725
2013	40,901	17,026

Information in the table above (and depicted in the figure) is from: ISO-NE Emissions reports for the years 2003 through 2013, with data in Table 5-1 in each year. http://www.iso-ne.com/system-planning/system-plans-studies/emissions. Other sources of information on the figure are from: Massachusetts Clean Energy and Climate Plan, Figure ES-5 (indicating the 7.7 percent target for reductions in GHG emissions from the power sector, relative to the state-wide emissions-reduction target of 25 percent below 1990 levels by the year 2020. MA DEP datafile (GWSA_Appendix1_final.xls); http://www.mass.gov/eea/air-water-climate-change/climate-change/massachusetts-global-warming-solutions-act/#3; Patricio Silva, ISO-NE, "Overview of Carbon Emission Trends from New England Generators," 21st NECA Conference Session 1A: Moving Toward a Lower Carbon Grid, May 14, 2014. http://www.iso-ne.com/committees/comm_wkgrps/prtcpnts_comm/eag/mtrls/2014/may282014/iso_ne_regional_carbon_trends_neca_2014.pdf;

[16] "After the first year, the [annual] price of power under the HQ PPA is derived by a formula based on regional electricity prices and the movement in general of price levels observed across the U.S. economy, subject to a damping feature that limits the change from the prior year's price." Vermont Public Service Board, Order on Petition of twenty Vermont utilities and Vermont Public Power Supply Authority requesting authorization, …for the purchase of shares of 218 MW to 225 MW of electricity of H.Q. Energy Services (U.S.) Inc., …" Docket No. 7670, Order entered April 15, 2011 (hereafter "Vermont PSB Order on the HQ PPA"), page 11. http://psb.vermont.gov/sites/psb/files/orders/2011/7670FinalOrder.pdf

[17] Note that the Vermont/Hydro Quebec contract provides for a total amount of energy at a starting price of 58.07/MWh , and supply of "218 to 225 MW per hour (the key 'peak load' hours), seven days a week, every day of the year for every year of the contract." Vermont PSB Order on the HQ PPA, page 13. The actual pricing of on-peak power for each of the prior three years is shown in the table below, with the forward prices for power in each of the upcoming five years.

Average Price ($/MWh) for On-Peak Power in New England (Actual and Future)	
	On-Peak MWh ($/MWh)
Actual Prices	
7/2012 – 6/2013	$59.71
7/2013 – 6/2014	$87.80
7/2014 – 6/2015	$54.22
Forward Prices (as of 8-18-2015)	
7/2015 – 6/2016	$55.28
7/2016 – 6/2017	$55.72
7/2017 – 6/2018	$53.51
Source: SNL Energy	

[18] This is based on 2100 MW of transmission capacity carrying fully loaded power supply on a 99-percent availability and 99-percent capacity factor (equivalent to 18.9 million MWh per year).

[19] If the Canadian suppliers were to price energy into New England in a similar way as the Vermont/Hydro Quebec power purchase agreement, then the delivered cost could be roughly 175 percent of the market price of power, based on the $42/MWh cost for transmission plus the forward market price (e.g., $55/MWh).

[20] Three projects in some stage of development/permitting include:

- TDI - New England's proposed Clean Power Link Transmission Line Project: estimated cost of $1.2 billion for a 154-mile 1,000-MW high-voltage transmission line from Canada into Vermont and with a 2019 in-service date. http://www.necplink.com/docs/001_05-31-2015-FINAL-Draft-EIS-to-DOE.pdf
- Eversource Energy's proposed Northern Pass transmission line project: current cost estimate is $1.4 billion for a 192-mile, 1,000-MW line (192 miles), with a proposed in-service date of 2019. http://media.northernpasseis.us/media/EIS-0463-DEIS-Summary-2015.pdf.
- Anbaric Transmission / National Grid's proposed 1,000-MW "Maine Green Line" transmission project, part of their Green Line Infrastructure Alliance. http://greenlineinfrastructurealliance.com/projects/

It is not clear what, if any, additional costs (e.g., system upgrades) would be required to enable reliable delivery to loads.

[21] Although originally proposed to have the costs of transmission paid for by the project sponsor, the current solicitations for hydropower being contemplated by the three states anticipate the possibility that sponsors may offer stand-alone "transmission-only" contracts, without renewable resources or hydroelectric power supply being bundled with the transmission service. See further discussion below, as well as the New England Clean Energy RFP website: http://cleanenergyrfp.com/.

[22] This estimate is based on a 2012 analysis of the cost of the Northern Pass transmission line, which at the time was estimated to be roughly $1.1 billion and capable of carrying 1,200 MW of capacity. That analysis produced a cost for Northern Pass of $28.50/MWh (which would be conservative for the current line with a higher cost ($1.4 billion) and smaller carrying capacity (now at 1,000 MW). Source: PA Consulting, "Electricity Market Impacts of the Northern Pass Transmission Project," June 2012, pages 4, 17.

[23] See footnote 17, above, for forward prices in the ISO-NE market.

[24] In the mid-1980s, the New England utilities entered into a firm, long-term (10-year) contract with Hydro Quebec for 7 million MWh of power a year, to be delivered over the new Hydro Quebec Phase II high voltage direct current transmission line from Quebec to New Hampshire, starting in 1990. This amount of power represented 6.7 percent of total New England electricity sales in 1990 (7 million MWh out of total demand in 1990 of 104 million MWh for the six New England states). The transmission line was for 2000 MW with a 1800-MW converter terminal in New Hampshire. Sources: U.S. Congress, Office of Technology Assessment, *Electric Power Wheeling and Dealing: Technological Considerations for Increasing Competition*, OTA-E-409, May 1989, Box 6-A, page 188; Energy Information Administration ("EIA"), 826 data for the six New England states for 1990.

[25] EIA, 826 electricity data for Massachusetts and the New England states.

[26] EIA, "Vermont Yankee nuclear plant closure in 2014 will challenge New England energy markets," *Today in Energy*, September 6, 2013. http://www.eia.gov/todayinenergy/detail.cfm?id=12851.

[27] During the first 11 months of 2014 (prior to its permanent shutdown in December 2014), Vermont Yankee produced 5.084 million MWh, with a capacity factor of 96.5 percent. International Nuclear Agency, Power Reactor Information System, information on Vermont Yankee nuclear station. https://www.iaea.org/PRIS/CountryStatistics/ReactorDetails.aspx?current=626.

[28] In 2014, Pilgrim nuclear station had a 97.3 percent capacity factor, producing 5.769 million MWhs. International Nuclear Agency, Power Reactor Information System, information on Pilgrim nuclear station. https://www.iaea.org/PRIS/CountryStatistics/ReactorDetails.aspx?current=639

[29] U.S. Bureau of Labor Statistics, data on Occupational Employment and Wages (May 2014), for power plant operators (51-8011: Control, operate, or maintain machinery to generate electric power. Includes auxiliary equipment operators. Excludes Nuclear

Power Reactor Operators: 51-8011). http://www.bls.gov/oes/current/oes518013.htm#st. Information on nuclear plant employment in Massachusetts (approximately 650 employees) is from Entergy.

[30] NESCOE, "Incremental Hydropower Imports Whitepaper: Considerations, Options and Market Overview Regarding the Potential to Increase Hydropower Imports from Eastern Canadian Provinces to New England," Fall 2013 (hereinafter "NESCOE Hydro Imports White Paper"), pages 47-48.

[31] As described in the whitepaper published by NESCOE, the principles that guided the states' approach to restructuring the electric industry were:

- "Market mechanisms are preferred over regulation to set price where viable markets exist.
- Risks of business decisions should fall on investors rather than consumers.
- Consumers' needs and preferences should be met with lowest costs.
- Electric industry restructuring should not diminish environmental quality compromise energy efficiency, or jeopardize energy security."

NESCOE Hydro Imports White Paper, pages 7-8.

[32] I was a utility regulator in Massachusetts and a federal policy maker at the eve of electric industry restructuring in the 1980s and 1990s. I note several parallel conditions between then and now, with regard to the availability of certain power-generation technologies that allow some customers to go "off grid" for at some of their power supply, and to exercise "choice" about buying utility service (versus self-supply). During the mid-1990s, it was large industrial customers who found it worthwhile financially to invest in (or threaten to invest in) on-site cogeneration/combined heat-and-power ("CHP") systems, in order to supply much if not all of their own electrical and process-steam requirements. Now, it is these same types of customers as well as commercial and residential customers that are eligible to install such on-site CHP and/or solar and/or wind facilities. During the mid-1990s, such developments created significant tension in the traditional utility business model at the time; and the same types of tensions are relevant today, especially as the cost of alternative technologies looks increasingly attractive for customers that want to avoid buying wires and/or supply service from the grid. Self-generation may be increasingly the case going forward, depending on pricing, technology, policy and other developments – and adding substantial costs on to the distribution tariff may encourage self-generation.

[33] Senate Bill 1965 is antithetical to the retail market design in Massachusetts. In Massachusetts, retail customers have the right to choose their electricity supplier, although all consumers take "wires services" (distribution service) from their local utility. The utility provides basic bundled service for those customers not choosing a supplier, and they do so through all-requirements supply contracts from competitive suppliers for relatively short-term periods of time. The risk of customers leaving basic service and choosing to buy power from another supplier is borne by the supplier holding the basic-service supply contract, not by the utility. Customers that choose to supply on-site power (such as through a solar panel or energy efficiency or CHP) end up paying lower costs for their own electricity from the grid, and the utility makes up any lost revenues from those customers through DPU-approved revenue decoupling mechanisms.

Now consider the potential unintended consequences of having the electric utility enter into a 15-25 year contract for a significant total share of their customers' demand and with the contractual commitment such that the electric utility is allowed to recover any out-of-market, generation-related costs through its distribution rates (rather than through rates charged for "generation service"). One potential outcome is that if out-of-market costs end up being high (as they were recently in Vermont after the state's utilities signed long-term supply contracts with Hydro-Quebec), it may encourage more customers to self-generate to avoid paying the higher wires-plus-generation charges. Note that in Vermont, customers do not have the option to choose their retail suppliers, as they do in Massachusetts. Putting this cost in electric utilities' distribution rates may create a stronger financial incentives for customers to generate on-site power and go off-grid. While that might lead to certain efficiency benefits, it could also lead to high amounts of revenues gaps to the utility that would need to reconciled and recovered from other customers (i.e., those that do not have their own on-site sources of power) through revenue decoupling mechanisms. The contract raises increasing tensions with the state's net metering and revenue-decoupling policies, and well as equity issues between customers who take all supply from the grid and those that self-generate some or all of their supply.

Another potential outcome is that over the course of the 15-25 year contract, adverse balance-sheet impacts could arise for Massachusetts' electric utilities holding the contracts, that were not anticipated at the time the contracts were entered into and approved by the DPU, with such impacts then raising the cost of capital for those utilities (with impacts on consumers). Such could arise given the very-large size of the contractual obligations and the uncertainty surrounding long-term business model and revenue-generation issues for local utilities. Almost by definition this is will have an impact on the electric utility's balance sheet, and a risk of stranded costs when customers move to self-generate – with such costs having to be collected from other customers.

[34] Source: DOER, Electric Customer Migration Data, with data as of June 2015. http://www.mass.gov/eea/grants-and-tech-assistance/guidance-technical-assistance/agencies-and-divisions/doer/electric-customer-migration-data.html.

[35] Data are from ISO-NE's monthly energy reports.

[36] Although the TDI-New England project, Northern Pass project, and the Maine Green Line project have been originally proposed as merchant projects, Senate Bill 1965 anticipates that this solicitation would entertain proposals where someone else besides the supplier pays for the transmission. Notably, the states have recently indicated their desire to support investment in transmission infrastructure in New England through a process that de-links payments for transmission with the prices supplies delivery over it. (See the December 2013 statement of the New England Governors and the January 2014 request by NESCOE to the ISO New England.) This is a change in posture from positions taken by New England policy makers as recently as 4-5 years ago. Such an approach would mask the total cost implications of imported power relative to alternative resources (including others with low-carbon profiles) in the market. Additionally, the current solicitation of renewable contracts by Massachusetts, Rhode Island and Connecticut includes the option for suppliers to offer delivery-only (i.e., transmission service without supply) proposals, suggesting that the electric utilities might seek to sign long-term contracts for transmission service separately from generation service (and/or put some of the transmission project(s) through ISO-NE's process for recovering transmission costs through the FERC-regulated tariffs. From consumers' point of view, all related costs that show up in the total electricity bill would be costs they pay for delivered supply from Canada, whether those costs show up as either bundled service or as transmission-only charges on top of the costs of electricity-supply contracts. Massachusetts regulators and energy officials know this well. Notably, Massachusetts regulators focus on integrating the costs of delivered power when they review the cost-effectiveness of energy efficiency relative to supply options (including their avoided generation, transmission and distribution costs).

Whether delivery costs are bundled with hydroelectric supply or provided on a stand-alone basis, these contracts would end up shifting costs from energy markets (e.g., through hoped-for price suppression impacts on wholesale energy prices) to other parts of the electricity bill (i.e., transmission costs picked up and paid through the ISO NE transmission tariff, and distribution costs that would be required to pick up any out-of-market costs associated with the Massachusetts share of 18.9 million MWh of hydropower supply). Without seeing the full effect of such cost (and risk) shifting, it will be very difficult if not impossible to see the full costs of alternative approaches.

These outcomes have been noted by NESCOE, when it reviewed the advantages and disadvantages of different approaches to structuring additions to the transmission grid: "Potential to shift risk of investment from project sponsors to ratepayers; New England states may prefer not to identify a transmission path for new resources absent a competitive process; New England has long indicated an interest in evaluating all-in costs of transmission and generation combined; Building and funding a transmission line provides no guarantee about ultimate costs to consumers (there is no basis to assume the costs of hydro to New England consumers will approximate the cost of hydro available to Canadian consumers); Potential to distort the competitive markets in favor of a resource that receives the benefits of the new transmission line, to the detriment of existing resources that incurred merchant risk." NESCOE Hydro Imports White Paper, page 54.

[37] NESCOE has recognized that there are indirect costs associated with significant reliance on imported power, because ISO-NE will need to keep significant local resources operating in real time in reserve, to provide instantaneous back-up power in the event of loss of a large quantity of supply from outside the region: "[I]ncreasing the extent to which New England relies on large quantities of power from distant resources over long transmission lines presents the risk of massive system failure and corresponding power loss, whether by a weather event, an act of terrorism, a technological failure or something as simple as a tree falling. Careful study of the technical implications of potential large-scale transmission expansions will enable evaluation of whether and how major new transmission facilities can be designed to preserve system reliability and avoid the potential for major disturbances in one area of the network from spreading to others. Risks associated with transporting power over very long distances, and associated costs, are minimized when generating resources are located close to load." NESCOE Hydro Imports White Paper, pages 47-48

[38] The states' energy officials (through NESCOE) have also observed the existence of such challenges associated with using remote hydro in a different control area and delivered by high-voltage direct current ("DC") lines to be used for balancing (or integrating) intermittent renewable energy locally in New England: "At a conceptual level, using controllable hydro resources to "firm up" wind[fn] and therefore fully utilize transmission infrastructure appears attractive. While technically feasible, the benefits associated with combining intermittent renewable resource output with hydro power depend on several factors. The respective locations of the wind resource, the hydro resource, the existing transmission grid, and the new interconnecting transmission all significantly affect the economics of pairing wind and hydro. The notion of pairing intermittent wind output with hydro power for firm delivery becomes complicated when the resources are in separate transmission grids, cross international boundaries, and/or require conversion from DC to AC [alternating current]. While balancing is a control area function[fn], NERC reliability standards do not

preclude the use of imported resources to balance. Doing so presents complexities, however, and New England would need to work out protocols, procedures and so forth with the control area on the other end of the transmission line. For intermittent wind output and hydro power to be successfully paired in conjunction with DC transmission technology[fn], the resources may need to be balanced on an AC system before being converted to DC. If the resources are not balanced before being converted to DC, a multi-terminal transmission configuration is necessary. Converter stations at each terminal are relatively expensive, such that DC is primarily considered for long-distance applications. It may not be cost effective to design a DC line with multiple terminals along the route to accommodate the collection of intermittent resource output." NESCOE Hydro Imports White Paper, pages 37-38.

[39] See FERC's order on the ISO-NE's 'pay-for-performance' changes in the FCM at *ISO New England Inc.*, 147 FERC ¶ 61,172 (2014).

[40] In the electric industry, 'firm' contract service is often equated with a supply with high (up to 100-percent) availability and penalties (e.g., liquidated damages) for non-performance. Conceptually, "firm" might also equate to a contract having 100-percent capacity value where the contract provides supply during on-peak periods. ISO-NE's FCM rules provide for no circumstances (e.g., no force majeure conditions) in which a capacity resource that fails to deliver when called upon by the ISO-NE may be excused from paying penalties. Thus, a contract with force majeure components related to the potential supply interruptions would raise questions about the assignment of risk (cost) relating to such potential penalties.

[41] *See:* PPL EnergyPlus, LLC v. Douglas Nazarian, et al, *Civil Action No. MJG-12-1286 (Maryland) in the U.S. Court of Appeals for the Fourth Circuit; and* PPL EnergyPlus, LLC v. Robert M. Hanna, et al, *Civil Action No. 11-745 (New Jersey) in the U.S. Court of Appeals for the Third Circuit. See also: Kate Konschnik and Ari Peskoe, "Minimizing Constitutional Risk in State Energy Policy: A Survey of the State of the Law," 45 ELR 10434, Environmental Law Reporter, May 2015.* http://statepowerproject.org/states/maryland-and-new-jersey/

[42] See: http://www.scotusblog.com/case-files/petitions-were-watching/, which indicates that as of August 24th, 2015, the petitions for review of these and other related cases were still pending before the U.S. Supreme Court.

[43] In the recent past, I have co-authored several studies that examine the economic impact to Massachusetts and other states of its participation in the Regional Greenhouse Gas Initiative and of its implementation of the Green Communities Act of 2008. See: Paul Hibbard, Susan F. Tierney, Andrea M. Okie, Pavel G. Darling, "The Economic Impacts of the Regional Greenhouse Gas Initiative on Ten Northeast and Mid-Atlantic States: *Review of the Use of RGGI Auction Proceeds from the Second Three-Year Compliance Period,* July 10, 2015; Paul Hibbard, Susan Tierney, and Pavel Darling, "The Impacts of the Green Communities Act on the Massachusetts Economy: A Review of the First Six Years of the Act's Implementation," March 4, 2014; and Paul Hibbard, Susan F. Tierney, Andrea M. Okie, Pavel G. Darling, "The Economic Impacts of the Regional Greenhouse Gas Initiative on Ten Northeast and Mid-Atlantic States: *Review of the Use of RGGI Auction Proceeds from the First Three-Year Compliance Period,* November 15, 2011.

[44] This provision governs the solicitation and execution of long-term renewable energy contracts by electric distribution companies, pursuant to Section 83A of An Act Relative to Green Communities, St. 2012, c. 209, §36 ("Section 83A").

[45] Testimony of Susan Tierney:

- Before the *Massachusetts Department of Public Utilities*, Investigation as to the Petition of Massachusetts Electric Company and Nantucket Electric Company each d/b/a National Grid for approval by the Department of Public Utilities of two long-term contracts to purchase wind power and renewable energy certificates, pursuant to G.L. c. 169, § 83 and 220 C.M.R. § 17.00 et seq. – Docket D.P.U. 10-54 (the Cape Wind contract proceeding), prefiled direct testimony (filed June 4, 2010), rebuttal testimony (filed September 1, 2010), testimony under cross examination (September 8, 13, 14, 23, 24, 2010); and
- Before the *Massachusetts Department of Public Utilities*, in the Petition of NSTAR Electric Company for Approval of a Proposed Long-Term Contract for Renewable Energy with Cape Wind Associates, LLC Pursuant to St. 2008, c. 169, §83, Prefiled Direct Testimony, March 30, 2012; testimony under cross-examination, August 2, 2012.

[46]Susan Tierney, Testimony on An Act Relative to Clean Energy Resources– H. 3968 before the Massachusetts Joint Committee on Telecommunications, Utilities and Energy, April 8, 2014.

[47] See my testimony before the FERC in the Matters of Centralized Capacity Markets in Regional Transmission Organizations and Independent System Operators," Docket No. AD13-7-000, re: considerations for the future, September 9, 2013; supplemental comments filed January 1, 2014. See also my 2014 report on the proposed Clean Energy Resources Bill, in which "I encourage[d] the state to view options through a lens that reflects the economic, policy, technical, technological, and market realities of the state's and region's electric systems, which include:

- A regional electric system, regulated by the federal government, built off of market principles (some of which require reforms in order to operate in a genuinely competitive way), intended to be neutral with regard to picking winners and losers, and relying on private markets to identify the types of resources able to supply consumers' electricity requirements efficiently and reliably;
- State policies that point to greater reliance on generating resources that emit increasingly fewer carbon pollution, but that needs other resources (including natural-gas-fired capacity, nuclear generation, and demand-side resources) to accommodate the full suite of system requirements reliably and affordably;
- An outlook for relatively flat demand, in light of the states' commitment to pursuing cost-effective energy efficiency and supporting distributed generation (e.g., through net metering policy and other state incentives) with implications for the ability of the system to smoothly absorb massive new quantities of supply imported into the region;
- A generating fleet that relies on natural gas and a market design that causes natural gas to set prices in the vast majority of hours in the short-term electricity product markets – and, in combination with an outlook for low average natural gas prices going forward;
- An increasing set of zero-carbon resources that tend to be price takers, contributing to price suppression in the wholesale energy markets;
- An overall set of conditions that will tend toward lower levels of capacity utilization (e.g., with more renewable resources, whose intermittency leaves them with lower capacity factors; and with need for the system's dispatchable resources to operate less as they provide less energy overall and increasingly supply balancing services for non-dispatchable renewable energy);
- A technological toolkit that does not yet allow for sufficient commercially available and competitively priced electricity storage and/or load-shifting capabilities to help mitigate the asset-utilization problem any time soon;
- A market where even suppliers of large quantities of zero-carbon electricity supply (e.g., nuclear generation provided by Vermont Yankee) have recently decided to exit New England's market because of adverse market conditions; and
- A system which, in the end, still needs to produce sufficient revenues across all short-term and long-term product markets and across an adequate base of resource suppliers in ways that meet the requirements of private investors on which virtually the entire asset base depends.

Tierney 2014 Report, pages 6-7.

[48] U.S. EPA, "Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Generating Units," Docket No. EPA–HQ–OAR–2013-0602, August 3, 2015, http://www2.epa.gov/cleanpowerplan/clean-power-plan-existing-power-plants.

[49] Gerald Silverman, "Emissions Trading: Most States in Northeast Trading Program On Track to Meet Clean Power Plan Targets," *Bloomberg BNA Daily Environment Report*, August 14, 2015.

[50] The Massachusetts 2010 Clean Energy and Climate Plan stated (on page 39) that:

> From 2005 to 2009, the electricity portfolio serving Massachusetts became more than 20 percent cleaner. This was largely the result of how much of the time each existing power plant was operated and which fuel they utilized, rather than investment in new capacity. The major changes were the nearly complete phase-out of fuel oil by 2007 because of high oil prices, a reduction in coal operation relative to natural gas since 2007 because of low natural gas prices, and a doubling of large hydro imports into New England from Canada. These developments demonstrate that the electricity sector even as it exists can operate more cleanly.
>
> This Plan will provide a signal to electricity suppliers to maintain and improve upon these cleaner energy portfolios by proposing a Clean Energy Standard, which would require electricity suppliers to increasingly favor low-emissions and no-emissions sources in the mix of electricity delivered to their customers. This could be designed to favor in the long-term sources like wind, solar, and hydro, which emit no GHGs, but also initially favor cleaner fossil fuels like natural gas, to act as a bridge to a clean energy future.

[51] http://www.mass.gov/eea/agencies/massdep/climate-energy/climate/ghg/ces.html

[52] In my view, the DEP's Clean Energy Standard ("CES"), as originally proposed, was not designed in a way that was competitively neutral, and I would support refinements to the approach so that it focuses exclusively on providing supply of resources with zero or low CO_2 emissions (whether new or existing) while also avoiding financial windfalls to existing generators. Such a design would allow new resources to obtain full "clean energy credits" ("CECs") for each MWh of zero-carbon supply, while providing some

discounted amount of CECs for existing renewable energy supply (e.g., hydroelectric resources) that do not qualify for the Renewable Portfolio Standard as well as for existing nuclear supply that emits no carbon emissions and/or even, potentially, for natural-gas-fired generation emitting carbon dioxide at rates below the Clean Energy Standard's performance standard.

[53] See, for example: Northeast Gas Association's summary of new pipeline projects under construction and in development, "Planned Enhancements, Northeast Natural Gas Pipeline Systems (as of 7-25-15)," http://www.northeastgas.org/pdf/system_enhance0715.pdf and http://www.northeastgas.org/pipeline_expansion.php.

[54] ISO NEwire, "New England power system performed well through winter 2014/2015," Tuesday, April 7, 2015, http://isonewswire.com/updates/2015/4/7/new-england-power-system-performed-well-through-winter-20142.html.

[55] ISO-NE, "Discussion paper on New England's capacity markets and a renewable energy future," June 3, 2015, page 1.

> New England has small, but rapidly growing levels of renewable energy resources—notably wind power and solar power. This growth is being spurred by state and federal policies that seek to introduce cleaner, lower-carbon-emitting resources into the energy mix.[footnote omitted] In New England, the states desire to see these policies influence the design and outcomes of the wholesale electricity markets.
>
> Because the resources the states are supporting have no fuel costs, they are generally dispatched ahead of conventional generation, such as gas-, coal-, and oil-fired resources that must include fuel costs in their offers to sell electricity into New England's wholesale electric energy market. State subsidies for renewable resources will put downward pressure on energy-market prices, but this action is not without consequences: it will put upward pressure on prices in the capacity market. The capacity market will help balance the revenue needs for resources as the energy market provides fewer opportunities for resources to recover their fixed costs.
>
> This paper describes the magnitude of renewable energy coming onto the system and the interaction of related state policies with the region's wholesale electricity markets. The capacity market will play a key role in ensuring that reliability is maintained as increasing levels of renewables are integrated onto the system. Additional renewables are expected to decrease wholesale electric energy prices, which will result in increased capacity prices to ensure resource adequacy. The shift in revenues from the energy to the capacity market will also affect the resource mix, putting additional financial pressure on energy-market dependent resources."

[56] See: Paul Hibbard, Andrea Okie, Susan Tierney, and Pavel Darling, "The Economic Impacts of the Regional Greenhouse Gas Initiative on Nine Northeast and Mid-Atlantic States: Review of RGGI's Second Three-Year Compliance Period (2012-2014)," July 14, 2015. http://www.analysisgroup.com/uploadedfiles/content/insights/publishing/analysis_group_rggi_report_july_2015.pdf.

[57] NESCOE Hydro Imports White Paper, page 48-49. Further borrowing from the language of NESCOE, this would mean avoiding action (such as enactment of Senate Bill 1965) that would:

- [award a r]atepayer subsidy to some resources but not all, *vis a vis* long-term contracts, [thus creating] market distortions and allegations regarding government selecting, by virtue of RFP [Request for Proposals] eligibility, winners and losers in a competitive market context;....
- distort the competitive marketplace in favor of the resources that receive the benefits of using any new transmission that is not market participant funded, to the detriment of existing resources that incurred merchant risk;
- [have w]holesale capacity market implications due to FERC [Federal Energy Regulatory Commission] orders protecting existing generation resources from economic harm associated with out-of-market subsidization of selected resources;
- [s]hift costs of non-PTF [Pool Transmission Facilities] transmission to ratepayers unless transmission is market participant funded;
- [s]hift project risks from investors to ratepayers, including the risk of the contract, over its life, being above market (unless contract has market tracker that precludes prices from going some level above market);
- [the p]otential to create power system reliability risks due to displacement of other resources from the market; ...
- [lead to b]enefits associated with reduced prices in the energy market [that] may [need to] be given back through increased prices in the capacity market

NESCOE Hydro Imports White Paper, page 55.