STATE OF VERMONT
PUBLIC SERVICE BOARD

Amended Petition of Entergy Nuclear Vermont Yankee, LLC and Entergy Nuclear Operations, Inc. for amendment of their Certificate of Public Good and other approvals required under 30 V.S.A. § 231(a) for authority to continue after March 21, 2012, operation of the Vermont Yankee Nuclear Power Station, including the storage of spent nuclear fuel	))))))	Docket No. 7862

DIRECT TESTIMONY OF ASA S. HOPKINS
ON BEHALF OF THE
VERMONT DEPARTMENT OF PUBLIC SERVICE

October 22, 2012

Summary: Dr. Hopkins introduces the other witnesses offered on behalf of the Department of Public Service (the "Department"), presents the Department's conclusions regarding whether the Board should grant the requested Certificate of Public Good under 30 V.S.A. § 231, and discusses whether the continued operation of the Vermont Yankee Nuclear Power Station would satisfy criteria in 30 V.S.A § 248(a), 248(b)(2), 248 (b)(4), and 248(b)(7). Finally, Dr. Hopkins provides the Department's recommendation that the Board should deny the petition because Entergy Nuclear Vermont Yankee, LLC and Entergy Nuclear Operations, Inc. ("Entergy") has not met its burden to show that it should be issued a Certificate of Public Good.

Dr. Hopkins sponsors the following exhibits:

Exhibit PSD-ASH-01	Vermont Comprehensive Energy Plan, Volumes I and II and Appendices (December 2011)
Exhibit PSD-ASH-02	Excerpts from Green Mountain Power 2011 Integrated Resource Plan; Stowe Electric Department 2011 Integrated Resource Plan; Vermont Electric Cooperative 2012 Integrated Resource Plan
Exhibit PSD-ASH-03	Vermont Electric Power Company 2012 Long-Range Transmission Plan
Exhibit PSD-ASH-04	ISO-New England Final Energy-Efficiency Forecast 2015-2021
Exhibit PSD-ASH-05	Efficiency Vermont 2011 Annual Report

Exhibit PSD-ASH-06	Efficiency Vermont Quarterly Report to the Public Service Board for the period April 1 to June 30, 2012
Exhibit PSD-ASH-07	Electric Energy Efficiency Potential for Vermont, GDS Associates (April 2011)
Exhibit PSD-ASH-08	From Potential to Action: How New England Can Save Energy, Cut Costs, and Create a Brighter Future with Energy Efficiency, Northeast Energy Efficiency Partnerships (October 2012)
Exhibit PSD-ASH-09	ISO-New England Strategic Planning Roadmap (March 2012)
Exhibit PSD-ASH-10	Department of Public Service forecast of expected regional electricity and capacity prices along with possible price impacts of VY station operation

Q1. Please state your name and occupation.

A1. My name is Asa Hopkins and I am the Director of Energy Policy and Planning at the Vermont Department of Public Service (the "Department"). My responsibilities include direction of overall energy planning activities for the Department and the State of Vermont.

Q2. Please describe your educational background and experience.

A2. I have a Bachelor's Degree in Physics from Haverford College and a Master's Degree and Doctor of Philosophy in Physics from the California Institute of Technology. I have worked at the Department for one year. Prior to joining the Department, I was an AAAS Science and Technology Policy Fellow at the U.S. Department of Energy, where I worked in the Office of the Undersecretary for Science. Prior to that, I was a postdoctoral fellow in the Environmental Energy Technologies Division at Lawrence Berkeley National Laboratory.

Q3. Have you previously testified before the Public Service Board?

A3. Yes, I submitted testimony in Docket No. 7815 regarding a proposed contract between Stowe Electric Department and NextEra, in Docket No. 7770 regarding the merger of Green Mountain Power and Central Vermont Public Service, and in Docket No. 7833 regarding a proposed biomass electric generating facility in North Springfield, VT.

I. INTRODUCTION AND SUMMARY OF TESTIMONY

Q4. What is the purpose of your testimony?

A4. My testimony introduces the other witnesses offering testimony on behalf of the Department concerning Entergy Nuclear Vermont Yankee, LLC and Entergy Nuclear Operations, Inc.'s ("Entergy") request to obtain a certificate of public good to operate the Vermont Yankee Nuclear Power Station (the "VY Station") for twenty years beyond its license term, provides an overview of energy supply, energy efficiency, and the sources of energy in Vermont, describes certain programs and policies relating to energy in Vermont, provides the Department's position on some of the requirements of 30 V.S.A. 231(a), some of the factors delineated in 30 V.S.A. 248(b), and the overall standard of 248(a), and provides the Department's recommendation that the Board deny Entergy's application because Entergy has not met its burden to show that it should be issued a Certificate of Public Good.

Q5. Please identify the witnesses other than yourself that will submit prefiled testimony on behalf of the Department, as well as the scope of their testimony.

A5. Daniel Garson will provide testimony relevant to this Board's determination under 30 V.S.A. 248(b)(1) and 248(b)(5). Specifically, Mr. Garson discusses the Vernon Town Plan and Windham Regional Plan, and concludes that operation of the VY Station for twenty years beyond its original license term is incompatible with the desired land use character and development pattern of the

proposed Village Center development area in Vernon. Mr. Garson also discusses why the large-scale industrial nature of the VY Station is incompatible with the type of development that is encouraged by the Town of Vernon's development objectives, and concludes that the extended operation of the VY Station would negatively impact the ability of the Town of Vernon and private developers to attract the types of businesses, including commercial and industrial uses of a suitable smaller scale along with farming, housing, and service sector businesses, to the proposed Vernon Village Center. Mr. Garson concludes that operation of the VY Station for twenty years beyond its original license term would interfere with the orderly development of the region in light of the recommendations of the relevant municipal and regional planning commissions.

Robert Stein will provide testimony relevant to this Board's determination under 30 V.S.A. 248(b)(2), 248(b)(3), 248(b)(5), and 248(b)(10). Specifically, Mr. Stein will discuss how the New England Independent System Operator ("ISO-NE") measures and ensures system reliability and how the electricity provided by the VY Station is currently treated by ISO-NE. Mr. Stein concludes that continued operation of the VY Station is not necessary to maintain system stability and reliability in Vermont or in the New England electrical grid. Mr. Stein also discusses scenarios in which replacement of the power supplied by the VY Station could both improve system stability and

reliability, as well as scenarios in which the electricity provided by the VY Station could be replaced by sources that would have the effect of decreasing, rather than increasing, regional greenhouse gas emissions.

Seth Parker will provide testimony relevant to this Board's determination under 30 V.S.A. 248(b)(3), 248(b)(4), and 248(b)(5), as well as under 30 V.S.A. 231(a). Mr. Parker's testimony addresses five broad issues: (i) the reliability need of the VY Station, (ii) the market energy price impacts of the VY Station, (iii) the capacity price impacts of the VY Station, (iv) environmental impacts of the VY Station, and (v) economic impacts of the VY Station. Mr. Parker concludes that the VY Station is not necessary to ensure system reliability in Vermont or in the region, and that retirement of the VY Station will not significantly raise market prices, and in particular that the rates paid by Vermonters are unlikely to be affected from any change in market energy prices because Vermont's utilities obtain almost all of their energy requirements from sources that are insulated from fluctuations in market prices. Mr. Parker also concludes that retirement of the VY Station would not affect market capacity price due to the surplus of generating capacity within the region and the small percentage of capacity supplied by VY Station to the region. Mr. Parker finally concludes that Entergy witnesses overstated the effect of retirement of the VY Station on air emissions and employment.

Thomas Kavet will provide testimony relevant to this Board's determination under 30 V.S.A. 248(b)(4). Mr. Kavet discusses Entergy's submissions concerning the economic impact to Vermont of retirement of the VY Station, and concludes that Entergy's submission is an unreliable and potentially misleading measurement of the likely economic impacts associated with closure of the VY Station. Mr. Kavet also addresses potential benefits that could offset any economic and fiscal gain that might result from extended operation of the VY Station for an additional twenty years, in particular benefits that may result from renewable sources of energy generation.

Nicolas Rockler will provide testimony relevant to this Board's determination under 30 V.S.A. 248(b)(4). Mr. Rockler analyzes the economic impact analysis conducted by Entergy witness Richard Heaps, and identifies numerous misapplications of the economic impact analysis offered by Entergy. Mr. Rockler concludes that Entergy's discussion of the potential adverse impacts to Vermont if the VY Station is retired is flawed and does not provide a reliable analysis of the likely economic impacts of such a retirement.

Warren Brewer will provide testimony related to 30 V.S.A. 248(b)(4) and 248(b)(5) and 30 V.S.A. 231(a). Specifically, Mr. Brewer analyzes the Decommissioning Cost Estimate report submitted on Entergy's behalf by William Cloutier of TLG Services, Inc., and concludes that the estimates used

in that report fail to accurately predict the expected costs associated with decommissioning, and that the funding sources Entergy intends to rely on for decommissioning will accordingly be inadequate. Mr. Brewer also discusses Entergy's assumption that all costs incurred for storage of Spent Nuclear Fuel will be recovered from the federal government.

Gregory Maret will provide testimony related to 30 V.S.A. 248(b)(4) and 248(b)(5) and 30 V.S.A. 231(a). Mr. Maret discusses the assumptions and analysis underlying the TLG decommissioning study. Mr. Maret also identifies site remediation costs that are likely to be incurred in connection with decommissioning of the VY Station that are either understated in or omitted altogether from the TLG study.

Marcia Greenblatt will provide testimony related to 30 V.S.A. 248(b)(5). Specifically, Dr. Greenblatt will discuss recent studies of the discharge of heated water (or thermal discharge) from the VY Station and concerns about the influence of that discharge on the Connecticut River and the biological community contained therein. Dr. Greenblatt describes concerns raised by recent studies about the temperature and effect of that thermal discharge, and concludes that the analyses Entergy offered to support the current permitted limits on the plant's thermal discharge may not capture conditions that may adversely affect the natural environment, and that Entergy therefore has not

shown that the VY Station's thermal discharge does not have an undue adverse effect on the river.

John Samuelian will also provide testimony related to 30 V.S.A. 248(b)(5). Dr. Samuelian will discuss the adverse impact that heated effluent can cause to species in rivers, and will discuss how heated effluent discharged from the VY Station may be causing such adverse impacts on species in the Connecticut River. Dr. Samuelian describes concerns raised by federal officials regarding discharge from VY Station, and also provides analyses of relevant recent scientific studies. Dr. Samuelian concludes that the evidence leads to serious concerns about the potential impact of the VY Station's discharge on the natural environment. The Agency of Natural Resources will also present testimony, complementary to the Department's testimony, relating to 30 V.S.A. 248(b)(5).

Bruce Hinkley will provide testimony related to 30 V.S.A. 248(b)(5) and 30 V.S.A. 231(a). Specifically, Mr. Hinkley addresses requirements expected to be imposed on the VY Station as a result of the 2011 natural disaster that affected the Fukushima Daichi nuclear plant, and logistical and procedural challenges related to those issues as they may affect continued operation and eventual decommission of the VY Station.

Andrea Cohen will present testimony related to 30 V.S.A. 231(a). Specifically, Ms. Cohen will address studies commissioned by the State of Vermont and surveys commissioned by Vermont Businesses for Social Responsibility that consider the Vermont "brand" and how Vermont is perceived by current residents, businesses, and visitors as well as potential residents, businesses, and visitors. Ms. Cohen also addresses how the VY Station and Entergy are viewed by the businesses in the State of Vermont, related to the "business reputation" criterion of 30 V.S.A. 231(a).

Q6. What is the Department's position regarding whether Entergy should be granted a Certificate of Public Good to operate for 20 years beyond its original license term under 30 V.S.A. 231?

A6. The Department believes that Entergy has not provided information that would allow the Board to conclude that issuance of a certificate of public good would promote the general good of Vermont.

II. VERMONT ENERGY CONTEXT

Q7. Upon what primary energy sources does Vermont rely?

A7. Because different sources of energy are measured in different units, I have used the Energy Information Agency's methodology for converting energy of all types into primary energy, measured in British Thermal Units ("BTU"). Measured in terms of BTUs, petroleum products form the greatest proportion

(55% in 2010) of Vermont's total energy mix. These fuels are used for home and business heating (including industrial processes) as well as for transportation. The next largest contributor in the state's portfolio in 2010 was hydro-electricity, followed closely by nuclear electricity (predominantly from the VY Station), then natural gas. Data for years after 2010 are not yet available.

Q8. Within the electricity sector, what resources form a part of Vermont's portfolio?

A8. The state's electric portfolio is currently in a state of readjustment in light of the recent end to the long-term power purchase agreement between Vermont's primary utilities and Entergy, as well as the upcoming expiration of several long-term contracts with Hydro-Québec (contracts that began in 1990 and phase out between 2012 and 2020). Another large Hydro-Québec contract begins to ramp up in 2012 and extends through 2038, and other long-term contracts for new resources (including power from the Seabrook Station nuclear power plant, owned by NextEra Energy Resources, and several wind facilities) begin this year or over the next few years. Generally speaking, what is known about the future combined utility portfolio is that it will include: NextEra contracts for nuclear-generated electricity supplied by the Seabrook Station; hydroelectricity from Hydro-Québec, the New York Power Authority, and in-state independent and utility-owned facilities; biomass electricity from in-state generators; wind electricity from in-state and out-of-state independent and utility-owned

generators; power from small renewable energy facilities constructed under the Standard Offer program or net metered; renewable methane-generated power from agricultural and landfill sources; and purchases of unit-contingent or generic market power, the majority of which is generated by fossil fueled sources. Vermont utilities continue to refine their portfolios, aided by the principles of least-cost integrated planning, and in the context of established state energy policy as well as statutory goals and programs, which I will discuss later.

Q9. What is the duration of the contracts for electricity from these resources?

A9. They vary over quite a wide range. Some resources are, of course, utility owned; these will be a part of the utility's portfolio as long as they are operational and cost-effective. There are hydroelectric facilities in the state's portfolio that have been operating for many decades. Energy and capacity from other resources are purchased through power purchase agreements or other bilateral market transactions of length varying from a month or two up to 25 years or longer. A small fraction of the state's electric energy comes from purchases made daily on the ISO-NE day-ahead and real-time energy markets.

Q10. Please define what you mean by "renewable energy," "energy efficiency," and "clean energy."

A10. By renewable energy, I mean energy that meets the statutory definition established in 30 V.S.A. 8002:

> "Renewable energy" means energy produced using a technology that relies on a resource that is being consumed at a harvest rate at or below its natural regeneration rate.

The definition continues to clarify whether particular technologies or resources are renewable or not. In particular for this testimony, "no form of nuclear fuel shall be considered renewable." 30 V.S.A. 8002(2)(B).

By energy efficiency, I mean actions that result in reduction in energy or power demand while still providing the same energy service. For example, replacing an older light bulb with a more efficient light bulb retains the same energy service (the same amount of light, on command) while using less energy. Energy efficiency can be considered as a supply resource in that forecast load can be met either with generation or with efficiency measures which reduce that load while efficiency program participants receive the same level of energy service otherwise provided.

By "clean energy" I mean renewable energy and energy efficiency.

Q11. Please describe some of the existing laws that apply to and shape energy policy in Vermont.

A11. Vermont has an extensive set of policies and goals that shape the electricity sector. These include, in Title 30:

- Section 202a, which establishes the core principles of adequacy, reliability, security, and sustainability; and emphasizes affordability, efficiency, and the necessity of environmental soundness. It also establishes the importance of planning to achieve these core principles through the principles of least cost integrated planning, with special mention of efficiency, conservation, load management, and renewable and environmentally sound resources.
- Section 209(d), which establishes the expectation that the state will achieve "all reasonably available, cost-effective energy savings" through utility efficiency programs.
- Section 218c, which defines least cost integrated planning as a plan to meet energy needs, after safety concerns are addressed, at the lowest cost, incorporating economic and environmental costs, through an integrated approach to utility actions.
- Section 8001, which expands upon the state energy policy in section 202a by supporting the development of renewable energy generation in the state to benefit both the state's economy and the environment.
- Section 8005, which establishes targets for the state's electric utilities to acquire an increasing percentage of their energy from long-term contracts with facilities that utilize renewable resources.

This list is not exhaustive; in some sense the bulk of Title 30 could be considered to shape the state's electricity sector. In addition, the state has established greenhouse gas reduction targets, codified in 10 V.S.A. 578, with

the goal of reducing emissions 25% below 1990 levels by 2012, 50% below 1990 levels by 2028 and, if practicable using reasonable efforts, 75% below 1990 levels by 2050.

In addition to the statutory policies and goals described above, the state develops a Comprehensive Energy Plan and an Electric Plan, which may establish their own policies, goals, and targets, consistent with those in statute. The 2011 Comprehensive Energy Plan ("CEP"), which incorporated the Electric Plan, established a goal of meeting 90% of the state's energy needs across all sectors through renewable energy by 2050. I discuss the 2011 CEP in greater detail below.

Q12. Please describe some of the history of how these policies and goals came to be established in law.

A12. Throughout the last thirty years, the Vermont legislature has considered significant energy legislation of some sort or another nearly every session. Common themes throughout this history include the pursuit of least-cost resources through careful planning, along with the pursuit of sustainability and the other values codified in section 202a.

Section 202a, describing state energy policy, was added to Title 30 in 1979. The Department then developed the state's first Electric Plan, published in 1983. The second Electric Plan, published in 1988, made the case for centrality of least-cost integrated planning. Following Board action in Docket

5270 to set a new framework for utility planning in the state, the legislature added section 218c to Title 30, which codifies the need for utilities to undertake least-cost integrated planning. The state's first Comprehensive Energy Plan was developed by Executive Order in 1991; the requirement to develop a CEP every five years was codified in 30 V.S.A. 202b shortly thereafter.

Section 209(d) of Title 30, establishing expectations of utility investments in energy efficiency, was added in 1981. As regulatory structures around energy efficiency have evolved, this section has been amended. The expectation to achieve "all reasonably available, cost-effective energy efficiency" was added in 1999.

Chapter 89 of Title 30, regarding renewable energy programs and encompassing sections 8001 through 8006, was added in 2003, and substantially amended in 2005. The SPEED program was established in 2005, and incorporated an initial set of targets for energy from new renewable resources in utility portfolios (whether or not renewable energy credits are attached), referred to as "SPEED resources." This section was extensively amended in 2012, and now incorporates a target for utility portfolios to include 55% renewable energy by 2017, and 75% by 2032, in addition to a target of 20% SPEED resources by 2017.

Q13. What programs has the state instituted in order to turn these goals and general policies into concrete action and impact the state's energy sector?

A13. While the 2011 Comprehensive Energy Plan describes the full spectrum of programs in greater detail, a selection of programs include:

- The diverse programs run by the state's two Energy Efficiency Utilities (Efficiency Vermont and Burlington Electric Department) and by Vermont Gas Systems. These include electric, heating, and process fuel efficiency programs funded by ratepayers as well as by revenues from both the ISO-NE Forward Capacity Market and RGGI.
- Property Assessed Clean Energy (or "PACE") programs in more than 30 towns, allowing homeowners to finance efficiency and renewable energy investments and pay back loans on their property tax bills.
- Department and Public Service Board review of utility Integrated Resource Plans ("IRPs"), which must include assessments of how the utilities will meet the goals for long-term contracts for power from renewable resources (SPEED resources) established in 30 V.S.A. section 8005, and evaluation of whether utility actions that require approval under section 248 are consistent with these IRPs.
- The establishment in 2011, by Executive Order 10-38, of the Governor's Climate Cabinet. Among the Climate Cabinet's duties is to coordinate activities across multiple agencies to implement the Comprehensive Energy Plan and strive for its goal of 90% renewable energy across all sectors by 2050.

- The Vermont Standard Offer feed-in-tariff program, which will result in 50MW of small (less than 2.2MW) renewable electricity generation projects in a variety of technologies online in Vermont within the next several years, and which was recently expanded to a total of at least 127.5MW. The expansion incorporates lessons from the first 50MW in that it uses an annual allocation, will likely incorporate a market-based mechanism to set prices, and allows additional projects that provide sufficient benefit to the operation of the electric grid or use agricultural methane.
- Allowance of net metering, up to a capacity of at least 4% of each utility's peak load, with streamlined permitting for projects under 150kW and a registration process for projects under 10kW. Amendments in 2011 created a solar credit to recognize the additional benefits that solar photovoltaic generation provides to the host utility.
- Establishment of the Clean Energy Development Fund. The goal of the Fund is to increase the development and deployment of cost-effective and environmentally sustainable electric power resources–primarily with respect to renewable energy resources, and the use of combined heat and power technologies–in Vermont.

Q14. Given this extensive history and active engagement by policymakers and stakeholders around the state in increasing the use of clean energy, what conclusions can you draw regarding the energy sector in Vermont?

A14. Energy is present at the surface of public conversation in Vermont in a way that I have not experienced when in living in other states. This reflects an advanced public and policymaker understanding of the impact of energy choices, and a desire to shape that impact in a way that maintains and enhances quality of life in Vermont. In general, there has been an increasing emphasis on sustainability (writ large) over time. Vermont is taking more responsibility for producing clean energy within the state, with its associated benefits and costs. Efficiency is by definition local and is the most sustainable resource; there is also an increasing demand for renewable energy production, especially where energy options have aspects of community ownership and are appropriate for Vermont's scale and land. Vermont also has a deep understanding and recognition that energy is pervasive, both in use and in generation, and energy choices are intimately linked with other choices.

III. COMPREHENSIVE ENERGY PLANNING IN VERMONT

Q15. What tools does the state government use to collect and examine its energy policies as a whole in order to set priorities and recommendations for future action?

A15. There are two statutorily mandated plans: a Comprehensive Energy Plan as described in 30 V.S.A. 202b; and an Electric Plan as described in 30 V.S.A. 202. Each is tasked with examining the present and future use of energy and providing recommendations for actions that the state or others can take to

advance state energy policy. Due to the common set of state polices and goals and the tight coupling between meeting energy goals across all sectors and meeting those goals in the electric sector, these plans may be combined into a single document.

Q16. When were the last Comprehensive Energy Plan and Electric Plan assembled?

A16. The 2011 Comprehensive Energy Plan, which incorporates the Electric Plan, was developed over the course of the year 2011, beginning in the spring. It was released to the public on December 15, 2011, and is reproduced in Exhibit PSD-ASH-01.

Q17. Please describe the process used to develop the 2011 Comprehensive Energy Plan.

A17. The Department sought significant input from citizens and stakeholders during the Comprehensive Energy Plan development process. The Department conducted two sets of half-day stakeholder meetings during which a wide array of participants shared their thoughts on the CEP. The Department held additional targeted stakeholder meetings by subject area. The Department also partnered with regional planning commissions, the Vermont Energy and Climate Action Network and the Vermont Natural Resources Council to hold four focused forums to hear from Vermonters, including a network of 100

community energy committees, about the policies, programs and practices that would help Vermont meet its energy goals.

After the draft CEP was issued, the Department conducted five public hearings throughout the state, during which members of the public commented on the final public draft of the Comprehensive Energy Plan. The Department also solicited written comments and created an on-line feedback form through which comments could be submitted; over 9,000 public comments were received.

During the development of the plan, the Department coordinated closely with many other state agencies, including the Agencies of Natural Resources, Transportation, Commerce and Community Development, Human Services, and Agriculture, and the Department of Buildings and General Services.

Q18. What are the general goals and principles espoused by the 2011 CEP?

A18. The 2011 CEP is grounded, first, in the policies and goals set forth by statute, described above. In order to create a central pillar around which to build detailed policies and programs, the CEP proposes a comprehensive new target: that Vermont should satisfy 90% of its energy needs from renewable sources by 2050. To quote from the CEP (PSD-ASH-01 p.3): “The goal is underpinned by this strategy: to virtually eliminate Vermont’s reliance upon oil by mid-century by moving toward enhanced efficiency measures, greater use of clean, renewable source for electricity, heating, and transportation, and electric vehicle

adoption, while increasing our use of natural gas and biofuels blends where nonrenewable fuels remain necessary. The moves must be deliberate and measured to ensure overall energy costs for our businesses and residents remain regionally competitive."

In developing this core statement into concrete recommendations, there are a few underlying principles. First, that efficiency and conservation are paramount. These tools allow Vermonters to save money (and increase business competitiveness) while simultaneously making comprehensive goals easier to achieve. Second, that we can harness technological change to accelerate progress. A linear path from our current energy mix to the 90% target could require excess costs in the near term–we can lay the groundwork today for future innovations to carry us faster in the future. Third, the public sector and regulatory policy alone cannot get the state to this goal–partnerships for financing, education, and innovation will be key leverage points, and citizen engagement and understanding will be essential.

Q19. The CEP goal is stated in terms of renewable energy, rather than on low or zero greenhouse gas emission energy sources. Why?

A19. Vermont's statutory policies charge us to consider the sustainability of our energy sources. While there may not be any absolutely sustainable energy source, some are clearly more sustainable than others. Merriam-Webster defines sustainable as "of, relating to, or being a method of harvesting or using a

resource so that the resource is not depleted or permanently damaged." This definition is very similar to the statutory definition of "renewable energy" found in section 8002 of Title 30. Sustainability is a broader concept than simply the energy content of the resource, however–a hypothetical perfectly sustainable energy source would result in no depletion or net negative change to any environmental resource. In practice, all energy technologies have some negative consequences, leaving some burden on future generations, and we must simply strive to minimize them as much as possible.

When considering pathways to reaching the state's greenhouse gas targets, for example, we should consider a wide range of potential policies and programs, and in particular look for and favor those which are compatible with other expressions of state energy policy. Because renewable sources are more sustainable than non-renewable sources, and state goals emphasize the importance of renewable resources to the state's economy, meeting the state's energy needs and greenhouse gas targets through renewable sources is more compatible with state policy than meeting those needs with other, non-renewable, resources, even those with low or zero greenhouse gas emissions. Relevant to Entergy's petition, although nuclear sources may offer energy with low greenhouse gas emissions, renewable sources, even those with greater greenhouse gas emissions than nuclear sources, are more compatible with state policy because nuclear energy is not renewable and is less sustainable than energy from renewable sources.

IV. ELECTRIC ENERGY EFFICIENCY

Q20. What programs and policies has Vermont established to encourage electric energy efficiency?

A20. Vermont electric utilities have long been required to deliver "comprehensive energy efficiency programs" as part of their responsibility to deliver electricity to customers at least cost (30 V.S.A. 218c). Although there were some successes with early efficiency programs, utilities were leaving efficiency savings on the table. As a result, Vermont changed its efficiency program structure in 2000 and created "Energy Efficiency Utilities" to offer coordinated efficiency delivery throughout the state. Beginning in 2000, Efficiency Vermont operated under contract to the Public Service Board to deliver efficiency services to customers of all utility territories outside of Burlington, and Burlington Electric Department ("BED") delivered efficiency services that have the same "look and feel" as the statewide programs offered by Efficiency Vermont.

Vermont's third-party energy efficiency delivery structure, operated by Efficiency Vermont, in coordination with BED's programs, demonstrated its effectiveness and was recognized as being one of the top programs in the country. Building on these nation-leading successes, the Public Service Board sought to improve the structure of program delivery further, and in Docket 7466 approved a second change in structure, moving from a short-term contract for Efficiency Vermont to a long-term "Order of Appointment." Efficiency

Vermont's Order of Appointment was approved in 2010. This change was made in part for the purpose of facilitating enhanced planning and delivery of long-term efficiency programs that are better suited to transform markets. Under this new regulatory structure, the Public Service Board conducted an in-depth public process that sets a general course for efficiency delivery by setting provisionary budgets for 20 years. These budgets, while subject to change, are used to make long-term commitments in capacity markets. The new structure also calls for regular regulatory performance assessments to ensure that program administrators are maximizing value for Vermont ratepayers. Vermont has a history of delivering comprehensive energy programs, and has mechanisms in place to ensure commitment to continuous improvement in such delivery.

Q21. Are the policies and programs that Vermont has established to promote energy efficiency effective?

A21. Yes. The full suite of efficiency policies in each state is evaluated annually by the American Council for an Energy Efficient Economy ("ACEEE"). In the most recent annual national "scorecard" issued by ACEEE, Vermont is ranked fifth in the country. This scorecard is available at http://www.aceee.org/sites/default/files/publications/researchreports/e12c.pdf. In the six such ACEEE scorecards since 2006, Vermont has been ranked 6th or better each year, including a tie for first in 2006. ACEEE also breaks down the scorecard to identify states with particularly effective efficiency programs in particular areas.

In the most recent scorecard, Vermont was recognized as having the highest Annual Savings in 2010 from Electric Efficiency Programs, achieving more than half a percentage point more savings that the second-placed state. The federal ENERGY STAR program also recognizes highly effective efficiency programs as "Partners of the Year"; Efficiency Vermont and Vermont Gas Systems received this honor in 2012.

Q22. How have the actions of Efficiency Vermont, BED, and the state's other distribution utilities affected the demand for both energy and capacity in Vermont?

A22. In recent integrated resource plans (IRPs) filed by the state's distribution utilities, the baseline or most likely load forecasts have shown at most slowly growing (and in some cases declining) energy sales over the course of 20-year forecast periods. Examples of the forecasts published in IRPs filed by Green Mountain Power, Stowe Electric Department, and Vermont Electric Cooperative are reproduced in Exhibit PSD-ASH-02. The "High Efficiency" forecast undertaken for the 2011 CEP (which corresponds to roughly the expected level of electric efficiency investment) also projects a roughly level energy demand for the next 20 years. Based on conversations with utility planning staff while reviewing these IRPs, I believe that this is a new paradigm for supply portfolio planning. While economic factors and structural changes

play a major role in these forecasts, this changed paradigm is attributable to a significant extent to the state's aggressive investments in energy efficiency.

On the capacity side, I have examined the most recent VELCO Long Range Transmission Plan (Exhibit PSD-ASH-03) and ISO-NE's forecasts for Vermont's peak load (Exhibit PSD-ASH-04), and see that ISO-NE projects a declining peak load after incorporation of energy efficiency, while VELCO projects historically low growth in the state's peak demand.

Efficiency Vermont's 2011 Annual Report, the introduction to which is found in Exhibit PSD-ASH-05, calculates the total energy savings produced through their actions since 2000 to equal 11.5% of state electrical energy demand in 2011. This would be equivalent, on an energy basis, to a round-the-clock power plant of more than 70MW. Efficiency Vermont met its commitments to deliver 48MW of capacity through the ISO-NE markets in 2011-2012, and it has made commitments to deliver a total of 84MW in 2014-2015 and 99MW in 2015-2016 (see Exhibit PSD-ASH-06).

Looking forward, an efficiency potential study found in Exhibit PSD-ASH-07 and conducted by GDS Associates for the Department in 2011 concluded that there is an achievable cost-effective electric energy efficiency potential equal to 25.4% of the state's forecast 2031 electric energy consumption and 19.9% of the forecast peak demand that could be acquired between 2011 and 2031. This potential is on top of the efficiency savings already acquired and summarized above. This potential forecast was used in

establishing the efficiency budgets for Efficiency Vermont and BED; the budgets were established to meet this potential under the statutory guidance to acquire "all reasonably available cost-effective energy efficiency."

Q23. What about other efficiency activities and policies that don't run through Efficiency Vermont and BED?

A23. A number of state and federal policies save Vermonters money and energy through efficiency, but are not captured in the verified savings achieved by the state's efficiency utilities. The 2011 CEP provides a more comprehensive discussion of such policies and activities, but a few include:

- Establishment of building codes in the residential and commercial construction sectors;
- The availability of Property Assessed Clean Energy ("PACE") financing tools for homeowners to undertake retrofits; and
- Federal minimum efficiency standards for lighting and appliances, as well as consumer choice of ENERGY STAR products outside of any energy efficiency utility program.

Q24. What can you conclude from this summary of Vermont's electric efficiency programs and policies?

A24. I conclude that Vermont is, in fact, treating efficiency investments as the first choice in electric energy policy.

VI. SECTION 248(b) CRITERIA

Q25. On which of the 30 V.S.A. 248(b) criteria will you be submitting recommendations?

A25. I will be submitting recommendations on the following 30 V.S.A. 248(b) criteria:

248(b)(2): Whether the proposed facility is required to meet the need for present and future demand for service which could not otherwise be provided in a more cost-effective manner through energy conservation or energy efficiency programs and measures. This criterion also requires an assessment of the environmental and economic costs of the facility in the manner set out under subdivision 218c(a)(1) (least cost integrated planning) of Title 30 and consideration as to whether the facility will avoid, reduce, or defer transmission or distribution system investments.

248(b)(4): Whether the proposed project will result in an economic benefit for the state and its residents.

248(b)(7): Whether the proposed project is in compliance with the electric energy plan approved by the Department under section 202 of Title 30.

30 V.S.A. 248(b)(2)

Q26. Is the facility required to meet the need for present and future demand for service in Vermont which could not otherwise be provided in a more cost-

effective manner through energy conservation or energy efficiency measures and programs?

A26. As a merchant generator with no Vermont contracts, the plant does not directly meet the present or future demand for service in Vermont, and it is not required to meet present or future demand.

Q27. How should merchant generators be considered when considering need for their output?

A27. The Board's orders in Dockets No. 6545, 4622/4724, and 6812 establish principles to be considered when assessing the need for merchant generators or other facilities that provide regional, rather than Vermont-specific, benefits under this criterion. In particular, the Board has concluded the region's needs and the benefits that flow to the region should be considered when establishing the need for operation of a merchant plant.

Q28. Would the VY Station meet the region's present and future demand for services that could not otherwise be provided in a more cost-effective manner through energy conservation programs and measures and energy efficiency and load management measures?

A28. Perhaps, at some times. Three regional requirements that the plant could potentially meet would be the need for energy, the need for capacity, and the need for reliability. Each of these needs must be evaluated against whether

demand-side measures could provide the equivalent resource in a more cost-effective way. The need for capacity is a kind of reliability need; there are also system configuration reliability concerns that are not related to overall system capacity. System configuration reliability implications of the VY Station are addressed in Mr. Stein's and Mr. Parker's testimony, in the context of criterion 248(b)(3). Their general conclusion is that the VY Station is not necessary to ensure system reliability. In this testimony, I address the region's need for energy and capacity.

Q29. Could efficiency or conservation meet the region's need for energy at lower cost than offered by Entergy for the VY Station?

A29. Energy efficiency and conservation measures will reduce the region's need for electric energy supply (relative to a hypothetical world in which these resources were not deployed). The measures deployed by utility and other efficiency programs are expected to meet cost-effectiveness tests, meaning that they provide net benefits, on a present value basis, to the participant and to society. As such, they are preferable, from a societal standpoint, to electric energy supply at any price. (They effectively have a negative price to society.) Given the market structure in New England, these efficiency resources displace more expensive generators before those which bid lower prices into the market. The VY Station, as a baseload plant that operates at high capacity factors, has marginal prices that are almost always below the market clearing price, so other

generators would be displaced by efficiency before the VY Station. This does not change the fact that net-negative-cost efficiency measures are less expensive than the market-priced resource offered by the VY Station. I address the market price impact of the VY Station's operation later in this testimony, in the context of criterion 248(b)(4).

Q30. Is there enough efficiency potential in New England to displace the need for energy from the VY Station?

A30. Yes. The Northeast Energy Efficiency Partnerships ("NEEP") report "From Potential to Action" found at Exhibit PSD-ASH-08 estimates that roughly 20% of the region's forecast 2018 load (or about 31,800GWh) could be met with efficiency implemented between 2010 and 2018, if there were sufficient investment. The VY Station produces less than 5,400GWh per year. Based on this significant energy efficiency potential, and the fact that energy efficiency is a lower cost resource, I conclude that the plant does not meet a regional need for energy that could not be otherwise supplied more cost-effectively through energy efficiency.

Q31. How would the VY Station meet the regional need for capacity?

A31. If the plant participated in the Forward Capacity Market ("FCM") auctions, and received a contract to supply capacity, it would be counted on by the ISO operators to provide that capacity, thereby supporting reliability in the region.

As discussed in greater detail in Mr. Stein's testimony, the plant has asked to be removed from these capacity auctions in each of the last several years. ISO-NE had accepted these bids for the years from 6/1/2013-5/31/2014 and 6/1/2015-5/31/2016. Evaluation continues on the intervening year. If ISO-NE accepts the de-list bid for the period 6/1/2014-5/31/2015, then the plant's capacity would not needed in any of the forward auction periods to date. If the de-list bid for 6/1/2014-5/31/2015 were rejected, that would mean the plant would be needed to meet regional reliability needs in that year. The FCM does not yet extend past 2016, so we must look to broader market conditions to forecast whether the plant is needed to meet the region's capacity needs, and compare efficiency, conservation, and load management potential to see whether the region's need for capacity could be provided more cost-effectively through other means.

Q32. Could efficiency, conservation, or load management meet the region's need for capacity at lower cost than offered by the VY Station?

A32. Because we don't know if the VY Station would participate in the regional capacity markets past 2016, this is difficult to say. If the plant does not participate, then it is not providing the capacity resource at all, so the question is essentially moot. If we assume that the plant would choose to participate in the capacity markets, then we should look at the potential for demand-side resources to provide equivalent capacity at lower cost.

The ISO-NE forecast of capacity, energy, loads, and transmission ("CELT forecast") shows more than 1200MW of additional passive demand-side capacity expected to bid into the FCM for capacity delivery between 2016 and 2021. ISO-NE does not forecast active demand response beyond that bid into the auctions which have already taken place, but there was a roughly 700MW increase in active demand response between 2011 and 2014. Based on the ISO-NE forecast and the regional energy efficiency potential described above (from the NEEP report), it would be safe to assume that there is the potential to achieve more than an additional 600MW of cost-effective efficiency and other load management within the decade.

Q33. Mr. Tranen discusses the potential that a large amount of the regions' capacity may retire, tightening the capacity market and raising the value to region of resources, such as the VY Station, that could provide capacity. How does this prospect affect your conclusions regarding the need that the VY Station might satisfy?

A33. The region currently has a significant excess of capacity. For example, almost 39GW of capacity qualified to participate in Forward Capacity Auction 6 ("FCA6"), which covers the 6/1/2015-5/31/2016 period; the required capacity in that auction was about 33.5GW, or roughly 5.5GW less than the regional qualified resource. The total capacity acquired in FCA6 exceeded the region's requirements by about 2.9GW, indicating that there is at least this much

relatively low-cost excess capacity. (The VY Station delisted in FCA6, so this captures the regional capacity situation in the absence of the plant.). ISO-NE estimates of the possible retirements caused by the issues that Mr. Tranen mentions total between 6 and 7GW, these estimates are included here as Exhibit PSD-ASH-09. These retirements, if they come to pass, would occur over the period from 2018-2024, producing a need for between 3 and 4GW of alternate capacity over that period. Each of these facilities could instead choose to retrofit their systems and not retire; in that case the regional need for alternate capacity would be reduced.

The question therefore becomes: is there enough potential to meet this capacity need through efficiency, conservation, or load management, at costs below the VY Station's cost, or would generation from the plant be required? Regional energy efficiency potential studies (such as the NEEP report referenced above) calculate the energy savings potential, rather than the capacity savings potential, so there is no comprehensive calculation on which to rely in answering this question. The evidence at hand does suggest that cost-effective efficiency, conservation, and load management could meet this need for capacity if not by 2018, at least by 2024. This tentative conclusion is based on the following directional indicators:

- The NEEP report suggests that between 2010 and 2018 the region could acquire cost-effectively efficiency equal to about 20% of its energy needs. If that mapped directly over to capacity, that would imply a potential to

achieve more than 6GW of capacity through efficiency by 2018. There are two reasons we shouldn't directly compare this 6GW number to the 3-4GW of required capacity to address generator retirement: First, the potential study addresses energy, not capacity, and it is certainly possible that the potential capacity savings would be less (as a fraction of the forecast) than the potential energy savings. Second, some of the efficiency potential would be needed to meet the region's growing need for energy services (e.g. due to support economic growth). The ISO-NE CELT forecast suggests that about a quarter of the 6GW in potential capacity would address this need and therefore be unavailable to address the need caused by generator retirement.

- There is likely to be additional efficiency potential, enabled by advances in technology, available to meet needs that arise between 2018 and 2024.
- The ISO-NE forecasts do not include growth in active demand response beyond that bid into the FCM for the next few years; there is likely to be additional potential for this resource to grow at costs lower than the cost of capacity from generation.
- The ISO-NE forecasts do not include potential impacts from two significant drivers of change in the energy sector: load reduction through distributed generation and load shaping that may be enabled by so-called "smart grid" technologies. Each of these could result in significant reductions in the regional need for capacity over the next decade, although the pace and size of that impact is difficult to predict.

- New renewable generation, required to meet the region's need for renewable energy as expressed in state renewable portfolio standards, will enter the market over the next decade or more.

Q34. Please summarize your conclusions regarding whether the VY Station is required to meet regional needs for energy or capacity that could not otherwise be met more cost-effectively through demand-side measures.

A34. The cost-effective energy efficiency potential in the region is significantly larger than the amount of energy produced by the plant, so the VY Station is not needed for this reason.

As discussed in greater detail in Mr. Stein's and Mr. Parker's testimony, we do not yet know ISO-NE's conclusions regarding whether the plant will be needed for reliability reasons during the period 6/1/2014-5/31/2015, although there is reason to believe that ISO-NE will conclude that the plant is not needed for reliability, for the reasons discussed by Mr. Stein. There is some chance that efficiency and other load management could not more cost-effectively offset the need for capacity from the plant during the few years after 2018, if significant generation retires over a short period of time. This window is a small portion of the 20 years over which the Petitioners have asked for the permit to operate.

Q35. The 248(b)(2) criterion includes a requirement to assess environmental and economic costs in the manner set out under 30 V.S.A. 218c(a)(1). How does

218c(a)(1), which requires that least cost integrated planning, including consideration of greenhouse gas emissions and reduction goals, inform your conclusions regarding need?

A35. While this subdivision is more directly applicable to utility decisions about power, some general principles can be applied to the evaluation of whether the VY Station is consistent with and beneficial to the goal of meeting the state's need for power and other attributes at the least cost. It is appropriate to consider the economic and environmental costs and benefits of the operation of the plant, as directed by the subdivision, with due regard to greenhouse gas impacts and the state's renewable energy goals as expressed in 30 V.S.A. 8001.

Q36. What can you tell us about economic and environmental costs and benefits?

A36. In this testimony I address economic impacts on the state in my discussion below regarding section (b)(4); Mr. Kavet, Mr. Rockler, and Mr. Parker also address these impacts. Some of the environmental costs of operation of the VY Station are addressed by the testimony of Mr. Garson, Dr. Greenblatt, and Dr. Samuelian, and other environmental costs will be addressed in testimony to be provided by the Agency of Natural Resources under sections (b)(5). Although my testimony is not focused on this point, the breadth of environmental costs and benefits is much greater than air emissions, and when considering environmental costs and benefits, Entergy's witness Mr. Tranen addresses only air emissions.

Q37. As noted above, Section 218c imposes a requirement to assess economic costs with due regard to Vermont's greenhouse gas emissions, our progress in meeting greenhouse gas reduction targets, and the value of financial risks associated with greenhouse gas emissions. How does this assessment inform your conclusions regarding balancing economic and environmental costs and benefits?

A37. The statutory greenhouse gas reduction targets in 10 V.S.A. 578 are defined based on "emissions of greenhouse gases from within the geographical boundaries of the state and those emissions outside the boundaries of the state that are caused by the use of energy in Vermont." Continued operation of the VY Station would have a negligible impact on emissions within the boundaries of the state, when compared with the case in which the plant is not operating. The plant's greenhouse gas emissions are also not directly related to emissions outside the state attributable to the use of energy in Vermont. To the extent that the plant, operating as a merchant generator, contributes broadly to the mix of power in New England, and Vermont utilities purchase undifferentiated power from the market, the state would see a small greenhouse gas benefit from the continued operation of the plant.

Q38. Economic costs are also to be assessed with due regard to meeting the state's renewable energy goals as expressed in section 8001(a). How does continued operation of the VY Station relate to meeting those goals?

A38. Continued operation of the VY Station would not help the state meet the goals described in 30 V.S.A. 8001. In fact, it would marginally reduce the ability of renewable energy generation to compete in the New England market by lowering the price of Regional Greenhouse Gas Initiative ("RGGI") allowances, and thereby the effective cost with which clean energy resources must compete. As Mr. Tranen says, "the demand for other resources to reduce the usage of fossil fuels to generate electricity in New England will be reduced." Tranen pf at 23. These "other resources" are other non-greenhouse-gas-emitting resources, such as renewables and energy efficiency. Continued operation would increase costs faced by other New England states to meet their renewable portfolio standards and impede development of renewable energy and related planned energy industries in Vermont. Reductions in the RGGI clearing price would also reduce revenues that Vermont uses to fund efficiency in heating and process fuels.

Q39. In determining need, the Board must also consider whether the facility will avoid, defer, or reduce the need for transmission or distribution system investments. Does the proposed facility have such impacts on the grid?

A39. Please see the testimony of Mr. Stein and Mr. Parker for a discussion of the plant's contributions to regional reliability. In my testimony, I address only the implications of the recent VELCO Long Range Transmission Plan, found at Exhibit PSD-ASH-03, for this question. This plan identifies four bulk system

reliability deficiencies, and examines whether continued operation of the VY Station defers the need for these investments.

- The plan does not indicate whether the need for a solution to the "Southeast Vermont" deficiency is deferred by the continued operation of the VY Station; if the solution were deferred indefinitely it would result in a savings of $6 million to the region, including about $240,000 to Vermont.
- The "Connecticut River Valley" deficiency has a need date in the past regardless of whether the VY Station is operational, so the continued operation has no impact on the need to solve this deficiency as soon as possible. Continued operation of VY Station would increase the fraction of the time that reliability is at risk until a solution is in place.
- The "Central Vermont" deficiency has four separate components. The need date for one component has passed regardless of whether the VY Station is operational. The other three components are needed sooner if the VY Station is operational than if it is not. That is, continued operation of the plant results in the need to address this deficiency sooner (and therefore at higher present value cost) than if the plant were not operational.
- The "Northwest Vermont" deficiency has four separate components. All four components are needed sooner if the VY Station is operational than if it is not. That is, continued operation of the plant results in the need to address this deficiency sooner (and therefore at higher present value cost) than if the plant were not operational.

In summary, continued operation of the VY Station is expected to result in a net increase in the cost of transmission infrastructure upgrades required in Vermont.

30 V.S.A. 248(b)(4)

Q40. What aspects of potential economic benefit to the state will you be testifying about?

A40. I will testify regarding two issues raised by Mr. Tranen in testimony for Entergy. First, I discuss calculating the value of the Revenue Sharing Agreement ("RSA"). Second, I discuss the impact of the VY Station operation on market clearing prices in New England.

Q41. Do you agree with Mr. Tranen's assessment of the value of the RSA to Vermont, and with the methodology used to calculate that value?

A41. I agree with neither his assessment of the value nor the methodology he uses to calculate that value. Putting aside his decision to neglect potential value in the RSA due to capacity revenue, Mr. Tranen overestimates the value of the RSA to Vermont as a result of two methodological choices with which I do not agree. He relies upon an adjusted version of the energy price forecast contained in the 2011 Avoided Energy Supply Cost ("AESC") study to calculate the value of the RSA, and adds to that an estimate of the value of the RSA in the case of two price spikes in an attempt to show the RSA's value as a hedge.

Q42. Please describe your concern with using the AESC energy price forecast to calculate the value of the RSA.

A42. The AESC study is conducted on a regular basis to inform the valuation of avoided energy costs (and other avoided costs) for efficiency cost-effectiveness calculations throughout the New England region. The AESC study is specifically not a price forecast for New England, because it assumes no demand response or energy efficiency. The point of the study is to determine the costs avoided by procurement of these resources, so AESC is the "but-for" case against which these costs are measured. It is therefore a forecast explicitly designed to be higher than market because it includes less supply relative to demand than the actual New England market. Adjusting the AESC to better align with more recent (lower) natural gas prices is a move in the right direction, but does not address the fact that the AESC forecast is simply not intended to be used as a market price forecast.

Mr. Tranen uses base and high cases of the AESC to define a range of potential values, and mentions the potential that prices could be lower, resulting in a zero value to Vermont. I agree that creating such a range can be useful, but its utility is hampered by the lack of any assessment of the relatively likelihood of the three cases; the use of the base case forecast in the price spike value calculation implies that Mr. Tranen sees the base case as the most likely.

Q43. Please describe your concern with Mr. Tranen's methodology for calculating the value of the RSA as a hedge, using the value of the RSA in the case of price shocks.

A43. I do not believe that Mr. Tranen's methodology gives a fair assessment of the likely value of the RSA to Vermont as a hedge against price shocks. My concern arises from several aspects:

- The use of the adjusted AESC base case only. Quite separate from the concerns expressed with the suitability of the AESC expressed above, the use of the base case only for price spike calculations is troubling. In particular, it results in an estimated minimum value of the RSA that is greater than zero; if a low price forecast were used in the price shock calculation, a minimum value of zero could very likely result.
- Mr. Tranen gives no evidence to support his assumption that there will be two major price shocks during the ten years of the RSA. While it is true that there were two price shocks in the preceding ten years, there have been significant changes in the natural gas market since those shocks occurred. My understanding of the changes wrought by the development of the shale gas resource leads me to expect that natural gas price shocks (and therefore New England electricity price shocks) may be less common in the next ten years than they have been in the past. Two significant factors here are, first, the evident decoupling between the price of natural gas and the global price of oil and, second, the increasing diversity of natural gas supply (especially

the development of supply that is significantly closer to New England) combined with new pipeline capacity to transport gas from this greater diversity of sources.

- The use of the AESC forecast, not a market price forecast, leaves me unsure as to whether Mr. Tranen's market price forecast already includes market expectations regarding the risk of shocks. Using an actual market price forecast, as I will discuss below, allows analysis to directly include expectations regarding price shocks. Therefore, I cannot evaluate whether it is appropriate to add Mr. Tranen's equilibrium value of the RSA to his price shock value.
- Mr. Tranen does not include the possibility that Entergy may enter long-term contracts for the output of the VY Station that would prevent Entergy from receiving increased revenue in the case of a price spike. That is, even if market prices did spike twice in the next ten years, Entergy's revenues may not show a comparable spike.

These factors lead me to believe that Mr. Tranen's assertion that the minimum value of the "combined benefit associated with the RSA" is greater than zero is not supported.

Q44. What do you think is the most likely value of the RSA to Vermont?

A44. Zero.

Q45. Why zero?

A45. In order to estimate the value of the RSA, I first used the Department's standard methodology to determine the electricity and natural gas markets' expected prices throughout the relevant period. In this case, the futures markets allow a direct look at market expectations for the price of electricity five years into the future, and the price of natural gas ten years into the future. Given the tight coupling between the price of natural gas and the price of electricity, one can map natural gas prices for years 6-10 into average annual electricity prices for those years. (For this conversion, I extrapolated the heat rate–effectively the ratio between natural gas and electricity prices–in years 2-5 for years 6-10 as well.) For projections beyond ten years, extrapolation is required. It is important to note that the market-based futures prices for electricity and natural gas already include a risk premium to account for the market's assessment of the risk that spot prices at the future time may be higher than projected.

I recently performed the calculation described above, and determined that the market expectation of the price of electricity, including the risk premium, is not expected to rise above $60 before 2022. The results of this calculation are found in Exhibit PSD-ASH-10. Given that the strike price begins at $61 in 2012, energy revenue is not expected to provide any value to be shared through the RSA. Entergy could choose to sign above-market contracts to supply power, but the contracts would need to be significantly higher than

even the risk-premium-adjusted market price to generate shared revenue under the RSA.

Q46. What about the RSA's value as a hedge?

A46. The RSA does have some value as a hedge. There is, of course, a possibility of price shocks greater than those anticipated by the market (and already priced into the baseline forecast, as discussed above), or that underlying natural gas prices may rise faster than expected. It is not, however, a hedge against inflation, because inflation is directly accounted for in the strike price escalation. Uncertainty also reduces the value of the RSA as a hedge. In particular, the relevant revenue is not directly based on the market price for energy or capacity; it is instead based upon Entergy's revenues, over which the beneficiaries of the RSA have no control.

Q47. What would have to happen to give the RSA a non-zero value for Vermont?

A47. Generally speaking, market prices would need to be significantly higher than market expectations, either over a sustained period or because of a price shock, and Entergy would need to be reaping the market value. As a baseload resource, I assume that Entergy has a low marginal operating cost for the VY Station, and is therefore an attractive partner for long-term contracts. In current market conditions, such contracts would be unlikely to cause Entergy's revenue to rise above the strike price.

Q48. Mr. Tranen testified that the market price impacts due to the operation of the VY Station within the ISO-NE energy market could provide value to Vermont in excess of $19 million per year (in present value terms). Do you agree?

A48. No, I do not agree.

Mr. Tranen undertakes two market price impact assessments. Both rely upon calculations undertaken for the purposes of determining the market price impacts of load reduction, but I agree with Mr. Tranen that a low-cost generating resource should reduce the market clearing price in a manner broadly similar to energy efficiency. It is not clear whether Mr. Tranen views the two calculations, one based on a Departmental report from 2006, and the other based on the 2011 AESC report, as additive. From the 2006 report, he concludes that "it is reasonable to assume that the benefit would be many millions of dollars per year." From the AESC analysis he concludes that "it is reasonable to estimate that the total present value of this benefit is measured in the tens of millions of dollars."

In examining Mr. Tranen's analysis, I turned to the AESC study, and its discussion of Demand Reduction Induced Price Effects ("DRIPE"), which was Mr. Tranen's cited source. The AESC study first introduces DRIPE and calculates potential DRIPE, which are the numbers that Mr. Tranen used to calculate his maximum potential (up to $23 million per year). Immediately following the discussion of potential DRIPE is a section on "energy DRIPE dissipation." This section describes several effects that mitigate the benefits of

DRIPE over the years following the installation of an efficiency measure, due to adjustments in the supply market. Mr. Tranen entirely neglects to include these dissipation effects in his calculation, resulting in significant over-estimates of the value of DRIPE-like effects from the VY Station's operation to Vermont. Decay mechanisms include changes in "customer usage, RPS requirements, generator deactivations (and reactivations) and incremental improvements, and possibly the timing of municipally-owned generation additions." (AESC study at p. 6-50). RPS requirements are not impacted by low-cost generation as they are by efficiency, so we can safely neglect that effect. Mr. Tranen also calculates the DRIPE-like benefit only over the ten years of the RSA, not over the 13 year period suggested by the AESC study. If we apply the decay factors presented in Exhibit 6-38 of the AESC study other than RPS, and extend the period to 13 years, the resulting maximum present value is $185 million, not the $203 million claimed by Mr. Tranen. Exhibit PSD-ASH-10 shows the DRIPE-like calculations used throughout this answer.

Mr. Tranen correctly raises the fact that Vermont utilities have significant portions of their portfolio tied to prices other than the spot market. However, he neglects to include the information provided in Exhibit 6-40 of the AESC study regarding "long term energy entitlements." If, as a crude approximation, we utilize the fraction of expected load already set to be covered by signed contracts as a proxy for the portion of the load served by sources that are not influenced by the spot market, the present value of DRIPE-like effects

falls to approximately $55 million. Finally, if we use the Department's energy price forecast, rather than the AESC (for the reasons identified above), the present value falls to about $45 million, with no present value benefit in any given year exceeding $6 million. So, while Mr. Tranen may be correct that "the total present value of this benefit is measured in the tens of millions of dollars," a more precise calculation indicates that the likely value is about 20% of his "Maximum Potential Market Savings."

30 V.S.A. 248(b)(7)

Q49. Is the continued operation of the VY Station by Entergy consistent with the electric plan adopted by the Department under 30 V.S.A. 202?

A49. The Electric Plan explicitly did not address the continued operation of the plant due to pending litigation against the state. ("The CEP will not take a position on whether VY should continue to operate; that is the role of state laws and processes and is the subject of [a] pending lawsuit." Exhibit PSD-ASH-01 p. 128. That said, we can look to the general principles of the 2011 CEP (and thus the Electric Plan), as grounded in statutory statements of state energy policy, to evaluate whether that plan provides good cause to permit the plant's continued operation. I address the more general question of whether the operation of the plant by Entergy promotes the general good of the state in answer to a subsequent question.

As I described above when introducing the 2011 CEP, it is grounded in statutory goals and policies, along with a core set of additional principles. Core principles of sustainability, adequacy, reliability, security, affordability, economic vitality, efficiency, and environmental soundness carry forward from the state's energy policy as expressed in 30 V.S.A. 202a, and are consistent with the direction that Vermont continues to espouse in developing and enhancing energy programs. It is also appropriate to be mindful of the long-term nature of energy choices and planning when evaluating energy choices on these principles. If continued operation of the VY Station advanced these core principles of state energy policy over the long term, I would say that operation met this criterion.

Sustainability. Continued operation of the plant would result in additional mining of a limited fuel resource while leaving an increased waste burden on future generations. Thus continued operation of the VY Station does not advance the sustainability principle of state energy policy.

Adequacy. As discussed in assessment of criterion 248(b)(2), New England has adequate supply of both energy and capacity to account for the retirement of this facility, thus continued operation is not necessary to advance this core principle of state energy policy.

Reliability. As discussed in Mr. Stein's and Mr. Parker's testimony, continued operation of the VY Station is not necessary to increase the reliability of energy supply in New England in general. In addition, continued operation

of the VY Station would in fact *increase the cost* of reliability upgrades within Vermont.

Security. Energy security is generally enhanced by having a diversity of plants and generating technologies; continued operation of the VY Station would likely therefore contribute to regional energy security.

Affordability. Although continued operation of the plant could result in some price suppression in the New England markets, continued operation would also increase regional costs of meeting renewable energy goals.

Economic vitality. While continued operation of the plant would provide some economic benefit to the state and its residents, this benefit is distinctly smaller than that presented by Entergy, as addressed in greater detail in Mr. Kavet's, Mr. Rockler's, and Mr. Parker's testimony and discussed above. Continued operation would also reduce the competitiveness of Vermont's renewable energy sector.

Efficiency. Continued operation would have little direct impact on energy efficiency, which would remain the state's first resource of choice for meeting energy needs.

Environmental soundness. Shutdown of the plant could, although would not necessarily, result in a net increase in electricity-related air emissions in New England. However, continued operation would have adverse impact on land and water, as discussed in the testimony of Dr. Greenblatt, Dr. Samuelian, and the testimony submitted by the Agency of Natural Resources.

30 V.S.A. 231(a)

Q50. One of the factors that the Board takes into account in considering a petition under 231(a) is the reputation of the applicant among the business community and with regulatory and other governmental agencies. Ms. Cohen's testimony addresses Entergy's reputation with the business community; can you speak to Entergy's reputation with Vermont regulators? Does the Department have a view on Entergy's application under this criterion?

A50. I have reviewed the history of Entergy's ownership of VY Station, including its dealings with the Department and the Board, and have reviewed the testimony of the Department's witnesses in this case. In the 10 years since Entergy began operating the VY Station, Entergy has lost the confidence of the Department as a fair and trusted business partner, and this weighs against approval of their petition. The company's testimony to this Board in Docket 7440 with respect to underground piping stands out in this regard, but other incidents have also contributed to the Department's lack of confidence in Entergy as a trusted business partner, including Entergy's resistance to honoring its commitments to Vermont utilities and ratepayers in connection with the collapses of its cooling towers.

Q51. Does the collapse of the cooling towers bear on any other criteria the Board evaluates under section 231?

A51. Yes. One of the criteria considered by the Board is the company's commitment to maintaining its facilities. While Vermont utilities no longer rely on the VY Station for purchased power, incidents at the plant affecting its ability to supply capacity suggest that any reliability benefits asserted by Entergy must at a minimum be discounted by incidents like this.

30 V.S.A. 248(a)

Q52. Pursuant to Section 248(a), no company may begin site preparation for or construction of an electric generation facility within the state unless the Public Service Board finds that the project will *promote the general good of the state* and issues a certificate to that effect. Will the continued operation of VY Station promote the general good of the state?

A52. While this proceeding concerns the continued operation of an existing facility, when considering a requested Certificate of Public Good under section 231, it is appropriate to consider the 248(a) requirement that the proposed continued ownership and operation promotes the general good. The Board has interpreted this language to require an analysis that goes beyond the criteria enumerated in Section 248(b); while satisfaction of the 248(b) criteria is a condition precedent to the ultimate determination of whether a project promotes the general good of the state and is necessary in order for a project to be granted a certificate of public good, it may not be sufficient.

The determination of whether a project promotes the public good under Section 248(a) is conducted only after the Board has concluded that there is adequate evidence to support findings that a project satisfies each of the 248(b) criteria. The Board's public good analysis involves weighing the potential benefits against the potential adverse impacts of a project.

The Department has evaluated the evidence presented by Entergy and the evidence that the Department presents in its testimony, and has concluded that Entergy has not demonstrated that each of the 248(b) and 231 criteria are satisfied. Given that, and considering the evidence as a whole, Entergy has not shown that the general good of the state would be served by its continued operation of the VY Station.

Q53. Does that conclude your testimony?

A53. Yes, it does at this time.