

**Rhode Island Energy Efficiency and Resources
Management Council (EERMC):**

Opportunity Report – Phase I

Submitted on July 15, 2008 to:

*The Rhode Island Public Utilities Commission, the General Assembly, the Office
of Energy Resources, and National Grid*

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Overview and Summary

I. Introduction

As part of its responsibilities set out in The Comprehensive Energy Conservation, Efficiency, and Affordability Act of 2006, the Rhode Island Energy Efficiency and Resources Management Council (“EERMC”) hereby submits this Opportunity Report-Phase I to the Public Utilities Commission, the General Assembly, the Office of Energy Resources, and National Grid. This submission is also consistent the Standards for Energy Efficiency and System Reliability Procurement approved by the PUC at the June 12, 2008 Open Meeting.

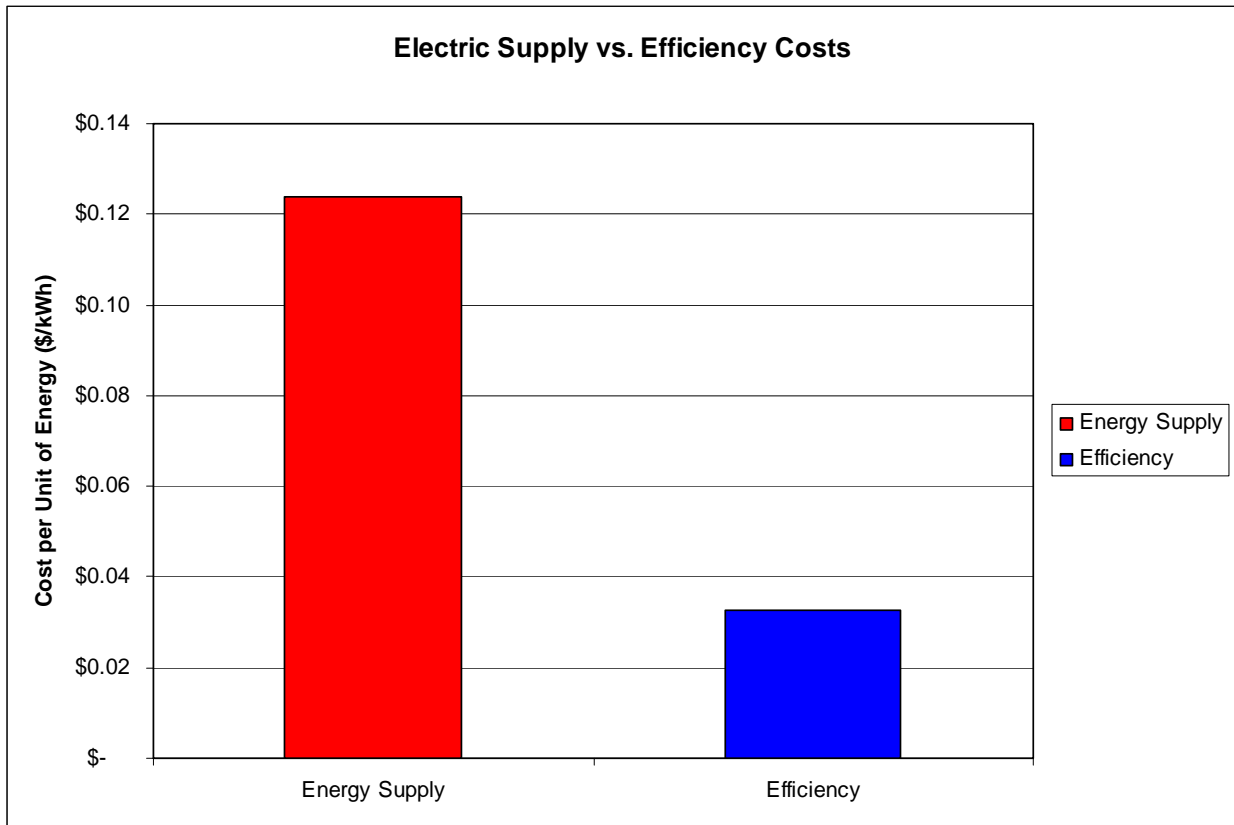
In the past eight years, the cost of purchasing electric supply from generators in New England has more the tripled, from 3.5 cents per kWh, with the rates paid by Rhode Islanders for supply now at 12.5 cents per kWh. This dramatic rise in the price of electric supply is a result of tightening global markets for fossil fuels and the resulting increases in commodity prices for oil and natural gas, as natural gas power plants almost always set the marginal price for electricity in New England.

In the past, the General Assembly required the distribution utility, National Grid, to invest in an arbitrary, fixed amount of low-cost energy efficiency programs to help customers save money and lower their energy bills. Over the last decade these efficiency programs, energy audits, and rebates for efficient appliances, light bulbs and the like have delivered energy savings for RI ratepayers at the low cost of 3 cents per kWh.

Showing foresight, in 2006, the General Assembly ushered in a new era for energy efficiency, moving from an “arbitrary” model for efficiency with a required, fixed utility investment level of 2.0 mills to an “economic” model for efficiency; one that directs the utility to invest dynamically overtime in all energy efficiency that is cheaper than supply. In the past, the General Assembly required National Grid to invest just \$16 million in energy

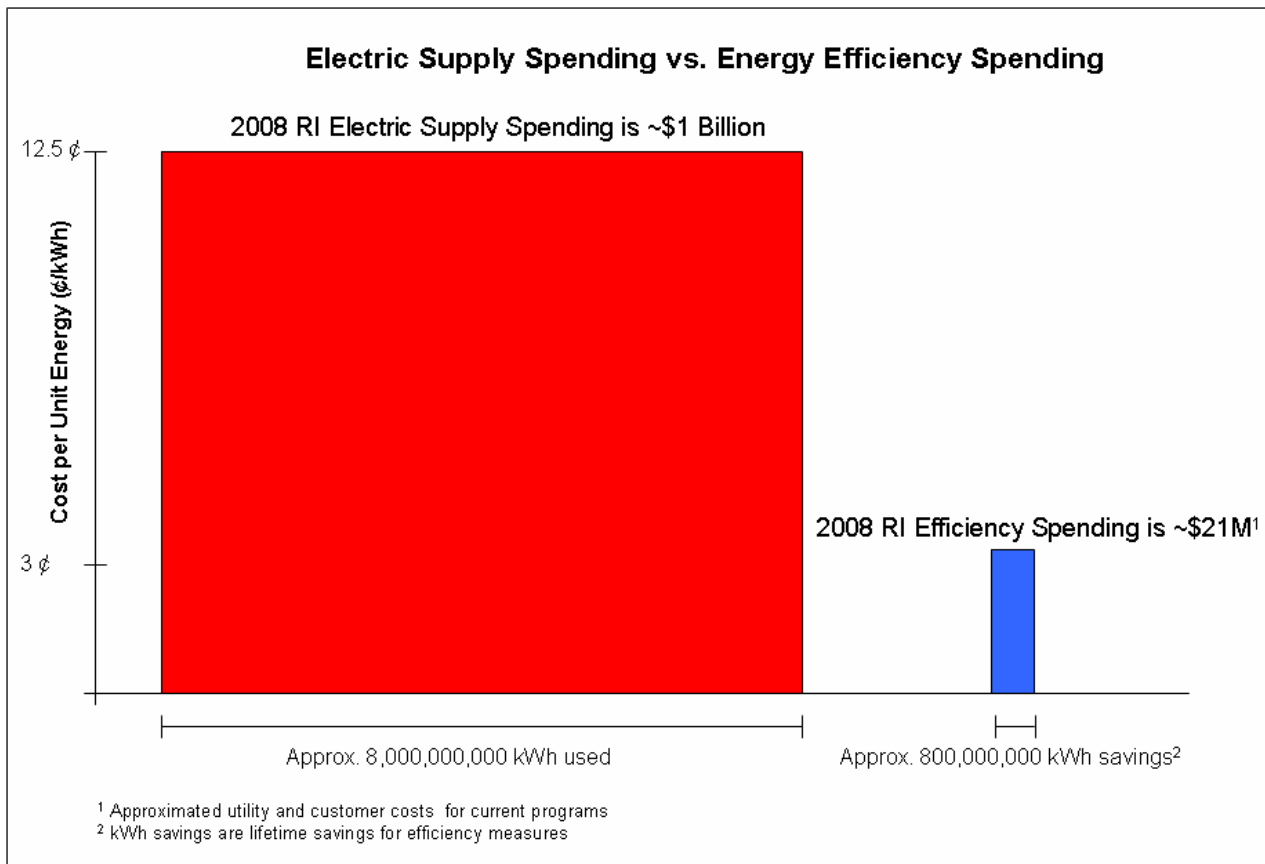
efficiency resources, leaving the remainder, roughly \$1 billion, to be spent on electric supply regardless of the cost of each.

Through the 2006 Act, the General Assembly and Governor made the groundbreaking choice to require the utility to invest in all energy efficiency that is cheaper than supply. At a time when we see electric supply costing 12.5 cents per kWh and rising, and energy efficiency resources only cost 3 cents per kWh saved, this policy of investing in all energy efficiency that is cheaper than supply is sound, strategic, and an economic imperative. Figure 1-7 from KEMA’s Efficiency Report illustrates the cost difference between electric supply and electric energy efficiency resources.



On September 1, 2008 National Grid is required by law to submit a Least Cost Procurement Plan describing how it will meet the legislative mandate by procuring low-cost efficiency resources in Rhode Island. The PUC’s Standards for Energy Efficiency and System Reliability Procurement as approved by the PUC on June 12, built upon draft recommendations from the EERMC and OER, with input from many stakeholders, specifies details and a process for how the September 1st Energy Efficiency Procurement Plan should be prepared and submitted. In this Plan the utility will need to describe how it will help Rhode Islanders save money on their energy bills, through strategic cost-effective efficiency investments in their homes, businesses, hospitals, schools, institutions, and places of work and worship.

Figure 1-8, found in the Executive Summary of KEMA’s Efficiency report, illustrates how the 2008 status quo of spending does not reflect Least Cost Procurement. This imbalance in resource acquisition is what National Grid must move to fix through its 2009-2012 Energy Efficiency Procurement Plan and supplemental annual Efficiency Program Plans. The goal of the Plans will be to ensure that Rhode Island ratepayers no longer spend so much for high cost electric supply when less expensive efficiency resources are available in the state.



The 2006 Act was also groundbreaking in that it requires National Grid to submit a System Reliability Procurement Plan including resources such as distributed generation, combined heat and power (CHP), renewables, and demand response in order to foster a more dynamic, homegrown energy system.

The General Assembly established the EERMC in the 2006 Act with representatives from the business, residential, low income, buildings, and environmental communities to help oversee and provide input into the development and implementation of National Grid’s Least Cost Efficiency Procurement and System Reliability Procurement Plans. The EERMC is charged with producing an “Opportunity Report” to identify the opportunities that exist to procure low-cost efficiency resources as well as system reliability resources such as distributed generation, renewables, and demand response. This Opportunity Report is being submitted today to the Public Utilities Commission, the General Assembly, the Office of Energy Resources, and National Grid in compliance with that statutory charge.

Since Rhode Island has decided, as a matter of law, to require the utility to acquire all energy efficiency savings opportunities that are lower cost than supply, the efficiency part of the report focuses on two key questions: “How much is it possible to save?” and “How much efficiency is out there that is cheaper than supply?” This Opportunity Report – Phase I is an important first estimate of the potential for saving Rhode Island consumers and businesses money on their energy bills through efficiency resources in the state. Its aim is to help guide and inform National Grid, state regulators, and community leaders as they develop the strategies necessary to secure all efficiency resources that are less expensive than supply.

It is important to note that in light of the fact that supply prices change over time and low-cost efficiency resources are both used up and replenished with technology innovation, the energy efficiency portion of the Opportunity Report is really the beginning of a dynamic and iterative process to constantly find better and cheaper ways to secure cost savings for ratepayers through energy efficiency resources. The report is intended to: (1) inform the National Grid’s Least Cost Procurement Plan due September 1st to the Public Utilities Commission by taking a snapshot of the magnitude of the cost-effective efficiency opportunity in Rhode Island and (2) inform the utility’s System Reliability Plan also due September 1st by identifying Rhode Island CHP, renewables, and demand response resources.

II. Overview

The General Assembly designed the 2006 Comprehensive Energy Bill to maximize ratepayers’ economic savings by placing a clear requirement on the distribution utility to procure all energy efficiency that is less costly than supply. To help determine the quantity of such efficiency resources and the cost savings to be enjoyed by Rhode Island ratepayers, the General Assembly charged the EERMC with producing an Opportunity Report that would identify: (1) the quantity of low cost efficiency resources existing in Rhode Island homes, business, and institutions and (2) System Reliability resources such as distributed generation, small scale renewables, and demand response in the state. The studies that follow were commissioned, directed, and managed by the EERMC to meet these goals. These studies are to be used by National Grid in developing its Least Cost Efficiency Procurement and System Reliability Plans, and by the EERMC in guiding the development of state policies and practices consistent with the findings and directives of the 2006 Comprehensive Energy Bill and the PUC’s Standards for Energy Efficiency and System Reliability Procurement.

The KEMA report (Attachment I) is an assessment of the electric energy efficiency potential in Rhode Island that is less expensive than supply and a preliminary assessment of the demand response (load management focused on peak summer electric impacts) potential. It will guide National Grid as it prepares its 3-year Least Cost Efficiency Procurement Plan by estimating the magnitude and cost of such efficiency resources and suggesting the new measures, program approaches and delivery strategies that will grow its current high quality energy efficiency programs into nationally leading least cost procurement efforts.

The NESCAUM study of opportunities for Combined Heat and Power CHP (Attachment II) adds a new dimension to the Rhode Island resource procurement strategy as this technology can provide significant efficiencies as well as customer, environmental and economic benefits. National Grid, on both the gas and electric sides, will be developing strategies to actively support CHP installations where they are cost-effective.

Finally, the University of Rhode Island (URI) report (Attachment III) is an assessment of the potential for small-scale renewable energy installations. Generally these installations will be on the customer side of the meter and will show up as a reduction in utility energy demand and consumption. URI indicates that the level of adoption of these measures in Rhode Island is limited, and the infrastructure to deliver these measures needs considerable development.

The EERMC wants to emphasize that we are pleased to meet this deadline for submission of the Opportunity Report, but we recognize that in an era of Least Cost Procurement and dramatic changes in energy markets and prices, such a report is only a "first step" in learning what levels of savings and distributed resource acquisition are really possible. As indicated in the KEMA report, there will be a "Phase II" of the opportunity assessment as we look more closely at Rhode Island businesses and homes. Similar follow-up and refinement of the estimates of potential will take place for all other resources and the Energy Efficiency and System Reliability Procurement Plans themselves are required by Rhode Island law to be repeated every three years.

Indeed, it is one of the characteristics of Least Cost Procurement that there will not be an arbitrary amount of resources procured; rather, the utility, the EERMC, and regulators will be continuously engaged in assessing how the state's energy needs can be met in the most affordable manner. This is truly a new dynamic in energy efficiency program delivery and resource acquisition, and we recognize that this Opportunity Report is a beginning step in what will be an ongoing process of making energy more affordable for Rhode Island consumers, and keeping more of Rhode Island's energy dollars at home and at work in the state's economy.

III. Process

The Rhode Island Energy Efficiency and Resource Management Council issued a Request for Proposals in March 2008 to prepare a report to characterize and quantify the electric efficiency resources available in the state that are lower cost than supply. KEMA was selected to complete the energy efficiency and demand response portion of the Opportunity Report in April. The University of Rhode Island Partnership for Energy (URIFE) evaluated small scale renewable potential and NESCAUM, with Pace Energy, prepared a study on combined heat and power.

This Report is the first of two phases. In Phase I basic data were developed, input from key market players collected, overall analytic framework developed, and the magnitude of the potential estimated. In Phase II, the team will collect primary data to refine the analyses of

Phase I. This will be completed by the spring of 2009. This Phase I report is intended to be a resource for National Grid in the development of its Least Cost Efficiency Procurement and System Reliability Plans due to the Public Utilities Commission by September 1, 2008.

The detailed reports prepared by each of these organizations, KEMA, URIPE, and NESCAUM are attached to this Phase I Report. Vermont Energy Investment Corporation (VEIC) which partners with Optimal Energy was engaged by the EERMC to coordinate the process and prepare this Phase I Report as well as serve as a general program and policy consultant to the Council.

In consultation with National Grid and others, the VEIC team developed and distributed a comprehensive list of assumptions and inputs for use by the Contractors. These inputs included:

- National Grid Load Forecast (MWh, Peak MW, by class)
- Economic factors (discount rates, inflation)
- Planning Period (2009-2018)
- Avoided costs (values, DRIPE, externalities, etc.) based on the Synapse 2007 Study and Company information
- Line losses
- Rating Periods
- Emissions Factors

A consistent list of inputs is necessary to assure benefit and cost comparability across initiatives.

IV. Limits of the Report

Estimates of the energy efficiency potential in other areas have been conducted using a variety of methodologies. These studies have typically underestimated the cost-effective efficiency potential due to a variety of reasons. First and foremost is an inherent conservatism. These studies are often a critical piece of infrastructure planning. The traditional utility “obligation to serve” has often been a strong driver to assure that the savings are not over-stated. There are additional factors that contribute to understatement of the benefits of energy efficiency, as briefly noted below:

- Emerging and unidentified technologies may provide opportunities for savings that could not rationally be captured in the study.
- Energy costs rising faster than anticipated may significantly alter the benefit/cost analysis.
- Lower measure costs, from economies of scale or other market effects, may have a similar effect.
- Changes in delivery strategy, at the program or portfolio level may significantly alter the adoption rate of a specific measure or bundle of measures.

Experience has also shown that energy efficiency potential is not a fixed quantity. Steve Nadel of ACEEE presented an example of this in an illustration he offered of the energy efficiency potential available in New York at two different time frames, 1989 and 2003. After 14 years of active energy efficiency investment in the intervening years, the energy efficiency potential remained at an almost identical level. The technology for efficiency constantly increases through research and development of market actors. Just as you would not expect to buy a laptop computer in 1998 that could deliver the same value as a 2008 laptop, so too, does energy efficiency technology constantly mature and improve. As we race to invest in and procure low cost efficiency resources in 2009 more efficiency opportunities will emerge in 2010 due to technology advancements – and this process of efficiency advance and new low-cost resource opportunities will continue each year.

The VEIC team advises readers that the constraints on time and budget for this Phase I Report meets the requirements of law and the objectives outlined in the RFP with output to be improved and refined with more local primary data collection and Rhode Island onsite and phone survey work in Phase II. It is our recommendation that the EERMC as well as the PUC, General Assembly, OER, and National Grid and other stakeholders, treat these studies as laying the groundwork for ongoing and more detailed and precise analysis.

V. Energy Efficiency Potential

A. Research Objectives

KEMA's Phase I effort included:

- review of a set of recent potential studies;
- review of the results of RI programs over the last three years;
- data collection and interviews with a set of key market players;
- development of a measure list and initial screening;
- development of initial resources estimates.

KEMA's deliverables were a review of the other potential studies and suggested levels for the initial potential estimates (see KEMA Appendix A) and the initial measure list, screened measure list, and documentation (see KEMA Appendices A and B).

B. Findings

1. Potential

This study assesses the magnitude and cost of the energy-efficiency resource potential for saving electricity in Rhode Island. It calculates technical, economic, and achievable efficiency potential savings for 3 years and 10 years, and is restricted to measures and practices that are presently commercially available. The energy savings that KEMA found

through low-cost efficiency are quite large and are measured in megawatt hours (MWh) and gigawatt hours (GWh).¹

In terms of estimating the demand-side resource (efficiency and some demand response) potential under three different scenarios: technical, economic and achievable potential,² the following definitions are employed:

“Theoretical” Technical Potential: Technical potential refers to the total demand-side resource potential over the planning period from all measures considered, regardless of whether those measures are cost effective, and without regard for market barriers or the ability of programs to capture it. This potential is defined as the additional savings over and above those expected to occur without efficiency program intervention.³

Economic Potential: Economic potential refers to the total demand-side resource potential over the planning period from all measures that are cost effective, based on a total resource cost test (TRC). The TRC for instance uses the cost of efficiency resources as compared with the avoided electric consumption valued at the forecasted electric supply costs, as well as any other quantifiable benefits such as fossil fuel and water savings. Economic potential does not take into account market barriers nor the costs of market intervention. As such, it can be considered an upper bound of the opportunities available for capture with energy efficiency programs that target all cost-effective efficiency that is cheaper than supply consistent with the mandate of the 2006 Energy Act and Least Cost Procurement.

“Conventional” Achievable Potential: Achievable potential refers to the estimated maximum demand-side resources that could be captured over the planning period, given aggressive, well designed, fully-funded programs. Achievable potential considers economic and other barriers to efficiency adoption, historic penetration rates from programs, and specific program strategies. As such, it provides an estimate of the portion of economic potential that may be expected to be captured with programs and assumed associated costs involved in capturing it. This estimate generally assumes traditional program approaches and consequently is a provisional first step but not definitive of what is actually achievable under RI law. This is because under Least Cost Procurement it is possible to leverage higher savings through bolstered marketing, financing, and community based delivery strategies.

In their analysis of Rhode Island, KEMA found a very large energy efficiency potential available at lower cost than supply. The table below summarizes their conclusions by showing the technical, economic, and achievable potential for energy savings in gigawatt hours.

¹ A megawatt hour is equal to 1,000 kilowatt hours (or kWh). A gigawatt hour is equal to 1,000,000 kilowatt kWh.

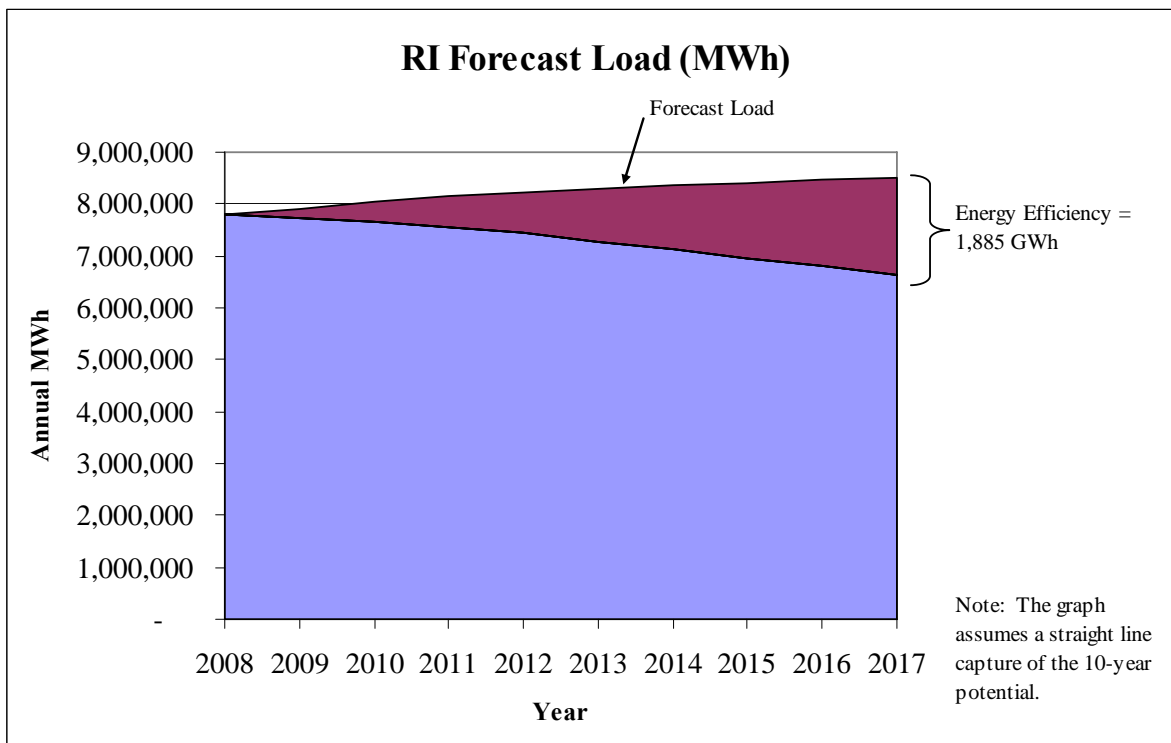
² Note, while all three analyses were performed for energy efficiency, demand response, CHP and small-scale renewables only estimated some of these metrics, depending on the specific resource. See the attached reports for more specific details.

³ The base case forecast and technology penetrations include effects from autonomous efficiency improvements that would result from natural market shifts, existing and expected codes and standards.

Energy Efficiency Potential, 10-year (2009-2018)

GWh	“Theoretical” Technical Potential		Economic Potential		“Conventional” Achievable Potential ^{4 5}		Δ Economic – “Conventional” Achievable	
	GWh	% of Forecast	GWh	% of Forecast	GWh	% of Forecast	GWh	% of Forecast
Residential	1,038	34%	870	28%	273	9%	597	19%
Commercial	1,161	32%	1,026	28%	371	10%	655	18%
Industrial	156	14%	154	14%	120	11%	34	3%
Overall	2,354	28%	2,050	24%	764	9%	1286	15%

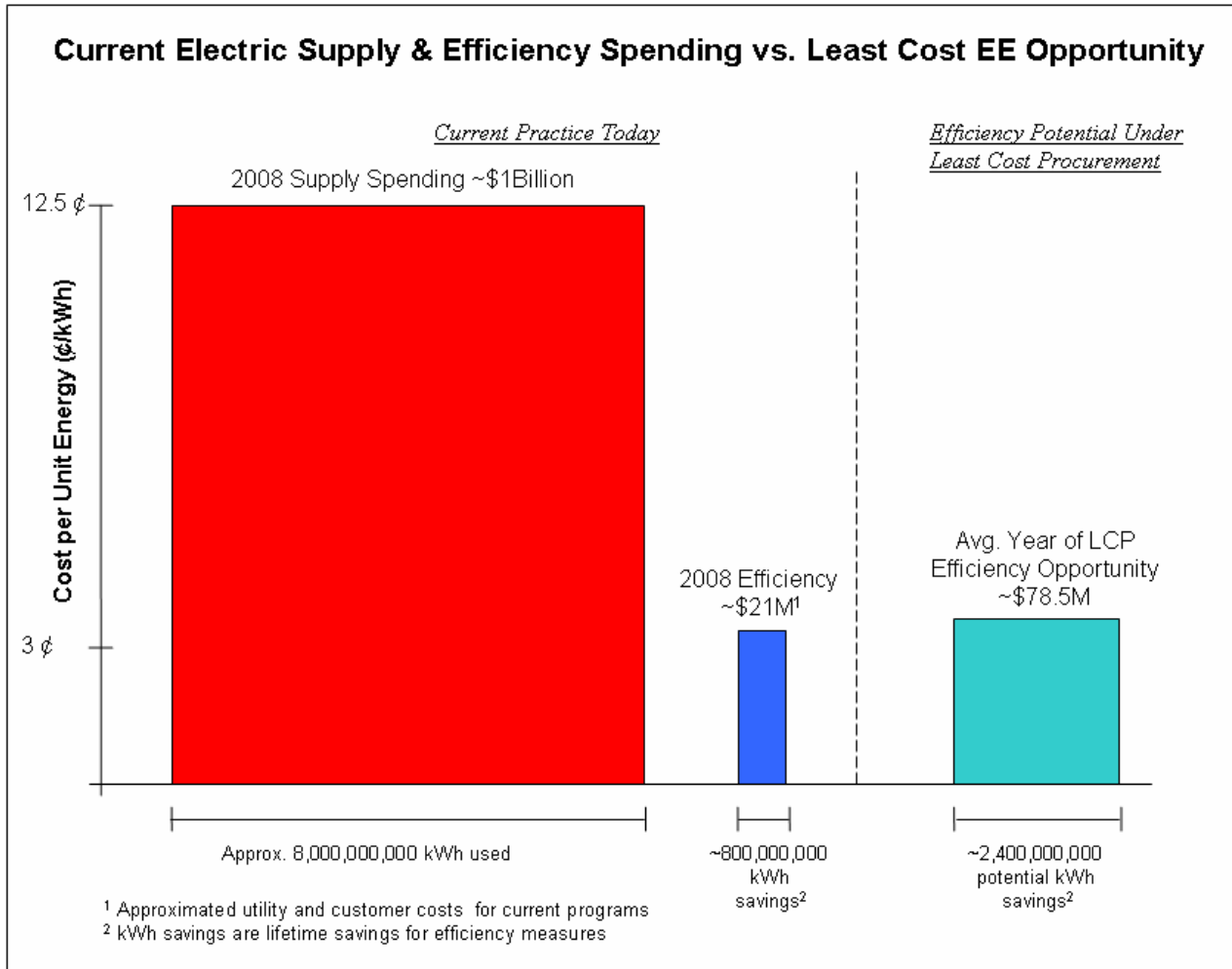
The size of the economic efficiency potential relative to current and projected load is illustrated in the graph below. Through the acquisition of the low cost efficiency resources KEMA found it is possible to reduce total energy usage while growing the economy.



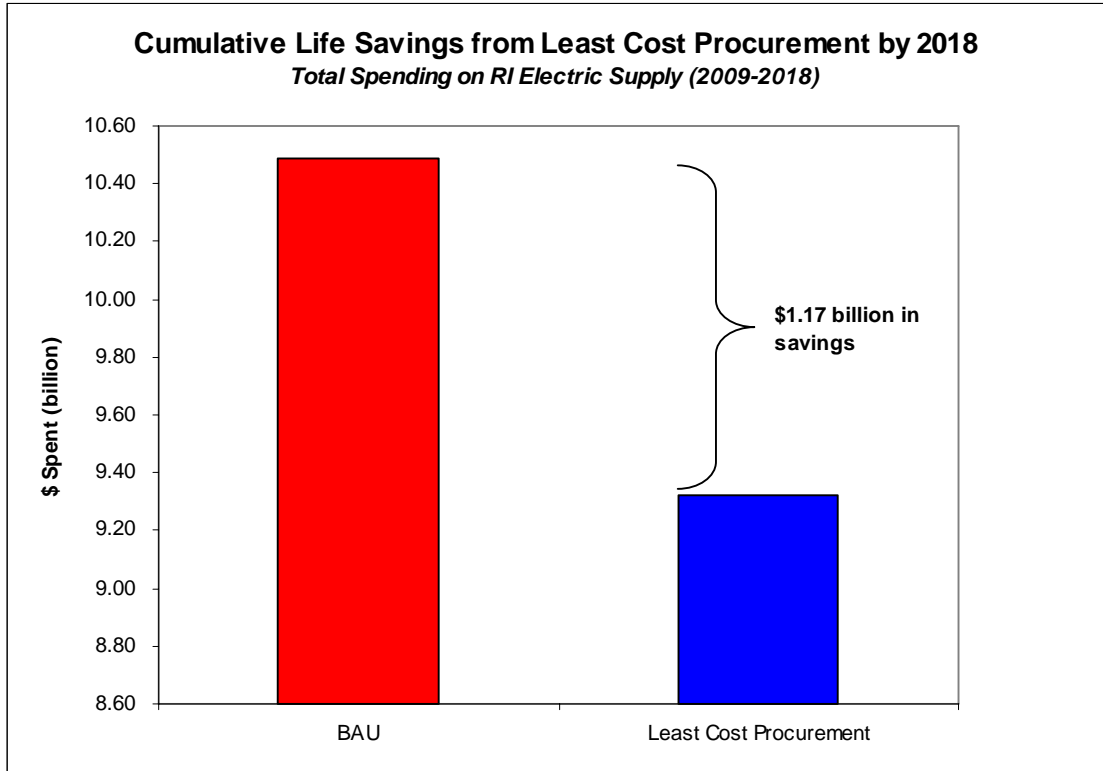
⁴ This estimate generally assumes traditional program approaches. It is a provisional first step but not definitive of what is achievable under RI law because under Least Cost Procurement it is possible to leverage more savings through bolstered marketing, financing, and community based delivery strategies.

⁵ Technical and economic potential does not include any reductions of savings for free riders by definition. Achievable potential reported here does include the reduction of savings from free riders.

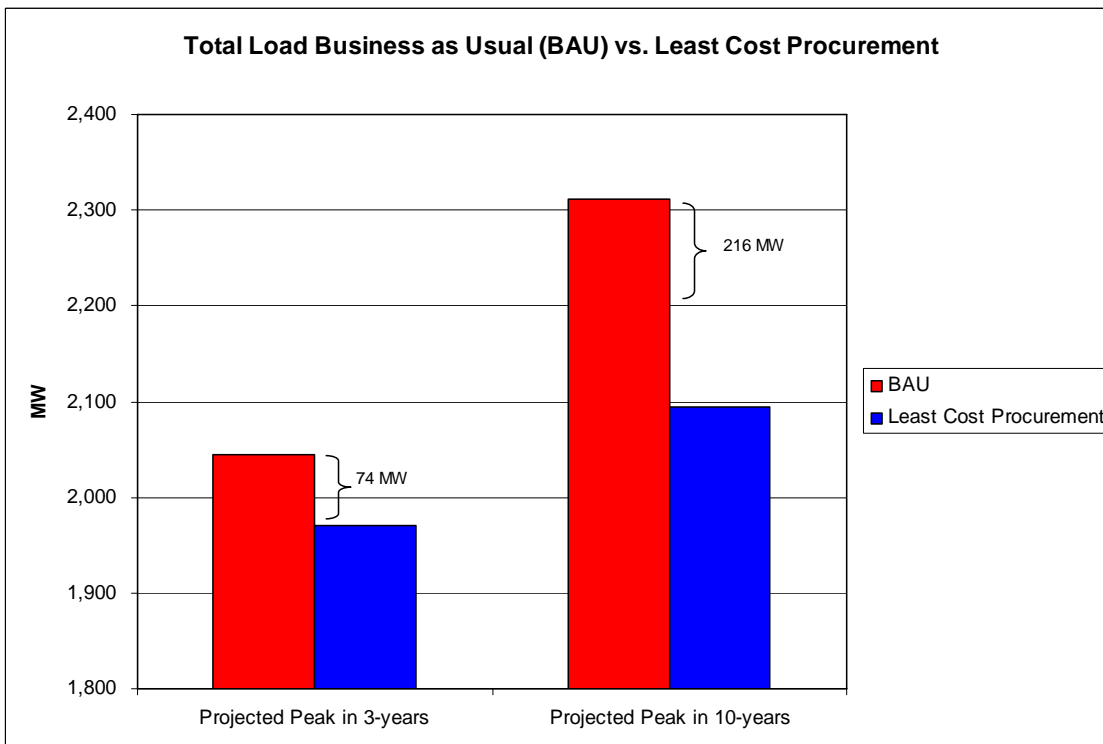
Over the 10 year time period of their study, KEMA found there exists is a very large, low cost economic efficiency potential. The graph below illustrates that in an average year from 2009 to 2018 there is approximately 2,400,000,000 kWh of efficiency resources available at a cost of just over 3¢/kWh, using the annual average savings from the economic potential. That is, the investment in low-cost efficiency resources could likely be quadrupled – to generate hundreds of millions of dollars in savings for ratepayers – and still remain much cheaper than the cost of electric supply.



In aggregate terms, KEMA found that the procurement of efficiency resources that are cheaper than supply would save Rhode Island ratepayers more than \$1 billion by 2018, as is illustrated in the following chart. This is an enormous untapped local Rhode Island energy resource and the process of procuring that resource would generate hundreds of non-utility jobs in the state.



In addition, the study found that the peak MW reduction impact of energy efficiency resources that are cheaper than supply is sizable as illustrated in the figure below.



KEMA also disaggregated the energy and capacity savings by sector and end-use, as shown in Appendix B.

2. Review of other potential studies

KEMA reviewed twelve recent potential studies. From this review they determined that the technical potential ranged around 30% for the residential and commercial sectors and around 20% for the industrial. KEMA also found that the economic potential was typically between 8% and 10% lower than the technical potential. Based on a subset of five studies they calculated the relationship between technical potential and achievable potential in the residential and commercial sectors at about 68% and the same ratio in the industrial sector at 76%. These findings validate the specific findings for Rhode Island.

3. RI Program Review

KEMA reviewed the Rhode Island programs against two major best practices studies and offered several recommendations for improvement. They noted that many of the RI offerings are currently included in these listings or similar to those listed, and that the cost per lifetime kWh of \$0.021 “falls comfortably in this range” between \$0.01/kWh and \$0.05/kWh.

C. Potential Phase II Objectives

1. Refine program designs and budgets
2. Modeling of potential new measures & programs
3. Confirm or revise technical, economic and achievable potential estimates based on primary research including on-site energy audits of facilities to capture primary data on saturations and efficiency level of equipment existing today.

VI. Combined Heat and Power Potential

A. Research Objectives

NESCAUM developed estimates of the potential for CHP installation in Rhode Island based on the NE-MARKAL modeling program. The model includes inputs for CHP technical characteristics, RI Commercial and Industrial (C&I) demand and base case fuel consumption characteristics. They developed an estimate for RI based on scaling of the commercial sector potential study from Massachusetts. For the purposes of this study, NESCAUM only considered natural gas-fueled units.

The analysis includes environmental and economic impacts, as well as energy. NESCAUM performed sensitivity analyses on a variety of factors including natural gas and oil prices, the costs of CHP equipment, availability factors, and the cost of energy efficiency.

B. Findings

NESCAUM bounded the technical potential for CHP application by the year 2020 between 350 MW and 714 MW based on two different analytic approaches. They developed a reference case for the year 2018 based on current rates of adoption in Massachusetts that put RI's cumulative CHP output at 141 MW.

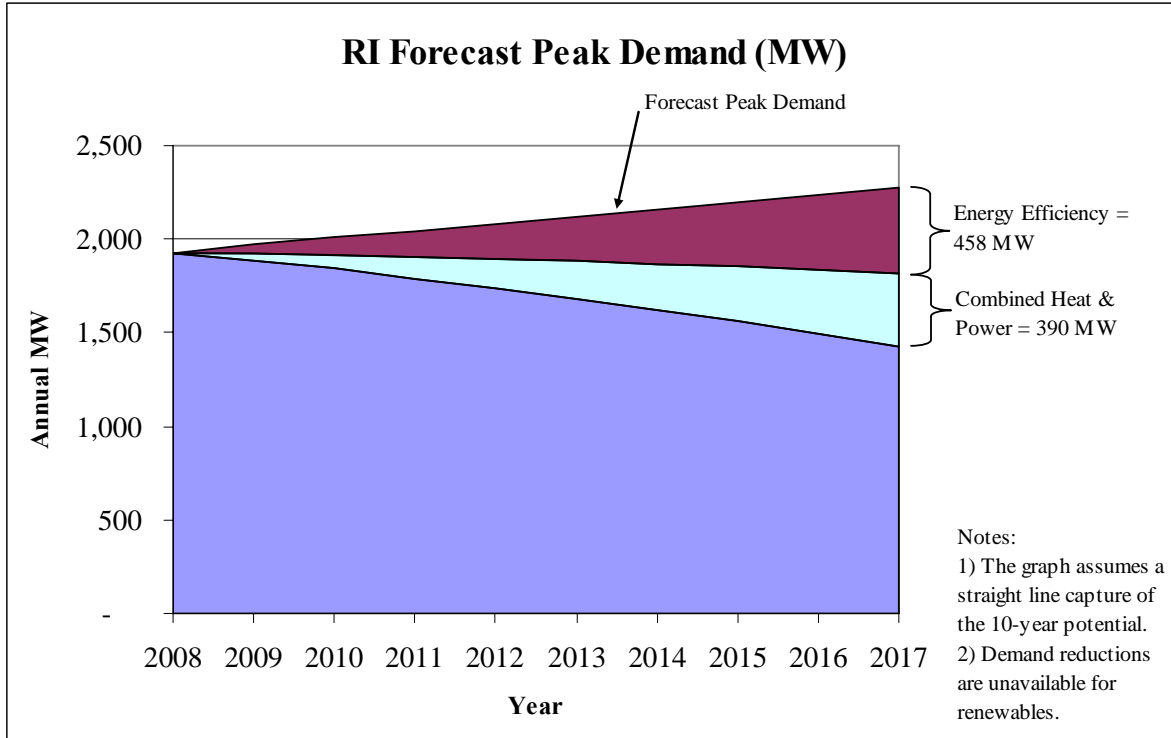
The analysis specifically adjusted for the following factors that influenced the economic and achievable potential of CHP:

- Whether gas is purchased at wholesale or retail
- The absence of specific back-up charges for electricity
- CHP system characteristics
- Natural gas prices
- Environmental requirements

NESCAUM developed estimates for both the high and low technical potential estimates based on a variety of scenarios.

The economic potential for incremental CHP installations over the reference case through the study period is estimated to be 200 MW and 330 MW respectively for the low and high technical potential scenarios. NESCAUM's analysis of the impact of the policy initiatives showed adoption of the high technical potential at about three times the reference case for the FCM scenario and double that of the reference case in the absence of back-up charges.

Taken together, the number of MWs that can be procured through cost-effective energy efficiency identified by KEMA coupled with the number of MWs of CHP identified by NESCAUM is summarized in the chart below.



C. Potential Phase II Objectives

1. Refine the estimates of technical, economic, and achievable potential under a variety of policy and market scenarios
2. Develop program designs and budgets to promote the adoption of CHP in RI.
3. Develop benefit/cost analysis for program(s).
4. Refine policy recommendations for CHP support, e.g. allocation of FCM payments and back-up and stand-by tariffs.

VII. Renewable Energy Potential

A. Research Objectives

Investigators from URIPE analyzed the potential for non-utility scale renewable energy sources including solar, wind, biomass and small scale hydropower. This review included a high level review of the resource potential, *e.g.* the amount of the wind resource available on lands that do not have an inherent prohibition against its development. It also included an estimate of the applicability, *i.e.* the number of customers or sites where it would be economically feasible to install a renewable energy source.

B. Findings

The URIPE team found that small-scale renewable energy sources can contribute to meeting Rhode Island's need for energy and that the market for these technologies is currently underdeveloped in the state. The report estimated the raw potential of the following renewable resources as follows:

- Solar – The total solar irradiance that falls on RI during an average day in June or July is 16,977.6 GWh, compared to the state's annual energy usage of 7,888 GWh. The researcher estimates that 1% of the states area in solar panels would meet 65% of the state's energy needs.
- Wind – RI has on average the potential for 109 MW of small wind energy totaling one billion kilowatt hours per year.
- Small Hydropower – RI has 674 dams with an untapped potential of 11.5 MW.

The URIPE report discusses the technology, regulatory and market context of renewables in Rhode Island and provides guidance for additional research.

C. Potential Phase II Objectives

1. Refine estimates of renewable potential specifically including biomass and solar hot water technologies.
2. Develop program designs and budgets to promote renewable energy resources
3. Develop benefit/cost analysis