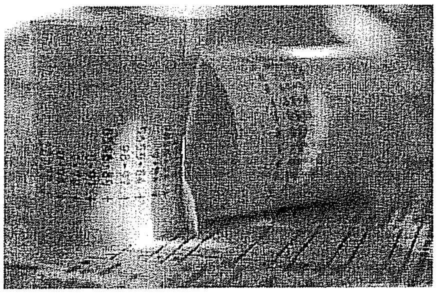
Block Island Power Company

Electric Resource Planning Study

September 2007




Prepared by
HDR Engineering, Inc.

HDR ONE COMPANY | *Many Solutions*

September 21, 2007

Dr. Al Casazza, President, Block Island Power Company
Mr. Everett Shorey, Shorey Consulting (Town of New Shoreham)
Mr. Stephen Scialabba, Chief Account, Rhode Island Division of Public Utilities and Carriers

Subject: Long-Range Electric Resource Planning Study

Dear Gentlemen:

HDR Engineering, Inc. (HDR) was retained by the Block Island Power Company (BIPCo) to provide a long-range resource planning study for the IRP Working Committee comprised of representatives of BIPCo, the Town of New Shoreham (Block Island) and the Rhode Island Division of Public Utilities and Carriers.. The study undertaken by HDR, in association with Charles J. Black Energy Economics, is intended to be comprehensive and provide to BIPCo an understanding of the various demand and supply side options that may be available to meet current and future load requirements.

Our review and resulting report was prepared utilizing data and information supplied to HDR by BIPCo, as well as other entities. In providing this planning study, HDR has utilized techniques and methods commonly used within the electric utility industry to evaluate various resources and available alternatives.

We appreciate your contributions and assistance, along with that of the BIPCO's management team and staff in the development of this report. Thank you for the opportunity to provide this technical assistance.

Sincerely,
HDR ENGINEERING, INC.

Steven Shelton, PE
Vice President

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Executive Summary

HDR Engineering, Inc. (HDR) was commissioned by a working committee comprised of representatives of Block Island Power Company (BIPCo), the Town of New Shoreham (Block Island) and the Rhode Island Division of Public Utilities and Carriers to prepare a comprehensive long-range resource planning study for BIPCo and Block Island covering electrical power needs, supply options and conservation options.

An important first step in development of an electrical resource planning study is to develop a long term load forecast. In developing a long term load forecast for Block Island, HDR included economic considerations, environmental considerations, land use and potential development, and historical load data and energy usage patterns to project a long term load forecast for Block Island. This load forecast is the foundation for determining demand and supply side options for consideration. Block Island is rather unique in its load requirements due to the small number of winter residents in comparison to the much larger load profile in the summer months when the island is populated with many tourists and summer home owners, as well as increased commercial activities to support the increased population.

HDR reviewed demand side/conservation options available to Block Island to increase efficiency in the consumption of electricity. One method to increase efficiency is through customer education. Another method is through the use of actual devices of means that reduce or manage energy demand or usage. To gain an understanding of the true nature of Block Island's capacity, interest and potential for demand side management programs, customer input was required. HDR completed a mix of personal interviews on the island as well as distributed a survey to all BIPCo customers. The interviews and surveys indicated a real interest in increasing energy efficiency, with no real understanding of a means for a coordinated effort to accomplish it. HDR provided recommendation and guidance for establishment of an Island Energy Advisor position to spearhead this effort. The study also provides examples of energy efficiency programs and conservation resource potentials by implementing various strategies.

The study reviews both traditional and renewable supply side resources for energy supply to meet the Island's energy needs. Traditional resources included continuation of the existing local diesel generation and the option for a submarine cable to connect to the electrical grid on the mainland. A proposed cable size, voltage and mainland grid connection options were evaluated and recommended. Renewable resources primarily focused on application of wind generation on the Island.

Wind generation on the Island appears to have good potential as a renewable resource. However, there are limitations due to the existing BIPCo electrical distribution system as well as winter versus summer load profiles. Also, whether the baseload energy supply is from local diesel generation or a submarine cable connected to the mainland, determines the amount of allowable wind generation the electrical system is able to accept.

With the data and information gathered, an economic evaluation of the alternative plans of service was prepared using a net present value (NPV) approach for a 20 year planning horizon. Plans included cost of local diesel generation utilizing projected fuel cost and installation of a submarine cable to the mainland with purchase power. Variations of these two base plans of service were to include renewable resources represented by wind and implementation of demand side resources represented by conservation measures to meet a portion of Block Island's long term energy needs.

Six alternative plans of service were evaluated: Diesel Generation Base Plan of Service, Submarine Cable Base Plan of Service, Diesel Generation with Wind and No Conservation, Submarine Cable with Wind and No Conservation, Diesel Generation with Wind and Conservation and Submarine Cable with Wind and Conservation. Based on the financial analysis with the assumptions used in the analysis, the diesel generation is a lower cost option in comparison to a dedicated submarine cable to the mainland funded totally and solely by Block Island. Addition of a wind renewable component to the diesel generation reduces the NPV of the base diesel generation option. Addition of conservation resources in addition to the wind renewable component further reduces the NPV of the base diesel option.

It should be noted that the submarine cable option does provide additional benefits in the engineering context for electrical system performance, as well as for environmental concerns. The financial analysis presented within this study assumes that the cost of the cable option is based on the recovery of cost by the BIPCo rate payers. This analysis does not include opportunities such as grants; potential offshore wind projects that would include cable to the mainland, which Block Island may be able to participate as a shared partner; or events that may allow socialization of the cost of a submarine cable to be covered over a larger population base.

Section 1
Introduction

1.1 Introduction

HDR Engineering, Inc. (HDR) was retained by Block Island Power Company (BIPCO) as the contracting entity for a working committee comprised of representatives from BIPCO, the Town of New Shoreham (Block Island) and the Rhode Island Division of Public Utilities and Carriers. HDR, in association with Charles J. Black Energy Economics was charged with the development of a comprehensive long-range resource planning study for BIPCO and Block Island covering electrical power needs, supply and conservation options. A major focus of this planning study is to review the various viable supply side options, as well as consider demand side options for BIPCO to meet their current and future load (resource) requirements. In providing this planning study, HDR has reviewed a number of various elements and components, that when taken together, will provide BIPCO and Block Island with a greater understanding of relative strengths, weaknesses and relative economics of each alternative.

1.2 Overview of the Resource Planning Study Undertaken

Electric resource planning studies can range from very complex and complicated studies to simple and fairly straight-forward studies. The level of complexity of a long-range resource planning study is in part driven by the resources that may be available to a particular electric utility and the unique and specific characteristics of the utility. Simply stated, BIPCO is a fairly unique utility in terms of its location, size and potential constraints (i.e. environmental, growth transmission access, etc.). Given these unique characteristics, HDR determined that BIPCO and Block Island required a comprehensive long-range resource planning study that was technically strong, but not overly complex such that the study shifted focus away from what makes Block Island unique. HDR believes that the approach used for this long-range resource planning study has balanced the need for a comprehensive and technically strong study with the need for a study that is clear and easily understood by BIPCO and the Block Island community.

The objective of a long-range resource planning study is to assess and evaluate both demand-side and supply-side resource options in a fair and consistent manner. This study should <u>not</u> simply focus on traditional supply side resources, but rather, recognize solutions are often a combination of demand and supply resources. The overall objective of the study is to minimize costs to both BIPCO and their customers. Finally, any long-range plan must recognize the uncertainly and variability in projecting future events and technology. Given that, this plan must recognize the issue of uncertainty and be flexible to allow for changes in conditions or circumstances.

In conducting a long-range resource planning study there are a number different elements that are included within the evaluation process. Among the key elements of a resource planning study are the following:

- Customer and Load Forecast
- Review of Demand Side Options
- Review of Supply Side Options
- Review of Renewable Resource Options
- Review of the Economics of the Various Resource Options
- Development of a Resource(s) Strategy

This report discusses in detail each of these components of the resource planning process and the research and technical analysis undertaken by HDR.

1.3 Organization of the Study

This report is organized in a sequential manner that roughly follows the process used by HDR to develop the long-range resource planning study for BIPCo. The following sections comprise the resource planning study for BIPCo:

- Section 2 – Overview of Block Island and BIPCo
- Section 3 – Development of the Customer and Load Forecast
- Section 4 – Review of the Demand-Side Options
- Section 5 – Review of the Supply-Side Options
- Section 6 – Economic Evaluation of the Alternative Plans of Services
- Section 7 – Development of a Long-Term Resource Strategy for Block Island

A Technical Appendices is attached at the end of this report, which details the various research and analyses that were used in the preparation of our review and the development of this report.

1.4 Summary

This report will discuss and review BIPCo's and Block Island's supply-side and demand-side options. An important starting point for developing the long-range resource planning study is to gain an understanding of Block Island and BIPCo. The next section of the report provides an overview of Block Island and BIPCo.

Section 2
Overview of Block Island and BIPCo

2.1 Introduction

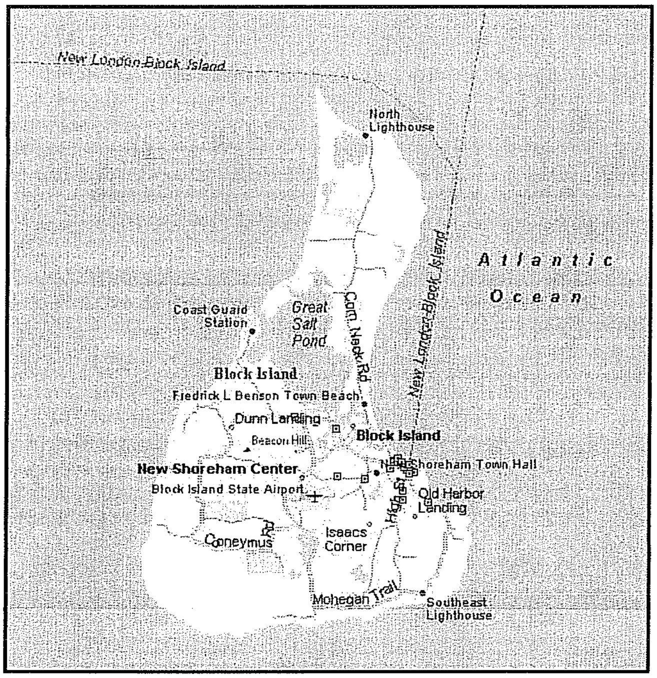
An important starting point of developing a resource planning study is to have an understanding of the local area and the electric utility that serves that area. Block Island is unique in a number of respects, which impacts the various opportunities available to the Block Island Power Company and their customers. This section of the report will provide an overview of Block Island and a brief overview of BIPCo.

2.2 Overview of Block Island

Block Island has a long and interesting history. Block Island is located 12 miles off the southern coast of mainland Rhode Island and 14 miles east of Montauk Point, N.Y. From its shore, Fisher's Island, N.Y.; and Watch Hill, Point Judith, Narragansett Pier and Newport, R.I. are visible.

The island is named after the Dutch navigator Adrian Block, who visited the island in 1614. European settlers arrived in 1661, and in 1664 the island came under the jurisdiction of the Rhode Island Colony.

Figure 2-1 Map of Block Island



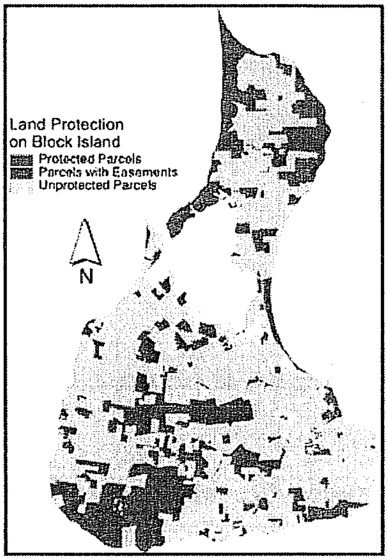
Interestingly, Block Island has no natural harbor: two were built in the nineteenth century. The Old Harbor was completed in 1876, and the New Harbor in 1896. The island has a limited year-round population and is primarily a tourist destination. With approximately 800-900 year-round residents, the population can swell to 15,000 in the summer months with visitors and day trippers. In addition to year round, full-time residents, there are also weekend homes that are utilized year-round. Figure 2-1 provides an overview map of Block Island.

The political name for Block Island is

also known as the Town of New Shoreham. The largest population center on the island is the Old Harbor Area. Much like the island, the Town of New Shoreham has a long and interesting history. The town was formally incorporated in 1672. The town is governed a Town Manager and five elected members of the Town Council. Many of the island's local businesses are located in New Shoreham, and being the largest population center on the island, it is the obvious hub of activity for the island. Block Island is unique in one special way: it is the smallest town (in population and size) in the smallest state.

Block Island is approximately 6,188 acres. A limiting factor to its growth is that nearly 43% of the Island's land area is under conservation. This includes wet lands, open water, government land and land owned by non-profit groups and homeowners' associations. In reviewing the land use maps there are still a number of undeveloped lots available for development and growth. The Nature Conservancy has purchased land that is to remain undeveloped. Figure 2-2 provides an overview map of the land protection on Block Island.

Figure 2-2 Land Protection of Block Island



Another limiting factor to growth is the limited transportation options to and from the island. The primary mode of transportation for both people and goods is provided by ferries. The ferries land at Old Harbor and the crossing time for the "traditional" ferries is approximately one hour. The ferries are operated by private companies and are relatively expensive on a per trip basis ($90/RT for standard size automobiles on one of the traditional ferries). The ferries operate on a varying schedule during the winter and summer. In the height of the summer season, ferries depart from Point Judith, RI, New London, CT and Montauk, NY making more than 15 crossings per day. In contrast to this, in the winter, the ferry may make only one to three crossings per day, depending upon the day of the week. In addition to transportation provided by the ferries, there is also the Block Island Airport. This small airport is primarily used for general aviation, but there is scheduled airline service provided by New England Airlines. The scheduled service is between Block Island and Westerly State Airport in Westerly, R.I. The Block Island airport is operated by the Rhode Island Airport Corporation.

On the island, there are both a water district and a sewer district. Both of these districts include the downtown Old Harbor and High Street areas on the east side of the island. The outlying areas of the districts do not necessarily overlap. Neither district serves the entire Island. Thus, many homes in the more outlying areas rely on wells and septic systems. In order to reduce summer demand on the electric system, the sewer district owns and operates its own diesel generator.

There is no industry, to speak of, located on the island. The majority of commercial businesses and resulting electric load is service (tourist) driven with a variety of hotels, bed & breakfasts, restaurants and small stores.

2.3 Block Island Power Company (BIPCo)

Block Island Power Company (BIPCo) basically serves all of the electric power needs of the island, with the exception of individuals who use their own power generators, solar panels and small wind turbines and seasonally, the sewer plant and one marina. BIPCo is a privately held utility, headquartered in the town of New Shoreham. BIPCo was incorporated in 1925. BIPCo is regulated by the Rhode Island Public Utilities Commission.

At the present time, BIPCo is not connected to the mainland electric grid system. As a result, BIPCo currently supplies the electrical needs of the island using reciprocating engine diesel generators. BIPCo currently has a total of five (5) units with a total generation capacity of 7,275 kW. These values were field verified. It should be noted that this is slightly different than the total generation shown in the BIPCo Rural Utilities Services (RUS) Form 12 dated December 2006. Future Form 12's will be corrected. All of the new units are equipped with pollution control systems. BIPCo's total generation costs in 2006 were approximately $2.6 million. Of this amount, approximately $1.9 million was fuel related.[1] Given the use of diesel fuel and its fluctuating costs, BIPCo includes a fuel adjustment charge within its rates to recover the varying cost of fuel.

BIPCo serves a total of 1,743 customers, who use a total of approximately 10.7 million kWhs. The annual revenue generated from these customers is approximately $4.0 million. A summary of this information, by customer type is provided below in Table 2-1. The average revenue per kWh is computed strictly from the numbers reported on the RUS Form 7.

Table 2-1
Summary Overview of Key BIPCo Operating Statistics

Customer Class of Service	No. of Customers	Annual kWh Sales	Annual Revenue	Ave. Revenue ¢ Per kWh
Residential	1,300	4,171,469	$1,481,100	35.51¢
Commercial (<1,000 KVA)	315	1,490,317	585,361	39.28¢
Commercial (>1,000 KVA)	95	4,171,906	1,667,643	39.97¢
Street/Highway Lighting	12	840,978	298,561	35.50¢
Public Authorities	21	110,400	12,607	11.42¢
Total	**1,743**	**10,785,070**	**$4,045,272**	**37.51¢**

Source: BIPCo Rural Utilities Service (RUS) Form 7, December 2006.

As can be seen in Table 2-1, the average cost serve the islands customer's is exceptionally high at approximately 37.5¢/kWh. Given this high cost, this resource planning study will explore supply and demand alternatives that may be more cost-effective for BIPCo and its customers.

[1] BIPCO Rural Utilities Service (RUS) Form 12, December 2006.

Based upon the seasonal nature of tourism and island living, the loads on the island vary greatly between the winter and summer periods. In the summer, with all of the businesses operating and the large number of vacationers and visitors, the summer peak demand currently reaches 4,000 kW. In comparison, the winter peak demand is much lower at about 1,500 kW. BIPCo's generation and distribution system must be designed and operated to handle the peak summer loads and still operate relatively efficiently year round.

Figure 2-2 BIPCO 10 MVA Substation

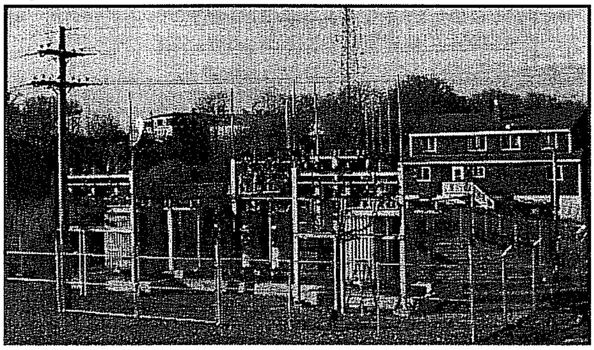
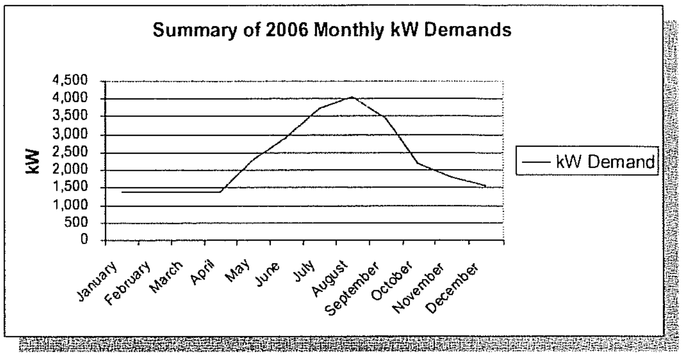


Figure 2-3



As for the distribution system, the generators are connected to the distribution system via a new 10 MVA substation (See Figure 2-2). The substation has two 5 MVA transformers. These transformers are presently connected 2.4 kV delta to 2.4 kV delta. The transformers are factory set up to be easily changed from 2.4 kV delta to 4.16/2.4 kV grounded wye on the distribution system side.

The Block Island electrical distribution system currently consists of six 2.4 kV delta distribution circuits emanating from the substation serving the island's loads. Overall, Block Island has 51.4 miles of distribution line with the majority of the line being overhead.

A long range plan that was completed in 2004 recommended converting the island's distribution system to 4.16kV. This conversion would substantially increase the capacity that the distribution circuits can carry as well as reduce losses in the lines.

2.4 Summary

This section of the report has provided a brief overview of Block Island and BIPCo. This overview should be helpful in understanding some of the issues and constraints associated with the various supply and resource options explored as a part of this study.

Section 3
Development of the Load Forecast

3.1 Introduction

An important component in the development of Block Island resource planning study was an understanding of potential customer and load growth. Given that, a 20-year forecast of load growth was developed for BIPCo. Ultimately, BIPCo must have sufficient resources (net of demand and supply-side changes) to meet the long-term forecasted needs of their customers. These forecasted loads are used within the economic analysis to determine a cost-effective means of meeting existing and future load requirements. This section of the report will discuss and review the load forecast undertaken as a part of this study.

3.2 Economic Conditions

As with many utilities, the economy plays a large role in the energy usage on the island. Since Block Island serves as a resort destination for many vacationers, the weather, or forecasted weather conditions play a vital role in the energy sales. A hot and dry weekend versus a cool and wet weekend can dramatically affect the power sales during the summer.

The number of new permits for home construction is down from past years, but the number of remodels is higher. These remodels and additions typically include substantial square footage additions which can more than double the existing home. In addition, the remodels and additions are increasingly including more energy consumption requirements for conveniences such as central air conditioning, de-humidifying equipment, larger and more varied kitchen appliances, larger lighted areas, etc.

3.3 Environmental Considerations

In 2006, BIPCo used 949,268 gallons of #2 fuel oil to generate the island's power requirements. This fuel had to be transported and stored. Fuel storage is provided with four-20,000 gallon tanks. Typically, for off peak months, the tanks provide adequate capacity for more than 1 month's worth of generation. During peak months, fuel storage capacity is less than one month with specific storage time dependent upon the current electrical system loading.

Due to the fact that the water supply for the island is considered to be a sole source aquifer, BIPCo is very concerned about the impact that a spill or leak would have on the aquifer. BIPCo's Spill Prevention Control and Containment Plan was updated in 2005.

3.4 Land Use

Block Island is comprised of a land area of 6,188 acres. Approximately 43% of the Island's land area is under conservation. This includes wet lands, open water, government land, land owned by non-profit groups and homeowner's associations. However, at the same time, there are still numerous undeveloped lots available for growth.

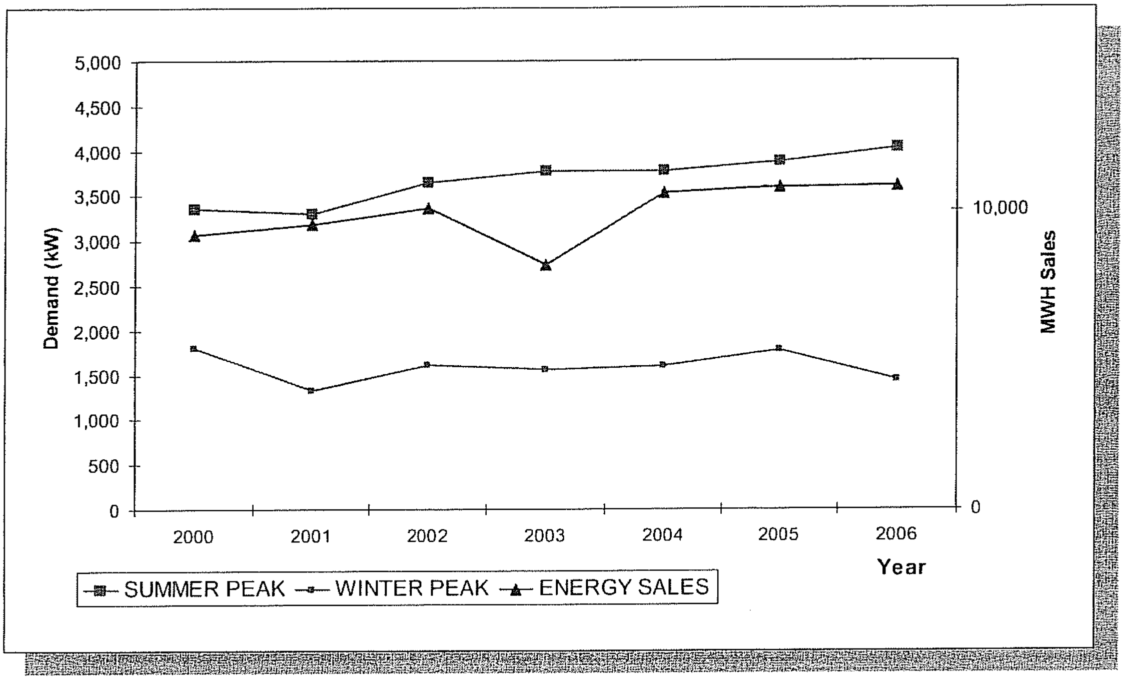
3.5 Historical Load Data and Usage Patterns

Table 3-1 shows the load and customer characteristics for Block Island for the past five historical years. The table includes data for BIPCo's peak demand, energy generated and sold, losses, customer growth and annual load factors.

Table 3-1
Historical System Annual Loads, Energy and Load Factor

	Noncoincident Peak Demand (kW)				Energy (MWh)						
Year	Winter	% Change	Summer	% Change	MWh Gener.	MWh Sold	% Change	Own Use	% Losses	Customers	Load Factor
2001	1,495	—	3,300	—	11,231	9,546	—	32	14.7%	1,526	38.9%
2002	1,610	7.7%	3,650	10.6%	11,273	10,109	5.9%	32	10.0%	1,527	35.3
2003	1,565	-2.8	3,775	3.4	10,255	9,207	-8.9	32	9.9%	1,527	31.0
2004	1,600	2.2	3,775	0.0	12,414	10,594	15.1	229	12.6%	1,684	37.5
2005	1,775	10.9	3,880	2.8	12,776	10,805	2.0	215	13.7%	1,716	37.6
2006	1,500	-15.5	4,030	3.9	12,810	10,785	-0.2	221	14.1%	1,736	36.3
5-Year Compound Growth 2001 – 2006		**0.1%**		**4.1%**			**2.5%**			**2.6%**	
Average Losses									14.2%		

Figure 3-1 Historical Data



As can be seen in Table 3-1, over the last five years, BIPCo's customer base has grown by an average of approximately 2.6% per year. Interestingly, the growth in the summer period has exceeded this level for demand. The summer peak demand has grown at 4.1%. This data simply supports the fact that Block Island's demand and energy use is driven by the summer tourist periods. Figure 3-1 is a graphical representation of the historical data in Table 3-1.

The relatively high losses shown in Table 3-1 are due to heavy loading on the distribution circuits during the summer, coupled with the transformer core and winding losses on seasonal transformers that are energized year round even though they are only serving load during the summer season. During the winter season, the transformers still generate losses. If the loads are completely off, the transformers could be de-energized, but this would take BIPCo man-hours of effort to disconnect and reconnect seasonally. Also, if homeowners keep the houses warm enough to keep pipes from freezing during the winter months, this would preclude the de-energization of the affected transformers.

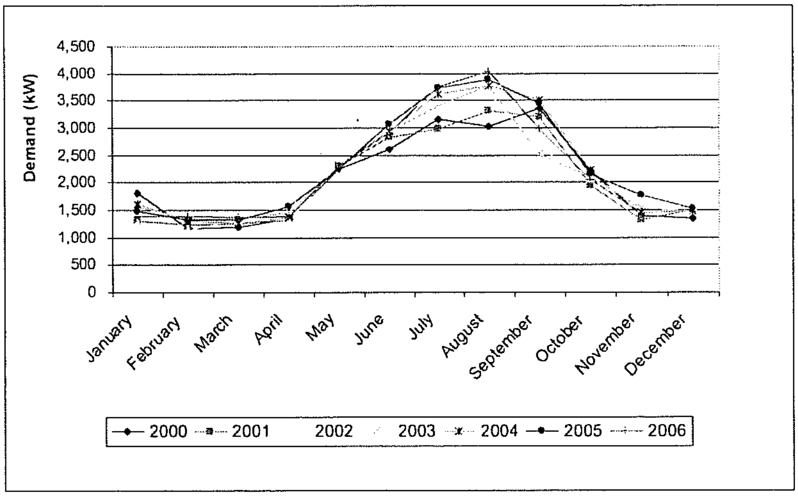
Table 3-2 shows the monthly historical demands. Figure 3-2 is a graphical representation of the monthly demands that emphasizes the seasonal trends. This seasonal trend closely follows the cooling degree patterns for Block Island.

Table 3-2
Summary of Historical Demands (kW)

	2000	2001	2002	2003	2004	2005	2006
January	1,800	1,300	1,250	1,565	1,600	1,480	1,380
February	1,160	1,225	1,155	1,350	1,300	1,325	1,380
March	1,200	1,250	1,325	1,340	1,250	1,330	1,360
April	1,355	1,325	1,325	1,450	1,360	1,575	1,385
May	2,250	2,300	2,300	2,325	2,325	2,250	2,290
June	2,600	2,825	2,950	2,930	2,925	3,075	2,910
July	3,160	2,985	3,630	3,390	3,615	3,720	3,740
August	3,025	3,300	3,650	3,775	3,775	3,880	4,030
September	3,350	3,200	2,620	2,525	3,500	3,440	2,975
October	2,200	1,940	2,080	2,100	2,225	2,150	2,050
November	1,400	1,325	1,610	1,525	1,450	1,775	1,440
December	1,350	1,495	1,575	1,475	1,480	1,520	1,500

As can be seen in Table 3-2, there is a very seasonal nature to BIPCo's loads. The lowest monthly demand during this seven year period was 1,155 kW which occurred in February 2002. In contrast to this, the highest peak demand of 4,030 kW occurred in August 2006. However, when looking at the seasonal demand patterns, as can be seen in Figure 3-2, the seasonal pattern is very consistent from year to year. The peak demands begin to increase in May and drop off in October. The highest peak demand occurred in August for six of the seven years.

Figure 3-2 Historical Demand Characteristics



3.6 Local Forecast Trends

Growth on Block Island follows general economic trends. Most load growth is due to new seasonally occupied residential homes and new seasonal commercial ventures, as well as change in usage. In addition, expansion of commercial businesses also adds to the growth. The historical number of building permits issued since 2000 is shown below in Table 3-3.

Table 3-3
Summary of Block Island's Historical Building Permits

Year	Single-Family	Apartments	Commercial
2000	18	0	2
2001	21	1	3
2002	13	30	2
2003	18	18	1
2004	17	1	1
2005	7	5	3

Although the new building permits for single family houses are declining, there has been an increase in the remodels and additions for existing homes. Some of these additions are extensive and in some cases result in the doubling of the square footage for the home. As noted previously, the trend for the newer houses, remodels and additions incorporate additional electrical conveniences and appliances increasing the electrical loading that had been the norm for the typical year-round residents. Many of the seasonal and weekend homeowners and renters are felt to be more in tune with the new modern conveniences and appliances than conservation.

In reviewing energy usage for a sample of the residential home accounts that are used year round, the energy usage for "smaller" homes seemed to range from 400 kWh to 600 kWh through the year. Assuming a load factor of 65%, this translates into an estimated demand from 1 to 1.5 kW per home. A few of the year round homes had usages that range from 600 to 1,400 kWh per month. This translates into demands of 1.5 kW in the winter to 3 kW in the summer. As for "seasonal" homes, the smaller usage homes range from 200 kWh in the off season to 1,200 kWh which indicates demands that may range from 1 kW in the winter to 3 kW in the summer. Larger "seasonal" homes had usages of 400 kWh in the winter and 3,000 kWh in the summer. This yields estimated demands of 1 kW in the winter to 6 kW in the summer assuming a 65% load factor. In viewing this data, the remodeling additions being added to existing homes can most likely translate into doubling the existing load, or at least on a similar scale, of adding another home.

In addition, nine new subdivisions have been established in the past three years, although buildout has not been completed. One of these is for 20 units of affordable housing on the West Side. This was established to help meet the town's goals to provide affordable housing for people who live and work on the island. This is to be completed in 2007 and will be used for year-round occupancy.

The tables and graphs on following pages are from the "Town of New Shoreham Comprehensive Plan" pages 7-11 which was adopted by the Town Council in 2002. The tables detail the land use projections assimilated for Block Island. Table 1 shows the development of land continuing through 2018. Map 2 shows the land which can be developed while Map 4 shows the details of the water and sewer regions.

Excerpt from Comprehensive Plan

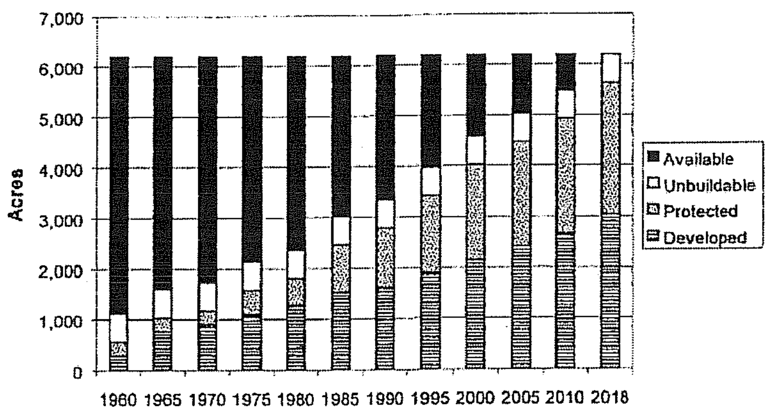
Table 1
BLOCK ISLAND LAND USE HISTORY & PROJECTION

Year	Acres of land				
	Developed	Available	Unbldble	Protected	Total
1960	286	5,079	557	266	6,188
1965	760	4,605	557	266	6,188
1970	893	4,470	557	268	6,188
1975	1,081	4,059	557	491	6,188
1980	1,283	3,832	557	516	6,188
1985	1,520	3,173	557	938	6,188
1990	1,610	2,849	557	1,172	6,188
1995	1,900	2,210	557	1,521	6,188
2000	2,150	1,610	557	1,871	6,188
2005	2,400	1,160	557	2,071	6,188
2010	2,650	710	557	2,271	6,188
2018	3,040	8	557	2,583	6,188

Projection basis:

Housing units per year:	20
Acres developed per unit:	2.5
Acres protected per year:	40

Chart 1
LAND USE PROJECTED
Block Island



1 Goals and Objectives Page 7

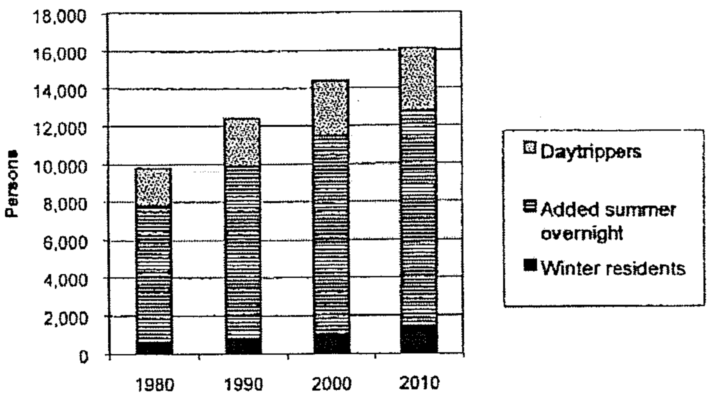
Excerpt from Comprehensive Plan Continued

Table 2.
POPULATION AND VISITORS

Category	1980	1990	2000	2010
Housing units	1,009	1,264	1,606	1,806
Winter residents				
US Census	620	836	1,010	
Groundhog Census		791	883	
Planning figure	600	800	1,000	1,300
Projections:				
RI Div of Planning		861	862	868
1994 Comprehensive Plan		800	956	1,135
Summer overnight				
In dwellings		5,300	6,400	7,200
In inns, B & Bs, etc.		1,300	1,600	1,800
In other rooms		300	300	400
On boats		3,000	3,200	3,400
Summer overnight total	7,800	9,900	11,500	12,800
Daytrippers	2,000	2,500	2,900	3,300
Typical summer peak persons	9,800	12,400	14,400	16,100

Sources: US Census, RI Division of Planning, Town records, Herr Associates analyses

Chart 2.
PEOPLE ON BLOCK ISLAND



1 Goals and Objectives

Excerpt from Comprehensive Plan Continued

Table 3.
EMPLOYMENT

Category	1980	1990	2000	2010
Annual average				
Construction	30	60	80	80
Transport, utilities	30	60	50	60
Retail trade	110	230	320	360
Services	110	220	210	260
Government	30	50	50	60
All Other	10	10	50	60
Total	320	630	760	880
All industries				
February	200	400	490	560
August	800	1,300	1,530	1,780
Ratio: August/February	4.0	3.3	3.1	3.2

Sources: 1990 - 2000 RI DET

2000 Government & all 2010 Herr Associates estimates or projections.

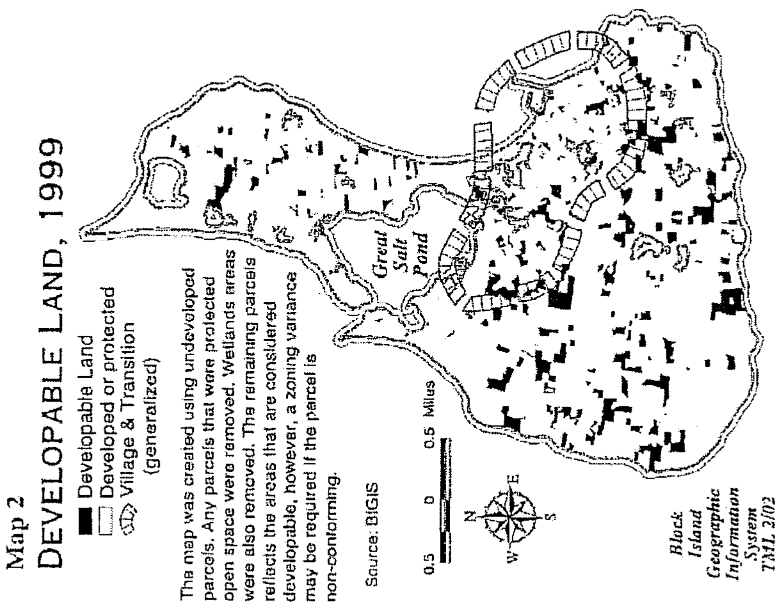
Table 4.
GROWTH IMPACTS

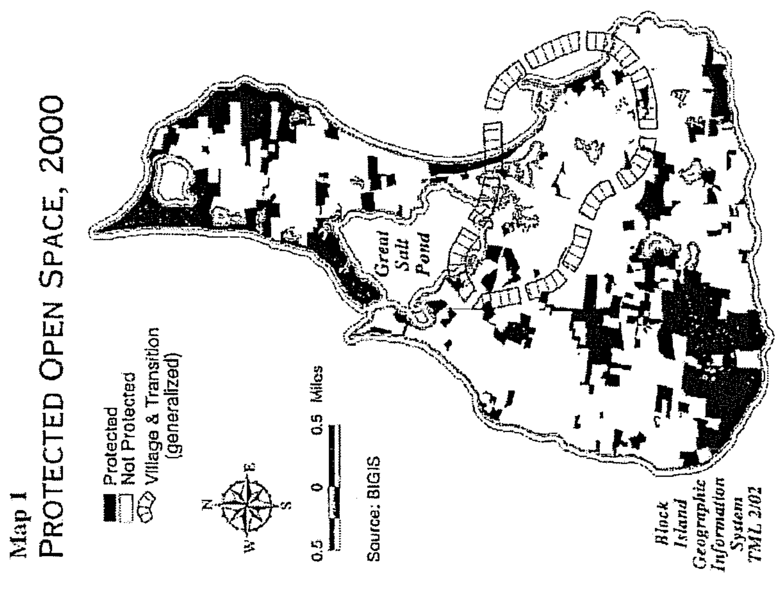
Category	1980	1990	2000	2010
Public school enrollment	73	117	130	150
Water demand (July gpd)				
Island-wide	440,000	560,000	660,000	730,000
Town water	92,000	110,000	100,000	110,000
Sewage collected (July gpd)	180,000	200,000	240,000	240,000
Daily on-Island auto trips	6,900	9,400	11,100	12,800

Source: Herr Associates projections based upon other spreadsheets

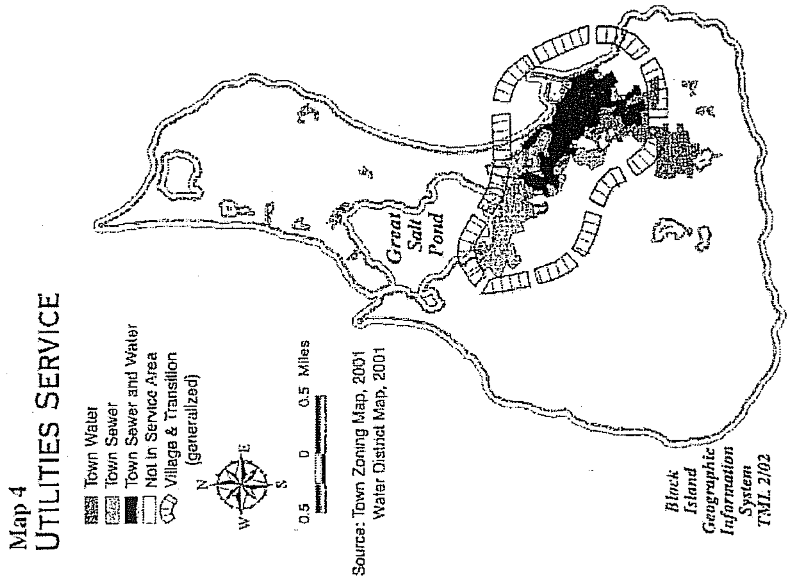
BI\Comp Plan A\DIMEN-2 03-Dec-01

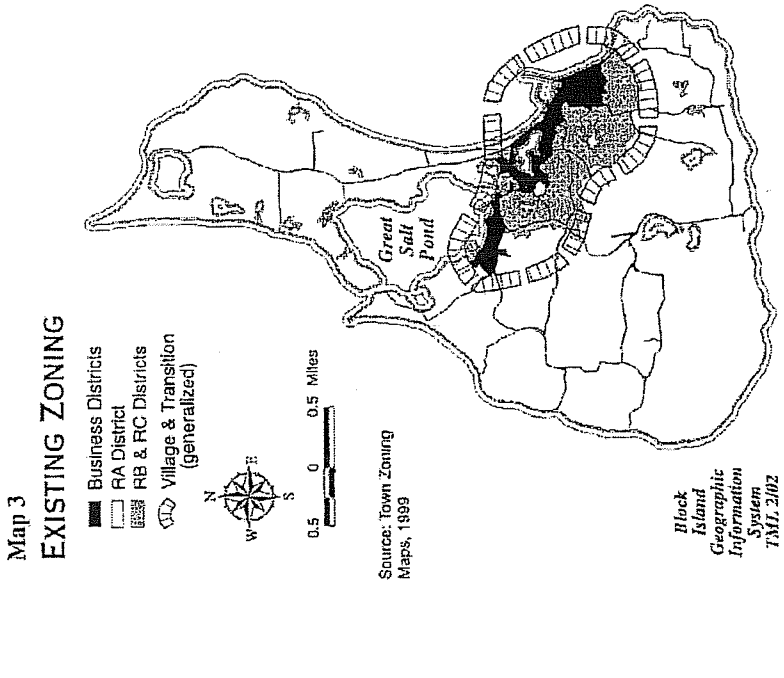
Excerpt from Comprehensive Plan
Continued





Excerpt from Comprehensive Plan Continued





In projecting the long term loads, three different scenarios were developed. The first or low scenario assumes a 3% growth for the remaining years. It represents a more pessimistic outlook with fewer new loads being added with normal weather patterns. This is slightly less than the 5-year historical average from 2001 to 2006 of 4.1% for the summer peak.

The second scenario is the most probable scenario where the remodeling is still taking place at current levels. In addition, the West Side 20 unit housing is added. Also, a project equivalent to the now defunct Sea Winds Condominium project is assumed to be constructed. This proposed project consists of 12 units which will be used primarily for the tourist season. Other projected special loads include a hotel expansion of 25 units in 2008, as well as a 5000 square foot grocery store expansion. This grocery expansion will include more refrigeration units. The projected demand was computed by using the existing grocery store load and projected additional space. These last two items came from the interviews and surveys that went out. Additionally, a three percent (3%) per year growth was included for the remaining loads to cover other growth.

The third scenario is the most optimistic projection. It also assumes normal weather patterns and includes the West Side 20 unit housing, a projected housing project similar to the Sea Winds project, the hotel expansion and the grocery store expansion. In addition, the Champlins load, which is currently being served with their own self generation, is assumed to come off of their own self-generation and be served by the Block Island Power Company. The assumption was made that it would happen in the later part of the load forecast since they just replaced their current generator. In addition, the sewer plant currently has its own generator which it uses in the summer months. The assumption was made that this load would be served by the Block Island Power Company in the later years. In addition loads grow at 3.8% percent.

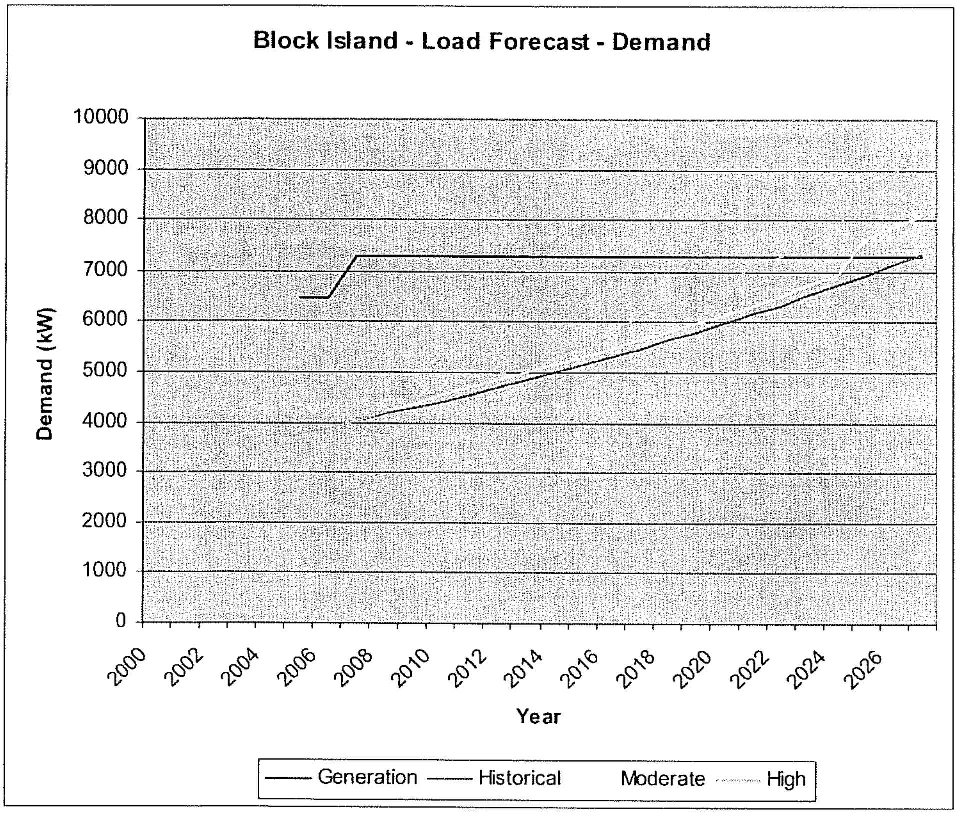
Table 3-4, shown below provides the forecast of the peak summer forecasted demands for all three scenarios. As noted in the table, the generation is held constant at a constant (current) value for comparison only. It is assumed that generators will be added or replaced as necessary. It should be noted that some combination of demand-side and supply side resources may be used to narrow this gap between available supply and future projected demands. Figure 3-3 shows the same information graphically.

Table 3-4
Summary of Block Island's Peak Summer Demand Load Forecast Scenarios (kW)

Year	Generation [1]	Low	Probable	Optimistic
Historical				
2000	–	3,025	3,025	3,025
2001	–	3,300	3,300	3,300
2002	–	3,650	3,650	3,650
2003	–	3,775	3,775	3,775
2004	6,450	3,775	3,775	3,775
2005	6,450	3,880	3,880	3,880
2006	7,275	4,030	4,030	4,030
Projected				
2007	7,275	4,155	4,205	4,243
2008	7,275	4,284	4,365	4,434
2009	7,275	4,417	4,546	4,658
2010	7,275	4,553	4,687	4,835
2011	7,275	4,695	4,832	5,019
2012	7,275	4,840	4,982	5,209
2013	7,275	4,990	5,136	5,407
2014	7,275	5,145	5,295	5,613
2015	7,275	5,304	5,459	5,826
2016	7,275	5,463	5,623	6,237
2017	7,275	5,627	5,792	6,474
2018	7,275	5,796	5,966	6,720
2019	7,275	5,970	6,145	6,976
2020	7,275	6,149	6,329	7,741
2021	7,275	6,334	6,519	8,035
2022	7,275	6,524	6,714	8,340
2023	7,275	6,719	6,916	8,657
2024	7,275	6,921	7,623	9,486
2025	7,275	7,129	7,852	9,847
2026	7,275	7,342	8,088	10,221

[1] – Generation is assumed to remain at 2006 levels for comparison purposes only. It is assumed that units will be upgraded as necessary.

Figure 3-3 Projection of Annual Peak Demands (kW)



A graph of Table 3-4 was developed to compare the data for the low, probable and optimist load forecast. As can be seen, it would appear that at some point BIPCo will need to either add supply or gain sufficient conservation/demand side resources to be able to meet future load projections.

From the forecast developed in Table 3-4, the data could be "shaped" for monthly peak demands. Table 3-5 provides the projected monthly kW demands for the probable scenario using the above scenarios. The data is projected for 2007 – 2027.

Table 3-5
Projected Monthly Peak Demands (kW)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Historical												
2000	1,800	1,160	1,200	1,355	2,250	2,600	3,160	3,025	3,350	2,200	1,400	1,350
2001	1,300	1,225	1,250	1,325	2,300	2,825	2,985	3,300	3,200	1,940	1,325	1,495
2002	1,250	1,155	1,325	1,325	2,300	2,950	3,630	3,650	2,620	2,080	1,610	1,575
2003	1,565	1,350	1,340	1,450	2,325	2,930	3,390	3,775	2,525	2,100	1,525	1,475
2004	1,600	1,300	1,250	1,360	2,325	2,925	3,615	3,775	3,500	2,225	1,450	1,480
2005	1,480	1,325	1,330	1,575	2,250	3,075	3,720	3,880	3,440	2,150	1,775	1,520
2006	1,380	1,380	1,360	1,385	2,290	2,910	3,740	4,030	3,440	2,189	1,811	1,550
Projected												
2007	1,401	1,405	1,384	1,410	2,331	3,047	3,902	4,205	3,544	2,228	1,847	1,581
2008	1,422	1,430	1,409	1,435	2,393	3,169	4,053	4,365	3,628	2,268	1,884	1,613
2009	1,443	1,456	1,435	1,461	2,481	3,309	4,224	4,546	3,738	2,309	1,921	1,645
2010	1,465	1,482	1,461	1,487	2,526	3,408	4,355	4,687	3,805	2,351	1,960	1,678
2011	1,487	1,509	1,487	1,514	2,571	3,507	4,490	4,832	3,874	2,393	1,999	1,712
2012	1,509	1,536	1,514	1,541	2,618	3,609	4,629	4,982	3,943	2,436	2,039	1,746
2013	1,532	1,564	1,541	1,569	2,665	3,713	4,772	5,136	4,014	2,480	2,080	1,781
2014	1,555	1,592	1,569	1,597	2,713	3,821	4,920	5,295	4,087	2,524	2,121	1,817
2015	1,578	1,620	1,597	1,626	2,762	3,932	5,073	5,459	4,160	2,570	2,164	1,853
2016	1,602	1,650	1,626	1,655	2,811	4,046	5,225	5,623	4,235	2,616	2,207	1,890
2017	1,618	1,679	1,655	1,685	2,862	4,163	5,382	5,792	4,311	2,663	2,251	1,928
2018	1,634	1,709	1,685	1,716	2,913	4,284	5,543	5,966	4,389	2,711	2,296	1,966
2019	1,650	1,740	1,715	1,747	2,966	4,408	5,710	6,145	4,468	2,760	2,342	2,006
2020	1,667	1,772	1,746	1,778	3,019	4,536	5,881	6,329	4,548	2,810	2,389	2,046
2021	1,683	1,803	1,777	1,810	3,074	4,667	6,057	6,519	4,630	2,860	2,437	2,087
2022	1,700	1,836	1,809	1,843	3,129	4,803	6,239	6,714	4,714	2,912	2,485	2,128
2023	1,717	1,869	1,842	1,876	3,185	4,942	6,426	6,916	4,798	2,964	2,535	2,171
2024	1,734	1,903	1,875	2,109	3,643	5,485	7,119	7,623	4,885	3,017	2,586	2,214
2025	1,752	1,937	1,909	2,147	3,708	5,644	7,333	7,852	4,973	3,072	2,638	2,259
2026	1,769	1,972	1,943	2,186	3,775	5,808	7,553	8,088	5,062	3,127	2,690	2,304
2027	1,787	2,007	1,978	2,225	3,843	5,977	7,772	8,322	5,153	3,183	2,744	2,350

From the demands contained in Table 3-5, projected monthly MWh energy use requirements were determined. This forecast is shown in Table 3-6. It should be noted that by the year 2010, it is assumed that the distribution system is converted to a 2.4/4.16 kV grounded wye as is recommended in the draft Long Range Distribution System Plan previously prepared by HDR for BIPCo. This improvement reduces the losses by 3.2%.

Table 3-6 Projected Energy Requirements (MWh's)													
Year	**Jan.**	**Feb**	**Mar**	**Apr.**	**May**	**June**	**July**	**Aug.**	**Sept.**	**Oct.**	**Nov.**	**Dec.**	**Total**
Historical													
2000	541	497	493	611	712	907	1,419	1,406	726	717	559	618	9,207
2001	250	487	457	483	739	812	1,433	1,079	1,078	1,217	897	614	9,546
2002	528	495	575	583	766	1,102	1,438	1,442	1,148	755	673	637	10,136
2003	614	671	572	641	775	671	1,514	1,735	927	771	656	601	10,148
2004	815	548	577	633	828	1,075	1,680	1,539	1,085	831	598	622	10,831
2005	670	558	642	690	785	1,107	1,744	1,666	1,128	846	613	623	11,072
2006	683	626	713	764	841	1,157	1,821	1,761	1,225	928	684	692	11,894
Projected													
2007	636	624	645	659	810	1,053	1,766	1,790	1,262	947	843	649	11,684
2008	646	635	656	671	832	1,095	1,835	1,858	1,291	964	860	662	12,005
2009	656	647	668	683	863	1,143	1,912	1,935	1,331	981	877	675	12,370
2010	665	658	680	695	878	1,178	1,971	1,995	1,355	999	895	689	12,658
2011	675	670	693	708	894	1,212	2,032	2,057	1,379	1,017	913	703	12,951
2012	686	682	705	720	910	1,247	2,095	2,121	1,404	1,035	931	717	13,252
2013	696	695	718	733	926	1,283	2,160	2,187	1,429	1,054	949	731	13,561
2014	706	707	731	747	943	1,320	2,227	2,254	1,455	1,072	968	746	13,877
2015	717	720	744	760	960	1,358	2,296	2,324	1,481	1,092	988	761	14,200
2016	728	733	757	774	977	1,398	2,365	2,394	1,508	1,111	1,008	776	14,528
2017	735	746	771	788	995	1,438	2,436	2,466	1,535	1,131	1,028	791	14,859
2018	742	759	785	802	1,013	1,480	2,509	2,540	1,562	1,152	1,048	807	15,199
2019	750	773	799	816	1,031	1,523	2,584	2,616	1,590	1,173	1,069	823	15,548
2020	757	787	813	831	1,050	1,567	2,662	2,694	1,619	1,194	1,091	840	15,904
2021	765	801	828	846	1,069	1,613	2,742	2,775	1,648	1,215	1,112	857	16,270
2022	772	816	843	861	1,088	1,659	2,824	2,858	1,678	1,237	1,135	874	16,645
2023	780	830	858	877	1,107	1,708	2,909	2,944	1,708	1,259	1,157	891	17,028
2024	788	845	873	986	1,266	1,895	3,222	3,245	1,739	1,282	1,180	909	18,232
2025	796	860	889	1,004	1,289	1,950	3,319	3,343	1,770	1,305	1,204	927	18,656
2026	804	876	905	1,022	1,312	2,007	3,419	3,443	1,802	1,329	1,228	946	19,091
2027	812	892	921	1,040	1,336	2,065	3,518	3,543	1,834	1,352	1,253	965	19,531

In summary, as a result of the load analysis, new planned developments, and trends, the peak demand will continue to grow at a slightly higher rate than historical figures due to a jump in demand related to the school addition, the affordable housing project and a project equivalent to the Sea Winds Condominium proposal. This results in a slightly higher growth rate the first few years, then the historical trend should continue. At the same time, MWh energy sales will continue to grow given this load growth.

3.7 Summary

This section of the report has discussed the general approach used to develop a 20-year customer and load forecast for BIPCo. This customer and load forecast becomes the basis for determining potential demand and supply-side options. Regardless of the demand or supply options reviewed and selected by BIPCo, in total, BIPCo must meet the load requirements of their customers.

Section 4
Review of Demand-Side Resources

4.1 Introduction

One perspective on demand-side management is to view it as making improvements to increase efficiency in the consumption of electricity. This can be accomplished in a number of different ways, from customer education to actual devices that reduce or manage demand and/or energy usage. As a part of the Block Island Long-Term Resource Planning Study, customer interviews and a written survey were conducted to better understand the potential demand-side resource opportunities for BIPCo and Block Island from the customer side. This section of the resource plan discusses the activities and research undertaken regarding demand-side resource options for Block Island.

4.2 Customer Input

In an attempt to better understand the true nature of Block Island's capacity, interest, and need for demand side management programs, HDR employed a mix of personal interviews and a survey distributed to all BIPCo customers as an insert to a summer bill. Provided below is an overview discussion and summarization of our findings.

4.2.1 Personal (Customer) Interviews

Thirty people were interviewed ranging from large and small business owners, full-time residents, cottagers, and public employees/officials. The majority of these interviews were conducted in person on the island.[2] The questions were segregated between residential and commercial customers and attempted to garner perspectives and opinions on a range of topics. The questionnaire topics for residential customers included items such whether they were full-time or part-time residents, their perspective on growth, conservation and their willingness to change their behavior to conserve energy, and the kind of incentives needed to make those changes. The questionnaire for the commercial customers was similar to the residential questions, but focused more upon the specific commercial business and their end uses of electricity.

Based upon the limited interviews conducted, several themes emerged from these interviews:

- High interest in energy production and usage on Block Island
- General frustration with quality and price of energy on the island
- Indication that there is no consistent and well-respected champion on the island to lead conservation initiatives
- Low understanding of business operations of BIPCo

[2] A full list of individuals interviewed, as well as a list of interview questions can be found in the Technical Appendices for Demand Side Options: Interview List; Interview Questions

- Indication that there is little or no collaboration between the users and user groups with respect to alternative energy sources and a comprehensive endeavor to lower island usage is lacking
- Willingness to increase efficiency of energy consumption but inconsistent understanding of ways to do so
- High interest in solar photovoltaic panels but the cost and maintenance are prohibitive – especially for part-time residents

4.2.2 Customer Survey

In addition to the personal interviews conducted with customers, a written survey was conducted to gain additional perspective. Surveys were distributed in the June 2006 electricity bill that was mailed to all BIPCo customers. The total response rate of the residential and commercial users combined was 34percent which is an above average response rate.[3]

Residential Results – Forty-six percent (46%) of residential customers (including year-round residents and cottagers) returned their surveys. Significant finding are as follows:

- 6% of homes utilize compact fluorescent lighting exclusively; 68% employ some.
- 5% of residential customers currently augment their power with solar resources
  - 13% will add some type of solar in the next five years – most likely solar water heaters.
- One-third of home owners currently own a variety of EnergyStar™ appliances
  - Most common appliances include: window air, humidifier, refrigerator, dish washer, clothes washer and dryer
- 85% of the appliances to be replaced in the next five years will be replaced with EnergyStar™ appliances
  - 95% of all refrigerators to be replaced in the next 5 years will have the EnergyStar™ rating

Interestingly, the findings of this written survey are somewhat conflicting – if there is such a high commitment to energy efficiency in appliance usage, why not for indoor lighting?[4] It may be that there is currently no on-island vendor of compact fluorescents, but the same is true for appliances – all must be shipped from the mainland. There is also no immediate financial incentive (i.e., rebate) for fluorescents, but neither is there for EnergyStar™ appliances.

Regardless of the pattern in lighting usage, the high trend of investing in EnergyStar™ – as well as the more modest trend of installing some sort of solar – is promising. It suggests that Block Island residents are willing to invest their own resources in energy conservation. In addition, as highlighted in the table below, interest in all conservation programs appears to be high.

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[3] It should be noted that there may be a bias in the survey results since they were distributed and collected by BIPCO; it is possible that response rate may have been even higher if a third party collected the surveys.

[4] One cottager expressed an alarming occurrence – renters of his cottage actually switched out the compact fluorescents for the duration of their stay!

Table 4-1 Residential Interest in Conservation Programs	
Conservation Program	**Residential Interest**
EnergyStar™ Appliances	32%
Solar Panels	29%
Solar Water Heaters	22%
Home Energy Audits	18%
Efficient Windows	14%
Improved Insulation	13%
Wind Turbines	11%

Commercial Results – Only 5% of commercial and industrial customers returned surveys, which is less than desired, but not totally unexpected. Those that did respond indicated a level of conservation behavior suggesting that only the conservation-minded business owners may have responded. While not representative of any single commercial user, this poor response rate may suggest a lack of interest in energy conservation throughout the commercial community as a whole.[5] Typically, interest in conservation in the commercial sector is highly dependent upon the capital investment required, potential savings, and any changes in their business operations. Conveniences expected by customers will be absorbed in the services paid for by the customer.

In summary, the customer interviews and written surveys provided an interesting perspective on a number of issues. Conservation and efficient use appears to be on people's minds, particularly among residential customers. This is, in part, driven by the high costs of electric service on Block Island.

4.3 Making Energy Efficiency a Resource

Within the last few years within the U.S. there has been a fundamental shift in thinking regarding energy efficiency and sustainability; particularly as they relate to energy resources. Energy efficiency has been recognized as a potential resource for the electric utility industry for the last 30 years. However, as energy costs have recently been rising, and the costs of alternative power resources have become more attractive, more consumers and utilities are beginning to embrace these alternatives. Given that, there may never have been a better time to heighten the focus on energy efficiency on Block Island. The State of Rhode Island is under several new legislative energy mandates that encourage smart energy policy which should benefit Block Island. Among these are the following:

- *Gas and Electric System Reliability and Least-Cost Pricing Act of 2006.* This bill encourages natural gas and electric utilities to diversify the types of energy resources that they use to serve their customers, and provides for least-cost procurement for gas and electric supply. The law would go into effect July 1, 2007, and extend through the year 2020. By

[5] This general lack of active interest is consistent with previous attempts to reach out to commercial users; in 1988 BIPCO offered free energy audits for large commercial users – only four participated.

Sept. 1, 2008, BIPCO will be required to submit "a plan for system reliability and energy efficiency and conservation procurement."

- ***Rhode Island Energy Resources Act.*** This bill creates the Office of Energy Resources (thereby replacing the State Energy Office) which would be required to "Develop and put into effect plans and programs to promote, encourage, and assist the provision of energy resources for Rhode Island . . . monitor, forecast, and report on energy use, energy prices, and energy demand and supply forecasts, and make findings and recommendations"; and develop "plans and programs to promote, encourage and assist the efficient and productive use of energy resources in Rhode Island . . ."
- ***The Renewable Energy Implementation Act of 2006.*** This bill authorizes the State Properties Committee to work with the Office of Energy Resources on guidelines for "locating renewable energy facilities" around the state: on "commercial, industrial, institutional, agricultural and state properties."

Given these recent developments at the state level, as well as the on-going effort of Block Island residents to find cost-effective and responsible energy solutions, the time to consider or seize this opportunity for change is now.

4.4 Cooperative Leadership

Previous studies on renewable technologies and energy efficiency strategies have been prepared for Block Island.[6] The two example studies identified energy and customer expenditure savings over a period of time for a variety of efficiency measures. What both of these studies failed to address, however, was the primary starting point of all demand side management (DSM) – leadership.

Before a portfolio of appropriate energy efficiency measures can be identified for the island, energy efficiency must be viewed as a resource.[7] Leadership, organizational alignment, and a high understanding of efficiency resources are the most basic requirements and are not currently being met on the island – even the most accurate conservation predictions could not be met under the current circumstances.

Based upon customer interviews and surveys, the customer's perception is that this leadership should come from BIPCo. Unfortunately, the current realities of the organizational make up and financial situation make it nearly impossible for BIPCo to take on the sole leadership of such a complex undertaking and program. Most notably, there currently is only one full-time BIPCo staff totally dedicated to administrative functions of the company. Additional staff would need to be added to lead and manage a DSM program. Secondly, the office technology and record keeping of the entity have not kept up with current technology which would make tracking the success of efficiency measures extremely difficult. Finally, the financial burden of implementing and financing a DSM program is one the company cannot bear alone.

[6] National Renewable Energy Laboratory (NREL) 1998; Peregrine Energy Group 2000
[7] National Action Plan for Energy Efficiency

The question of alternative leadership was posed during the personal interviews conducted at the start of this project and the consensus was that such a program should be championed through a collaborative initiative lead by local leaders. Such a group could likely be made up of representation from various organizations including the following seven organizations:

- The Nature Conservancy
- The Block Island Land Trust
- The Block Island Conservancy
- The Block Island Public School
- The Town of New Shoreham
- The Block Island Times
- BIPCo

The Cape Light Compact, comprised of representation from Cape Code, Martha's Vineyard, and Barnstable and Dukes counties is an example of such cooperative community leadership.[8] On Block Island, this group could be purely advisory, could form a non-profit, or could find alternative ways to champion the cause of energy efficiency as a resource on Block Island. The first and most important step the cooperative leadership group should take is to create a Block Island Energy Advisor.

4.4.1 Block Island Energy Advisor

There are many state and national energy management resources that Block Island could be taking advantage of and is not currently. A primary reason is that there is no clearing house or point person whose sole responsibility is to research these programs, promote their availability to the residents of Block Island, and work with the appropriate local entities to build energy conservation into the pulse of island life.

For the first year, this position could be jointly funded by representative organizations in the cooperative leadership entity. As the organization matures and gains footing and support, the overall funding requirements would need to be determined. One of the duties of the Energy Advisor position would be to secure funding and grants from other outside agencies. Ideally, the Energy Advisor position would obtain grant funding to cover a growing percentage of his/her salary. Regardless of the eventual outside funding sources of this organization, if the organization is effective and desired by the community as an expert resource on these issues, then BIPCo should continue to take a leadership position from a financial perspective. This may imply a $20,000 to $30,000 per year contribution on the part of BIPCo to help fund this position initially and move the concept forward. This position would not necessarily need to be a full-time position and a part time position would likely be adequate. The duties, responsibilities, time commitment required and compensation of this individual would need to be determined by the group. A purely volunteer group, particularly at the Energy Advisor level, would be doomed to fail. Therefore, it is assumed that BIPCo will need to fund a portion or a majority of this position initially.

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[8] www.capelightcompact.org

Ultimately, Block Island's Energy Efficiency program should be robust enough that it targets the diverse users of energy on the island. The following table lists the minimum combination of programs recommended for Block Island and shows each program's corresponding target group and ability to impact energy demand.

Table 4-2
Energy Advisor's Program Responsibilities

Program / Activity	Target User Group	Potential to Impact Demand
Administrative Activities		
Collaborate with BIPCo to design a realistic mechanism to track energy efficiency effectiveness	All	Low
Collaborate with the Block Island Times to run energy education articles and sponsor other promotional events	All	Low
Initiate on-going communication with the Rhode Island State Energy Office (RISEO) and the Public Utilities Commission (PUC).	All	Low
Energy Efficiency Measures		
Promotion of no-cost energy efficiency guides[9]	Commercial and Residential	Medium
Home and business energy audit program	Commercial and Residential	High
Commercial rate incentive for peak usage	Commercial	High
Energy efficient street lighting program (i.e., switch out all existing lights with more efficient mercury vapor / high pressure sodium lights).	Public	Medium
International Energy Conservation Codes incorporated into the building codes for new construction, renovation, and remodeling.	Commercial and Residential	Medium
Energy efficient procurement guidelines used for entities seeking to hire architects or engineers for the design new, renovated, or remodeled structures.	Commercial, Residential, and Public	High
Block Island Public School's participation in the National Energy Education Development Project (NEED) and/or the EnergySmart Schools Program	All	Medium
Energy Star rebate program	Commercial and Residential	Low
Low-cost financing altern. for equipment upgrades for comm. customers.	Commercial	High
Fluorescent light rebate program	All	Medium
Small business workshops - Energy Efficiency Pays: A Guide for Small Business Owners[10]	Commercial	Medium
Financial incentives for solar installation programs	Commercial and Residential	Medium
Net Metering	Commercial and Residential	Low
Energy conservation section included in all renters' handbooks.[11]	Residential / Rental Properties	Medium

[9] The EnergyStar homepage offers the most comprehensive set of available no-cost resources: http://www.energystar.gov/

[10] Energy Efficiency Pays: A Guide for the Small Business Owner is a 46-page booklet that includes an introduction to energy efficiency and list of simple energy saving techniques. Sections include: Lighting, Office Equipment, HVAC, Refrigeration, and Hot Water Use & Efficiency

[11] A standard Renter's Handbook needs to be developed for the island with a section that can be tailored to items specific to each rental property.

4.4.2 DSM Funding From BIPCO

The Block Island Energy Advisor[12] and associated activities will not move forward absent adequate funding. A key question is what level of funding should BIPCo provide to this effort, along with other DSM programs measures. BIPCo is regulated by the Rhode Island Public Utilities Commission (Commission). Authorization to include funding within BIPCo's revenue requirements and rates would need to be provided by the Commission. Therefore, BIPCo must make a case or compelling argument for inclusion of these costs within their revenue requirements.

There are a number of different approaches that may be used to establish DSM spending levels.[13] These include the following:

- Based on cost-effective DSM potential estimates
- Based on percentages of utility revenues
- Based on mills/kWh of utility electric sales
- Levels set through resource planning process
- Expenditures set through the restructuring process
- Tied to projected load growth
- Case-by-case approach

Each of these methods of establishing funding/spending levels for DSM is in use throughout various locations within the United States. A discussion of each of these methods and a rough approximation of the funding level if it were applied to BIPCo is as follows:

Based On Cost-Effective DSM Potential Estimates – The California Public Utility Commission uses this approach. The advantage of this approach is that it allows for and provides funding for all cost-effective DSM. This approach is not a simple one-time analysis, but rather is updated on a regular 3-year basis to reflect changing conditions and costs to ascertain cost-effective DSM. In the case of BIPCo, a detailed estimate has not been developed of all cost-effective DSM. At the current time, a detailed approach appears to be too complicated and costly for a utility the size, and possessing the technical resources, of BIPCo. This approach is used for the four major investor-owned utilities in California which have extensive technical and financial resources to conduct a study of this depth and magnitude.

Based Upon Percentages of Utility Revenues – Minnesota, Oregon, Vermont and Wisconsin use this approach. With the exception of Minnesota that uses 1.5% to 2.0% for funding levels, the other states use 3.0% as a target. Assuming a 3.0% target for BIPCo and rate revenues of $2.4 million, this would suggest a funding level of $72,000 per year.

[12] Block Island Energy Advisor is used in a generic sense. The final title and position responsibilities are open for discussion.

[13] Demand-Side Management: Determining Appropriate Spending Levels and Cost-Effectiveness Testing, Summit Blue Consulting and The Regulatory Assistance Project, January 30, 2006.

Based on Mills/kWh of Utility Electric Sales – Connecticut and Massachusetts have established spending levels of 3.0 and 2.5 mills/kWh of the utility's total electric sales. Assuming a 3.0 mills/kWh target for BIPCo and annual kWh sales of 11,000,000, this would suggest a funding level of $33,000 per year.

DSM Spending Levels Set Through Resource Planning Processes – Under this approach, the resource planning process dictates the level of funding. It is not a formulistic approach. Typically, the resource planning process must include both supply-side and demand-side resources. The result is a determination of those programs that are found to be most cost-effective. Given that this is not a "formulistic" approach, no comparison to BIPCo could be determined. However, using the results and findings of this study, this may be an applicable approach for BIPCo.

DSM Expenditures Set Through the Restructuring Process – Competition, restructuring and unbundling of services and rates have driven the funding of DSM. New York and New Jersey have utilized this approach. This would not appear to be an applicable approach in the case of BIPCo.

Levels of DSM Tied to Projected Load Growth – Under this approach, DSM is more forward looking. It requires that a portion of future load growth be met by DSM. As an example, Texas requires 10% of future (projected) load growth be met with DSM. While this sets a target for savings achieved by DSM, it does not provide a funding level, nor does it require cost-effective DSM. BIPCo would appear to have a limited amount of growth. At the same time, it would seem that a significant component of the DSM for BIPCo and Block Island customers should be directed at reducing existing loads and demands, not necessarily simply meeting future load growth.

Case-By-Case DSM – Under this approach, the regulatory authority (i.e. Commission) establishes the spending level on an ad hoc basis. These may be negotiated or included as a part of a rate case or rate case settlement. In the case of BIPCo, this was the approach that was used to establish their current funding level for IRP/DSM endeavors.

From the discussion above, it is clear that no single approach is universally used, and that no single funding/spending amount can simply be deemed prudent. The methods noted above would suggest funding levels in the range of $33,000 to $72,000.

Based upon BIPCo's general rate filing (Docket 3655), the Commission allowed for a $0.01/kWh surcharge in the summer period to fund IRP/DSM endeavors. The Commission estimated that this would generate approximately $55,000 per year. On the surface, this amount would appear to be a reasonable starting point for funding BIPCo's DSM endeavors. However, it is recommended that BIPCo closely assess the level and cost-effectiveness of DSM and community outreach programs, and use the "case-by-case" approach if additional funding may be advisable and warranted. HDR would not recommend any funding less than the current level of DSM funding provided within BIPCo's rates.

4.4.3 Role of Communication and Education

One of the primary attributes of an effective DSM program is an emphasis on customer communication and education. Absent effective and timely communication and education, customers are typically not aware of the benefits of certain DSM program measures, or more importantly, what DSM opportunities are available within the community (e.g. rebates, below cost light bulb replacement, etc.).

Communication and education is often achieved in a variety of ways. Utility mailers are a very common method of both educating consumers (e.g. benefits and savings of turning down a thermostat), while at the same time communicating various programs or rebate offers that may be available to customers. This type of an approach may be best met through the collaborative group. Community outreach can occur at fairs and community events. Often, these types of events provide educational materials and access to knowledgeable individuals. Finally, there may be opportunities to speak to community groups regarding efficient energy use and available DSM opportunities (e.g. energy audits, available technical assistance, rebates, etc.). These speaking opportunities may be geared more towards the commercial sector, but may be an effective way of connecting with this group of customers.

Historically, BIPCo has not had effective communication and education regarding DSM. One of the benefits of recommending a collaborative leadership approach and the Block Island Energy Advisor is to extend communication and education out into the community through the various other organizations that are involved.

4.4.4 Example Energy Efficiency Programs

A sample of energy efficiency programs in use within Rhode Island and across the country is provided in the appendix of this report. A special section on Block Island Public School leadership has been included on the following pages to illustrate the immediate and meaningful role they could play in terms of island energy efficiency.

Block Island Public School – As indicated in the Cooperative Leadership section of this report, the Block Island Public School can and should be taking a leadership role in energy efficiency on the island. This section provides an overview of the wealth of scholastic energy programs available immediately.

SOLAR ON SCHOOLS[14] - The Solar on Schools Program provides each of the participating school systems with a solar photovoltaic (PV) installation, as well as web-based data display on the PV system performance. The data collection and display system allows teachers and students to access system performance data and use it in science or other curricula. Through the web-based system, participating schools and other education-oriented institutions can compare the operating results of their PV systems to that of other schools in the Program. Each of the participating schools receives:

[14] www.riseo.state.ri.us/programs/solschools.html

- A 2,000-watt solar photovoltaic installation, including data acquisition and performance tracking system, and
- A data display system and energy curricula, including teacher training, mentoring, course materials and internet access to the PV system output data of the schools and institutions participating in the Program.

NATIONAL ENERGY EDUCATION DEVELOPMENT PROJECT (NEED)[15] - The mission of the NEED Project is to promote an energy conscious and educated society by creating effective networks of students, educators, business, government and community leaders to design and deliver objective, multi-sided energy education programs.

The NEED Project's non-biased information on all aspects of energy, including production, consumption, and economic and environmental effects, gives students an understanding of the interrelationship between energy and the environment. More important, NEED's student-directed activities empower students to take active roles in educating their peers, families, and communities about energy issues and in identifying and solving problems unique to their communities. NEED's Energy Management for Schools program also allows many schools to participate in saving vital energy dollars for their districts.

The Rhode Island State Energy Office sponsors four teacher/student day-long workshops during the fall and winter of the school year. These energy education workshops are grade appropriate and are hosted at various schools throughout the state. At the workshops, teachers and four of their students are given tools to implement energy education programs in their classrooms and local communities.

4.5 Assessing Conservation Resource Potential

An important step in the electric resource planning process is to estimate the amounts of conservation resources that are available and will become available for development during the planning period.

Assessments of conservation resource potential typically segment conservation resources into two categories:

- Retrofit Conservation: This type of conservation involves making efficiency improvements to existing consumer end uses of electricity. A common example of a retrofit conservation measure would be to replace the incandescent light bulb in an existing light fixture with a compact florescent light bulb.
- Lost Opportunity Conservation: This type of conservation involves implementing measures to improve the efficiency of electricity consumption in conjunction with other facility investments. A common example of a lost opportunity conservation measure would be to install high-efficiency lighting fixtures when a new commercial building is constructed or as part of a major remodel of an existing building.

[15] www.riseo.state.ri.us/programs/k12.html

Retrofit conservation measures typically provide greater flexibility in terms of when they can be installed. In contrast, lost opportunity conservation measures are often 'use-it-or-lose-it' propositions that are most feasible and cost-effective to implement during construction or remodeling.

Assessments of resource potential for both retrofit and lost opportunity conservation resources normally follow a sequential approach. The first step in the approach involves estimating the amount of technical resource potential. Technical resource potential is the amount of conservation resources that is technically feasible, regardless of factors such as cost, customer acceptance or institutional barriers. The second step is to estimate the amount of conservation resource potential that is achievable. Achievable resource potential is the subset of technical resource potential that can actually be acquired, given customer acceptance and institutional barriers. Then, after the estimate of achievable resource potential has been developed, the results become an input to the economic evaluation of all types of resources, including conservation and power supplies.

Section 4.6 provides the estimate of conservation resource potential that was used in the economic evaluation for the Block Island Long-Term Resource Planning Study. The following Sections 4.5.1 through Section 4.5.3 provide illustrative estimates of conservation resource potentials for selected types of conservation measures.

4.5.1 Conservation Potential of Compact Fluorescent Light Bulbs

The technical potential for compact fluorescent light (CFL) bulbs was explored to better understand the conservation potential for this single measure. As Table 4-3 indicates, significant savings can occur from the installation of CFLs.

Table 4-3
Comparison of Incandescent to Compact Fluorescent Light Bulbs (Watts/Bulb)

Incandescent Light Bulb	CFL Bulb	Potential Savings
40 Watts	8 – 13 Watts	27 – 32 Watts
60 Watts	14 – 18 Watts	42 – 46 Watts
75 Watts	20 – 22 Watts	53 – 55 Watts
100 Watts	27 – 38 Watts	62 – 73 Watts

Using a simple example, a 100 watt light bulb used for 8 hours per day uses 0.8 kWh's per day or 292 kWh's per year. That same light fixture, installed with a 35 Watt CFL bulb (equivalent to a 100W incandescent) uses 0.28 kWh's per day or 102.2 kWhs per year. That is an annual savings of 189.8 kWh's or a 65% reduction in total energy use. Of course, a critical consideration for the consumer in switching to CFLs is the trade-off between the high initial purchase price and the value of the kWh's saved (lower bills). However, CFLs over their assumed life[16] show savings even at fairly low kWh energy costs. Because retail electricity costs

[16] CFLs last an average of 10,000 hours compared to 850 hours for an incandescent bulb.

are higher on Block Island than on the mainland, CFLs are even more cost effective for consumers on the island.

Given that CFLs are likely cost-effective for BIPCo customers, an estimate was developed of the potential annual energy savings from CFLs for Block Island. The analysis segregated lighting between residential and commercial customers. For the residential customers, the usage was segregated between seasonal and year-round customers. It was conservatively assumed that each home had, on average, five light bulbs, of which three (3) were incandescent and two (2) were CFL's. Given those basic assumptions the analysis determined that annual kWh savings (technical potential) for the residential customers could be reduced by approximately 270,000 kWhs. This is approximately 7% of the current residential load. At the same time, it was estimated that the achievable potential from this retrofit measure would be between 60% and 70% for the seasonal and year-round residential customers. This resulted in an estimate of approximately 200,000 annual kWh savings from having CFL's installed. This equates to approximately 4.6% of the total residential load. A similar analysis was conducted for the commercial customer class of service. The technical potential was estimated at approximately 136,000 kWhs per year or 2.2% of the current commercial load. The achievable potential was estimated at 70% of the technical potential or approximately 95,000 kWhs per year, or 1.6% of the total commercial load. The detailed analysis of the CFL retrofit can be found in the technical appendices.

4.5.2 Conservation Potential of EnergyStar™ Appliances

Another key area of potential demand and energy conservation is EnergyStar™ appliances. Table 4-4 provides a comparison of the potential savings and efficiency of the typical certified EnergyStar™ products.

Table 4-4
Potential Savings From EnergyStar™ Products/Appliances[1]

Product/Appliance	Estimated Savings vs. Conventional Product
Clothes Washer	Up to 50%
Dehumidifiers	10% - 20%
Dishwashers	Up to 40%
Refrigerator	Up to 40%
Room Air Conditioner	At least 10%

[1] Source: EnergyStar™

In the survey conducted of BIPCo customers it was noted that roughly one-third of those responding indicated an interest in purchasing EnergyStar™ products or appliances. Given the high capital cost of these types of appliances, along with their long useful life, there is a very limited opportunity for significant annual savings from retrofits. However, over time, as existing appliances are replaced, and new building stock is added, the installation of these appliances may provide fairly substantial savings. Table 4-5 provides an overview of the limited opportunity that Block Island may have for the installation of EnergyStar™ appliances.

Table 4-5
Average Useful Life of Selected Products/Appliances[1]

Product/Appliance	Average Useful Life
Room Air Conditioner	12 years
Dehumidifier	11 years
Clothes Dryer	13 years
Clothes Washer – Top Load	14 years
Clothes Washer – Front Load	11 years
Range – Single Oven	17 years
Dishwashers – Built-In	13 years
Refrigerator	14 – 19 years
Freezer	15 – 18 years

[1] Source: Association of Home Appliance Manufacturers

Even with the limited opportunity to install EnergyStar™ appliances, a simple review was undertaken of the conservation technical potential and achievable potential for a limited set of appliances. These estimates are based upon a very limited understanding of the appliances in use at Block Island, along with the impact of these appliances upon seasonal energy use. Provided below is a discussion of each of the appliances reviewed.

- ***Refrigerators*** – It was assumed that all year-round and seasonal homes have refrigerators. Based upon the survey undertaken, it was noted that approximately 1/3 of existing homes have EnergyStar™ appliances. Given that, the remaining 2/3 of homes were assumed to provide the technical potential for EnergyStar™ refrigerators. The analysis did assume lower seasonal use for the seasonal rentals. In summary, it appeared that based upon the assumptions used within this analysis Block Island would have a technical potential to save 348,000 kWhs on an annual basis or 8.1% of the total residential load. It was assumed that 85% of this total amount could be achievable or 296,000 kWhs or 6.9% of the total residential load.[17] This study assumed that all new homes constructed on Block Island would have new EnergyStar™ appliances installed.

- ***Dishwasher*** – It was assumed that 90% of all year-round and seasonal homes have automatic dishwashers. As a dishwasher is a fairly standard appliance in a kitchen, Block Island has an older stock of homes that may not have dishwashers. Using the same survey results, it was assumed that of this remaining amount, approximately 1/3 of those homes have an EnergyStar™ dishwasher. As with the refrigerator analysis, the dishwasher analysis assumed lower seasonal use for the seasonal rentals. An important assumption within this analysis was that hot water heaters are not electric, but rather propane or another source. In summary, it appeared that based upon the assumptions used within the dishwasher analysis Block Island would have a technical potential to save 128,000 kWhs on an annual basis or approximately 3.0% of the total current residential load. Similar to the assumption above, it

[17] Annual residential kWh sales are assumed to be approximately 4.3 million.

was assumed that 85% of this total amount could be achievable conservation or 109,000 annual kWhs. This is approximately 2.5% of the total current residential load.

- *Clothes Washer* – It was assumed that all year-round and seasonal homes have clothes washers. Similar to the other appliances, it was assumed that approximately 1/3 of those homes have an EnergyStar™ clothes washer. As with the other analyses, this appliance analysis assumed considerably lower seasonal use for the seasonal rentals. Most people on vacation do not wash their clothes, but rather wait until they return home. Another key assumption for clothes washers is the source of hot water. For those utility systems where electric hot water is used in the washing process, significant savings can be achieved. As was discussed above, it has been assumed that Block Island has very limited electric water heating and propane is the main source for hot water heating. In summary, it appeared that based upon the assumptions used within the clothes washer analysis, Block Island would have a technical potential to save only 4,200 kWh's on an annual basis or about 0.1% of the total residential load. It was assumed that 85% of this total amount could be achievable or about 3,500 kWhs on an annual basis, or about 0.1% of the total residential load. These limited savings are simply a function of the assumed energy source for water heating. At an individual level, significant energy savings may be achieved by converting to an EnergyStar™ rated clothes washer, but for Block Island, as a whole, the energy savings appear to be very limited.

- *Room Air Conditioner* – It was assumed that roughly one-third of Block Island residential customers have a room air conditioner. Given that room air conditioners are seasonal in nature, there was not a significant load associated with these appliances. In summary, it appeared that based upon the assumptions used within the room air conditioner analysis Block Island would have a technical potential to save 47,000 kWhs on an annual basis or 1.1% of the total residential load. It was assumed that 85% of this total amount could be achievable or 40,000 kWhs and 0.9% of the total residential load. No assumption concerning air conditioning load was assumed for new or future construction.

- *Dehumidifier* – Dehumidifiers would appear to have very limited use on Block Island. Therefore, it was assumed that only 20% of all Block Island residences have a dehumidifier. In addition, dehumidifiers are seasonal in nature, and as a result, there was not a significant load associated with these appliances. In summary, it appeared that based upon the assumptions used within the dehumidifier analysis Block Island would have a technical potential to save only 38,000 kWhs on an annual basis or 0.9% of the total residential load. It was assumed that 85% of this total amount could be achievable or a savings of 32,000 kWh's or 0.9% of the total residential load.

Detailed exhibits are contained within the Technical Appendices of the analysis undertaken for each of the appliances.

4.5.3 Commercial Conservation Measures

The above discussion has focused on residential conservation measures. The reality is that commercial customers should also have significant conservation opportunities available to them.

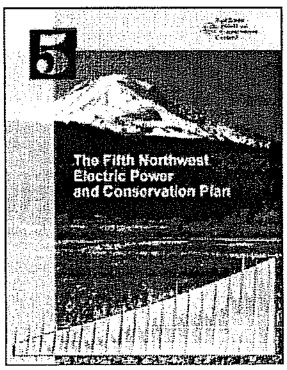
As with the residential customers, the commercial customers will need to determine those conservation measures which are cost effective and have short pay-back periods. In making decisions about facilities and equipment, commercial customers may view conservation measures from a slightly different perspective than residential customers (e.g. simple payback, total capital outlay, maintenance requirements, etc.). However, the cost-effectiveness of measures such as lighting, refrigeration, insulation, etc. should be similar to those found for residential customers.

This study has not attempted to quantify the technical potential or achievable potential for commercial conservation measures. Absent a more detailed understanding of the commercial end-uses and the facilities currently in place, reasonable estimates of the conservation potential could not be developed. Block Island should focus on both residential and commercial conservation, with the understanding that the commercial conservation program and incentives may be different than those targeted at residential customers.

4.6 Estimating Conservation Resource Potentials for Purposes of the Economic Analysis

While Sections 4.5.1 through 4.5.3 above provide an illustration of the conservation potential associated with individual appliances, etc. they do not provide a comprehensive estimate of the overall amount of conservation resource potential for Block Island. As discussed previously, for a larger and more sophisticated utility, typically a "bottoms-up" resource potential assessment would be conducted for a full range of conservation measures. However, given the limited resources of Block Island and this study, this approach was not feasible. Therefore, it was concluded that in order to conduct the economic evaluation portion of this study, a simplified approach would be used to reasonably estimate the total amount of conservation resource potential.

In order to conduct the economic analysis, an estimate of the total amount of achievable conservation resource potential is needed. The estimate of conservation resource potential is used to evaluate and compare plans of service with and without conservation resources. By viewing conservation resources in this manner, conservation and power supply resources can be evaluated on a consistent basis. Initially, the evaluation is from a societal cost perspective, before addressing any participant/non-participant equity issues.



For the Block Island Long-Term Resource Planning Study, a rough estimate of the amount of conservation resource potential on the island was developed by "calibrating" it to the results of a surrogate conservation resource potential assessment. In this particular case, the conservation resource potential assessment from the Northwest Power and Conservation Council's Fifth Power Plan, adopted and published in 2005, was used. This plan provided a comprehensive review of the amount of conservation resource potential in the Pacific Northwest. It concluded that conservation could cost-effectively effectively meet 44% of forecasted load growth for the Pacific Northwest, a region with one of the lowest costs of electricity in the U.S. and that has already acquired significant amounts of conservation resources. Clearly, Block Island has much higher electricity costs than the Pacific Northwest, and development of conservation resources has not been emphasized on the island for as many years. For these reasons, the amount of conservation resource potential for Block Island was deemed to be proportionally larger than for the Pacific Northwest.

Consequently, for the purposes of the Block Island Long-Term Resource Planning Study, it was assumed that the amount of achievable conservation resource potential equals 60 percent of the forecasted amount of growth in the island's retail electric loads during the next 20 years.

When considering the assumption that amount of conservation resource potential is equal to 60 percent of forecasted load growth, it is important to recognize the following:

- Retrofit conservation measures can make some of the existing electric loads on Block Island more energy efficient.
- Lost opportunity conservation measures can make some of the new loads more energy efficient.

Thus, when added together, the amounts of retrofit conservation measures plus lost opportunity conservation measures are estimated to equal 60 percent of the forecasted load growth for Block Island. In other words, it has not been assumed that all of the conservation resource potential for Block Island will be limited to lost opportunity conservation measures associated with new loads.

4.7 Designing an Energy Efficiency Program for Block Island

Without the aforementioned leadership structure and program implementation mechanism in place, the ability to recommend a course of action with a high probability of implementation is difficult. Based on the residential survey responses however, several energy efficiency measures can be analyzed with respect to their near-term (within five years) impact on island energy consumption. Provided below is a discussion of each of these near-term options.

4.7.1 No Action Alternative

If no action is taken to reduce demand and/or energy use, it is likely that the following residential energy efficiency activity included on Table 4-6 would take place on its own.

Table 4-6 No Action Residential Energy Efficiency 5-Year Implementation Plan	
Energy Efficiency Measures	**5-Year Implementation (Units/% Increase)**
EnergyStar™ Replacements	
Refrigerator	83 / 19%
Dishwasher	46 / 14%
Clothes Washer	45 /12%
Clothes Dryer	30 / 11%
Individual Self-Generation	
Solar Water Heaters	12%
Photovoltaic Panels	49 / 12%
Fluorescent Light Replacements	30%

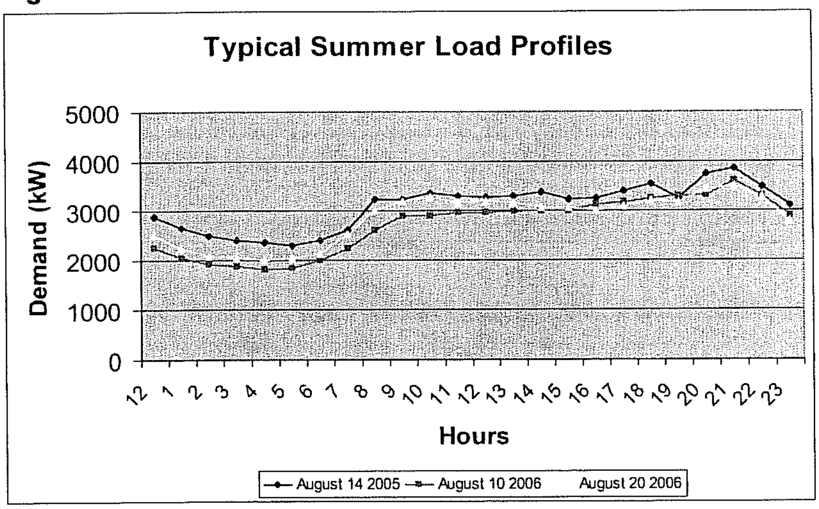
Based on the limited survey response, it is not likely that any other user group would change energy consumption behavior in manner significant enough to truly impact demand.

4.7.2 Immediate Policy Change Alternatives

There are two policy changes that could be made immediately that could impact peak demand. Each of these would require very little implementation effort as they fit into existing bureaucratic structures. The immediate policy change alternatives are noted below:

City of New Shoreham Street Lighting Policy Change – Given that peak demand occurs at a time when the island's street lights are on it would be beneficial for the Town of New Shoreham to replace all street lamps with mercury vapor / high pressure sodium bulbs. The cost of this upgrade could be spread out over five years and included in the yearly capital improvements program (CIP) budget. The following chart shows that the summer peak routinely occurs at 9:00 p.m.

Figure 4-1



This policy may not result in a large reduction in energy or demand or cost savings to the Town, but would demonstrate the Town's commitment to energy savings. It should also be noted that the Town is also looking at ways to assist BIPCo with undergrounding the electrical distribution power lines in the downtown area which would require replacing the existing streetlights on the power poles with new post style streetlights which should definitely utilize energy efficient lamps.

Table 4-7
Public Energy Efficiency 5-Year Implementation

Energy Efficiency Measure	5-Year Implementation (Units/%Increase)
Public Lamp Bulb Replacement	100%

BIPCo Pricing/Rate Policy Change – As highlighted by the low survey response rate, and with the need to service customers for their business, the commercial users appear to have little or no incentive to change consumption behaviors. Since the 16 largest commercial customers account for 22% of the island's total peak system kW demand (Peregrine Study 2000), one method of changing customer behavior is via pricing mechanisms. Time-of-use pricing may be one approach to controlling peak demands on BIPCo's system.

It is well known that certain rate structures and pricing schemes can be helpful in encouraging efficient use. In the case of BIPCo, it is interesting to note that their prices should be sufficiently high to encourage efficient use. However, if BIPCo determines that encouragement and education are not sufficient, pricing may be used to encourage use in low-peak times and discourage use in high peak times. However, the use of punitive pricing may have very limited impacts upon behavior, given the already high price of BIPCo power. In addition, demand and energy use on BIPCo's system is primarily driven by tourist activities. As such, commercial customers can not easily "shift" loads to off-peak periods.

Finally, this report does recognize that BIPCo rates are regulated and any changes must be approved. It would seem difficult for BIPCo to implement a punitive rate structure. Given that, BIPCo may need to find alternative methods, other than pricing, to gain any needed behavioral changes.

Comprehensive Island Solution Alternative – This alternative assumes complete implementation of all Energy Advisor's Program Responsibilities as outlined earlier in this report. Five-year implementation goals are driven by the decrease in demand needed to either hold the summer time peak steady or to decrease to a level that compliments the supply and demand profile for the island. No estimates of the potential conservation savings have been developed.

Provided in the following Table 4-8 is an overview of a potential comprehensive island solution for energy efficiency measures.

Table 4-8 Comprehensive Island Solution
Energy Efficiency Measure
Promotion of no-cost energy efficiency guides[18]
Home and business energy audit program
Energy efficient street lighting program (i.e., switch out all existing lights with more efficient mercury vapor / high pressure sodium lights).
International Energy Conservation Codes incorporated into the building codes for new construction, renovation, and remodeling.
Energy efficient procurement guidelines used for entities seeking to hire architects or engineers for the design new, renovated, or remodeled structures.
Block Island Public School's participation in the National Energy Education Development Project (NEED) and/or the EnergySmart™ Schools Program
EnergyStar™ rebate program
Low-cost financing alternatives for equipment upgrades for commercial customers.
Compact fluorescent light (CFL) rebate program
Small business workshops - Energy Efficiency Pays: A Guide for Small Business Owners[19]
Financial incentives for solar installation programs
Net Metering
Energy conservation section included in all renters' handbooks.[20]

4.8 Summary

This section of the report has discussed the issues of demand side management and conservation resource potential for BIPCo. Any demand side options that BIPCo pursues must be manageable, meet specific objectives and be cost-effective investments. Given an understanding of the potential demand–side resource options for BIPCo, the next section of the report will discuss supply-side options.

[18] The EnergyStar homepage offers the most comprehensive set of available no-cost resources: http://www.energystar.gov/

[19] Energy Efficiency Pays: A Guide for the Small Business Owner is a 46-page booklet that includes an introduction to energy efficiency and list of simple energy saving techniques. Sections include: Lighting, Office Equipment, HVAC, Refrigeration, and Hot Water Use & Efficiency.

[20] A standard Renter's Handbook needs to be developed for the island with a section that can be tailored to items specific to each rental property.

Section 5
Review of the Supply-Side Options

5.1 Introduction

The previous section of this report focused on the demand-side options for Block Island. It is important to also review and consider the various supply-side options for Block Island. While Block Island's supply needs are currently met with diesel generation, the supply-side options explored within this report expand beyond the diesel generation options. As Section 3 has noted, Block Island expects load growth, which must be met either through a combination of demand side and/or supply side options.

5.2 Overview of the Supply-Side Options

As noted previously, Block Island is located 12 miles off the coast of Rhode Island. Historically due to its remote location, Block Island Power has utilized diesel generators to supply the electric needs of the consumer on the Island. Block Island is a popular destination for both day trip and longer vacations during the summer season. This results in a large peak demand of 4 MW in the summer months, which continues to grow, with a much lower peak demand of 1.5 MW in the winter.

In studying the supply-side options, various options were explored. The supply-side options explored included both "traditional" and "renewable" resources. The following supply-side resources were reviewed as a part of this study:

- Traditional Supply Side Resources –
  - Expansion of the existing diesel generation
  - Construction of a submarine cable of purchase of power
- Renewable Resources –
  - Solar generation
  - Wind generation
  - Tidal/Wave generation

In conducting this study, it was recognized that Block Island requires a firm and reliable resource. For that reason, the "traditional" resources of diesel and submarine cable/purchased power were viewed as providing the firm resource. However, at the same time, this study recognized the value of renewable resources and how they may be incorporated into Block Island's resources.

5.3 Review of the "Traditional" Supply-Side Options

As was noted above, two supply side options were explored to provide firm and reliable power supply for Block Island. These two options were diesel generation and the construction of a submarine cable combined with a purchased power agreement. Each of these options is discussed in more detail below.

5.3.1 Diesel Generation

A logical starting point for reviewing supply-side options was to consider Block Island's current generation facilities; diesel generation. Therefore, the first supply side option explored was to continue to supply the island utilizing reciprocating engine diesel generators. Currently, Block Island Power owns five (5) diesel generators with a production capacity of 7,275 kilowatts (kW). The oldest unit is #19 which has been in service since 1989. The table below lists the current plant generators.

Table 5-1
Overview of Block Island's Diesel Generator Information

Generator #	Capacity	Cumulative Hours[1]	In Service
#19	1,135 kW	38,097.0	1989
#22	1,390 kW	24,932.0	2000
#23	1,285 kW	16,917.0	2001
#24	1,640 kW	21,935.5	2002
#25	1,825 kW	245.0	2006
Total	7,275 kW	102,127.0	

[1] – As of year end 2006

The diesel generators typically need an overhaul after 10,000 hours of use. In 2006, generators 24 & 25 were utilized as base load units and one of the others generators supplied the required peaking capacity. In the future, to serve the projected loads it is assumed that two new generator units will be required. Also, the assumption was made that unit #19 will be retired.

Storage for the #2 fuel oil is provided for with four (4) - 20,000 gallon tanks. Typically for off peak months the tanks provide adequate capacity for more that 1 month's supply of generation. During the peak summer months, storage capacity is less with specific storage time dependent upon the current system loading.

In 2006, based upon information from the RUS form 7, the system outages were 0.4 average hours per consumer. The largest portion of this was 0.3 average hours per consumer was due to "extreme storm", while the remainder is categorized as "all other". During the initial interviews, some comments were made regarding power quality and reliability. These comments were not tied to any specific time frame. In recent years, the older generators with the manual type governors have been replaced with electronic governors. These newer governors allow the generators to better follow the loads. Based upon earlier work, distribution load flow analysis pointed out that summer loads were causing low voltages on the system during the system peak. Since that time, Block Island Power has added line voltage regulators to help improve the system voltage. Without doing actual power quality measurements, it is difficult to ascertain whether the voltage fluctuations and power quality issues are due to the power supply (diesel generators) or due to the heavily loaded distribution system. It is possible that any fluctuations are related to the periods of time when the operators are loading up a single generator near capacity before they bring a second one on line. This type of fluctuation will be even more prevalent with large distributed generation such as wind connected.

In evaluating the generator option, the assumption was made that top end overhauls would be done in-house every 10,000 hours of operation at a cost of $30,000. Major overhauls would be done every 20,000 hours at a cost of $60,000. The cost of a new 1825 kW generator unit is $548,000 based on a recent 2006 purchase. In addition, it is assumed that in 2012, Block Island will have to replace the existing below ground tanks with double walled tanks with monitoring. Currently, Block Island stores 80,000 gallons in the 100,000 gallons worth of storage tanks. The remaining capacity is for a private company. The assumption was made that Block Island will likely need to purchase new underground tanks.

5.3.2 Submarine Cable and Purchased Power

The second "traditional" supply-side alternative reviewed involves installing a 34.5 kilovolt (kV) submarine cable from the mainland. This option was explored since it may provide an economically viable reliable alternative to the current diesel generators. By virtue of connection to the mainland electric grid, the cable will also provide improved power quality related to frequency and voltage swings due to local diesel generator operation for loading fluxuations. Typically, submarine cables of this type would be expected to have a life of 30 years. The idea of a cable connecting to the mainland electric grid has been considered in the past, but each time determined to be too costly. However, as the price of diesel fuel has significantly increased over the last year or so, the potential economics of a submarine cable have also changed. While the cost/benefit economics of building a submarine cable are a critical component in the decision-making process, this option is relatively complicated and will involved decisions in areas other than strictly the economic benefits of constructing a cable. Exploring possible cable routes and the facilities required to make the interconnection was reviewed as a part of this study.

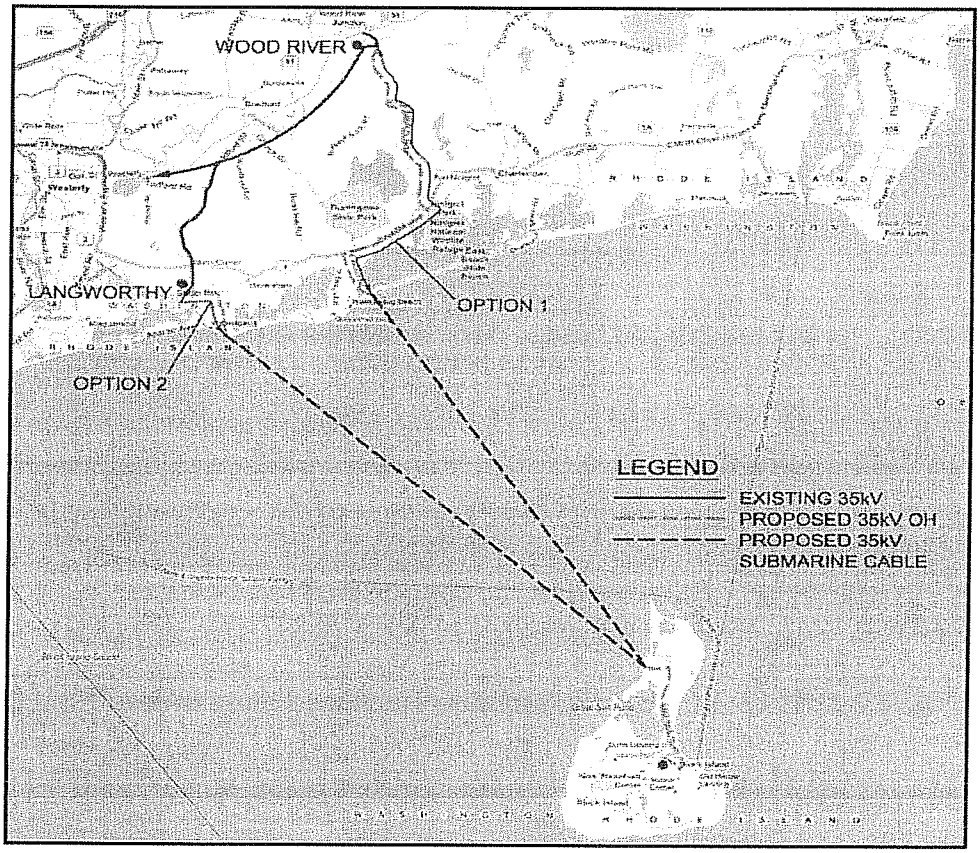
The first step in the analysis was to perform a load flow analysis to determine the optimum voltage required for the submarine cable and interconnection to the mainland based upon what is readily available on the mainland. Initially, 12.5kV was reviewed, but that voltage level could not adequately serve the projected loads. Based upon the fact that 34.5kV located nearby on the mainland, that voltage level was studied. The preferred delivery point for power supply on the mainland is the National Grid Wood River Substation which has a voltage of 34.5 kV. From there two different overland routes were analyzed. The first considered a new 9.5 mile, 34.5 kV 477KCM AL distribution line to Quonochontany Pond. This new line would be a dedicated line serving Block Island. This option would require 13.25 miles of submarine cable. This length is based upon following the route that was determined by the underwater survey that was completed several years ago. The second overland route is to tap the existing National Grid 34.5

kV line at Langworthy Substation and construct an additional 2 miles of 477 KCM AL distribution line to the coast. The Langworthy line also originates from the Wood River Substation and terminates at the Langworthy Substation. This line is currently serving 12 MW of National Grid load on the mainland which is projected to grow to 16.1 MW over the next 10 years. This option would require an additional 1.25 miles of submarine cable.

Based upon the environmental work that was previously done, the preferred landing site on the Island is by the landfill on the west side of the island Once on the island, 3 miles of new 477 KCM AL distribution line needs to be constructed down Cornneck Road and Ocean Road to the existing power plant substation. Another option would be to bury the 34.5kV distribution line along the same route. A new 34.5KV – 2.4/4.16KV 10 MVA transformer would be required to interconnect with the existing substation. It may be constructed just north of the existing substation connecting onto the existing substation buswork. The assumption for this sized transformer is based on the 4.16KV distribution conversion that was recommended in the BIPCo December 2004 Long Range Plan has been completed. This would enable a single three phase transformer to be used. If not, the new substation interconnection would require three (3) single phase transformer units which could be connected as either 2.4 KV delta or 4.16 KV grounded wye. This would make the overall substation "foot print" even larger.

Figure 5-1 provides a graphical overview of the options explored as a part of this study.

Figure 5-1 – Submarine Cable Options



It should be noted that prior to installing a submarine cable, a new underwater survey will be required. At that time, the route can be re-evaluated. Another potential landing area that could be considered is near the Coast Guard Station. This would reduce the amount of 34.5kV distribution on the island, but conversely would increase the amount of submarine cable required.

Several submarine cable sizes were analyzed for the two above options and various load levels. The primary constraint was voltage drop on the 34.5 kV system as opposed to ampacity of the submarine cable. Typically for distribution systems, the voltage drop is limited to 8 volts on a 120 volt base or 6.7% before additional line voltage regulation is required. Several load flows were run to analyze the system. The following table summarizes the load flow results.

Table 5-2
Summary of the Load Flow Results

Case	Tap Point	Submarine Conductor Size	Block Island Load	Assumed PF	Max Voltage Drop	Amps Load	Cable Rating	Percent Capacity
Case 1-1	Wood River	4/0 cu	7.4 MW	94%	6.7%	141	300	47.0%
Case 1-2	Wood River	250 cu	7.8 MW	94%	6.7%	148	330	44.8%
Case 1-3	Wood River	350 cu	8.7 MW	94%	6.7%	166	397	41.8%
Case 1-4	Wood River	500 cu	9.6 MW	94%	6.7%	183	482	38.0%
Case 2-1	Langworthy W/12 MW of mainland load	250 cu	4 MW	94%	6.7%	76	330	23.0%
Case 2-2	Langworthy with 12 MW mainland load and 34.5 KV regs	250 cu	7.8 MW	94%	6.3%	145	330	43.9%
Case 2-3	Langworthy with 16 MW of mainland load and 34.5 KV regs	250 cu	5.8 MW	94%	6.5%	109	330	33.0%

As can be seen from Table 5-2 above, the 350 kcmil copper 34.5 KV submarine cable from a dedicated circuit from Wood River (Case 1-4) can carry the moderate long range load of 8.3 MW projected for year 2027 as shown in section 3 Development of the Load Forecast. With an estimated cost of $84/foot, the 350 kcmil copper 34.5 KV submarine cable costs $490,000 more than the 250 kcmil copper submarine cable which is estimated at $77/foot. The capacity that the two cable sizes can carry before the voltage criteria is exceeded is less than 1 MW. Given the 34.5 KV voltage, one solution is to install three (3) 200 amp 34.5 KV padmount voltage regulators at the landfill on Block Island just after landing the cable. This will boost the voltage to acceptable levels. In fact, with 250 kcmil copper cable and 34.5KV voltage regulators, the cable can support up to 12 MW of load for Block Island. The estimated installed cost for the voltage regulators is $110,000. The assumption was also made to use voltage regulators with an environmentally friendly fluid such as Envirotemp FR3.

Cases 2-1 through 2-3 explored load serving capabilities from the Langworthy tap point. With 250 kcmil copper cable, only 4 MW of load at Block Island can be served and meet the voltage criteria. Information regarding the 12 MW of existing load on the mainland was provided by National Grid. Three 200 amp 34.5 KV voltage regulators can be installed on the mainland at the Langworthy tap point. As shown in case 2-2, this allows for 7.8 MW of load on Block Island to be served. The limiting point is the voltage drop between Wood River and Langworthy on the National Grid system. As the loads on the mainland grow at the projected 3.5% per year for the next 10 years to 16 MW, only 5.8 MW of load can be served on Block Island. This shows that Block Island would likely need to participate in system upgrades to serve the desired 8 MW of load or construct the dedicated separate line from Wood River.

Although Block Island is not a typical rural electric cooperative, they have borrowed money from Rural Utilities Services (RUS). RUS allows for only one set of voltage regulators as a long term solution. Thus, a second set of voltage regulators would not be recommended.

The relative costs are shown following in Table 5-3.

Table 5-3
Summary of Costs Related to Cable Options [1]

Item	Wood River – Option 1 350 cu	Wood River – Option 1 250 cu	Langworthy – Option 2
Mainland Portion			
Revisions at tap substation	$350,000	$350,000	$200,000
9.5 miles 477 AAC O/H with dist. underbuild	2,850,000	2,850,000	600,000 [2]
34.5 kV voltage regulator	0	0	110,000
Subtotal	**$3,200,000**	**$3,200,000**	**$910,000**
Undersea Portion			
70,000 ft Copper 35kV 3 phase cable, armor	$5,900,000	$5,400,000	$5,900,000
Shipping (cable to U.S.)	1,400,000	1,400,000	1,400,000
Sub-bottom survey	800,000	800,000	800,000
Mobilization of Laying Barge	700,000	700,000	700,000
Cable Installation	1,800,000	1,800,000	1,800,000
2 switchgear terminal & risers	150,000	150,000	150,000
Subtotal	**$10,750,000**	**$10,250,000**	**$10,750,000**
Island Portion			
3 miles 477 AAC O/H, 35kV with dist. underbuild	$900,000 [3]	$900,000	$900,000
Substation addition	2,000,000	2,000,000	2,000,000
34.5 kV voltage regulator	0	110,000	
Subtotal	**$2,900,000**	**$3,010,000**	**$2,900,000**
Plus: 10% contingency	**$1,680,000**	**$1,650,000**	**$1,460,000**
Grand Total	**$18,530,000**	**$18,110,000**	**$16,020,000**

[1] Costs based on 2007 dollars.
[2] – 2.0 miles of 477 KCM AAC
[3] – Cost increases to $1,400,000 if 34.5 kV 250 kcmil copper cable is direct buried on the Island.

For all of the above cost estimates, the submarine cable installation involves directional drilling on the landings for the portion from the landing to the shelf which extends out from the coast on both ends. The deeper portion in the center will be installed using a jet plow method. This type of installation helps to minimize annual maintenance costs associated with the cable. In addition, the cable is assumed to be armored to give it additional strength. Given the costs listed above, the least cost alternative that still serves the total load is the option with 250 kcmil cu 34.5kV submarine cable with future 34.5kV padmount voltage regulators. Given that the cost savings only represents 2% of the overall project cost, the decision may be made to install the larger conductor to gain additional capacity and reduce losses. For analysis purposes, the option with the 250 kcmil cu cable will be used. With the new submarine cable option, the majority of the diesel generators would be removed and sold for salvage. This analysis is similar to the assumptions behind the Nantucket cable project. Based upon the critical loads in the summer and winter, two (2) generators would be retained for backup in the event of a cable failure.

Another consideration is to install fiber optic cable within the submarine cable for communications and other uses. Thirty-six pairs of fiber would add approximately $350,000 to the submarine capital investment, excluding fiber installation on the mainland and Island, as well as terminating equipment.

From a strictly engineering perspective, the Wood River option would be preferred since it can carry the projected loads into the future and would help insulate Block Island from National Grid System growth issues on the mainland. The annual cost paid to National Grid each year amounts to 10% of the installed cost of facilities. This means that the Wood River option would cost more than the Langworthy option would cost by $229,000 more per year. With the National Grid mainland growth projections and the Block Island projections, the existing Langworthy line on the mainland for the Langworthy circuit could possibly be overloaded within 5 years. The types and costs of improvements which would be required on the mainland for the Langworthy circuit would need to be ascertained by National Grid. How this could potentially affect Block Island is impossible to predict at this time.

In conjunction, to the capital investment for the cable option, Block Island would still need to secure a long term purchased power agreement through National Grid or other provider. It is the total combination of capital costs associated with the cable option and the cost of purchased power that is compared to the other supply and demand side options.

Overall, the option with a submarine cable will help to improve reliability in that any voltage fluctuations seen by operation of the diesels will be eliminated during normal operation. In addition, it has the added benefit of reducing pollution due to the diesel generators

Given the above review of the "traditional" supply side options available to Block Island, the focus shifts to renewable power supply options.

5.4 Review of the Renewable Supply-Side Options

With the recent increase in diesel fuel prices, increasing emphasis has been placed upon the development of renewable resources. Historically, renewable resources have not typically been cost-effective against more traditional power supply resources, and the marketplace has not fully developed or evolved as it relates to renewable resources. This situation, however, is quickly changing and renewable resources are becoming a part of many electric utility's resource portfolio. In the case of Block Island, diesel generation is very expensive and as a result, renewable supply-side options become more economically attractive. This portion of the report will discuss the supply-side options reviewed and provide a background discussion of each and the various advantages and disadvantages of each option.

5.4.1 Wind Generation

For Block Island, wind generation would seem to have great potential. The technology associated with wind generation has improved in recent years and wind farms are a more common sight. Given that, wind generation was considered for Block Island in relation to the two primary (traditional) supply-side options.

As a renewable resource, wind is classified according to wind power classes. These classes are based upon typical wind speeds. The classes range from Class 1 (the lowest) to Class 7 (the highest). In general, wind power Class 3 and higher can be useful for generating electricity with utility scale (large) turbines. Small turbines can be used with any wind speed. Typical wind speeds for each class are shown below in Table 5-4 for reference. Typically, wind power is assumed to have an ampacity factor of 0.35.

Table 5-4
Wind Power Classification

Wind Power Class	Wind Speed (M/S) 50M (164 FT)	Miles Per Hour (MPH)
1	0 - 5.6	0 - 12.5
2	5.6 - 6.4	12.5 - 14.3
3	6.4 - 7.0	14.3 - 15.7
4	7.0 - 7.5	15.7 - 16.8
5	7.5 - 8.0	16.8 - 17.9
6	8.0 - 8.8	17.9 - 19.7
7	8.8 - 11.9	19.7 - 26.6

Data from National Renewable Energy Laboratory (NREL) classifies Block Island as solid wind power Class 4. This level of wind power would appear to make utility scale wind turbines potentially feasible.

The Renewable Energy Research Laboratory (RERL) has some wind data taken in the New Harbor area of Block Island at a height of 45 meters. This would correlate to hub height for the turbine. This data was used to prepare the following charts. As is shown in the Summer Wind chart, Figure 5-2, the 3 select dates vary greatly with an average wind speed of 6.5 m/s. The correlating wind turbine output is also listed in Table 5-5. With the average wind speed of 6.5 m/s, the average generator output is 250 kW. It should be noted that for nearly half of the days of the month at 9:00pm, the generation is less that 200 kW. As for the Winter Wind chart, Figure 5-3, the 3 days vary greatly. Overall in the January wind data, the average wind speed is 9 m/s correlates to 750 kW.

Figure 5-2

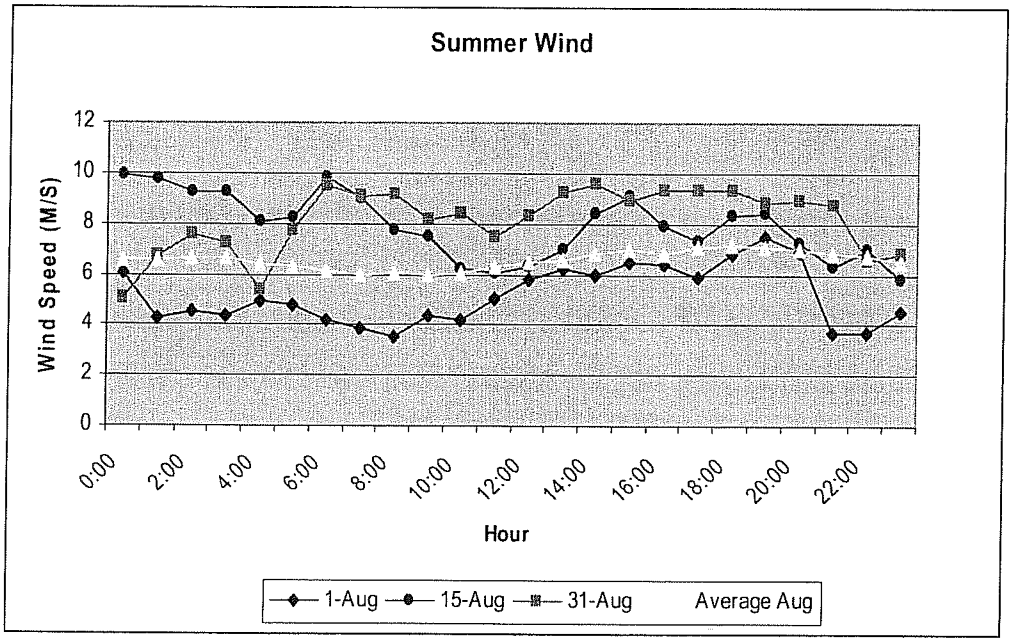


Figure 5-3

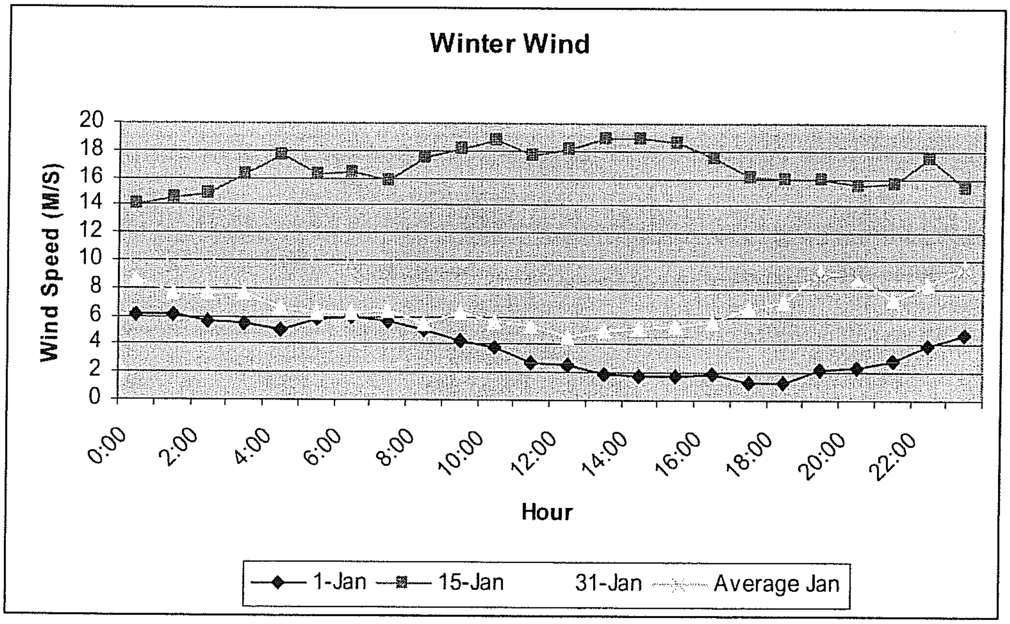


Table 5-5 Wind Speed vs. Power Output		
Wind Speed (M/S)	Generation Output 600 kW	Generation Output 1,500 kW
2	0	0
4	26	45
6	116	195
8	290	525
10	519	1,000
12	600	1,500
14	600	1,500
16	600	1,500

Based upon 5 years of the RERL data and some typical turbine wind curves, table 5-6 shows the estimated wind energy production. The better wind production months based upon the wind speeds are November through March. This would be the expected energy provided that all energy can be used and none needs to be dissipated due to light loads.

Table 5-6 Estimated Wind Energy Production		
Wind Speed (M/S)	kWh's @ 600 kW Unit	kWh's @ 1,500 kW Unit
January	248,995	569,424
February	168,653	374,190
March	203,119	452,996
April	147,357	317,355
May	131,705	277,606
June	89,365	181,896
July	86,091	175,263
August	74,678	151,114
September	106,166	219,414
October	153,122	325,449
November	189,640	412,023
December	213,233	485,270
Total kWh's	**1,812,125**	**3,942,000**
Capacity Factor	**34.48%**	**30.00%**

As shown in the table above, the wind generates the most power in the winter. January through March has historically had the lowest peak demand. The peak demands during these months is approximately 1,400 kW with off peak demands of 775 kW. This means that for a 1,500 kW generator, production based upon wind speeds of greater than 10 m/s will likely result in too much energy production by the wind turbines. This will result in a slightly lower capacity factor.

In the peak months of August, the wind generation is at its lowest. This is usually when the Block Island loads are at their peak.

In the case of supply-side option #1, the diesel generator option, the wind options could involve the possible placement of 600 kW of wind turbines either as one 600 kW unit or three 200 kW units, located on one of the various BIPCo distribution circuits. This can be done once the BIPCo distribution system is converted to 4.16kV grounded wye as recommended in the December 2004 Long Range Distribution Plan. Another possibility is to locate up to three(3) 200 kW units on three separate circuits. From an electric distribution standpoint, only a single turbine could be located on any one of the BIPCo distribution circuits without overloading the existing lines. The key would be locating sites that cause the minimum problems from a siting standpoint. Given the bird population, studies would need to be undertaken before final siting occurred. There is open land available. The Nature Conservancy may be helpful if their support to garnered early on in the siting process. On any of the distribution lines with voltage regulators, the regulators would need to be retrofit for reverse powerflow. If wind turbines are added, BIPCo would still need to run the generators to help firm up the wind, as well as provide a stable frequency. During light load times, one or more of the generators could be shut down to help mitigate the frequency control issues. It should be noted that in the past, the older generators had manual governors which could not keep up with the changes in wind power. The current generators are equipped with electronic governors which can operate quickly to help keep up with wind turbines.

It would be difficult to place a single large turbine on the island with the existing distribution system circuit configuration and with only the diesel generators as a power source. For instance if a 1.5 MW generator was placed at the landfill, the existing 2.4kV delta distribution circuit can not carry the generation. The maximum current produced by the wind turbine is 361 amps on the 2.4kV delta. The mainline conductor along Corn Neck road is #2 copper which is rated at 230 amps for a conductor at 75 degrees C with air at 25 degrees C and wind of 2 feet per second. If the electric distribution system is converted to 4.16kV as proposed in the Long Range Plan, the #2 copper along Corn Neck Road would be loaded to 87% of its ampacity rating. In addition, the ½ mile of distribution line from the landfill to the mainline on Corn Neck Road would have to be rebuilt with a larger conductor. Another downside for this size of wind turbine is that it can only generate during the summer months during high load conditions and turned off in the winter due to the ratio of wind generation to diesel generation to maintain system stability. The landfill area is proposed as a possible site that may have less opposition for the siting process.

With added wind generation, there may be control issues during light load times. The diesel generators would still need to operate to provide reactive volt ampere (VAR) and frequency support. VAR support is typically required to operate the wind generator. When the diesel generators operate, they put out kW and VARs to operate the normal system. With the addition of a wind turbine, the diesel generators would have to put out more VARs. With newer controllers on the wind turbines, this support is often less that older style induction type units. It should be noted that currently the diesel generators are required to follow load. Typically load follows a more gradual cycle of slowly increasing or decreasing. Therefore, generators are ramped up or others switched on based upon the load. This is continually being done by the diesel generator operators at Block Island Power. The wind will be more difficult to follow in that it may go from 20% to 80% in a matter of minutes. This may require the diesels to be running in more of a standby mode to insure that adequate generation is readily available in the event that the wind drops off suddenly. While the generators are running, diesel is being consumed and is an added cost. Thus in the winter time, under light load conditions, the fuel cost savings would be very limited. Since the winter loads vary from 775 kW to 1,400 kW, during these light load times in the winter, any excess generation would need to be "dumped". At all times, some amount of diesel generation must be maintained to keep the system frequency intact. This frequency control is critical. Block Island Power will need to work with the turbine manufacturers to establish a fast method for dumping the generation with some type of rapid communication system.

In the case of supply-side option #2, the submarine cable option, a large 1.5 MW unit could be considered near the landfill. The landfill site is proposed to reduce the problems of siting a wind turbine. The wind turbine could be connected to the new 34.5 kV distribution line. According to NREL, the new solid state units can be equipped with special equipment to help mitigate any stability concerns with the remaining diesel generators in the event that the submarine cable is out of service. It should be noted that under emergency conditions with the loss of the submarine cable and with wind production, the diesel generators would still need to operate to provide VAR support and frequency support. Thus, if the submarine cable is out of service during lighter load periods, the cost of power during outages will be higher since the fuel will still be necessary to run the generators.

Additionally, the State of Rhode Island is considering some off-shore wind projects, one of which would be near Block Island. As this option is further developed, the preferred supply side alternative may be to participate in the project so that the submarine cable can be routed such that it lands on the island before continuing on the mainland. This would provide the advantage of being connected to the mainland plus utilizing renewable energy. The cost to participate should be weighed against the other alternatives.

5.4.2 Solar Power Generation

Solar Power Generation or Photovoltaics involves converting sunlight to electricity. The electricity produced is in the form of direct current (DC) and can be converted to alternating current (AC). These cells are made of semi-conductor materials. One benefit with solar is that it is actually higher in the summer than in the winter which better follows the pattern of load on Block Island. Solar power can be implemented with either Option #1 (Diesel) or Option #2 (Cable). Given that the highest system peak occurs generally at 9:00 pm at night in August, the solar power alone will not help to offset the need for diesel generation in Option #1 unless some type of storage is used to use during selected periods.

In order to produce 400,000 kWhs annually, using 0.648 kWh/M^2/day for collection surface and assuming a factor of 2.5 times the collection surface to avoid shadow, the minimum land required would be 10.5 acres. This does not count any access to the site or any land for the battery storage device if required. This analysis is based upon an annual average solar radiation of 4.5 kWh/M^2/day (NREL) and a solar conversion efficiency of 15% and a DC/AC conversion efficiency of 96%.

A disadvantage to solar is the amount of space that it takes up. To find a site with approximately 12 acres to locate the solar panels would be a challenge. A better approach may be to support the use of solar water heating on the customer side rather than use a utility sized system.

5.4.3 Wave/Tidal Power Generation

Wave and tidal power generation can take several different forms. Many of these types of generation are currently being tested in sites. The basic premise is to convert energy from the ocean waves or tides and turn it into electricity. Tidal generation relies on substantial variations of low tide to high tide to produce electricity. Papers indicate that there are few sites that have adequate tide variation to be suitable sites. Therefore, wave generation in considered for this report.

Based upon an article in the May 5, 2007 issue of The Block Island Times, the State of Rhode Island and Block Island are currently pursuing a pilot project using Oceanlinx (formerly Energetech) type of wave generation. Therefore, this type of wave generator is analyzed in this report. Basically, this type of generation uses the rise and fall of the water to move air which in turn spins an air turbine. The proposed project is looking at a 1500 kW unit. The power is then connected via submarine cable to the land. Oceanlinx typically uses 3.3kV cable. Once on land, a transformer will be required to convert it to 4.16kV. Assuming that the unit will be placed either to the west of the island or southwest, the 4.16kV conversion recommended in the Long Range Plan is assumed to be in place. This limits the amount of reconductoring required on the existing distribution system. For instance, if the unit is placed southwest of the island and connected to the Airport circuit, approximately 1.0 miles of existing #4 copper distribution line must be reconductored to at least #2 copper. This assumes that the electric distribution system is converted to 4.16kV grounded wye. As stated above in the wind section, the #2 copper conductor does not have enough capacity to carry the 1500 kW if it is operated at a 2.4kV delta.

As with the wind turbines, frequency must be maintained with the diesel generators. The Oceanlinx wave generator requires external voltage from the distribution system to synchronize with. As with wind, wave energy production tends to be higher in the windier months. This means that the majority of production occurs in the winter months as opposed to the summer. Therefore, the wave generation will need to be reduced during the winter months. A contact at Oceanlinx suggested that one method to reduce the output would be to "detune" the generator to be less efficient. It was stated that this could be done automatically via the wave generator controller. Block Island Power would have to work closely with Oceanlinx to come up the best method to program the controller to insure that the wave generation output can be limited during off peak times. One method may be to provide limits within the controller based upon set criteria such as seasonal conditions. Another method would be to provide communication from Block Island Power to the controller. The alternatives will need to be explored with Oceanlinx. They also indicated two other methods for limiting the output to the distribution system. One would be to use the energy for another purpose like desalination of seawater or production hydrogen. The other method is to just dump the energy via a resistor. Overall, this limitation on the production will reduce the annual load factor from 33% to something less; depending on the amount of time that the production exceeds the loads.

5.5 Summary

This section of the report has reviewed both "traditional" and "renewable" supply-side resources. In addition to the current diesel generation, an in depth look and proposed plan for a submarine cable connecting to the mainland electric grid was presented. Review of renewable supply side options including various options, opportunities and limitations for wind generation was presented. This review has provided an important context concerning the resources that may be available to Block Island and BIPCo. This discussion is the starting point that will eventually lead to the economic analysis of the various supply-side options.

Section 6
Economic Evaluation of the Alternative Plans of Service

6.1 Introduction

This section describes the approach, documents the inputs, and presents the results of the economic evaluation of the alternative plans of service that were addressed in the Block Island Long-Term Electric Resource Planning Study. The section begins with a brief narrative summary of the evaluation results. Next, the resource planning approach that was used to perform the evaluation is described. The section continues by identifying the alternative plans of service that were evaluated. Then, key assumptions and forecasts that were used in the evaluation are presented. Finally, further details on the results of the evaluation are provided.

6.2 Narrative Summary of Results

The economic evaluation addressed six alternative plans of service for meeting the long-term electric resource needs of Block Island which are summarized in Table 6-1. The economic evaluation began by addressing the following two base plans of service:

- Continued use of on-island diesel generators powered by No. 2 distillate fuel oil purchased in the mainland market and transported by boat to Block Island, or
- Installation of a submarine cable that is then used to transmit power purchased in the wholesale electric supply market from the mainland to Block Island.

The results of the economic evaluation indicate that over a 20-year planning horizon, the net present value (NPV) cost of power for the on-island diesel generation base plan of service is expected to be $41.5 million. The 20-year NPV cost of power for the submarine cable with mainland power purchases base plan of service is expected to be $44.7 million. In other words, the 20-year NPV cost of power is expected to be 7.1 percent lower for the on-island diesel generation base plan of service than for the submarine cable with mainland power purchases base plan of service. This analysis excludes any grants or socialization of the cable costs which would reduce the cost of the submarine cable option for Block Islanders. Also, revenue generated by leasing fiber optics in the cable has not been evaluated. The submarine cable option assumes connection at Wood River. If the Langworthy option is used, the initial annual cost savings would be $229,000 per year. However, based upon load projections for Block Island and the mainland, the source at Langworthy would only suffice for approximately 5 years. Beyond that, the costs associated with this option are unknown.

The 20-year NPV cost of power for the on-island diesel generation base plan of service is most strongly influenced by a single factor – the market price of No. 2 distillate fuel oil. No. 2 distillate fuel purchase expenses make up 74 percent of the 20-year NPV cost of power and are subject to significant, ongoing market price uncertainty.

The 20-year NPV cost of power for the submarine cable with mainland power purchases base plan of service is strongly influenced by two primary factors – capital and other fixed costs for submarine cable, and market prices for power in the mainland wholesale electric supply market. Costs for the submarine cable and related facilities represent 41 percent of the 20-year NPV cost of power and are comparatively certain. Power purchase expenses represent 37 percent of the 20-year NPV cost of power and are subject to significant, ongoing market price uncertainty.

Table 6-1

20 Year Net Present Value of Cost of Power for Plans of Service Evaluated	Millions of Real 2007 $
Diesel Generation Base Plan of Service	41.5
Submarine Cable Base Plan of Service	44.7
Diesel Generation with Wind and No Conservation	37.0
Submarine Cable with Wind and No Conservation	44.8
Diesel Generation with Wind and Conservation	36.1
Submarine Cable with Wind and Conservation	44.7

In addition to the two base plans of service, the economic evaluation also addressed two types of variations on each base plan of service. One type of variation on the base plans of service included renewable generating resources (represented by wind power) to meet a portion of Block Island's long-term electric resource needs. The other type of variation on the base plans of service included both renewable resources (represented by wind power) and demand-side resources (represented by conservation) to meet a portion of Block Island's long-term electric resource needs.

Including renewable generating resources and demand-side resources produced significantly different impacts on costs for the two base plans of service. Using wind power to meet part of Block Island's resource needs reduced the 20-year NPV cost of power for the on-island diesel generation plan of service by 11 percent. Using both wind power and conservation to meet part of Block Island's resource needs reduced the 20-year NPV cost of power for the on-island diesel generation plan of service by a total of 13 percent. However, using wind power and conservation to meet part of Block Island's resource needs as part of the submarine cable with mainland power purchases plan of service caused only small (less than $0.1 million) changes in the 20-year NPV cost of power.

On-island diesel generation with wind power and conservation resources was the lowest-cost plan of service, with a 20-year NPV cost of power of $36.1 million. Submarine cable with wind power and without conservation was the highest cost plan of service, with a 20-year NPV cost of power of $44.8 million.

6.3 Resource Planning Approach

The resource planning approach used to evaluate the alternative plans of service was based upon the following principles:

- Appropriate Scope
- Economic Perspective
- Transparency and Credibility
- Simplicity and Rigor

Following are brief descriptions of each of the principles for the resource planning approach.

Appropriate Scope

To ensure the economic evaluation covered a reasonably broad range of potential resource strategies, a total of six alternative plans of service were formulated and evaluated. These plans of service included two base alternatives, with each base alternative relying on a different type of electric supply resource. Two variations on each of the two base alternatives were also created by including additional types of resources. This approach for constructing the alternative plans of service allowed a range of types of electric resources to be addressed, including traditional power supply resources, renewable generating resources and demand-side resources.

Each of the alternative plans of service that was evaluated included a sufficient quantity of electric resources to reliably meet the amount of electric demand in the 'Probable' scenario of the electric load forecast presented in Section 3.

The scope of the evaluation reflects a long-term resource planning perspective. Consistent with standard electric utility industry resource planning practices, a 20-year planning period was used for the evaluation, encompassing the years 2008 through 2027.

Economic Perspective

Each of the alternative plans of service was quantitatively assessed and compared in economic terms, thereby ensuring a clear, straightforward and consistent basis for the evaluation. The specific economic perspective used for the evaluation was the net present value (NPV) cost of power in dollars, summed across the entire 20-year planning period.

The scope of the evaluation included fixed and variable costs for the electric resources included in each alternative plan of service, including capital facilities, power and fuel supplies, mainland transmission and other power costs, where applicable. Distribution system costs and other non-power costs were not included in the evaluation.

The economic perspective and emphasis on the 20-year NPV cost of power also reflects a broad societal view. Evaluating each alternative plan of service in terms of its 20-year NPV cost of power allows lower-cost alternatives to be identified without becoming prematurely sidetracked into issues of how costs and benefits should be allocated among various stakeholders.

Transparency and Credibility

One of the hallmarks of modern electric resource planning is the use of an approach that is transparent and credible. In order to achieve this goal, an open-book approach was used for the resource planning methodology, inputs and results. All of the data used for the economic evaluation is available for review. In addition, care was taken to ensure that consistent methods, assumptions and forecasts were used in the evaluation of the alternative plans of service.

Simplicity and Rigor

Finally, the approach used for the evaluation sought to achieve simplicity without sacrificing the need for rigorous, sound analysis. This was accomplished in several ways. First, the unique characteristics of Block Island were recognized, including its location, size, the seasonal profile of its electric consumption and the local environment. Second, modern electric utility resource planning concepts and methods were used. Third, existing sources of information were used where possible. Fourth, the evaluation focused on major topics and issues, sidestepping overly complex analytical approaches and avoiding putting too much emphasis on factors that are not likely to significantly affect the relative economics of the alternatives.

6.4 Six Alternative Plans of Service Evaluated

For the Block Island Electric Resource Planning Study, six different plans of service were created and quantitatively analyzed:

1. Diesel Generation – Base Plan of Service
2. Submarine Cable – Base Plan of Service
3. Diesel Generation – With Wind Power Resources
4. Submarine Cable – With Wind Power Resources
5. Diesel Generation – With Wind Power and Conservation Resources
6. Submarine Cable – With Wind Power and Conservation Resources

This approach to formulating the alternative plans of service was designed to accomplish several objectives. One objective was to provide a straightforward means for comparing the costs of the two base alternatives – namely, continuing to use on-island diesel versus installing a submarine cable. Another objective was to enable the analysis to determine whether including renewable resources and demand-side resources can reduce the overall lower-cost for a mix of resources used to serve electric loads on Block Island. A third objective was to examine whether including renewable resources and demand-side resources creates differing impacts on costs for the two base plans of service.

Diesel Generation – Base Plan of Service

This plan of service assumes that the existing system of diesel engine generators located on Block Island remains in place throughout the 20-year planning period of 2008 through 2027. The fuel source for the diesel generators is assumed to continue to be No. 2 distillate fuel oil, purchased at market prices in the mainland commercial market, transported in tanker trucks via ferry to Block Island and stored in tanks at the generation site on Ocean Road.

The resource adequacy standard used for this plan of service includes sufficient generating capacity in all years to meet expected summer peak loads, plus a reserve cushion equal to or greater than the sum of the capacity of the single largest generating unit plus one year of forecasted load growth. Under the "Probable" scenario of the load forecast for Block Island (described in Section 3), the existing fleet of diesel generators (described in Section 5.3.1) is expected to provide sufficient capacity to meet the resource adequacy standard until the year 2013. Therefore, this plan of service assumes that a new diesel generating unit is placed in service in 2013. Then, due to continued growth in peak loads under the "Probable" scenario of the load forecast, another new diesel generating unit is assumed to be placed in service in the year 2023.

Submarine Cable – Base Plan of Service

This plan of service assumes that a new primary source of power for Block Island is obtained by installing a submarine cable from the mainland to Block Island and using it to transmit power purchased in the mainland power supply market. The submarine cable and related transmission facilities needed for this plan of service are described in Section 5.3.2.

Once a submarine cable is installed and power begins flowing from the mainland to Block Island, the need to generate power using the existing diesel generators would be eliminated under ordinary circumstances. However, for reliability purposes, it would be prudent to maintain some on-island generation to provide backup protection against unplanned outages of the submarine cable system or related facilities. Therefore, for this plan of service, it was assumed that two of the existing diesel generating units on Block Island would be kept ready for emergency use.

Plans of Service with Wind Power Resources

For the purposes of formulating plans of service with renewable resources, wind power was used as the representative type of renewable resource. This assumption was based on several factors. First, wind power has become the largest commercially available form of renewable resource being installed by the electric utility industry. Second, wind power has relatively low costs compared to other available forms of renewable resources. Third, the wind patterns on and near Block Island are good, making wind power an attractive, locally-available form of renewable resource.

Consequently, in addition to the two base plans of service described above, two more plans of service were created to evaluate whether renewable resources, represented by wind power, might help reduce the overall cost of serving electric loads on Block Island.

One of the plans of service (Diesel Generation – With Wind Power Resources), is based on the diesel generation plan of service. Under this plan of service, electricity generated by the wind power resources is assumed to displace a portion of the generation that would have otherwise been required from the on-island diesel generating units.

The other plan of service (Submarine Cable – With Wind Power Resources) is based on the submarine cable plan of service. Under this plan of service, electricity generated by the wind power resources is assumed to displace a portion of the power that would have otherwise been purchased in the mainland market.

It should be noted that there was no intent to exclude additional types of renewable resources besides wind power from the economic evaluation, or to diminish their potential. When other forms of renewable resources such as solar power or wave power become available at costs that are competitive with wind power or provide other advantages, it is recommended that they be included in future evaluations of resource alternatives for Block Island.

Plans of Service With Wind Power and Conservation Resources

For the purposes of formulating plans of service with demand-side resources, conservation was used as the representative type of demand-side resource. This assumption was based on several factors. First, conservation resources appear to be more compatible with the size and types of electric loads on Block Island. Second, conservation is a form of demand-side resource that may be implemented more quickly and easily than certain other types of demand-side resources such as customer demand response programs. Third, the results of the review of demand-side options (presented in Section 4) indicate strong customer interest in increased development of conservation resources.

Consequently, in addition to the four plans of service described above, two more plans of service were created to evaluate whether a combination of wind power and conservation resources might help reduce the overall cost of serving electric loads on Block Island.

One of the plans of service (Diesel Generation – With Wind Power and Conservation Resources), is based on the diesel generation plan of service. Under this plan of service, the amount of energy savings produced by the conservation resources, along with the amount of electricity generated by the wind power resources, is assumed to displace a portion of the generation that would have otherwise been required from the on-island diesel generating units.

The other plan of service (Submarine Cable – With Wind Power and Conservation Resources) is based on the submarine cable plan of service. Under this plan of service, the amount of energy savings produced by the conservation resources, along with the amount of electricity generated by the wind power resources, is assumed to displace a portion of the power that would have otherwise been purchased in the mainland market.

6.5 Key Assumptions and Forecasts

In order to perform the economic evaluation of the six plans of service described above, it was necessary to develop a number of key assumptions and long-term forecasts. Some assumptions were relevant to all plans of service. In addition, certain assumptions and forecasts applied specifically to plans of service based on diesel generation, while other assumptions and forecasts applied specifically to plans of service based on a submarine cable. Finally, assumptions about wind power and conservation resources were required for plans of service that included those types of resources.

A number of the price forecasts used in the economic evaluation were either taken directly from or based upon the U.S. Department of Energy, Energy Information Administration's 2007 Annual Energy Outlook (www.eia.doe.gov/oiaf/aeo/index.html). Purposes for using forecasts from the 2007 Annual Energy Outlook included consistency, credibility and the ability to contain study costs by using publicly-available forecasts.

<u>Assumptions and Forecasts Used for All Plans of Service</u>

<u>Demand Forecast:</u> The economic evaluations were performed using the projected monthly energy requirements presented in Table 3-6.

<u>Price Inflation Forecast</u>: The general level of annual price inflation used in the economic analysis was based on the long-term forecast of the Gross Domestic Product (GDP) Chain-Type Price Index from the US DOE EIA 2007 Annual Energy Outlook. See Table 6-2.

Table 6-2
Forecast of Gross Domestic Product Chain-Type Price Index

Year	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
GDP Chain-Type Price Index	1.2096	1.2313	1.2529	1.2755	1.2986	1.3212	1.3433	1.3658	1.3899	1.4153
Percent Annual Change	1.83%	1.79%	1.75%	1.81%	1.81%	1.74%	1.68%	1.67%	1.76%	1.83%
Year	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**
GDP Chain-Type Price Index	1.4407	1.4675	1.4946	1.5231	1.5535	1.5839	1.6157	1.6479	1.6797	1.7127
Percent Annual Change	1.79%	1.86%	1.84%	1.91%	1.99%	1.96%	2.01%	1.99%	1.93%	1.96%

<u>Interest Rate and Financing</u>: Capital expenditures were assumed to be financed entirely with long-term bonds at an annual interest rate of 6.00 percent. Investments in submarine cable and related facilities, as well as new diesel units were assumed to be financed using mortgage-style bonds with payment periods of 30 years. Investments in wind power facilities and conservation

measures were assumed to be financed using mortgage-style bonds with payment periods of 20 years.

Real Discount Rate: Net present value costs were calculated using a real discount rate of 3.00 percent. Before applying the real discount rate, costs expressed in nominal dollar amounts were converted to real (constant 2007) dollar amounts using the GDP Chain-Type Price Index.

Assumptions and Forecasts Used for Plans of Service Based on Diesel Generation

Forecast of Mainland Market Prices for No. 2 Distillate Fuel Oil: The long-term forecast of mainland market prices for No. 2 distillate fuel oil was developed in several steps. First, the forecast of annual prices for No. 2 distillate fuel prices for New England was taken from the 2007 Annual Energy Outlook and adjusted upward by $0.15 per MMBtu (in 2005 dollars) to reflect the historical differential between prices in New England and Rhode Island. Then, the annual prices were expanded out to monthly prices, using historical monthly profiles for No. 2 distillate fuel prices in Rhode Island. See Table 6-3.

Table 6-3
Forecast of No. 2 Distillate Fuel Prices
(nominal dollars per MMBtu)

Year	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
January	16.17	15.35	14.80	14.26	13.80	13.37	13.43	13.75	14.17	14.48
February	16.37	15.53	14.98	14.43	13.97	13.53	13.59	13.92	13.43	14.65
March	16.00	15.18	14.64	14.10	13.65	13.22	13.28	13.60	14.02	14.32
April	14.87	14.11	13.60	13.11	12.69	12.29	12.35	12.64	13.03	13.31
May	14.67	13.92	13.42	12.93	12.52	12.13	12.18	12.47	12.85	13.13
June	14.92	14.16	13.65	13.15	12.73	12.33	12.39	12.69	13.07	13.36
July	15.48	14.69	14.16	13.65	13.21	12.79	12.85	13.16	13.56	13.86
August	16.36	15.53	14.97	14.42	13.96	13.52	13.58	13.91	14.33	14.64
September	16.91	16.05	15.47	14.91	14.43	13.98	14.04	14.38	14.82	15.14
October	16.65	15.8	15.23	14.68	14.21	13.76	13.82	14.16	14.59	14.90
November	16.23	15.40	14.85	14.31	13.85	13.41	13.47	13.80	14.22	14.53
December	16.45	15.61	15.05	14.50	14.04	13.60	13.66	13.99	14.41	14.73
Annual	15.92	15.11	14.04	14.04	13.59	13.16	13.22	13.54	13.95	14.25

Year	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
January	14.86	15.48	15.88	16.34	16.97	17.03	17.64	18.23	18.59	19.27
February	15.04	15.66	16.07	16.53	17.18	17.24	17.85	18.45	18.81	19.50
March	14.70	15.31	15.71	16.16	16.79	16.85	17.45	18.03	18.39	19.06
April	13.66	14.23	14.60	15.02	15.61	15.66	16.21	16.76	17.09	17.72
May	13.48	14.04	14.40	14.82	15.40	15.45	16.00	16.53	16.86	17.48
June	13.71	14.28	14.65	15.07	15.66	15.71	16.27	16.81	17.15	17.78
July	14.22	14.81	15.20	15.64	16.25	16.30	16.88	17.44	17.79	18.44
August	15.03	15.65	16.06	16.52	17.17	17.23	17.84	18.44	18.80	19.49
September	15.54	16.18	16.60	17.08	17.75	17.81	18.44	19.06	19.44	20.15
October	15.30	15.93	16.35	16.82	17.47	17.54	18.16	18.76	19.14	19.84
November	14.91	15.53	15.93	16.39	17.03	17.09	17.70	18.29	18.65	19.34
December	15.12	15.75	16.15	16.62	17.27	17.33	17.94	18.54	18.91	19.60
Annual	14.63	15.24	15.63	16.08	16.71	16.77	17.36	17.94	18.30	18.97

Forecast of Expenses to Transport No. 2 Distillate Fuel to Block Island: Expenses to transport No. 2 distillate fuel oil from the mainland to Block Island include costs for a tanker truck with driver, and round-trip ferry. These costs were forecasted to be $1,079 per 10,000 gallons of fuel in 2007 dollars, escalating annually at the GDP Chain-Type Price Index. The $1,079 amount included $500 for the tanker truck and driver, plus $579 for the ferry.

Non-Fuel Generation Expenses: Non-fuel generation expenses for the diesel generation plan of service were based on actual amounts taken from Block Island Power Company's Rural Utilities Service Operating Report for 2006 (RUS Form 12). The expense categories included were Operation, Supervision & Engineering, Generation Expenses, Miscellaneous Other Power Generation Expenses and Maintenance Expense. These amounts totaled $675,854 in 2006. Forecasts of non-fuel generation expenses for the years 2008 through 2027 were developed by escalating the 2006 amount using the GDP Chain-Type Price Index.

Capital Costs for New Diesel Generating Units: Under the diesel generation plan of service, one new generating unit is forecasted to be installed in the year 2013 and another new generating unit is forecasted to be installed in the year 2023. The economic evaluation assumed that the new units would be similar to Block Island Power Company's newest unit (No. 25), which has a capacity of 1,825 kilowatts and was installed in 2006 at a cost of approximately $548,000. The nominal cost to install new generating units in 2013 and 2023 was escalated using the GDP Chain-Type Price index.

Assumptions and Forecasts Used for Plans of Service Based on Submarine Cable

Capital Expenditures for the Submarine Cable and Related Facilities: Capital expenditures for the submarine cable and related facilities were based on the Wood River – Option 1 shown in Table 5-3. The direct amount of capital expenditures was $18.53 million, including $10.75 million for the undersea portion, $3.2 million for the mainland portion, $2.9 million for the island portion and $1.68 million for a 10 percent contingency. The total amount of direct capital expenditures was further increased by $0.89 million, which was assumed to be payable to National Grid for income taxes (27.84% gross up) on Contributions in Aid of Construction. This additional cost is based on the requirement that the mainland portion of the facilities would be transferred to National Grid. As a result, capital expenditures for the submarine cable and related facilities totaled $19.43 million.

Operating Expenses: Operating expenses associated with the submarine cable facilities were assumed to be mainly for annual inspections of the cable landings and transitions. The annual cost for the inspections was assumed to be $50,000 in 2006 dollars, escalating annually at the GDP Chain-Type Price Index.

Mainland Market Prices for Electricity: The submarine cable plan of service would enable power supplies to be purchased at competitive market prices on the mainland and transmitted for use on Block Island. The long-term forecast of power prices used to evaluate this plan of service was developed in two parts – an energy component and a non-energy component.

The energy component of the power price forecast was developed by forecasting monthly 'locational marginal prices' (LMPs) for electricity in the mainland ISO New England market. Several steps were taken to produce the forecast of LMPs. First, a monthly 'market heat rate' was calculated for each of the 12 calendar months, January through December. This calculation was performed by dividing ISO New England LMPs for Rhode Island (in dollars per megawatt-hour[21]) by Rhode Island natural gas prices to electric generators (in dollars per MMBtu), using several years of historical data. Next, the long-term forecast of annual market prices for natural gas for electric generation in New England was taken from the 2007 Annual Energy Outlook and converted into a forecast of monthly natural gas prices for January 2008 through December 2027, using a monthly pattern that was calculated also using historical data. Then the forecast of monthly LMPs (in dollars per MWh) was produced by multiplying the monthly market heat rates (in MMBtu per MWh) times the monthly forecast of natural gas prices (in dollars per MMBtu). The forecast of locational marginal prices for ISO New England, Rhode Island is shown following in Table 6.4.

[21] 'Dollars per megawatt-hour' is the unit of measure typically used in electric resource planning and for transactions in wholesale power markets. An amount of ten dollars per megawatt-hour is equivalent to one cent per kilowatt-hour.

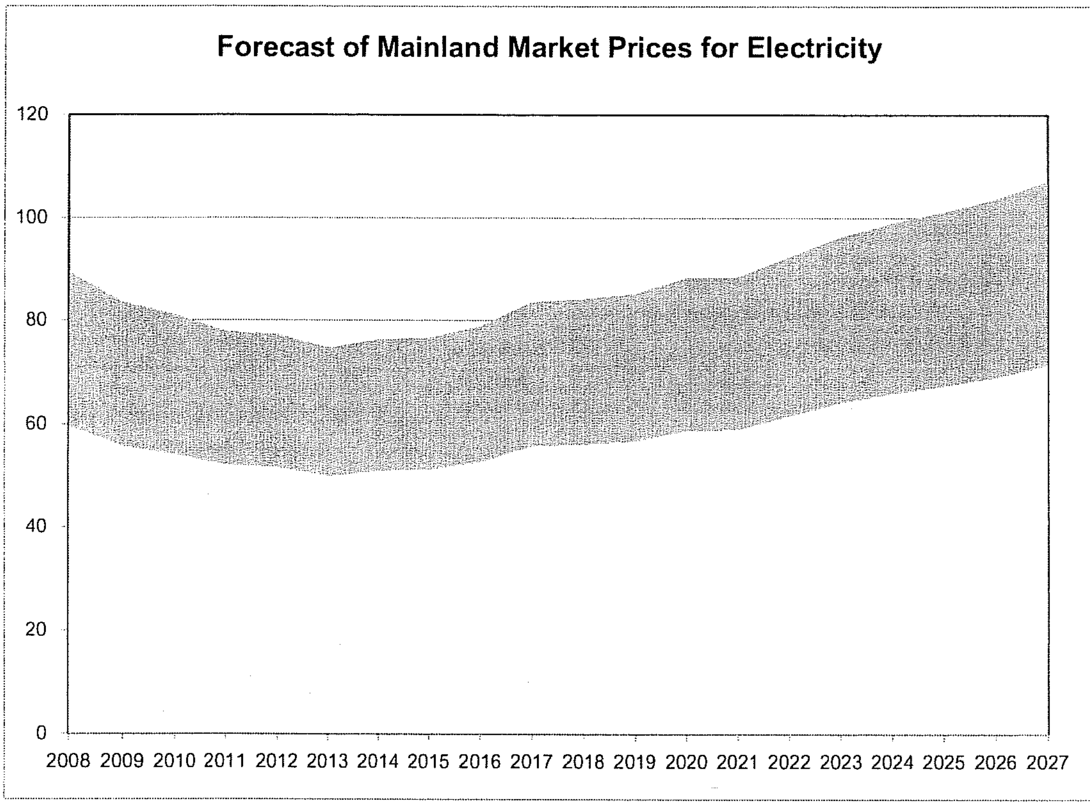
Table 6-4
Forecast of Locational Marginal Prices
ISO New England, Rhode Island
(nominal dollars per Megawatt-Hour)

Year	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
January	$69.74	$65.15	$63.22	$60.69	$60.22	$58.29	$59.53	$59.81	$61.54	$65.20
February	$58.60	$54.75	$53.12	$51.00	$50.60	$49.98	$50.03	$50.26	$51.71	$54.79
March	$56.00	$52.31	$50.76	$48.74	$48.35	$46.80	$47.80	$48.02	$49.42	$52.35
April	$57.74	$53.94	$52.34	$50.25	$49.85	$48.26	$49.29	$49.51	$50.95	$53.98
May	$52.78	$49.30	$47.84	$45.93	$45.57	$44.11	$45.05	$45.26	$46.57	$49.34
June	$54.46	$50.88	$49.37	$47.40	$47.03	$45.52	$46.49	$46.71	$48.06	$50.92
July	$56.52	$52.80	$51.23	$49.19	$48.80	$47.24	$48.25	$48.47	$49.88	$52.84
August	$60.04	$56.09	$54.42	$52.25	$51.84	$50.18	$51.25	$51.49	$52.98	$56.13
September	$55.60	$51.94	$50.40	$48.39	$48.01	$46.47	$47.46	$47.68	$49.06	$51.98
October	$54.80	$60.54	$58.74	$56.40	$55.95	$54.16	$55.32	$55.57	$57.18	$60.58
November	$62.84	$58.70	$56.96	$54.69	54.26	$52.52	$53.64	$53.89	$55.45	$58.74
December	$66.13	$61.77	$59.94	$57.55	$57.10	$55.27	$56.45	$56.71	$58.35	$61.82
Annual	$59.60	$55.68	$54.03	$51.87	$51.47	$49.82	$50.88	$51.12	$52.60	$55.72

Year	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
January	$65.69	$66.40	$68.84	$69.02	$72.05	$75.11	$77.21	$78.88	$80.80	$83.54
February	$55.20	$55.80	$57.85	$58.00	$60.54	$63.12	$64.89	$66.28	$67.90	$70.20
March	$52.75	$53.32	$55.27	$55.42	$57.85	$60.31	$62.00	$63.34	$64.88	$67.08
April	$54.38	$54.97	$56.99	$57.14	$59.65	$62.18	$63.93	$65.30	$66.89	$69.16
May	$49.71	$50.25	$52.09	$52.23	$54.52	$56.84	$58.43	$59.69	$61.14	$63.22
June	$51.30	$51.86	$53.76	$53.90	$56.26	$58.66	$60.30	$61.60	$63.10	$65.24
July	$53.24	$53.82	$55.79	$55.94	$58.39	$60.88	$62.58	$63.93	$65.48	$67.70
August	$56.55	$57.17	$59.26	$59.42	$62.03	$64.67	$66.48	$67.91	$69.56	$71.92
September	$52.37	$52.94	$54.88	$55.03	$57.44	$59.89	$61.56	$62.89	$64.42	$66.60
October	$61.04	$61.70	$63.96	$64.13	$66.95	$69.80	$71.75	$73.30	$75.08	$77.63
November	$59.19	$59.83	$62.02	$62.19	$64.92	$67.68	$69.57	$71.07	$72.80	$75.27
December	$62.59	$62.96	$65.27	$65.44	$68.31	$71.22	$73.21	$74.79	$76.61	$79.21
Annual	$56.14	$56.75	$58.83	$58.99	$61.58	$64.20	$65.99	$67.41	$69.05	$71.40

The non-energy component of the power price forecast was developed by forecasting other price components not included in the forecast of monthly LMPs. The magnitude of the non-energy component was assessed by examining historical relationships between Basic Service Rates in Massachusetts and LMPs. This examination led to a projection that the non-energy component of power prices may represent approximately a 50 percent adder to LMPs. Examples of wholesale power supply costs that may be included in the non-energy component of power prices include distribution system losses, shaping services to fit power supplies to actual retail loads, capacity costs, hedging & risk management costs, transaction costs and profit margins.

Figure 6-1



Mainland Transmission Costs: The forecast of mainland transmission costs included several components. One component was for Regional Network Service, which is provided by ISO New England and whose rate was $26.44501 per kilowatt-year, effective March 1, 2007. Two additional mainland transmission cost components were for Ancillary Service 1 and a Meter Surcharge by National Grid. Rates for these services in effect at the time of the economic evaluation were $0.1179 per kilowatt-month and $111.45 per meter-month, respectively. The final – and largest – component of transmission costs was for Direct Assignment Charges by National Grid. For this component of costs, it was assumed that mainland portion of the submarine cable facilities would be transferred to National Grid and that Direct Assignment Charges would be paid at an annual amount equal to 10 percent of the capital costs for the mainland portion of the facilities. Transmission rates were assumed to increase each year at the GDP Chain-Type Price Index.

On-Island Backup Generation Expenses: The submarine cable plan of service assumed that two of the existing diesel generating units would be maintained in readiness for emergency operation in the event of any unplanned outages on the submarine cable or related facilities. Non-fuel generation expenses were assumed to be 25 percent of the actual amounts taken from Block Island Power Company's Rural Utilities Service Operating Report for 2006 (RUS Form 12). Forecasts of costs for 2008 through 2027 were developed by escalating the 2006 amount using the GDP Chain-Type Price Index. Small annual amounts were also included to reflect the cost of fuel used during periodic test runs of the units.

Assumptions Used for Plans of Service that Included Wind Power

Plans of service that included wind power resources assumed that three wind turbines, each with a generating capacity of 600 kilowatts, would be installed at several locations on the Block Island electrical system in the year 2008. The monthly amount of electric energy production from each of the three wind turbines was assumed to follow the profile presented in the first data column of Table 5-6. Consequently, annual generation was assumed to total 5,436 megawatt-hours per year. Capital expenditures for the wind power resources were assumed to be $2,500 per kilowatt of capacity. As a result, capital expenditures for the 1.8 megawatts of wind power generating capacity were assumed to total $4.5 million. Operating and maintenance costs were assumed to be $15 per megawatt-hour, or $81,546 per year in 2007 dollars, escalating from 2008 through 2027 at the GDP Chain-Type Price Index.

Additional assumptions were made regarding how much of the wind power production could actually be used. Plans of service that included wind power along with on-island diesel generation assumed that to follow variations in system loads and for reliability purposes, it would be necessary to operate the diesel generating units to serve at least 25 percent of each month's electrical loads. (As a result, some generation from the wind power would not be usable to serve on-island load during winter months.) Plans of service that included wind power along with the submarine cable assumed that all of the wind power could be used, either to serve loads on Block Island or, when greater than Block Island loads, sold into the mainland wholesale power market.

Assumptions Used for Plans of Service that Included Conservation

Plans of service that included conservation assumed the development of the achievable amount of conservation resource potential described in Section 4-6. As a result, new conservation resources were added for each year in amounts equal to 60 percent of that year's amount of forecasted load growth. The forecast of costs for conservation resources included two components. The first component represented capital costs for conservation measures. Due to the Block Island electrical system's small size, island location and other characteristics, a capital cost of $3,000 per average kilowatt of conservation energy savings was assumed. (This amount is 150% of the average regional cost to acquire conservation in the Pacific Northwest during 2004.) The second component of costs to acquire conservation resources was an annual expense for conservation program costs such as planning, design and participant assistance. The second component was assumed to be $80,000 per year, escalating at the GDP Chain-Type Price Index from 2008 through 2027.

6.6 Detailed Results of Economic Evaluation

The results of the economic evaluation included forecasts of monthly costs of power from January 2008 through December 2027. The cost of power forecasts included a number of types of costs, as applicable to each plan of service.

Cost Categories for Plans of Service Based on On-Island Diesel Generation

Cost categories that were forecasted for plans of service based on on-island diesel generation included:

- Fuel Expenses (No. 2 Distillate Fuel Oil Purchase Expenses, and Fuel Delivery Expenses)
- Non-Fuel Generation Expenses
- Capital Recovery Costs for New Diesel Generating Units

Cost Categories for Plans of Service Based on Submarine Cable

Cost categories that were forecasted for plans of service based on a submarine cable with mainland power purchases included:

- Submarine Cable Costs (Capital Recovery Costs for Submarine Cable and Related Facilities, and Expenses for Annual Inspections of Submarine Cable)
- Mainland Power Purchase Expenses
- Mainland Transmission Expenses
- On-Island Backup Generation Expenses

Cost Categories for Plans of Service With Wind Power

Cost categories that were forecasted for plans of service with wind power resources included:

- Capital Recovery Costs for Wind Power Resources and Related Facilities
- Operating and Maintenance Expenses for Wind Power Generating Resources

Cost Categories for Plans of Service With Conservation

Cost categories that were forecasted for plans of service with conservation resources included:

- Capital Recovery Costs for Conservation Resources
- Conservation Program Administration Expenses

Cost Results for Base Plans of Service

Figure 6-2 shows annual costs of power for the On-Island Diesel Generation Plan of Service, including each of the cost categories applicable to that plan of service.

Figure 6-2

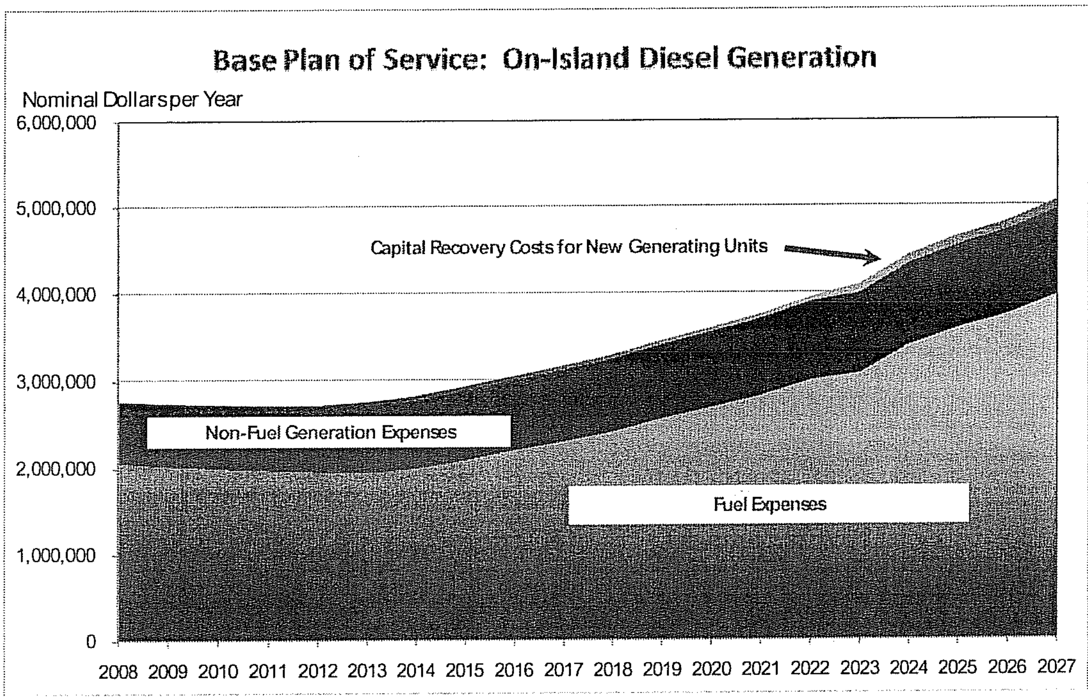


Figure 6-3 shows annual costs of power for the Submarine Cable Plan of Service, including each of the cost categories applicable to that plan of service.

Figure 6-3

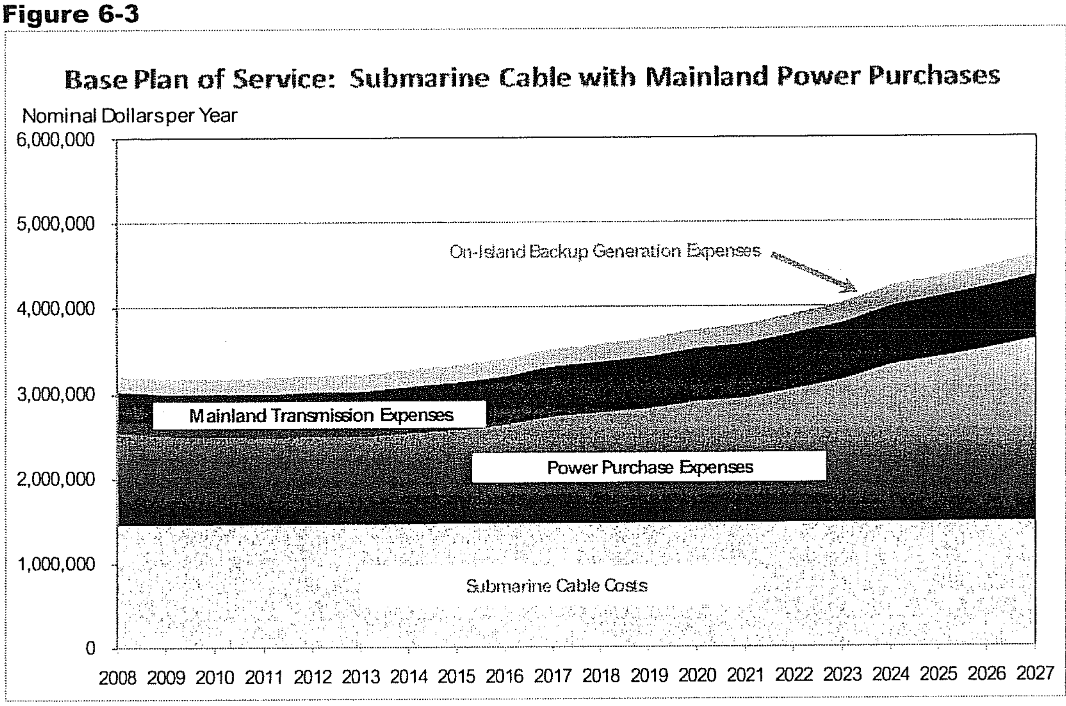
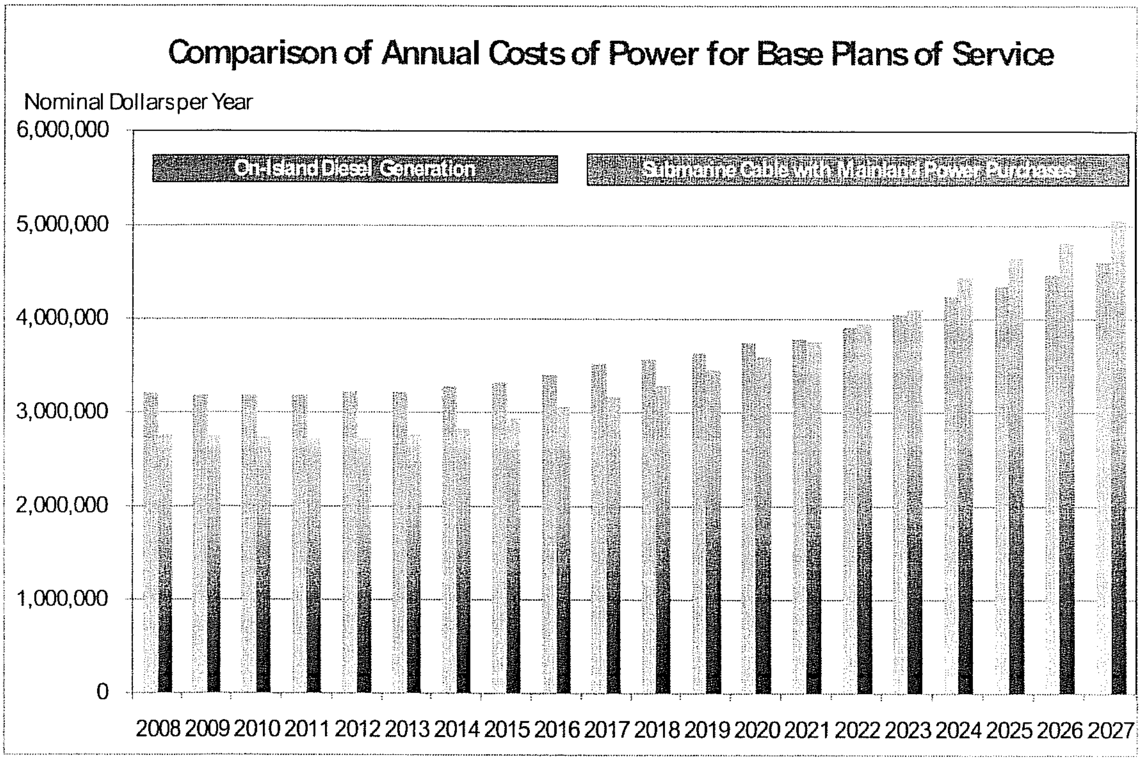


Figure 6-4 provides a comparison of annual costs of power for the two base plans of service.

Figure 6-4



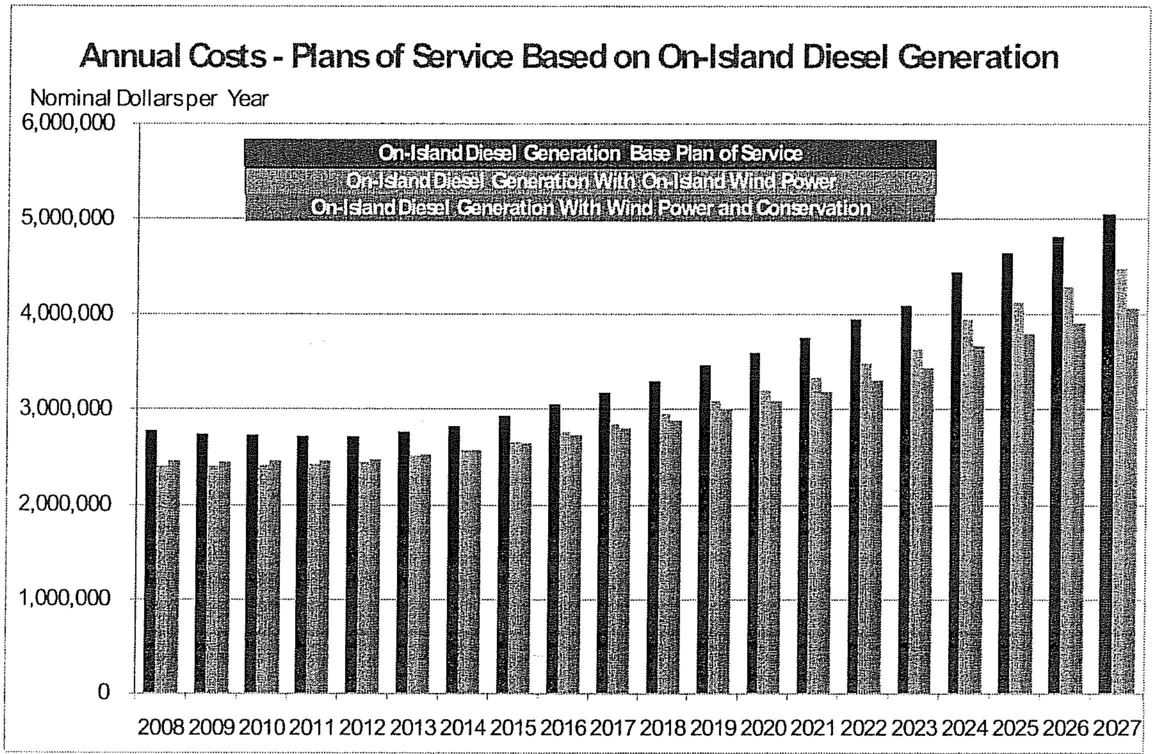
The 20-year NPV cost of power for the On-Island Diesel Generation Base Plan of Service was $41.5 million. The 20-year NPV cost of power for the Submarine Cable with Mainland Power Purchases Base Plan of Service was $44.7 million.

Cost Results for Plans of Service with Wind Power and Conservation Resources

For plans of service based on on-island diesel generation, including wind power and conservation resources caused the 20-year NPV cost of power to decrease by significant amounts. For the On-Island Diesel Generation with Wind Power Plan of Service, the 20-Year NPV cost of power was $37 million or $4.5 million (11 percent) less than the On-Island Diesel Generation Base Plan of Service. For the On-Island Diesel Generation with Wind Power and Conservation Plan of Service, the 20-Year NPV cost of power was $36 million or $5.3 million (13 percent) less than the On-Island Diesel Generation Base Plan of Service.

Figure 6-5 provides a comparison of the annual costs of power for the plans of service based on on-island diesel generation.

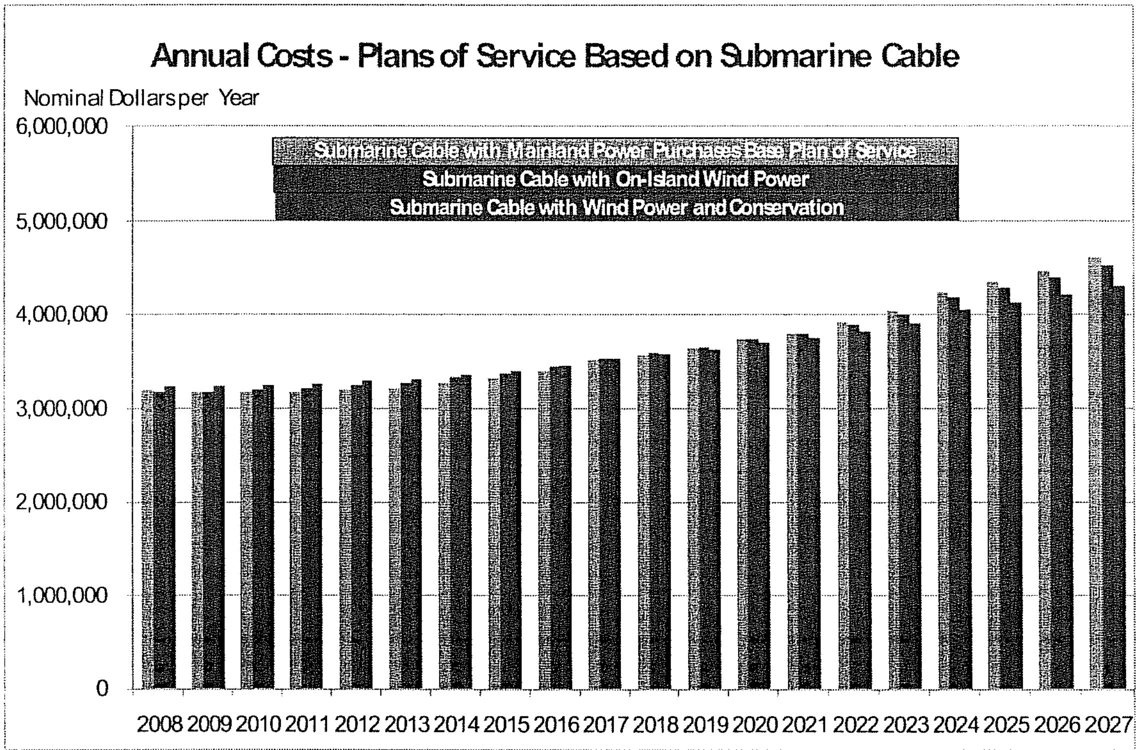
Figure 6-5



For plans of service based on a submarine cable, including wind power and conservation resources did not cause the 20-year NPV cost of power to change by significant amounts. For the Submarine with Wind Power Plan of Service, the 20-Year NPV cost of power was $44.8 million or $0.1 million (0.2 percent) more than the Submarine Cable Base Plan of Service. For the Submarine Cable with Wind Power and Conservation Plan of Service, the 20-Year NPV cost of power was $44.7 million, the same as the Submarine Cable Base Plan of Service.

Figure 6-6 provides a comparison of the annual costs of power for the plans of service based on a submarine cable with mainland power purchases.

Figure 6-6



Comparison of 20-Year NPV Cost of Power Results Across All Plans of Service

The results of the economic evaluation of the six plans of service are summarized in Table 6-5. This table shows that 20-year NPV costs of power are significantly lower for the plans of service that are based on on-island diesel generation than for the plans of service that are based on a submarine cable with mainland power purchases. The table also shows that including wind power and conservation resources helps to lower the 20-year NPV cost of power for plans of service that are based on on-island diesel generation.

Table 6-5

20-Year Net Present Value Cost of Power for Plans of Service Evaluated	Millions of Real 2007 $
Diesel Generation Base Plan of Service	41.50
Submarine Cable Base Plan of Service	44.70
Diesel Generation with Wind and No Conversation	37.00
Submarine Cable with Wind and No Conservation	44.80
Diesel Generation with Wind and Conservation	36.10
Submarine Cable with Wind and Conservation	44.70

Section 7
Development of a Long-Term Resource Strategy for Block Island

7.1 Introduction

This section develops and presents the recommended long-term resource strategy for serving the future needs of retail electricity consumers on Block Island. The section starts by focusing on the two base plans of service, highlighting that continued use of on-island diesel generation has lower expected costs than installation of a submarine cable to deliver power purchases from the mainland market. Then, the impacts of supplementing the base plans of service with wind power and conservation resources are presented and discussed. The section proceeds by identifying which of the six alternative plans of service that were evaluated appears to best meet future needs. Next, recent efforts by the state government to promote development of wind power resources in the waters off Rhode Island are described. Further progress on such efforts could create a path toward an even more attractive strategy for meeting Block Island's future electric resource needs. The section concludes by identifying action steps that are compatible with both the best plan of service evaluated and with the potentially more attractive strategy.

7.2 Diesel Generation is the Lower-Cost Base Plan of Service

Section 6 of this report provides a detailed description of the economic evaluation of the alternative plans of service that were identified for the Block Island Long-Term Electric Resource Planning Study. As discussed in Section 6.2, the evaluation first considered two base plans of service:

- Continued use of on-island diesel generators powered by No. 2 distillate fuel oil purchased in the mainland market and transported by boat to Block Island, or
- Installation of a submarine cable that is then used to transmit power purchased in the wholesale electric supply market from the mainland to Block Island.

The primary benchmark used to compare the economic merits of each plan of service was an estimate of each base plan of service's net present value (NPV) cost of power for the 20-year period 2008 through 2027. Table 7-1 shows the 20-year NPV cost of power for the Diesel Generation Base Plan of Service at 41.5 million dollars, compared to the 20-year NPV cost of power for the Submarine Cable Base Plan of Service at 44.7 million dollars. In other words, over the 20-year planning period, the cost of power for the Diesel Generation Base Plan of Service was estimated to be 7.1 percent lower than the cost of power for the Submarine Cable Base Plan of Service using the given assumptions.

Table 7-1	
20-Year Net Present Value Cost of Power for Base Plans of Service	**Millions of Real 2007 $**
Diesel Generation Base Plan of Service	41.50
Submarine Cable Base Plan of Service	44.70

Therefore, based on the analysis for the Block Island Long-Term Electric Resource Planning Study, the Diesel Generation Base Plan of Service was clearly identified as being lower-cost than the Submarine Cable Base Plan of Service.

It should be noted that these results are dependent on the assumptions and forecasts used in the analysis, including forecasts of market prices for No. 2 distillate fuel oil and mainland market prices for power supplies. If factors such as the level of fuel oil prices relative to mainland market prices for power supplies turn out to be significantly different than expected, the gap between 20-year NPV power costs for the two base plans of service could narrow or potentially reverse. Other factors are the point of interconnection on the mainland as well as any grant money that could potentially effect the cable option.

7.3 Adding Wind Power and Conservation Resources

In addition to each base plan of service, two more plans of service were identified and evaluated as variations that included wind power or wind power and conservation. In other words, three versions of each of the two basic types of plans of service were created and analyzed. This made it possible to examine the impacts of including wind power and conservation resources on power costs for Block Island. It also helped to determine whether wind power and conservation affect power costs differently for the diesel generation and submarine cable plans of service.

Table 7-2 displays the results of the analysis of 20-year NPV power costs for the three plans of service that were based on diesel generation.

Table 7-2	
20-Year Net Present Value Cost of Power for Plans of Service Based on Diesel Generation	**Millions of Real 2007 $**
Diesel Generation Base Plan of Service	41.50
Diesel Generation with Wind and No Conservation	37.00
Diesel Generation with Wind and Conservation	36.10

Table 7-2 shows that modifying the Diesel Generation Base Plan of Service by adding wind power resources reduces the 20-year NPV cost of power from 41.5 million dollars to 37.0 million dollars. Table 7-2 also demonstrates that adding conservation resources (in addition to wind power) further reduces the 20-year NPV cost of power to 36.1 million dollars.

Table 7-3 displays the results of the analysis of 20-year NPV power costs for the three plans of service that were based on a submarine cable.

Table 7-3	
20-Year Net Present Value Cost of Power for Plans of Service Based on Submarine Cable	**Millions of Real 2007 $**
Submarine Cable Base Plan of Service	44.70
Submarine Cable with Wind and No Conservation	44.80
Submarine Cable with Wind and Conservation	44.70

Table 7-3 shows that modifying the Submarine Cable Base Plan of Service by adding wind power resources does not significantly change the 20-year NPV cost of power. Table 7-3 also demonstrates that adding conservation resources (in addition to wind power) does not significantly change 20-year NPV cost of power.

One of the more important conclusions that can be drawn from the economic evaluation is that adding wind power and conservation resources to the two different base plans of service creates significantly different impacts on the 20-year NPV cost of power. Adding wind power and conservation resources significantly lowers the 20-year NPV cost of power for the diesel generation plan of service, but does not materially change the 20-year NPV cost of power for the submarine cable plan of service.

The primary reason for the differing impacts is that the two base plans of service have different proportions of variable and fixed costs.

For the Diesel Generation Base Plan of Service, the majority of costs are purchase expenses for No. 2 distillate fuel oil. Adding wind power and conservation resources to this plan of service reduces the need to run the diesel generators, thereby avoiding a commensurate amount of variable costs for No. 2 distillate fuel oil.

In contrast, for the Submarine Cable Base Plan of Service, costs are divided more equally between fixed costs (e.g., for the submarine cable and associated facilities) and variable costs (e.g., for power purchases in the mainland market). Thus, adding wind power and conservation resources to this plan does not avoid the fixed costs, just a smaller proportion of variable costs.

It is also important to note that including wind power and conservation resources offers significant environmental benefits for either base plan of service. These additional benefits are provided by the reduction in air emissions that result from the reduction in need to use fossil-fueled generation to serve electricity demands on Block Island. While not explicitly quantified as part of this analysis, the magnitude of the net reduction in air emissions is likely larger for the diesel generation plan of service.

7.4 Diesel Generation with Wind Power and Conservation is the Best Plan of Service Evaluated

Among the six plans of service that were evaluated in depth for the Block Island Long-Term Electric Resource Planning Study, the Diesel Generation with Wind Power and Conservation Plan of Service emerged as the best alternative. The primary basis for this conclusion was the economic evaluation, which showed that the 20-year NPV cost of power for the Diesel Generation with Wind Power and Conservation Plan of Service was the lowest, at 36.1 million dollars. This amount was 12.9 percent lower than the 20-year NPV cost of power for the Diesel Generation Base Plan of Service, which did not include wind power or conservation resources. The 20-year NPV cost of power for the Diesel Generation with Wind Power and Conservation Plan of Service was also 19.1 percent to 19.3 percent lower than the 20-year NPV cost of power for the three plans of service based on a submarine cable.

In addition to the results of the economic evaluation of the alternative plans of service, other factors appear to favor the Diesel Generation with Wind Power and Conservation Plan of Service.

For example, the costs associated with installing and relying on a submarine cable are proportionally large, both relative to the amount of electrical loads on Block Island, and for a utility the size of Block Island Power Company. If Block Island were located closer to the mainland, the cost of the submarine cable would not be as high and would not represent such a proportionally large commitment. Or, if the amount of electrical load on Block Island was significantly larger, it would be possible to spread the cost of a submarine cable across a larger quantity of sales, reducing the unit cost of power to consumers.

Also, including wind power and conservation resources can provide additional benefits that improve upon the Diesel Generation Base Plan of Service. These benefits include the reduction in overall risks that can be achieved by diversifying the number and types of resources used to serve electricity consumers on Block Island. The benefits also include the reduction in environmental impacts that can result from using clean energy sources (i.e., wind power and conservation) to displace a portion of the diesel generation that would otherwise be needed.

7.5 An Even Better Strategy May Become Possible

As noted above, six plans of service were identified and subjected to economic evaluation for the Block Island Long-Term Electric Resource Planning Study. However, as the study process was nearing completion, important new developments were taking place that may create opportunities to pursue an even more attractive resource strategy for Block Island.

<u>**Grants of Other Considerations for Submarine Cable Options**</u>

An avenue which should be explored is grants or other sources of funding to help offset the costs associated with installation of a submarine cable. Examples would be a grant from Rural Utilities Services (RUS) or possibly Federal or State agencies. Additionally, possible revenue generated from the leasing of fiber optic cables within the submarine cable should be explored to help offset the costs.

Wind Power Siting Study and Proposed Power Authority

On April 18, 2007, Governor Donald L. Carcieri unveiled a wind power siting study that concluded Rhode Island has nearly 100 square miles of area where development of wind power would be technically and economically feasible. Much of that area is located in waters off the Rhode Island coastline, including a number of potential sites near and on Block Island.

The 132-page study (www.energy.ri.gov/documents/independence1/RIWINDSReport.pdf), prepared by Applied Technology and Management, Inc., indicated that development of wind power would require installation of submarine cable facilities to transmit power from the offshore wind power generating sites to the mainland.

Following issuance of the study results, Governor Carcieri announced the formation of a community stakeholder group to address where the wind power generating facilities should be located.

The wind power siting study also favorably addressed the formation of a Rhode Island power authority to advance the wind power initiative. Governor Carcieri subsequently submitted a bill to the Rhode Island General Assembly to create the power authority. However, on June 22, 2007, the Rhode Island House Environment and Natural Resources committee decline to approve the proposed legislation. The proposed bill would have created a quasi-public agency and granted it the authority to issue bonds to finance wind power and other renewable energy projects.

Implications for Meeting Block Island's Future Electric Resource Needs

Although legislation to create the Rhode Island Power Authority was not passed in the most recent session, the prospects for development of offshore wind power projects in Rhode Island appear strong. It is possible that legislation to form a power authority could be approved in an upcoming legislative session. Alternatively, commercial entities may be allowed to pursue development of wind power projects at sites identified in the study. Under either approach, it is likely that large-scale wind power projects would be proposed for development in areas near Block Island, perhaps within the next couple of years.

It is also evident that development of wind power projects near Block Island would require installation of submarine cable facilities to integrate generation from the individual wind power project sites and transmit the power to the mainland. In turn, this would create a potential opportunity to also use the submarine cable facilities to deliver power to serve the electrical needs of Block Island. In other words, if significant wind power development occurs in the waters near Block Island, it may be possible to design and develop the submarine cable facilities to transmit electricity from the wind power projects to the mainland, while also delivering power supplies to serve Block Island.

Assuming that the technical aspects of this approach can be verified, it may offer a lower-cost strategy than any of the plans of service that were identified and evaluated for the Block Island Long-Term Resource Planning Study. It appears possible that significant savings could be achieved through joint development and shared use of the submarine cable facilities. More specifically, joint use of such facilities could substantially reduce the amount of fixed costs that Block Island would need to pay for the submarine cable.

In short, recent activities involving the Rhode Island state government appear to be moving toward the creation of new possibilities to pursue an even more attractive resource strategy to meet the future electricity needs of Block Island.

7.6 Action Steps

In addition to developing a preferred long-term resource strategy, a productive long-term electric resource planning process identifies action steps to be taken during the next several years to begin implementing the strategy. Quite often, the action steps involve several types of activity, such as beginning the process to acquire certain types of resources, while conducting further evaluation of other types of resources.

At this point in time, the Rhode Island government has not yet reached decisions about an extensive offshore wind power program. It is also not clear whether such a program will be set up in a way that makes the potentially more attractive resource strategy described in Section 7.5 possible, or if Block Island will need to adopt the strategy identified in Section 7.4 as a fallback. Therefore, it is recommended that Block Island take actions in parallel that are directed toward the following objectives:

- Proceed with preparations to develop wind power and conservation resources on Block Island. Also monitor and evaluate other forms of renewable resources.
- Position Block Island to beneficially participate (including joint use of submarine cable facilities) if and when state-authorized development of wind power resources in the coastal waters of Rhode Island becomes a reality.

Specific steps that are compatible with this parallel path approach include the following actions.

<u>Prepare to Develop Wind Power to Serve Block Island Loads</u>

- Conduct engineering feasibility studies on technical issues related to developing and using large wind power generating facilities to meet a substantial portion of Block Island's electric resource needs. Identify the number, size and location of wind turbine generators that could be developed and used in combination with diesel generating units to safely, reliably and cost-effectively serve customer loads on Block Island.
- Evaluate and identify several promising sites to develop utility-scale wind turbine facilities on or near Block Island. Criteria for the evaluations should include site-specific wind generating potential, compatibility with the Block Island Power Company electrical system and acceptability to the local community.

- Use results from the engineering and siting studies to prepare an updated and more detailed economic assessment of using wind power and diesel generation resources to serve consumer electricity loads on Block Island.

Acquire Conservation Resources

- Determine whether Block Island Power Company, or perhaps another organization, can take on lead responsibility and authority to establish and operate an energy conservation resources program for Block Island.
- In concert with determination of a lead organization for the conservation resources program, identify specific functions to be performed and source(s) of funding to conduct the program.
- Investigate funding mechanisms and if available, hire a dedicated staff person to operate the conservation program. Functions for the staff person should include design and implementation of activities to acquire specific conservation resource measures, as well as providing public information and advising customers on energy conservation opportunities.

Monitor Other Types of Renewable Resources

- Monitor developments and opportunities related to other forms of renewable resources, including solar power and wave power.
- If breakthroughs occur that improve the viability of other types of renewable resources, evaluate the technical feasibility and cost-effectiveness of using them to help meet resource needs on Block Island.

Promote Favorable Outcomes for Rhode Island Wind Initiative

- Gain familiarity with governmental and other processes that may lead to a state-authorized program to develop wind power resources in the coastal waters of Rhode Island. Become an active participant and influential stakeholder in the processes. Identify and take steps to promote the interests of the Block Island community.
- Conduct or participate in engineering and economic studies to evaluate the feasibility of developing submarine cable facilities to both transmit power from offshore wind power resources to the mainland and to serve consumer electricity loads on Block Island (including use during periods when winds are low and power would need to flow from the mainland to Block Island).
- Work to create opportunities for Block Island to benefit from joint use of a submarine cable to the mainland, as a condition for supporting the development (by the state government or by other parties) of wind power resources in the waters near Block Island.
- Explore grant possibilities for the submarine cable option.

TECHNICAL APPENDICES

Customer Interview/Survey

Customer Interview List

√	Last	First	Business
√	Balser	Mary Jane	Grocery Store Owner
√	Brady-Brown	Jennifer	Land Use Administrative Officer
√	Casazza	Al	BIPCo Owner
√	Cole	Nancy	Block Island School
√	Comings	Margie	Planning Commission
√	Dodge	Nancy	Town Manager
√	Gaffett	Kim	Resident
√	Gilpen	Doug	Cottager
√	Glen	Pam	Resident
√	Lang	Bette and Fraser	Block Island Times
√	Leeder	Fred	Postman
√	Littlefield	Chris	Nature Conservancy
√	Littlefield	Verna	Wind Generating Customer
√	Marcoux	Chick	Resident
√	Marthens	Brad & Rita	Atlantic Inn, one restaurant
√	McClurkey	Dorothy	Resident
√	Milner	David	BIPCO Manager
√	Oppenheimer	Michael	Cottager
√	Peters	Dave	Cottager
√	Powers	Linda	Resident
√	Roldan	Frank	Resident
√	Scialabba	Steve	PUC
√	Shorey	Everett	Town Rep
√	Simmons	Dave (Gravy)	Water
√	Smith	Bob	Town Council
√	Tillson	Marc	Town Building Official
√	Wagner	Mike	Retiring BIPCO Manager
√	Warfel	Chris	Resident
	Brown	Tom	Airport Manager
	Bushea	Renee	sewer utility
	DiBiase	Frank	Spring House
	Draper	Steve	Manisees, 1661, two restaurants
	Filippi	Paul	Ballards Inn
	Finnimore	Mike	Developer
	Fuller	Julie	National Hotel
	Leone		Aldo's
	McGinnis	Cliff	BIPCo Owner
	Migliacco	Rally	Boat Basin
	Payne	Cliff	Payne's Dock
	Pike	Norris	Local Builder
	Savoie	Jack	First Warden, Contractor
	Sisto	Johno	Second Warden
	Tretheway	Rich	Sharky's
	Willie	Chris	Harbor Master

Interview Questions

Residential Questions

What would you like to see come of this study? Do you live on the island full-time? What is your average winter electricity bill? What is your average summer electricity bill? If you rent your home, how price sensitive are your customers? Describe the islands growth over the past 10 years - impact on electrical use What do you think the island's growth potential is over the next 10 years? Describe the appliances used in your home Do you have plans to update or add additional appliances? Can you think of areas where you could conserve energy? How willing are you to make significant changes in your life to conserve energy? What kinds of incentives would encourage you to make those changes? Who are the people we need to talk to gather data for this study? Who would be a good champion on the island to lead an energy efficiency program?

Commercial Questions

What would you like to see come of this study?
What is your average winter electricity bill?
What is your average summer electricity bill?
How do you pass those costs on to the customer?
How price sensitive are your customers?
Describe your growth over the past 10 years - impact on electrical use
What do you think the growth potential is over the next 10 years?
Describe the appliances used in your business
Do you have plans to update or add additional appliances?
Can you think of areas where you could conserve energy?
How willing are you to make significant changes in your life and business to conserve energy?
What kinds of incentives would encourage you to make those changes?
Who are the people we need to talk to gather data for this study?
Who would be a good champion on the island to lead an energy efficiency program?

Survey Results

Our thanks to you for completing the Block Island Energy Survey! We had a 34% response rate which gives us a real indication of what is happening on the island.

The survey revealed that there is a strong culture of energy conservation on the island. 41% of home owners have chosen to invest in Energy Star refrigerators. Of the small percentage of owners who use window air conditioners, 59% chose Energy Star. Most respondents reported a conscience effort to turn off and even unplug appliances when not in use and almost 50% of residences have some presence of fluorescent light.

With regard to an interest in formal conservation programs, the most popular was an Energy Star appliance program, followed by use of solar panels.

Many respondents requested more information about the Energy Star designation. With the right amount of planning and appropriate funding mechanisms, the programs outlined below (taken from the Energy Star website: www.energystar.gov) can be included in an energy conservation program for Block Island.

ENERGY STAR is a joint program of the U.S. Environmental Protection Agency and the U.S. Department of Energy helping us all save money and protect the environment through energy efficient products and practices.

For the Home
Energy efficient choices can save families about a third on their energy bill with similar savings of greenhouse gas emissions, without sacrificing features, style or comfort. ENERGY STAR helps you make the energy efficient choice.

- If you are looking for new household products, look for ones that have earned the ENERGY STAR. They meet strict energy efficiency guidelines set by the EPA and US Department of Energy.
- If you are looking to make larger improvements to your home, EPA offers tools and resources to help you plan and undertake projects to reduce your energy bills and improve home comfort.

For Business
EPA's ENERGY STAR partnership offers a proven energy management strategy that helps in measuring current energy performance, setting goals, tracking savings, and rewarding improvements.

1) **Number of Total Respondents: 443**

2) **Major Appliances for Residential Users**

	Major Appliance	Currently Energy Star	Plan to Replace in Next 5 Years	Replace With Energy Star
Electric Stove	21.2% (94)	23.4% (22)	5.0% (22)	86.4% (19)
Electric Oven	24.2% (107)	24.3% (26)	4.5% (20)	85.0% (17)
Refrigerator	96.8% (429)	41.5% (178)	20.1% (89)	93.3% (83)
Humidifier	16.3% (72)	39.2% (21)	2.3% (10)	70.0% (7)
Electric Furnace	9.9% (44)	22.7% (10)	0.5% (2)	100.0% (2)
Window Air	9.9% (44)	59.1% (26)	2.7% (12)	91.7% (11)
Central Air	3.8% (17)	35.3% (6)	0.7% (3)	66.7% (2)
Dishwasher	74.0% (328)	36.3% (119)	12.6% (56)	82.1% (46)
Clothes Washer	87.6% (388)	32.5% (126)	13.1% (58)	77.6% (45)
Clothes Dryer	59.6% (264)	31.4% (83)	8.4% (37)	81.1% (30)
Gas Furnace	17.4% (77)	15.6% (12)	1.8% (8)	75.0% (6)
Other [please specify]	15.8% (70)			
TOTAL	***1,934***	***32.5% (629)***	***319***	***84.6% (270)***

3) **Planned installation in the next 5 years (Residential):**
Central Air: 1.8% (8) Window Air / Energy Star: 5.6% (25) / 76.0% (19)

4) **Number of major expansions/renovations planned:** 7.9% (35)
(Detailed explanation attached)

5). **Number of clients who generate energy with an alternative source of power:**
0.2% (1) Diesel generation 4.8% (21) Solar panels 0.7% (3) Wind turbine
__ Other Emer. Generator (2), improve. insulation(4), effic. windows (4), solar panels for hot water only (3), Propane (1)

6) **Plan to generate energy with an alternative source of power in the next five years:**
0.2% (1) Diesel generation 12.4% (49) Solar panels 2.5% (11) Wind turbine
__ Other PU for heat, Geothermal, Replacing incandescent lights with fluorescent where available,

7) **A. Number of lights in household:** 309 houses have a total of 1556 light bulbs
B. Number of fluorescent bulbs: 209 houses have a total of 728 fluorescent bulbs; 18 houses have all fluorescent bulbs
C. Do you turn off lights, appliances, TVs, stereos, computers when not in use? Y – 93.2% (413), N – 6.7% (30)
D. Do you employ power strips as a way of disconnecting multiple appliances or avoiding constant draw when not in use?
Y – 30.7% (136), N – 69.3.8% (307)
E. Do you unplug electric space heater when not in use? Y – 89.2% (395), N – 10.8% (48)
F. Do you wash clothing in cold water? Y – 57.6% (255), N – 42.4% (188)
G. Unplug chargers, laptops, & all other appliances with a constant 'draw' when not in use? Y–64.3% (285), N–35.7% (158)
H. On elec. dryer: clean filter, clean and straighten exhaust hose/duct and vent outside? Y – 72.9% (323), N – 27.1% (120)
I. Have you had a home energy audit in the past 5 years? Y – 4.3% (19), N – 95.7% (424)

8) **Interest in the following conservation programs:**
32.3% (143) Energy Star Appliances 12.6% (56) Improved insulation 21.7% (96) Solar Water Heaters
10.8% (48) Wind Turbines 28.7% (127) Solar Panels 17.6% (78) Home Energy Audits 13.5% (60) Efficient Windows
Other Hydrogen Power, Propane operated aux. generator, Wind turbines on scholls offshore, Use of buoys on ocean as energy source, Tankless hot water heater, Radiant Solar Heating, Off peak-load shifting, Source for reasonably priced fluorescent bulbs, Lighting, Refrigeration, How to stop leaks and cracks in the house w/o tearing it down and rebuilding

**The survey results presented in this table have been condensed for distribution. A full list of comments will be available in the final report.*

Rhode Island Energy Efficiency Programs

RHODE ISLAND

Program Administrator and Web Site			Program Description
Rhode Island Statewide Overview	Rhode Island passed and enacted restructuring of its electric utility industry in 1997. Retail choice became available to all customers in January 1998. Rhode Island's restructuring law set a minimum floor for systems benefits funding for efficiency, renewables and related public purpose energy programs. The Public Utility Commission has oversight of the programs. Utilities must submit their plans to the PUC for approval. The programs themselves are administered through utility-based collaboratives and use several allocation methods, including an RFP process, to select contractors. Low-income programs were unaffected by restructuring and continue to be operated and funded as they were before restructuring--a combination of state, federal and community-based programs.		
Narragansett Electric http://www.narragansett.com	Program	Lighting Conservation	This program provides customers with the opportunity to purchase energy-efficient bulbs at a discount price.
	Program Web Site	http://www.narragansett.com/cust/res/conserv/eeprgrms/index.htm	
	Program Code	PC103	
	Sector Level 1	Residential	
	Sector Level 2	General	
	Approach	Rebate (discounted purchase price)	
	Enduse Code	EU10	
	Enduse	Lighting	
	Annual Funding		
	Duration		
	Contact	800-473-9150	

Program Administrator and Web Site			Program Description
Narragansett Electric http://www.narragansett.com	Program	Residential Lighting - Starlights	Customers can receive instant rebates on ENERGY STAR® light bulbs and fixtures from participating retailers. A mail order catalog also is available to residential customers. Costs are subsidized by NE to provide these products at significant discounts.
	Program Web Site	http://www.narragansett.com/cust/res/conserv/eeprgrms/index.htm	
	Program Code	PC103	
	Sector Level 1	Residential	
	Sector Level 2	General	
	Approach	Rebate	
	Enduse Code	EU10	
	Enduse	Lighting	
	Annual Funding		
	Duration		
	Contact	800-473-9150	
	Program	ENERGY STAR® Homes	The program provides a variety of incentives and technical support to help customers build their new homes in conformance with ENERGY STAR® criteria.
	Program Web Site	http://www.narragansett.com/cust/res/conserv/eeprgrms/index.htm	
	Program Code	PC106	
	Sector Level 1	Residential	
	Sector Level 2	General	
	Approach	New Construction	
	Enduse Code	EU19	
	Enduse	Whole house	
	Annual Funding		
	Duration		
	Contact	800-628-8413	

Source: American Council for an Energy Efficiency Economy

Program Administrator and Web Site			Program Description
Narragansett Electric http://www.narragansett.com	**Program**	Tumblewash Energy-Efficiency Program	Tumblewash is a program sponsored by several participating electric and gas utilities. Its goal is to encourage consumers to purchase energy efficient tumble-action clothes washers by offering rebates towards their purchase.
	Program Web Site	http://www.betterwaytosave.com/	
	Program Code	PC103	
	Sector Level 1	Residential	
	Sector Level 2	General	
	Approach	Rebate	
	Enduse Code	EU15	
	Enduse	Clothes washing	
	Annual Funding		
	Duration		
	Contact		
	Program	Energy Wise	The program offers the installation of insulation and efficient lighting in electrically heated houses and apartments. Services are also available to multifamily units without electric heat.
	Program Web Site	http://www.narragansett.com/cust/res/conserv/eeprgrms/index.htm	
	Program Code	PC101, PC102, PC 121, PC122	
	Sector Level 1	Residential	
	Sector Level 2	General, Multifamily	
	Approach	Direct install, Weatherization	
	Enduse Code	EU10, EU12	
	Enduse	Lighting, Heating	
	Annual Funding		
	Duration		
	Contact	RISE Engineering 888-633-7947	

Program Administrator and Web Site			Program Description
Narragansett Electric http://www.narragansett.com	**Program**	Appliance Management Program	Special services are available to low income customers to help lower electric bills.
	Program Web Site	http://www.narragansett.com/cust/res/conserv/eeprgrms/index.htm	
	Program Code	NA	
	Sector Level 1	Residential	
	Sector Level 2	Low-income	
	Approach	NA	
	Enduse Code	NA	
	Enduse	NA	
	Annual Funding		
	Duration		
	Contact	800-264-9900	
	Program	Design 2000plus	Program offers design assistance, financial incentives and equipment consultations to facilitate energy-efficient design in new commercial construction, remodeling and renovation projects.
	Program Web Site	http://www.narragansett.com/cust/bus/programs/programs/d2000/index.htm	
	Program Code	PC206	
	Sector Level 1	Commercial	
	Sector Level 2	General	
	Approach	New Construction	
	Enduse Code	EU20, EU21, EU25, EU28	
	Enduse	Lighting, HVAC, Motor-ASDs, Whole Building	
	Annual Funding		
	Duration		
	Contact	800-322-3223	

Program Administrator and Web Site			Program Description
Narragansett Electric http://www.narragansett.com	Program	Energy Initiative	The program offers business customers rebates, technical consulting and commissioning to encourage replacement of equipment with energy-efficient alternatives and to ensure proper installation of operation of the new equipment.
	Program Web Site	http://www.narragansett.com/cust/bus/programs/programs/ei/index.htm	
	Program Code	PC203, PC200	
	Sector Level 1	Commercial	
	Sector Level 2	General	
	Approach	Audit (technical assistance), Rebate	
	Enduse Code	EU20, EU21, EU25, EU29	
	Enduse	Lighting, HVAC, Motor-ASDs, Comprehensive	
	Annual Funding		
	Duration		
	Contact	800-322-3223	
	Program	Energy Audit	On-line energy auditing and performance tracking by energyguide™ software.
	Program Web Site	http://www.energyguide.com/energysmartsbe/SBEMasterFrame.asp?bid=nees&target=narragansett	
	Program Code	PC200	
	Sector Level 1	Commercial	
	Sector Level 2	General	
	Approach	Audit	
	Enduse Code	EU28	
	Enduse	Whole Building	
	Annual Funding		
	Duration		
	Contact	800-322-3223	

Program Administrator and Web Site			Program Description
Narragansett Electric http://www.narragansett.com	Program	Small C/I Programs	This program is designed for smaller businesses that use less than 100kW of electricity. The program features energy-efficient lighting and low-cost refrigeration measures along with other electrotechnologies that save energy and money.
	Program Web Site	http://www.narragansett.com/cust/bus/programs/programs/scip/index.htm	
	Program Code		
	Sector Level 1	Commercial	
	Sector Level 2	General	
	Approach		
	Enduse Code	EU20, EU24	
	Enduse	Lighting, Refrigeration	
	Annual Funding		
	Duration		
	Contact	800-322-3223	

Example Energy Efficiency Programs

Sample Energy Efficiency Programs

The Home Energy Saver[22]

The Home Energy Saver is designed to help consumers identify the best ways to save energy in their homes, and find the resources to make the savings happen. The Home Energy Saver was the first Internet-based tool for calculating energy use in residential buildings. The project is sponsored by the U.S. Department of Energy (DOE), as part of the national ENERGYSTAR™ Program for improving energy efficiency in homes, with previous support from the U.S. Environmental Protection Agency (EPA), the US Department of Housing and Urban Development's PATH program, and the California Energy Commission's Public Interest Energy Research (PIER) program.

The Home Energy Saver quickly computes a home's energy use on-line based on methods developed at Lawrence Berkeley National Laboratory. Users can estimate how much energy and money can be saved and how much emissions can be reduced by implementing energy-efficiency improvements. All end uses (heating, cooling, major appliances, lighting, and miscellaneous uses) are included.

The Home Energy Saver's Energy Advisor calculates energy use and savings opportunities, based on a detailed description of the home provided by the user. Users can begin the process by simply entering their zip code, and in turn receive instant initial estimates. By providing more information about the home the user will receive increasingly customized results along with energy-saving upgrade recommendations.

- Users can choose from 239 weather locations around the United States. DOE-2 performs a very sophisticated series of calculations, but the web-based user interface is relatively simple and results are distilled into a useful form.
- Default energy prices for each fuel and state are also available, or users can enter a specific price of their choosing.
- Users can see how household size, age of occupants, equipment efficiencies, and water inlet temperatures affect bottom-line energy costs.
- By simply entering the number and approximate age of their major appliances, users can estimate their energy consumption, based on historic sales-weighted efficiency data.

The results pages provide a list of recommendations--ranked by payback time--tailored to the particular home being evaluated. The user can vary the energy efficiency assumptions in many cases, as well as the retrofit costs and then recalculate the table. The results can be viewed on line, and via a detailed printable report which includes retrofit description and other details as well as links to additional information.

[22] http://hes.lbl.gov/

Kaua'I Island Utility Cooperative - Solar Water Heating Incentive Program[23]

Lihue, Kauai, HI - 3/6/06 - KIUC is announcing a new solar water heating incentive program. KIUC is partnering with Kauai Community Federal Credit Union (KCFCU) and Kauai County Housing Agency (KCHA) to provide qualifying members with no interest loans for solar water heating.

KCHA, through funding from the Community Development Block Grant Program and KCFCU, will provide the funding for the loans. KIUC will market the program and verify that systems will meet Energy Wise program standards for sizing and installation. Participants will pay the loan back to the lender with 60 monthly payments. KIUC will pay the interest on the loan directly to the lender for the member/participant. The loan payment will be made to the lender who issues the loan. Loan payments cannot be paid to KIUC through the electric bill or at the KIUC office.

"This is a true partnership," said Dutch Achenbach, KIUC President & CEO. "KIUC was exploring various program designs with the end result being a zero-interest loan program for KIUC members. A number of financing scenarios were considered. Both KCFCU and KCHA have years of financing experience and are better equipped to navigate the complex state and federal requirements that exist for the banking industry. Each partner is leveraging their strengths for the betterment of the community. It seems like a perfect match."

Electric water heating can account for 40 to 50 percent of the average residential electric bill. KIUC will continue to offer solar rebates, as well as the loan program. Members will have a choice of which incentive best suits their needs. The state of Hawaii offers tax credits for solar water heating. Starting in January 2006, the federal government is also offering tax credits.

Between KIUC solar incentives and government tax credits, it seems to be a pivotal time to seriously consider installing solar water heating, especially with world oil prices at historical highs.

[23] http://www.kiuc.coop/pdf/releases/pr030606-solar_loan.pdf

Renewable Energy and Efficiency Incentives

Federal Incentives for Renewables and Efficiency[24]

Incentive Programs

Corporate Deduction	Energy Efficient Commercial Buildings Tax Deduction
Corporate Depreciation	Modified Accelerated Cost-Recovery System (MACRS)
Corporate Exemption	Residential Energy Conservation Subsidy Exclusion (Corporate)
Corporate Tax Credit	Business Energy Tax Credit
	Energy Efficient Appliance Tax Credit for Manufacturers
	New Energy-Efficient Home Tax Credit for Builders
	Renewable Electricity Production Tax Credit
Federal Grant Program	Tribal Energy Program Grant
	USDA Renewable Energy Systems and Energy Efficiency Improvements Program
Federal Loan Program	Energy Efficient Mortgage
	Veterans Housing Guaranteed and Insured Loans
Personal Exemption	Residential Energy Conservation Subsidy Exclusion (Personal)
Personal Tax Credit	Residential Energy Efficiency Tax Credit
	Residential Solar and Fuel Cell Tax Credit
Production Incentive	Renewable Energy Production Incentive (REPI)
Alternative Fuel and Vehicle Incentives	U.S. Department of Energy's Alternative Fuels Data Center

Rules, Regulations & Policies

Appliance/Equipment Efficiency Standards	Federal Appliance Standards
Energy Standards for Public Buildings	Energy Goals and Standards for Federal Buildings
Green Power Purchasing/Aggregation	Federal Government - Green Power Purchasing Goal
Alternative Fuel and Vehicle Policies	U.S. Department of Energy's Alternative Fuels Data Center

[24] http://www.dsireusa.org/library/includes/genericfederal.cfm?CurrentPageID=1&state=us&ee=1&re=1

Rhode Island Incentives for Renewables and Efficiency[25]

Incentive Programs

Personal Tax Credit	Residential Renewable Energy Tax Credit
Production Incentive	People's Power & Light - Renewable Energy Certificate Incentive
Property Tax Exemption	Solar Property Tax Exemption
Sales Tax Exemption	Renewable Energy Sales Tax Exemption
State Rebate Program	Energy Star Rebate Program
	Greenhouse Gas Rebate Program
	Small Customer Incentive Program for Green Power Marketers
Utility Loan Program	National Grid (Narragansett) - Energy Wise Program
	National Grid (Narragansett) - Small Business Energy Efficiency Program
Utility Rebate Program	National Grid (Narragansett) – Commercial Energy Efficiency Incentive Programs
	National Grid (Narragansett) - Residential Energy Efficiency Incentive Programs
Alternative Fuel and Vehicle Incentives	U.S. Department of Energy's Alternative Fuels Data Center

Rules, Regulations & Policies

Appliance/Equipment Efficiency Standards	Appliance and Equipment Efficiency Standards
Building Energy Code	Rhode Island Building Energy Code
Energy Standards for Public Buildings	Green Building Standards for State Facilities
Generation Disclosure	Energy Source Disclosure
Green Power Purchasing/Aggregation	Rhode Island - Green Power Purchasing
Interconnection	Interconnection Standards
Net Metering Rules	Rhode Island - Net Metering
Public Benefits Fund	Public Benefits Fund
Renewables Portfolio Standard	Renewable Energy Standard
Solar Access Law/Guideline	Solar Easements
Alternative Fuel and Vehicle Policies	U.S. Department of Energy's Alternative Fuels Data Center

[25] http://www.dsireusa.org/library/includes/map2.cfm?CurrentPageID=1&State=RI&RE=1&EE=1

EnergyStar Appliances and Energy Savings

Reducing appliance energy use

FACT SHEET

ENERGY STAR PRODUCTS

For more information call 800-762-7077 or visit focusonenergy.com

Electricity use is on the rise in most homes. One reason we're using more electricity is because we're using more electronic equipment. We have home computer systems, home entertainment systems, VCRs and answering machines as well as the traditional home appliances (refrigerators, stoves, washers, etc.). Some of these appliances use electricity even when they are turned off. The average Wisconsin homeowner spends about $400 per year on electricity to run their appliances and household electronic equipment.

BUYING EFFICIENT APPLIANCES

One way to reduce appliance energy use is to buy the most energy efficient appliances available. When you're in the market for a new appliance or other household electronic equipment, look for ENERGY STAR qualified products. The ENERGY STAR label is awarded to those products that meet or exceed established criteria for energy efficiency and are as much as 10 percent to 60 percent more efficient than their conventional counterparts. They use less energy and save you money.

Refrigerators and air conditioners

In many households, the refrigerator uses more energy than any other household appliance. An average older model uses more than 1,000 kWh per year. New models that meet the federal appliance efficiency standards use only 800 kWh per year and ENERGY STAR qualified refrigerators use less than 600 kWh per year. Replacing an older refrigerator with an ENERGY STAR qualified model can save you up to $85 in annual energy costs. Even if your old refrigerator still runs, it makes economic sense to replace it.

REFRIGERATORS (18.5–20.5 CUBIC FEET)

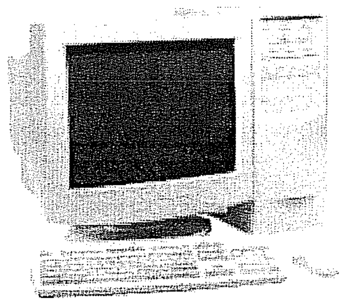
[illegible]	[illegible]	[illegible]
Top freezer—purchased before 1990	100	$8.00
Top freezer—purchased between 1990 & 1993	70	$5.60
Top freezer—purchased after 1993	55	$4.40
ENERGY STAR—top freezer	37	$2.96
Side-by-side—purchased before 1990	135	$10.80
Side-by-side—purchased between 1990 & 1993	100	$8.00
Side-by-side—purchased after 1993	70	$5.60
ENERGY STAR—side-by-side	48	$3.84

Conventional room air conditioners are also high energy users. Even if your current air conditioner still runs, it may be cost-effective to replace it with an ENERGY STAR qualified model. Doing so can save you up to $60 a year in energy costs.

Computers and monitors

Frequently, computer equipment is turned on and left on even if it is not being used. ENERGY STAR qualified computer equipment has a "sleep" mode that reduces the power consumption when the equipment is on but not being used.

An ENERGY STAR qualified monitor consumes up to 90 percent less energy than models without power management features.



focus on energy
The power is within you.

COMMON HOUSEHOLD APPLIANCES				
EQUIPMENT	**TYPICAL WATTAGE**	**HOURS IN USE PER MONTH**	**KWH/MONTH**	**ESTIMATED MONTHLY COST**
Air Conditioner		(typical July)		
Central (30,000 BTU)				
Conventional SEER 7.5	4,000	180	720	$57.60
Conventional SEER 10	3,000	180	540	$43.20
Energy Star SEER 13	2,300	180	414	$33.12
Room (8,000 BTU)				
Conventional EER 7.5	1,070	180	193	$15.41
Conventional EER 10	800	180	144	$11.52
Energy Star EER 11	730	180	131	$10.51
Aquarium Pump	Varies	730	Varies	up to $40.00
Blender	300	*	*	*
Broiler (portable)	1,200	7	8	$0.64
Can Opener	100	*	*	*
Clock Radio	8	730	6	$0.47
Clothes Dryer	5,500	16	88	$7.04
Clothes Washer (25 loads/month)				
(Electric Water Heater)				
Conventional	NA	NA	68	$5.46
Energy Star	NA	NA	29	$2.29
(Gas Water Heater)				
Conventional	NA	NA	see footnotes bottom left	$2.60
Energy Star	NA	NA		$1.11
Coffee Maker (drip)				
Brew Cycle	1,100	8	9	$0.72
Warm	70	57	4	$0.32
Convection Oven (portable)	1,500	3	5	$0.40
Corn Popper				
Hot Air	1,400	1	1	$0.40
Oil	575	2	1	$0.08
Curling Iron	40	*	*	*
Deep Fryer				
Regular Size	1,500	2	3	$0.24
Small Size	600	2	1	$0.08
Dehumidifier				
Conventional (40 pint)	900	240	216	$17.28
Energy Star (40 pint)	600	240	144	$11.52
Dishwasher (one load/day)				
Not including hot water				
Conventional Unit	2,000	25	58	$4.67
Energy Star Unit	1,800	25	46	$3.70
With hot water from electric water heater	1,200	100	120	$9.60
With hot water from gas water heater	NA	NA	1 Therm	$0.64
Electric Blanket	75	240	18	$1.44
Fan				
Ceiling	100	250	25	$2.00
Energy Star Ceiling	40	250	10	$0.80
Window	200	150	30	$2.40
Food Processor	720	*	*	*
*CALCULATED AT $.08 PER KWH				

*Uses less than one kWh/month; costs less than 10 cents per month to operate.

[1]Conventional Gas Water Heater—based on 6 kWh of electricity and 3 therms of gas.

[2]Energy Star Gas Water Heater—based on 3 kWh of electricity and 1 therm of gas.

COMMON HOUSEHOLD APPLIANCES

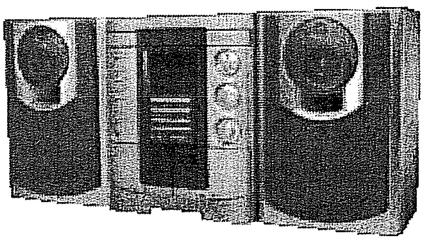
EQUIPMENT	TYPICAL WATTAGE	HOURS IN USE (PER MONTH)	KWH/MONTH	ESTIMATED MONTHLY COST
Freezer (16 cu.ft., upright)	200	375	75	$6.00
Frying Pan	1,200	7	8	$0.64
Garage Door Opener	350	3	1	$0.08
Garbage Disposal	445	*	*	*
Hair Dryer (hand held)	1,400	2	3	$0.24
Heat Lamp (infrared)	250	4	1	$0.08
Hot Tub	Varies	Varies	Varies	$30.00
Humidifier (portable)	175	149	26	$2.08
Iron (steam)	1,200	4	5	$0.40
Mattress Pad Heater (full-queen)	180	122	22	$1.76
Microwave Oven (full power)	1,500	7	10	$0.80
Nightlight	7	730	5	$0.41
Radio	8	730	6	$0.47
Range (electric)	12,200	6	75	$6.00
Refrigerator (see table on page 1)				
Sandwich Grill	1,150	3	3	$0.24
Sewing Machine	75	13	1	$0.08
Slow Cooker	200	50	10	$0.80
Space Heater	1,500	90	135	$10.80
Swimming Pool Pump (1/2 hp)	600	730	432	$35.04
Toaster (two slice)	1,100	3	3	$0.24
Toaster Oven/Broiler				
Toaster	1,500	2	3	$0.24
Oven	1,500	3	5	$0.40
Broiler	830	5	4	$0.32
Toothbrush (with charger)	1	730	1	$0.06
Trash Compactor	480	2	1	$0.08
Vacuum Cleaner	1,000	6	6	$0.48
Waterbed (king size 90°F)				
Room 70°F With Comforter	370	332	123	$9.84
Room 60°F With Comforter	370	527	195	$15.60
Water Heater (52 gal.—electric)	4,500	76	342	$27.36
Water Pump	480	43	20	$1.60
Water Softener	4	730	3	$0.23

*CALCULATED AT 8¢ PER KWH

*Uses less than one kWh/month; costs less than 10 cents per month to operate.

HOME ELECTRONIC AND COMPUTER EQUIPMENT					
EQUIPMENT	WATTS USED WHEN "ON"	WATTS USED WHEN "OFF" OR "ASLEEP"	HOURS IN USE (PER MONTH)	KWH/MONTH	ESTIMATED MONTHLY COST*
Conventional TV	75.0	5.9	180	16.7	$1.34
Energy Star TV	71.6	2.5	180	14.3	$1.14
Conventional VCR	12.5	5.1	10	3.7	$0.30
Energy Star VCR	10.9	3.5	10	2.6	$0.21
Conventional DVD	17.8	4.5	70	4.5	$0.36
Energy Star DVD	14.1	0.9	70	1.8	$0.15
Stereo (rack system)	51.9	3.2	30	3.8	$0.30
Energy Star stereo (rack system)	49.6	0.9	30	2.1	$0.17
Conventional computer	55	NA	5	8.3	$0.66
Energy Star computer	49	30	3 on & 2 in sleep	6.1	$0.49
Conventional monitor	85	NA	5	12.9	$1.02
Energy Star monitor	81	15	3 on & 2 in sleep	8.2	$0.66

*CALCULATED AT 8¢ PER KWH



Home electronic equipment

Many home electronics use electricity even when the equipment is switched off. Standby electricity accounts for about four to seven percent of total electrical consumption in Wisconsin homes (40 to 70 watts—equivalent to leaving an incandescent lightbulb burning all the time). Any appliance with an external power supply, remote control or clock display requires standby electricity. These appliances include TVs, VCRs, cable boxes, stereo systems and telephone answering machines.

USING A WATT METER TO MEASURE APPLIANCE ENERGY USE

A watt meter is an electronic instrument that can help you determine exactly how much energy your appliances are using. Plug the meter into the appliance and you can measure how much electricity your appliances are using and what they are costing you. The meter will display wattage, cumulative kilowatt hours and cumulative cost. In many Wisconsin communities, you can borrow a watt meter from your public library.

The amount of electricity used is measured as a kilowatt-hour, which is equal to one kilowatt (or 1,000 watts) of electricity used steadily for one hour. For example, ten 100-watt light bulbs, left on for one hour, would use one kilowatt-hour (or 1,000 watt hours) of electricity.

LEARN MORE

focusonenergy.com

Contact Focus to learn more about smart energy choices.

energystar.gov

Energy Star Appliances: This site provides information on energy efficient appliances that meet Energy Star standards. The product information page has a link to a calculator that lets you compare operating costs and energy use of an Energy Star qualified appliance with a non-Energy Star qualified appliance.

homeenergy.org/consumerinfo/refrigeration2/article.htm

Home Energy Magazine, Consumer Information: "Identifying Refrigerators to Recycle Early: Replacing Your Refrigerator." This online article provides information on determining whether it is cost effective to replace your refrigerator. Includes links to a database of older model refrigerators.

homeenergy.org/consumerinfo/fans/ceilingfans.html

Home Energy Magazine, Consumer Information: "Getting the Most from Your Fan: Tips for Maximizing Energy Savings."

Focus on Energy is a public-private partnership offering energy information and services to energy utility customers throughout Wisconsin. The goals of this program are to encourage energy efficiency and use of renewable energy, enhance the environment, and ensure the future supply of energy for Wisconsin. For information about the Focus on Energy services and programs, call 800.762.7077 or visit focusonenergy.com.

Focus on energy
The power is within you.

Analysis of Block Island's Conservation Potential for Lighting and Specific Appliances

Evaluation of Lighting Technical and Acheivable Conservation Potential

	Total		Ave. Bulbs Per Site	Existing Bulbs Incand.	Existing Bulbs Fluor.	Annual Hours Per Bulb	Wattage of Existing Bulbs Incand.	Wattage of Existing Bulbs Fluor.	Annual kWh's	kWh's @ Technical Potential
Residential										
- Year Round	472	[g]	5 [b]	3	2 [c]	1,825	100	35	318,718	150,745
- Seasonal	1,134		5 [b]	3	2 [c]	600	100	35	251,748	119,070
Total Residential	1,606	[a]							570,466	269,815
Annual Resid. kWh Sales [h]										
% Reduction in kWh's										

	Total Business	304 Total Rooms	Occupancy Winter	Occupancy Summer	Ave. Bulbs Per Rm/Site	Existing Bulbs Incand.	Existing Bulbs Fluor.	Annual Hours Per Bulb	Wattage of Existing Bulbs Incand.	Wattage of Existing Bulbs Fluor.	Annual kWh's	kWh's @ Technical Potential
Commercial	[d]											
Hotels	8	304 [e]	10%	95%	4	2	2 [g]	652	100	35	53,516	27,749
Inns	24	495 [e]	10%	95%	4	2	2 [g]	652	100	35	87,140	45,184
Guest House/B&B's	40	180 [e]	10%	95%	2	1	1 [g]	652	100	35	15,844	8,215
Restaurants/Casual Dining	20				20 [f]	15	5 [g]	1,825	100	35	61,138	25,550
Pizza, Ice Cream, Takeout	11				10 [f]	7	3 [g]	1,825	100	35	16,160	7,026
Cafes	3				15 [f]	10	5 [g]	1,825	100	35	6,433	2,874
Taverns & Nightclubs	10				15 [f]	10	5 [g]	1,825	100	35	21,444	9,581
Theaters	2				10 [f]	5	5 [g]	1,825	100	35	2,464	1,278
Total Commercial	118	979									264,138	127,457
Annual Comm. kWh Sales [h]												
% Reduction in kWh's												
Grand Total											834,604	397,272

[a] - Source: 2000 U.S. Census Bureau, Census Tract 415, Washington County, Rhode Island
[b] - Source: HDR Survey 1,556 lights in 309 households = 5.03 lights/household
[c] - Source: HDR Survey; 209 homes responded that they had 728 fluorescent bulbs - 728/1,556 = 46% fluorescent
Assumed an average of 60% of installed bulbs were incandescent and 40% fluorescent
[d] - Source: Block Island Directory www.blockisland.com
[e] - Source: Block Island Water Use and Availability, Univ. of R.I. (2000)
[f] - Number of bulbs per site estimated
[g] - Estimated
[h] - Block Island Rate Filing; Docket 3655

Evaluation of Appliance Technical and Acheivable Conservation Potential

	Total	Est. Current Homes w/ E.S. Appl. Installed	Available Retrofits
Resid. - Year Round	472 [b]	157 [c]	315
Resid. - Seasonal	1,134	378 [c]	756
Total Residential	1,606 [a]	535	1,071
Annual Resid. kWh Sales [g]			
% Reduction in kWh's			

Refrigerator

Homes w/ Tech. Potential	Non-Energy Star Product: Assumed Hours/Mth Use	Assumed Months Used	Assumed Non E.S. Watts	Estimated Annual KWh Use	Energy Star Product: Assumed Hours/Mth Use	Assumed Months Used	Assumed E.S. Watts	Estimated Annual KWh Use	Technic kWh @ Tech. Pot.
315	215	12	600	487,620 [d]	117	12	800	353,808 [e]	353,808
756	215	8	600	780,192 [d]	117	8	800	566,093 [e]	566,093
1,071				1,267,812				919,901	919,901

Dishwasher - No Electric Water Heater; Heat Dry

Homes w/ Tech. Potential	Non-Energy Star Product: Assumed Hours/Mth Use	Assumed Months Used	Assumed Non E.S. Watts	Estimated Annual KWh Use	Energy Star Product: Assumed Hours/Mth Use	Assumed Months Used	Assumed E.S. Watts	Estimated Annual KWh Use	Technic kWh @ Tech. Pot.
315	25	12	2,000	189,000 [h]	25	12	1,200	113,400 [e]	113,400
680	12	8	2,000	130,637 [h]	12	8	1,200	78,382 [e]	78,382
995				319,637				191,782	191,782

Clothes Washing Machine - No Electric Water Heater [i]

Homes w/ Tech. Potential	Non-Energy Star Product: Assumed Loads	Assumed Months Used	Assumed Non E.S. kWh/Mth	Estimated Annual KWh Use	Energy Star Product: Assumed Loads	Assumed Months Used	Assumed E.S. Watts	Estimated Annual KWh Use	Technic kWh @ Tech. Pot.
315	20	12	3.6	13,608 [d]	20	12	2.8	10,584 [e]	10,584
756	5	8	0.9	5,443 [d]	5	8	0.7	4,234 [e]	4,234
1,071				19,051				14,818	14,818

Room Air Conditioner (8,000 BTU)

Homes w/ Tech. Potent. [j]	Non-Energy Star Product: Assumed Hours/Mth Use	Assumed Months Used	Assumed Non E.S. Watts	Estimated Annual KWh Use		Energy Star Product: Assumed Hours/Mth Use	Assumed Months Used	Assumed E.S. Watts	Estimated Annual KWh Use		Technic kWh @ Tech. Pot.
104	90	4	1,100	41,164	[d]	90	4	730	27,318	[e]	27,318
249	90	4	1,100	98,794	[d]	90	4	730	65,563	[e]	65,563
353				139,958					92,881		92,881

Dehumidifier

Homes w/ Tech. Potent. [k]	Non-Energy Star Product: Assumed Hours/Mth Use	Assumed Months Used	Assumed Non E.S. Watts	Estimated Annual KWh Use		Energy Star Product: Assumed Hours/Mth Use	Assumed Months Used	Assumed E.S. Watts	Estimated Annual KWh Use		Technic kWh @ Tech. Pot.
47	240	4	900	40,824	[e]	240	4	600	27,216	[e]	27,216
113	180	4	900	73,483	[e]	180	4	600	48,989	[e]	48,989
161				114,307					76,205		76,205

[a] - Source: 2000 U.S. Census Bureau, Census Tract 415, Washington County, Rhode Island
[b] - Estimated
[c] - Source: HDR Survey; approximately 1/3 of homes have an EnergyStar approved item; unclear as to specific Energy Star appliance.
[d]- Source: Clallam County PUD estimates of typicall non-Energy Star appliance hours/month use and watts per appliance
[e]- Source: Clallam County PUD estimates of typicall Energy Star appliance hours/month use and watts per appliance
[f] - Source: HDR Survey; Estimated 85% of appliances will be replaced with EnergyStar products
[g] - Block Island Rate Filing; Docket 3655
[h] - EnergyStar - Reducing Electric Appliance Energy Use: Fact Sheet
[i] - Assumes non-electric water heating. Significant savings for EnergyStar Clothes Washers is gained from savings on electric water heating
[j] - Assumes that 33% of potential homes would utilize room air conditioners
[k] - Assumes that 20% of the potential homes would utilize room