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David C. Stewart and Associates

Clean Nova Scotia
inspiring environmental change

Eastern Shelburne County Energy Strategy

FINAL - December, 2010

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[1] Exclusive of HST

The Project team and the ICSP Planner/Project Coordinator would like to acknowledge the generous contributions of time and knowledge from the staff and Councilors from the Municipality of the District of Shelburne; the Town of Shelburne; and the Town of Lockeport.

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Endorsement by Council

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1.0 Introduction

Energy and energy efficiency issues have been identified as important considerations in the Integrated Community Sustainability Plans (ICSP) for the Municipality of the District of Shelburne and the Towns of Shelburne and Lockeport (Eastern Shelburne County). Specific issues included: the rising cost of, and dependency on, non-renewable energy sources; the desire of the municipalities to reduce greenhouse gases; and the need for a reliable, available and cost effective source of electricity. In addition to cost and the reliance on non-renewable energy sources, concerns were raised during the ICSP process regarding the resiliency of the existing energy infrastructure serving the Eastern Shelburne County (ESC) and the overall future security of energy in ESC. Additionally, the use and development of renewable energy and energy efficiency were identified as key economic issues to help the growth of a renewable energy industry in the region.

Eastern Shelburne County has the potential for both energy efficiency gains and the development of renewable energy from wind, solar, biomass, and ocean sources. This Energy Strategy examines these opportunities, provides an assessment on their viability, and provides ESC with an approach to taking action on these opportunities in the short, medium, and long terms.

This Energy Strategy is an important first step in achieving energy efficiency and renewable energy goals of the municipalities. An Energy Strategy provides a road map for the municipalities to follow to increase the efficient use of energy across all sectors and to identify renewable energy opportunities that can benefit local economic development and marketed to community-based and private renewable energy developers.

Specifically, the Energy Strategy provides:

- Practical and achievable energy efficiency and renewable or alternative energy opportunities for ESC.
- Measures to reduce overall greenhouse gas emissions.
- A strategy for the education of residents and businesses on the economic and environmental benefits of energy efficiency and renewable and alternative energy development in ESC.
- An action plan for municipal governments to pursue the opportunities that are relevant to the ESC's economic development and investment opportunities.

The strategy is organized as follows: Section 2 describes the current energy profile and issues for Eastern Shelburne County; including: sources of energy; energy security; and potential energy assets. Section 3 provides potential municipal, commercial, and residential project opportunities and associated funding prioritized into short-term, medium-term, and long-term opportunities and actions. Section 4 describes the proposed greenhouse gas reduction targets. Section 5 provides recommended engagement strategies to help Eastern Shelburne County facilitate up-take of opportunities. Section 6.0 provides overall recommendations for implementing the Energy Strategy.

2.0 Energy Profile

2.1 Current Energy Use and Greenhouse Gas Emissions

In Eastern Shelburne County the sources of energy for the residential, commercial, institutional, and industrial sectors include:

- electricity provided by Nova Scotia Power Inc. (NSPI);
- light and heavy heating oil provided by various oil suppliers in the region,;
- propane supplied by two main suppliers: Superior and Irving; and
- wood supplied by local vendors and/or gathered by users from their own wood lots.

Energy and greenhouse gas (GHG) information for 2007 for the three Municipal Units: Town of Shelburne, Town of Lockeport and the Municipality of the District of Shelburne were compiled using the Union of Nova Scotia Municipalities (UNSM) emissions inventory spreadsheet and an industrial use spreadsheet provided by MDS.

Typical of many smaller municipalities in Nova Scotia energy use is dominated by electricity and oil (Table 2-1, Table 2-2, Table 2-3 and Figure 2-1). Overall, transportation (gasoline and diesel) makes up of the energy use at 36.1%; electricity makes up 29.2 % followed by oil at 23.2 %. Wood makes up 8.8 % of the total energy use. Diesel and propane for heating make up a relatively small portion of the energy mix at 1.9 % and 0.8 % respectively.

Table 2-1 Estimated 2007 Energy Breakdown for Eastern Shelburne County

Sector	Town of Lockeport			Town of Shelburne			District of Shelburne		
	Electricity (MWh)	Oil/Propane (MWh eq)	Wood (MWh eq)	Electricity (MWh)	Oil/Propane (MWh eq)	Wood (MWh eq)	Electricity (MWh)	Oil/Propane (MWh eq)	Wood (MWh eq)
Residential	3,953	2,866	1,005	11,497	8,335	2,924	29,504	21,389	7,503
Commercial	3,161	3,049	-	12,645	12,195	-	1,897	1,829	-
Industrial	5,925	7,288	4,506	4,444	5,466	3,380	5,925	7,288	4,506

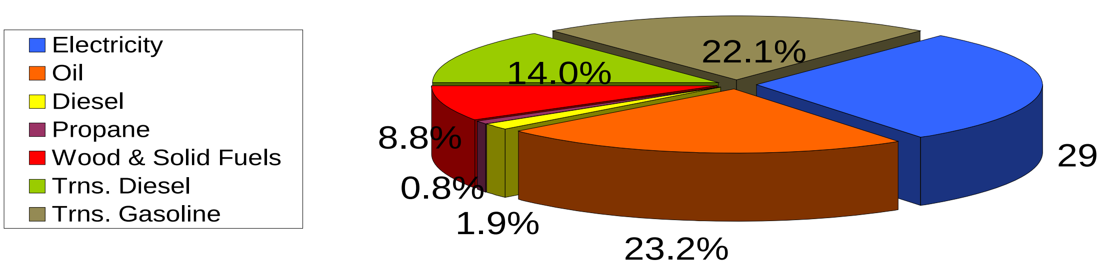
Table 2-2 Estimated 2007 Transportation Energy for Eastern Shelburne County

Sector	Town of Lockporte		Town of Shelburne		Municipality of Shelburne	
	Diesel (MWh eq)	Gasoline (MWh eq)	Diesel (MWh eq)	Gasoline (MWh eq)	Diesel (MWh eq)	Gasoline (MWh eq)
Transportation	3,325	5,256	9,671	15,274	24,819	39,198

Table 2-3 Total Energy Usage for Eastern Shelburne County

	Electricity (MWh)	Heating Oil (MWh)	Propane (MWh)	Heavy Fuel Oil (MWh)	Diesel (MWh)	Wood and Solid Fuels (MWh)	Gasoline (MWh)	Total Energy Used (MWh eq)
Residential	44,953	32,589	-	-	-	11,432	-	88,794
Commercial	17,702	9,657	2,051	5,006	358	-	-	34,774
Industrial	16,294	-	-	15,326	4,715	12,391	-	48,726
Transportation	-	-	-	-	37,846	-	59,722	97,568
Total	**78,949**	**42,246**	**2,051**	**20,332**	**42,919**	**23,823**	**59,722**	**269,862**

Figure 2-1
Annual Energy Usage- Eastern Shelburne County



GHG emissions associated with each of the energy sources for each municipality was then calculated to determine the GHG footprint for each of the municipalities using emission conversion factors with the UNSM database (Table 2-4). In terms of GHG emissions, electricity makes up 55.2 % of the CO_2e contribution due largely to the predominance of coal and heavy oil in Nova Scotia Power Inc.'s generation mix. Gasoline and diesel for transportation make up 13.7% and 9.2% of total GHG emissions. For heating, oil use contributes 15.4 % and wood makes up 5.0 %. Diesel (1.1%) and propane (0.4%) make up the remaining 1.5 % contribution from heating sources (Table 2-5, Table 2-6, Table 2-7 and Figure 2-2).

Table 2-4 Energy Source Emission GHG Equivalent CO_2 (CO_2e) for 2007

Source	Conversion
Electricity[2]	0.740 tonnes/MWh (205.4 tonnes/TJ)
Light Heating Oil	0.263 tonnes/MWh (73 tonnes/TJ)
Heavy Heating Oil	0.264 tonnes/MWh (73.2 tonnes/TJ)
Propane	0.216 tonnes/MWh (59.95 tonnes/TJ)
Wood	0.073 tonnes/MWh (20.26 tonnes/TJ)
Diesel (Vehicle)	0.257 tonnes/MWh (71.20 tonnes/TJ)
Gasoline (Vehicle)	0.243 tonnes/MWh (67.36 tonnes/TJ)

Table 2-5 2007 Greenhouse Gas (CO_2e) Breakdown for Eastern Shelburne County

Sector	Town of Lockeport			Town of Shelburne			District of Shelburne		
	Electricity (tonnes)	Oil/Propane (tonnes)	Wood (tonnes)	Electricity (tonnes)	Oil/Propane (tonnes)	Wood (tonnes)	Electricity (tonnes)	Oil/Propane (tonnes)	Wood (tonnes)
Residential	2,900	700	100	8,500	2,200	200	21,800	5,600	500
Commercial	2,400	800	-	9,400	3,100	-	1,400	500	-
Industrial	4,400	1,900	1,600	3,300	1,400	1,200	4,400	1,900	1,600

Table 2-6 2007 Transportation Greenhouse Gas (CO_2e) Emissions for Eastern Shelburne County

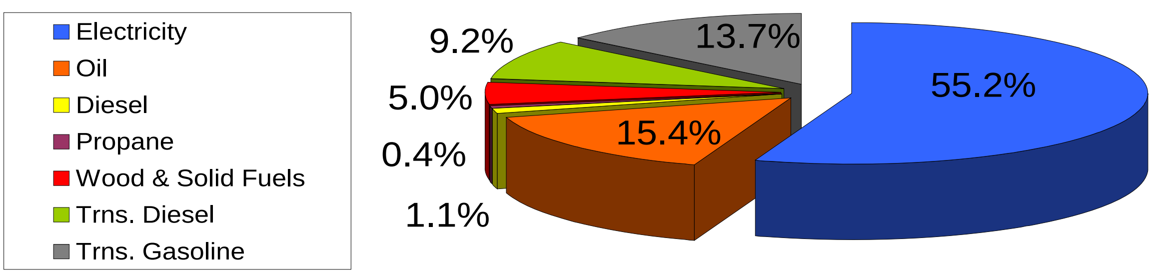
Sector	Town of Lockporte		Town of Shelburne		Municipality of Shelburne	
	Diesel (tonnes)	Gasoline (tonnes)	Diesel (tonnes)	Gasoline (tonnes)	Diesel (tonnes)	Gasoline (tonnes)
Transportation	900	1,300	2,500	3,700	6,400	9,500

[2] The emission factor for electricity varies annually with the fuel mix used to produce electricity.

Table 2-7 Total 2007 Greenhouse Gas (CO_2e) Production for Eastern Shelburne County

	Electricity (tonnes)	Heating Oil (tonnes)	Propane (tonnes)	Heavy Fuel Oil (tonnes)	Diesel (tonnes)	Wood and Solid Fuels (tonnes)	Gasoline (tonnes)	Total (tonnes)
Residential	33,300	8,500	-	-	-	800	-	42,600
Commercial	13,200	2,500	400	1,300	100	-	-	17,500
Industrial	12,100	-	-	4,000	1,100	4,500	-	21,700
Transportation	-	-	-	-	9,700	-	14,500	24,200
Total	**58,500**	**11,000**	**400**	**5,300**	**10,900**	**5,300**	**14,500**	**106,000**

Figure 2-2
Distribution of Shelburne's Annual CO_2 eq Emissions



An important factor in determining appropriate energy efficiency and renewable energy approaches is the peak electrical demand for the municipalities. This is useful for determining the amount of renewable electricity that could be brought on in. Typically this is up to 15 % of the existing load capacity before the distribution system grid has to be upgraded to handle intermittent loads such as wind. Peak electrical demand in each of the municipalities and for ESC in total is provided in Table 2-6 below.

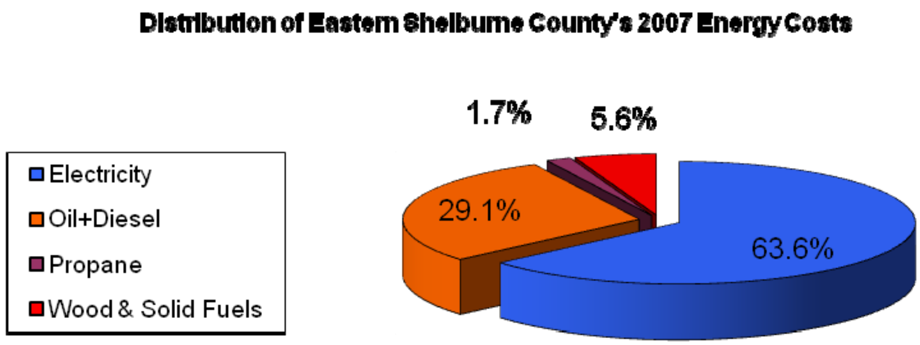
Table 2-8 Estimated 2007 Electrical Peak Demand (MW) For Eastern Shelburne County

Town of Shelburne	Town of Lockeport	District of Shelburne	Total
8.0	3.3	8.7	20.0

2.2 Energy Cost Review

In total, electricity makes up 63.6 % of the energy costs in ESC followed by oil and diesel making up 29.1 % of the energy costs. Wood and propane energy costs make up a relatively small percentage of energy costs at 5.6 % and 1.7 % respectively (Figure 2-3).

Figure 2.3



Nova Scotia Power Inc. (NSPI) has recently announced a price increase in electricity costs for the various customer rate classes. The approved rate increase for residential customers will be 6.5 per cent starting on January 1, 2011. The commercial rate increases will be 8.6 per cent, and the industrial rate increase will be 11.3 per cent. Based on these increases, the cost for the residential rate class will be $ 0.17 per kWh including HST. The cost for the commercial rate class excluding the 15 % HST will be $ 0.12/kWh and for industrial rate class excluding HST will be $ 0.11/kWh. The Demand Side Management Cost for 2011 is not included in the price of electricity. This is estimated to add an additional 2.3 % to the cost of electricity.

Heating oil average cost per litre in 2007 was $ 0.68 and is projected to be in 2011 will be $ 0.90 excluding HST. Oil average cost per equivalent kWh (ekWh) in 2007 was $ 0.063 and in 2011 will be $ 0.083 excluding HST. Propane average cost per litre in 2007 was $ 0.85 excluding HST and is expected to remain constant in 2011. The average cost of propane per ekWh in 2007 was $ 0.121.

The average cost of wood per cord in 2007 was $ 200 and in 2011 is projected to be $ 250 excluding HST. The average cost for wood per ekWh in 2007 was $ 0.028 and in 2011 will be $ 0.032 excluding HST. Based on central Nova Scotia estimates, the average cost per ekWh in 2011 for wood pellets (delivered) is $ 0.044 excluding HST for commercial use and $ 0.071 for residential use. Currently, wood pellet distribution is being set up for western Nova Scotia for commercial customers, however, the final price with transportation is still being negotiated.

With the exception of propane, energy costs are increasing in Nova Scotia with increases ranging between 6.5% (for residential electricity) to 32% (for heating oil). Based on energy use in ESC, energy cost increases will range from $95,200 for wood to $1,361,500 for electricity (Table 2-7).

Electricity costs at the residential level have gone up by almost 60% in the last 10 years and these costs are expected to continue rise in the foreseeable future. Similarly, global oil supplies will come close to a peak by 2035 when oil prices will exceed $200 a barrel, the International Energy Agency said on November 9, 2010, as China and other emerging economies drive demand higher[3]. The recent example of this volatility was in 2008 when the cost for a barrel of oil rose from approximately $60.00 US per barrel in early 2007 to $147.27 US per barrel by July 2008.

[3] Trade Arabia Business News Information – November 9, 2010 http://www.tradearabia.com/news/INTBIZ_188810.html

Table 2-7 Estimated Cost[4] Increases for Entire Eastern Shelburne County

	Energy Used (MWh)	Approx. 2007 Cost ($)	Approx. 2011 Cost ($)	Approx. Increase in Cost ($)	% Increase in Cost
Electrical	78,949	9,332,000	10,693,500	1,361,500	14.6
Oil	67,652	4,262,100	5,615,100	1,353,000	31.8
Propane	9,657	246,000	246,000	-	0
Wood	23,823	815,800	911,000	95,200	11.7

2.3 Energy Security

Nova Scotia as a whole is heavily dependent on fossil fuels (oil, coal, natural gas) to meet its energy needs. Approximately 90% of the electricity generated in the province is generated by fossil fuels and of that 63% is generated by imported coal and oil.

The Nova Scotia Department of Energy notes that there is uncertainty with respect to the province's energy supply in terms of pricing for oil, natural gas, and coal as these supplies are priced on a regional or global basis[5]. In addition, the amount of potential developable hydrocarbon resources in Nova Scotia such as offshore and onshore natural gas is currently uncertain.

The federal government is also moving forward with proposed emissions regulations affecting the electricity sector. The proposed regulations to be published in early 2011 are expected to mandate a reduction of coal-fired generation across Canada from older facilities. This could significantly affect the price of electricity Nova Scotia as 75% of the electricity generated in the province is coal-fired.

Nova Scotia's Energy Strategy Toward a Greener Future (Energy Strategy) recognizes that to counter this uncertainty, investment is needed in existing forms of renewable energy in the province *e.g*. wind, and new

[4] Exclusive of HST

[5] Nova Scotia Department of Energy, 2009. Background: Energy Security.

leading edge forms of renewable energy such as solar, geothermal, and tidal power[6]. The provincial Energy Strategy and the 2010 Renewable Electricity Plan are discussed in Section 2.4.

2.4 Energy Assets in Eastern Shelburne County

One of the primary interests of the community noted in the ICSP process was to determine if Shelburne had or could tap into natural resources within ESC to lessen its dependence on NSPI and associated imported fuel supply and greenhouse gas emissions. To address the question, an inventory of natural resources that could generate electricity or produce was undertaken as a first step in assessing the viability of locally sourced energy, specifically renewable energy.

2.4.1 Wind

Data were obtained through existing publically available data sources including the Nova Scotia Wind Atlas (http://www.nswindatlas.ca/); solar insolation mapping; and biomass (forests). Wind energy is the most obvious to stakeholders in ESC as a result of the success of the Pubnico Point Wind Farm in Yarmouth County. Indeed, Eastern Shelburne County also has an excellent wind resource, especially along the coastal areas (Figure 2-4). While there is a potentially viable resource, development of the resource is subject to a number of environmental, social, and regulatory constraints. Figure 2-5 shows the constraints typically associated with wind development in Nova Scotia including: wilderness areas, wetlands, areas of known species at risk and important bird areas. As well, a 550 m buffer was placed around residences and businesses (Figure 2-6). Although Nova Scotia does not have set back criteria at this time, the 550 m setback criterion was based on the standard residential setback in Ontario. Overlaying the Figures 2-5 and Figures 2-6 provide an indication of those areas potentially suitable for wind development assuming land owner permission (Figure 2-7). The overlay indicates there are several potentially viable wind resource locations in ESC including: Western Head, Sandy Point, and inland from Ingomar and North East Harbour. One constraint to bear in mind, is that while there are several high potential locations for wind development, the scale of wind development must be tied to the grid capacity to take on new energy sources. Preliminary information on the distribution line (generally lines below 69 kV) capacity in ESC indicates that a wind development may be limited to 1 – 2 MW along a given line. A detailed interconnect

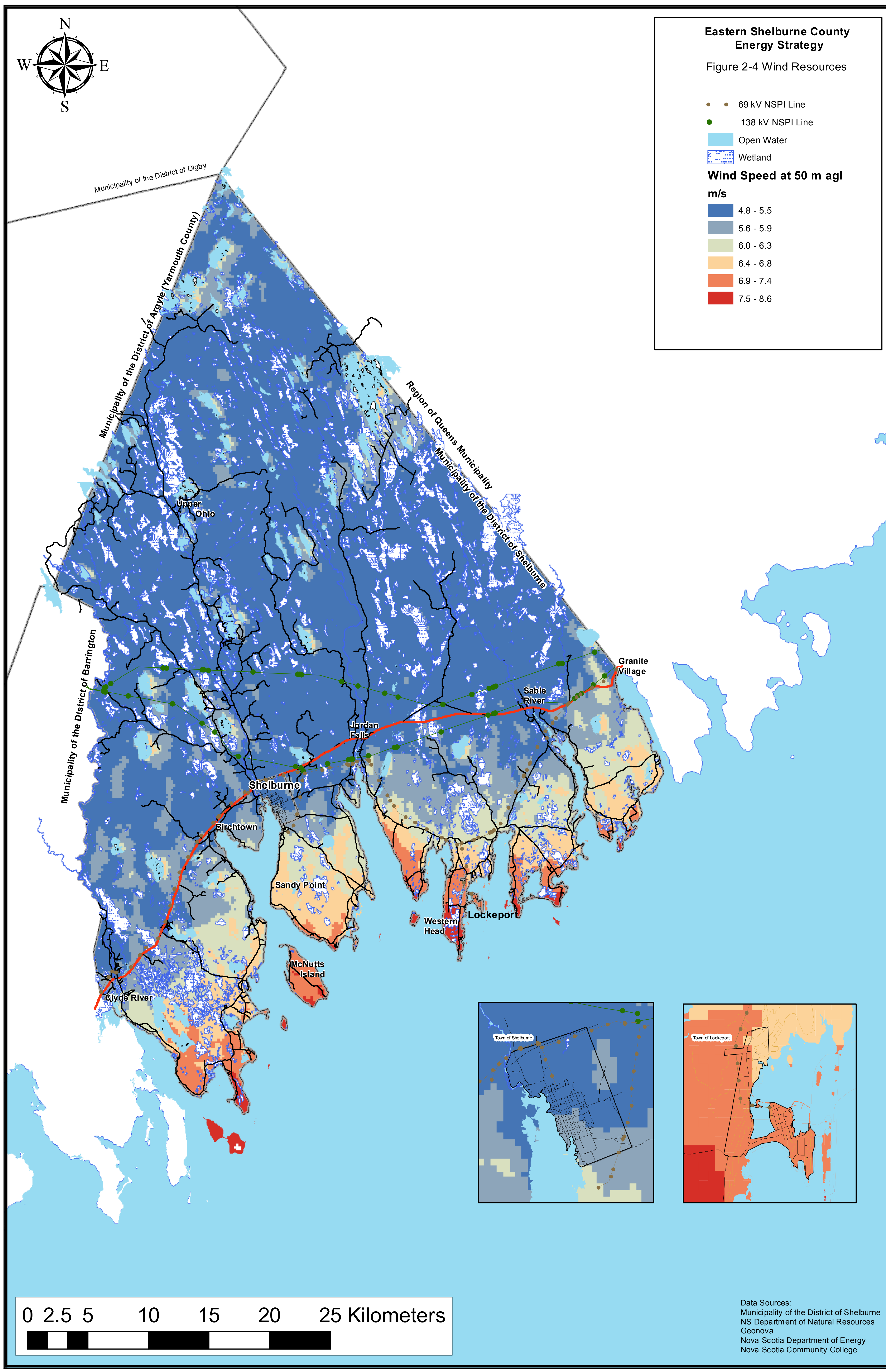
[6] Nova Scotia Department of Energy, 2009. Toward a Greener Future: Nova Scotia's Energy Strategy.

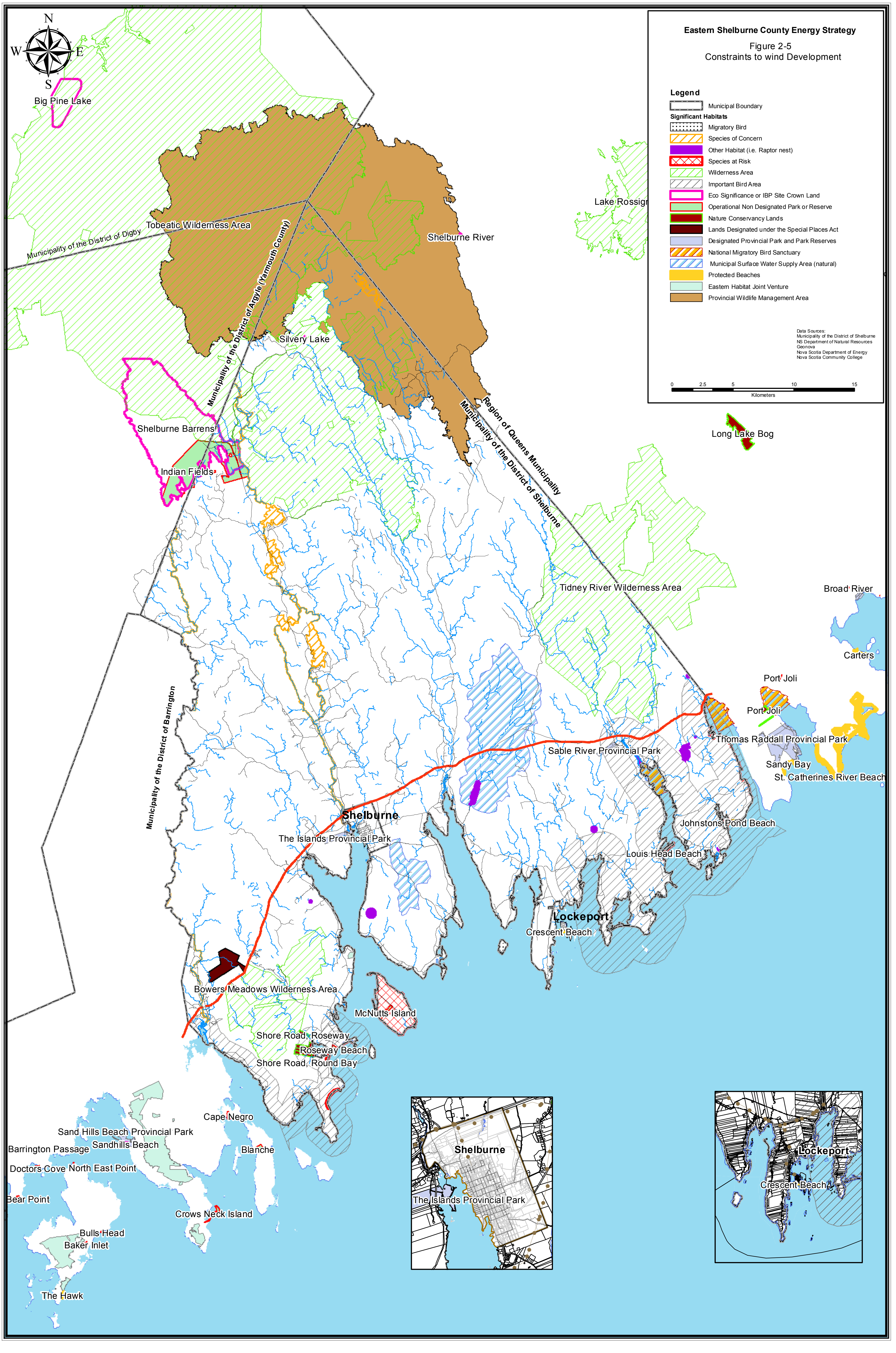
request with NSPI would be required to fully assess grid capacity by location. A larger scale, transmission connected wind project may be viable in ESC with the construction of a tap line, however, further project specific discussions with NSPI would be required, as well as an interconnect request. In order to assist with the implementation of Nova Scotia's community feed-in-tariff (COMFIT), the Nova Scotia Department of Energy will be producing guidelines that will provide guidance to municipalities and community groups on how to participate in the COMFIT program.

2.4.2 Solar

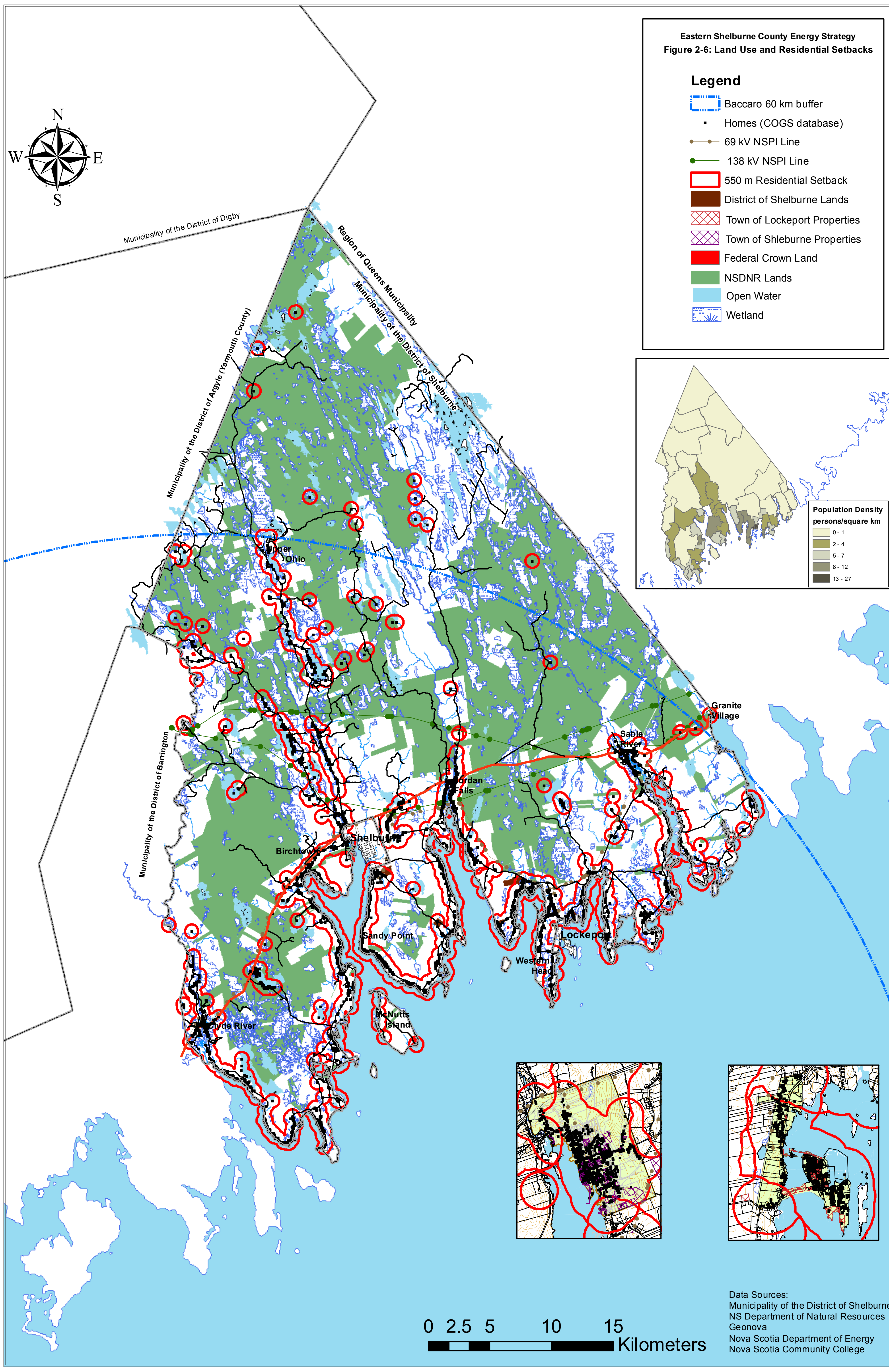
Solar insolation for the years 2005 – 2007 are presented in Figure 2-8. While insolation varies year to year, the annual average global horizontal irradiation in southwest Nova Scotia ranges between 3,450 $Mh/m^2/day$ and 3,720 $Mh/m^2/day$ which is comparable to the annual average global horizontal irradiation ranging of between 3,560 $Mh/m^2/day$ and 3,630 $Mh/m^2/day$ in southern Ontario where a number of utility scale solar projects are underway (http://www.greenpowerlabs.com/solarfortheworld.php). This demonstrates that there is sufficient solar resource for either solar thermal (water heating) and solar photovoltaic (electricity generation) projects.

Solar thermal is a viable and well established technology and currently being used at Heritage Hall in the Town of Shelburne and can be utilized in all sectors (residential, municipal, commercial, industrial, institutional) in ESC. As a possible model for ESC, Halifax Regional Municipality has recently launched a program to subsidize the installation of solar thermal systems through a property tax rebate program. The program is currently under development and will be presented to Council for approval in the near future.


Eastern Shelburne County
Energy Strategy
Figure 2-4 Wind Resources
69 kV NSPI Line
138 kV NSPI Line
Open Water
Wetland
Wind Speed at 50 m agl
m/s
4.8 - 5.5
5.6 - 5.9
6.0 - 6.3
6.4 - 6.8
6.9 - 7.4
7.5 - 8.6
N
S
E
W
Municipality of the District of Digby
Municipality of the District of Argyle (Yarmouth County)
Region of Queens Municipality
Municipality of the District of Shelburne
Municipality of the District of Barrington
Upper Ohio
Granite Village
Sable River
Jordan Falls
Shelburne
Birchtown
Sandy Point
Lockeport
Western Head
McNutts Island
Clyde River
Town of Shelburne
Town of Lockeport
0 2.5 5 10 15 20 25 Kilometers
Data Sources:
Municipality of the District of Shelburne
NS Department of Natural Resources
Geonova
Nova Scotia Department of Energy
Nova Scotia Community College



Eastern Shelburne County Energy Strategy
Figure 2-5
Constraints to wind Development
Legend
Municipal Boundary
Significant Habitats
Migratory Bird
Species of Concern
Other Habitat (i.e. Raptor nest)
Species at Risk
Wilderness Area
Important Bird Area
Eco Significance or IBP Site Crown Land
Operational Non Designated Park or Reserve
Nature Conservancy Lands
Lands Designated under the Special Places Act
Designated Provincial Park and Park Reserves
National Migratory Bird Sanctuary
Municipal Surface Water Supply Area (natural)
Protected Beaches
Eastern Habitat Joint Venture
Provincial Wildlife Management Area
Data Sources:
Municipality of the District of Shelburne
NS Department of Natural Resources
Geonova
Nova Scotia Department of Energy
Nova Scotia Community College
0
2.5
5
10
15
Kilometers
N
W
E
S
Big Pine Lake
Tobeatic Wilderness Area
Municipality of the District of Digby
Municipality of the District of Argyle (Yarmouth County)
Shelburne River
Lake Rossign
Silvery Lake
Region of Queens Municipality
Municipality of the District of Shelburne
Shelburne Barrens
Indian Fields
Long Lake Bog
Tidney River Wilderness Area
Broad River
Carters
Port Joli
Port Joli
Thomas Raddall Provincial Park
Sable River Provincial Park
Sandy Bay
St. Catherines River Beach
Municipality of the District of Barrington
Shelburne
The Islands Provincial Park
Johnstons Pond Beach
Louis Head Beach
Lockeport
Crescent Beach
Bowers Meadows Wilderness Area
McNutts Island
Shore Road, Roseway
Roseway Beach
Shore Road, Round Bay
Cape Negro
Sand Hills Beach Provincial Park
Barrington Passage
Sandhills Beach
Blanche
Doctors Cove North East Point
Bear Point
Crows Neck Island
Bulls Head
Baker Inlet
The Hawk
Shelburne
The Islands Provincial Park
Lockeport
Crescent Beach



Eastern Shelburne County Energy Strategy
Figure 2-6: Land Use and Residential Setbacks
Legend
Baccaro 60 km buffer
Homes (COGS database)
69 kV NSPI Line
138 kV NSPI Line
550 m Residential Setback
District of Shelburne Lands
Town of Lockeport Properties
Town of Shleburne Properties
Federal Crown Land
NSDNR Lands
Open Water
Wetland
Population Density persons/square km
0 - 1
2 - 4
5 - 7
8 - 12
13 - 27
N
S
E
W
Municipality of the District of Digby
Region of Queens Municipality
Municipality of the District of Shelburne
Municipality of the District of Argyle (Yarmouth County)
Municipality of the District of Barrington
Upper Ohio
Granite Village
Sable River
Jordan Falls
Shelburne
Birchtown
Sandy Point
Lockeport
Western Head
McNutts Island
Clyde River
0 2.5 5 10 15
Kilometers
Data Sources:
Municipality of the District of Shelburne
NS Department of Natural Resources
Geonova
Nova Scotia Department of Energy
Nova Scotia Community College

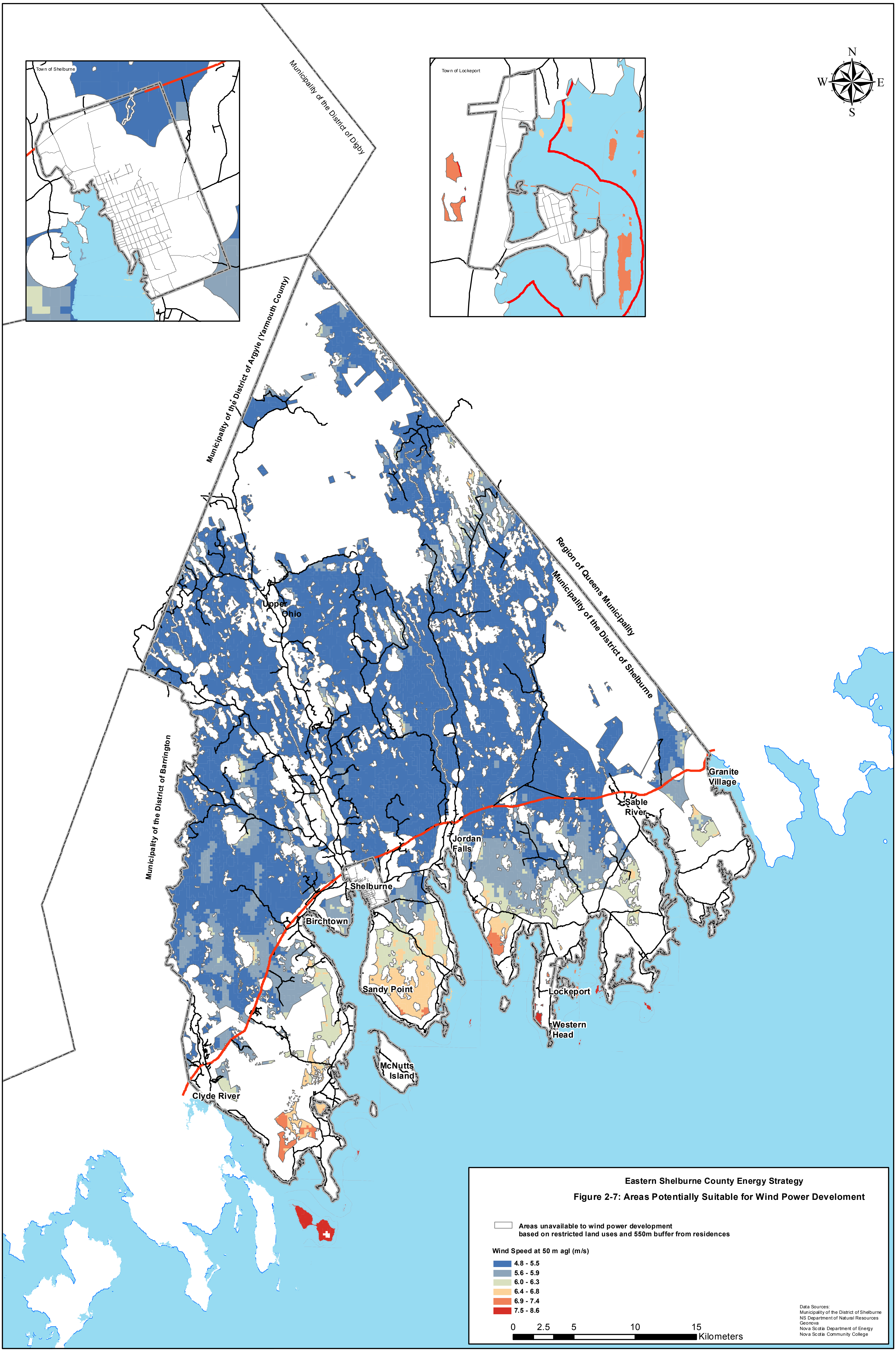


Figure 2-7: Areas Potentially Suitable for Wind Power Develoment

Solar photovoltaic panels, while a proven technology, are not currently viable in the absence of a feed-in-tariff due to the high cost of solar photovoltaic panels and the long back period. For example, in Ontario, solar photovoltaic projects receive a feed-in-tariff of up to 80 cents/kilowatt hour in order to attract solar developers. At present, Nova Scotia does not have an equivalent program to encourage solar photovoltaic projects.

2.4.3 Biomass

Eastern Shelburne County has significant forest biomass resources that can be potentially used for energy as round wood, chips or when feasible, pellets. The biomass of merchantable timber ranges from 60-70 tonnes/ha in South Shore ecodistrict (coastal areas south of Highway 103) to 80-90 tonnes/ha in the Sable ecodistrict (the remainder of Eastern Shelburne County north of Highway 103)[7]. Currently wood pellets are being provided to the Tri-County School Board for a new school in Yarmouth from Enligna in Upper Musquodoboit. However, wood pellets could be produced locally if local demand increases.

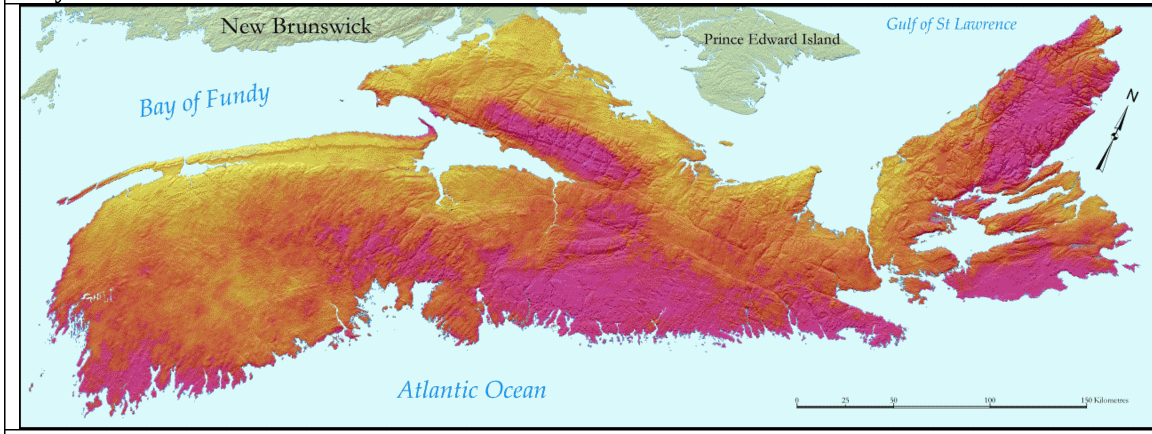
Energy crops, such as willow, miscanthus, and switchgrass are common alternatives to the use of forest biomass in many jurisdictions as these species can be grown on marginal and underutilized land. However, based on a recent study by the Nova Scotia Agricultural College[8], the total available marginal land in Nova Scotia for energy crop production is 40,000 ha of which only 400 ha is located in Shelburne County. This limited amount of land, if suitable, could have the potential to generate 4,000 tonnes of wood chips from willow and similar species for heat offsetting 1.4 million l of light fuel oil.

[7] Nova Scotia Department of Natural Resources, 2008. Forest Biomass of Living, Merchantable Trees in Nova Scotia. Report FOR 2008-9.

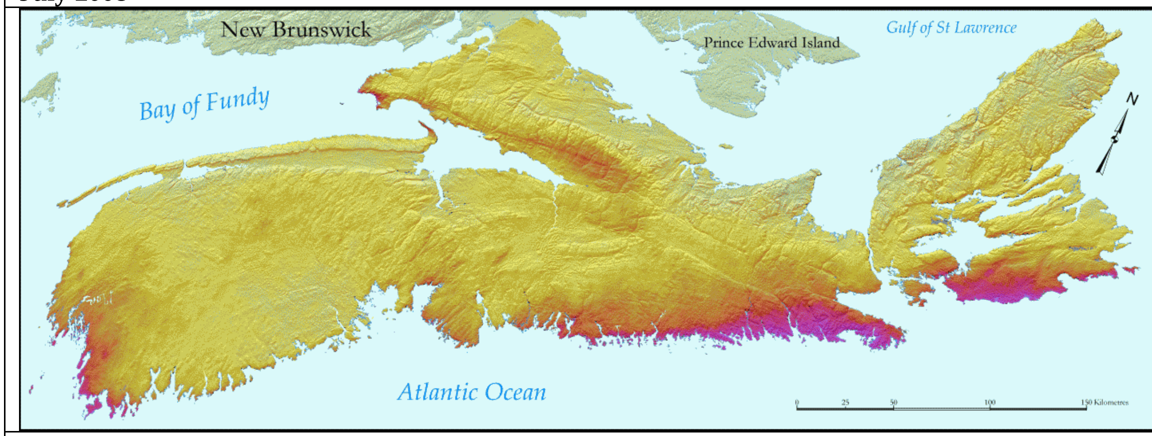
[8] Dr. Michael Main, Nova Scotia Agricultural College. Presentation – Agricultural Biomass Availability for Bioenergy Applications in Nova Scotia. 2008.

Figure 2-8: Average Insolation map of Nova Scotia - July 2007 to July 2009

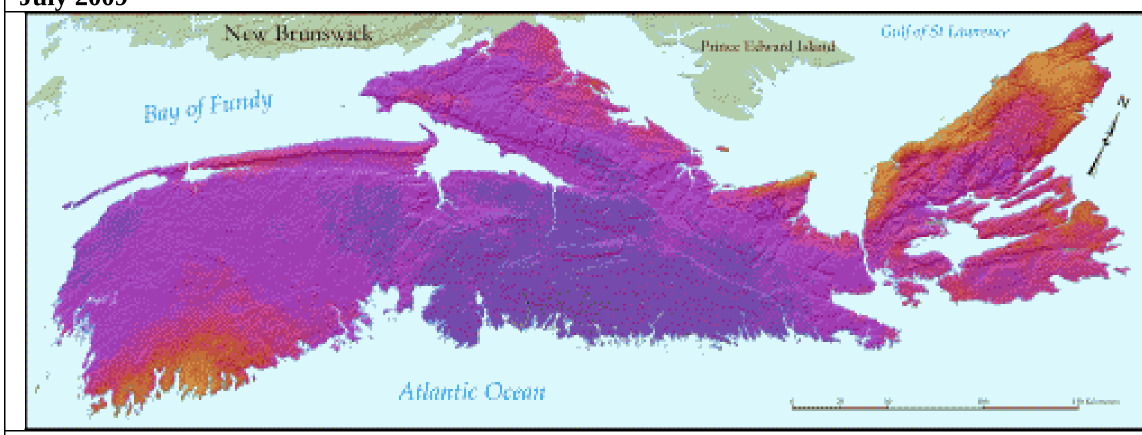
July 2007

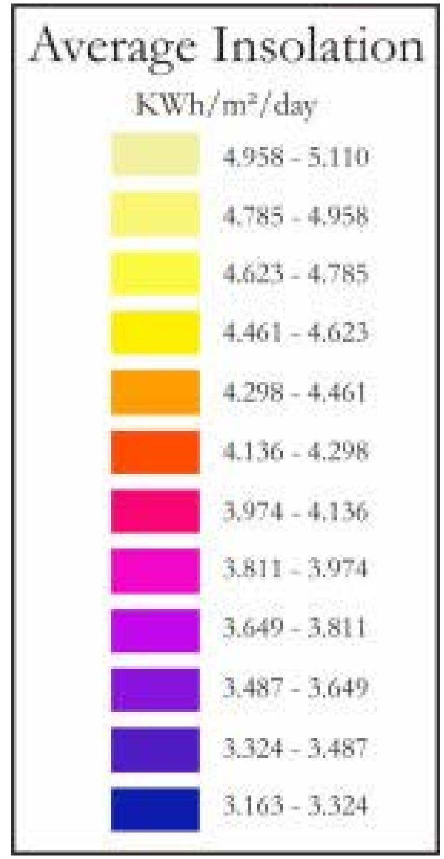


July 2008



July 2009





Credit: David Colville, Wayne Reiger and Steven Bird: Applied Geomatics Research Group Nova Scotia Community College
Alexandre Pavlovski and Vladimir Kostylev: Green Power Labs Inc.

2.4.4 Other

Other energy assets within ESC include tidal energy, wave energy, and hydro-electric generation (low head dams or run-of-river). Tidal and wave energy are still in research and development and are not likely to become commercialized during the timeframe of this energy strategy. In addition, tidal energy requires a flow of approximately 4 knots whereas tidal flows in Shelburne Harbour for example are in the range of 2 knots.

Hydro-electric generation is also a potential asset in ESC, however, the potential capacity, associated capital costs, and regulatory requirements tend to be site specific and were not available for incorporation for this strategy.

2.5 Provincial Plans and Policies

The Energy Strategy (Nova Scotia Department of Energy, 2009b) promotes an orderly approach to transitioning the province from coal to a cleaner, more diversified energy mix. The Energy Strategy recommends that 25% of Nova Scotia's energy be derived from renewables by 2020. More recently, Nova Scotia's Renewable Electricity Plan, amendments to the *Electricity Act*, and the recently promulgated *Renewable Energy Regulations* establishes an overall target of 40% by 2020, with a shorter term target of 25% of total electricity revenue by 2015. These targets will be achieved through a combination of new renewable generation by NSPI and independent power producers; conservation (energy efficiency); and the establishment of a Community Feed-in-Tariff (COMFIT). These represent important opportunities for ESC to reduce reliance on fossil fuels. NSPI has already initiated several energy efficiency programs to begin to address the conservation element. These programs have been incorporated into the opportunities discussed in Section 3. In addition, depending on the tariffs (rates paid to energy providers), the municipalities in ESC could be in position to take advantage of the COMFIT once the province begins to accept applications (expected to be late winter 2011) to help finance renewable energy projects.

In order to facilitate delivery of energy efficiency programs in Nova Scotia, the province is in the process of setting up a new, not-for-profit organization – Efficiency Nova Scotia (ENS). The final form and mandate of

Efficiency Nova Scotia is still being finalized, as is, its relationship with the existing Conserve Nova Scotia and Clean Nova Scotia. ENS's proposed launch date is January 1, 2011.

Clean Nova Scotia (CNS) is a non-profit environmental organization that provides information and resources to the public to encourage positive environmental decisions. CNS coordinates several programs for residents, municipalities, and business dealing with energy conservation, energy efficiency transportation, air quality, water conservation, waste diversion, and recycling. Example CNS programs include: home energy evaluations; environmental home assessment; DriveWiser (how to green your driving); Retire Your Ride; and WiserTrips (how to green your transportation needs). CNS also conducts education and outreach programs to inform communities on how they can make greener environmental choices and take advantage of their programs.

3.0 Opportunities

3.1 Evaluation Methodology

3.1.1 Identification of Potential Opportunities

Given current energy usage and the projected increase in energy costs, it is clear that the energy strategy should focus on reducing energy costs and greenhouse gas production by strategically investing in cost effective energy efficiency strategies and renewable energy technologies in the short (today), medium (1-5 years) and long (greater than 5 years) terms in order to meet energy related objectives in the municipalities' ICSPs.

As a first step in the identification of potential project opportunities, a long-list of project ideas, concepts, and technologies was prepared by the project team in consultation with Eastern Shelburne County municipalities. The list was divided into three project-type categories: energy efficiency; district energy; and renewable energy generation. In addition, the sector(s) to which each opportunity could be applied was identified. The sectors included: municipal, residential, commercial, industrial, institutional, public-private-partnership, and private developer.

The list was subsequently qualitatively screened to identify those technologies most likely to be implementable in ESC. Primary considerations for whether a project or technology could be implemented included:

- Was there an example of the opportunity or technology installed in the province?
- Was the opportunity or technology commercially available in the province?
- Could, based on a pre-feasibility assessment and the project team's experience, the opportunity or technology be attractive from a life cycle cost perspective (reasonable pay-back and/or available funding)?

This initial screening is summarized in Table 3-1.

Table 3-1 Results of Initial Opportunity Screening

Opportunity	Installed or Implemented in Nova Scotia	Commercially Available	Potentially Financially Viable	Timeframe[9]	Sector[10]	Comments
Energy Efficiency						
Building envelope improvements	Yes	Yes	Yes	S	M, C, I, In, R	Broad range of envelope improvements funded under ecoEnergy and NSPI Custom programs.
Lighting and motor improvements	Yes	Yes	Yes	S	M, C, I, In	
Wood and wood waste biomass retrofit for boilers	Yes	Yes	Yes	M	M, C, I, In	
Boiler and chiller improvements	Yes	Yes	Yes	S – M	M, C, I, In	
Industrial process improvements	Yes	Yes	Yes	S – M	I	Recommended for future study as process specific data are required to identify areas for improvement.
Waste heat and waste cold opportunities	Yes	Yes	Yes	M	M, C, I, In	Recommended for future study as process specific data

[9] S = Short (today), M = Medium (1-5 years), L = Long (5 years +)
[10] M = Municipal, C = Commercial, I = Industrial, In = Institutional, R = Residential, PPP = Private/Public Partnership, PD = Private Developer

Opportunity	Installed or Implemented in Nova Scotia	Commercially Available	Potentially Financially Viable	Timeframe[9]	Sector[10]	Comments
						are required to identify areas for improvement.
District Energy						
Biomass cogeneration (Roseway Hospitial)	Yes	Yes	Yes	M	I, In	
Hospital, seniors residence, NSCC, plus industrial park also has potential with option to hook up former youth detention centre	Yes	Yes	Yes	M	In with potential to expand to I	Hospital and NSCC included in evaluation. Further study and energy information recommended to determine viability of adding industrial users.
Harbour cooling to promote industry requiring cold (above 0 °C)	Yes	Yes	Yes	L	I	Further study required to identify suitable industries and infrastructure required.
Cold water opportunity for Clearwater at Government Wharf	Yes	Yes	Yes	L	I	Recommend further study of use of cold at plant and feasibility.
Underground thermal storage for heating and cooling loads	No	No	No	-	-	
Arena, Community Centre, and adjacent businesses have potential for a system. (heat from arena to heat	Yes	Yes	No	-	-	Not included in evaluation due to limited heat available from arena due to

Opportunity	Installed or Implemented in Nova Scotia	Commercially Available	Potentially Financially Viable	Timeframe[9]	Sector[10]	Comments
neighbouring businesses)						operating period.
Clearwater plant in Lockeport and immediately surrounding area (heat from refrigeration plant to heat neighbouring businesses)	Yes	Yes	No	L	I	Recommend further study of energy use at plant and neighbouring businesses.
Renewable Energy						
Solar thermal	Yes	Yes	Yes	S	M,C, I, In, R	HST rebate available.
Biomass electrical generation system	Yes	Yes	Yes	M	I, In	Can be either distributed generation or utility scale.
Site specific or utility scale wind development	Yes	Yes	Yes	M	M, C,I, In, PPP, PD	Net metering regulations being finalized. Wind potential needs to be marketed to the wind industry. Requires NSPI to undertake an interconnect study.
Former base lands are an opportunity for wind or other renewables	-	-	Yes	M	PPP, PD	Lands may be suitable for wind development. See comment above.
Photovoltaic solar – roof top	No	No	No	L	M, C, I, In, R	Requires a feed-in-tariff or similar program to be viable.
Photovoltaic solar – generation	No	No	No	L	PPP, PD	Requires a feed-in-

Opportunity	Installed or Implemented in Nova Scotia	Commercially Available	Potentially Financially Viable	Timeframe[9]	Sector[10]	Comments
or utility scale						tariff or similar program to be viable.
Small hydro and low head dam refurbishments; run-of-river hydro	No	No	Unknown	-	-	Further study of environmental impacts required.
Residential wind	Yes	Yes	Yes	S - M	R	
Peat bog as an energy source	No	No	Unknown	-	-	Would not likely be approved as bogs are considered wetlands under the Environment Act
In-stream Tidal	Yes. Experimental	Yes	No	-	-	Tidal range in Shelburne Harbour (<1 knot) is less than recommended (3.9 knots)[11].
Emerging Technologies/Opportunities						
Wood pellet industry	Yes	Yes	Potentially	L	PD	Requires further market and feasibility assessment.
Plug in hybrid car for energy storage	No	No	Yes	L	M, C, I, In, R	More appropriate in jurisdictions where energy mix includes more renewables. Vehicles not readily available.

[11] Triton Consultants Limited, 2002. BC Green Energy Study – Phase 2 – Tidal Current Energy.

Opportunity	Installed or Implemented in Nova Scotia	Commercially Available	Potentially Financially Viable	Timeframe[9]	Sector[10]	Comments
Wave energy	No	No	No	L	PPP, PD	Technology in prototype/experimental stage
Production of butanol opportunity using biomass	No	No	Unknown	L	PD	Technology in early experimental stage.

3.2 Opportunity Evaluation

3.2.1 Energy Efficiency

Energy efficiency is one of the two pillars of a sustainable energy policy [12], the other being renewable energy. In many countries energy efficiency is also seen to have a national security benefit because it can be used to reduce the level of energy imports from foreign countries and may slow down the rate at which domestic energy resources are depleted.

According to the International Energy Agency, improved energy efficiency in building, industrial processes and transportation could reduce the world's energy needs in 2050 by one third, and help control global emissions of greenhouse gases.[13]. An example of how energy efficiency should be adopted would be the conversion of an 60 W incandescent light bulb used outdoors on a house, left on night to a 13 W compact fluorescent light bulb on a daylight photocell timer. The bulb is replaced with a CFL saving 47 W per hour it is on and the daylight photocell timer only brings the light on when it is dark and shuts the light off after midnight savings a total of 320 kWh per year or $ 39 per year at $ 0.17 per kWh including taxes.

Organizations should pursue energy efficiency prior to conversion to renewable energy systems because it reduces the demand for energy and thereby reducing the size of renewable energy systems and associated need for additional capital.

There other motivations to improve energy efficiency are

- Reducing energy costs, which results in financial savings to consumers, and
- Reducing greenhouse gases may result in a financial cost saving to consumers when greenhouse gas reduction regulations are developed.

Energy efficiency measures range from changing lighting from incandescent to fluorescent, to building envelope improvements such as improving insulation or updating windows, to industrial process improvements.

[12] The Twin Pillars of Energy Efficiency, ACEEE.ORG, 2008-05-05
[13] Invest in Clean Energy Technology – Sophie Hebden, June 22, 2006 Environmental News (EN)

In addition, energy efficiency measures are attractive because of the range of government and utility funding programs available to encourage implementation of energy efficient projects. A review of funding programs identified the following programs applicable to ESC municipal, commercial, industrial, institutional, and residential sectors:

Municipal, Commercial, Institutional, Industrial

- The Federal ecoEnergy Retrofit for Building Program, which will pay $10 per GJ to any measure which reduces energy consumption from any energy source.
- The Federal ecoEnergy Retrofit for Industry Program, which will pay $10 per GJ to any measure which reduces energy consumption from any energy source.
- The Federal ecoEnergy for Solar Thermal Program, which will pay $275 per square meter of solar system installed and is applicable to the residential sector.
- The Provincial Solar hot water rebate which will pay up to $20,000 or 15 % of the total system cost and is applicable to the residential sector.
- The Nova Scotia provincial Solar air rebate which will pay up to $20,000 or 15 % of the total system cost.
- The Nova Scotia Power Inc. Small Business Lighting Solutions Program which will pay 80 % of the lighting retrofit costs to upgrade the fluorescent lighting system and have the remaining 20 % be paid over two years.
- The Nova Scotia Power Inc. Business Energy Rebate Program which will pay approximately 25 % of the capital cost of selected electrical consuming appliances including variable speed drives.
- The Nova Scotia Power Inc. Commercial Industrial New Construction Program, which will pay up to $500,000 in energy efficiency measures. The incentives for this program are the same as the Commercial and Industrial Custom program that is a maximum $500,000 per project, calculated as the lesser of $0.15 per kWh or 50% of the incremental cost.

Residential

- The Nova Scotia EnerGuide for New Houses Program through Efficiency Nova Scotia which will pay up to $750 to register the house in the program.
- The Nova Scotia R-2000 Program through Efficiency Nova Scotia, which will pay up to $1,000 and reduced financing rates to register the house in the program.
- The Nova Scotia EnerGuide for Multi-unit Residences Program administered through Clean Nova Scotia which will pay up to $4,500 to air seal a multi-unit residential building.
- The Nova Scotia Home Assessment Program through Clean Nova Scotia which will pay up to $1,500 to air seal a building.

Financing Programs

In addition to the direct funding programs described above, there are also financing programs available to assist in the development of renewable energy and electricity systems. Because these are tax based, these programs can only be accessed through a private partner. These programs include:

- The Federal Accelerated Capital Cost Allowance 43.1 Program, which permits 30% capital cost deduction for tax purposes for certain renewable electricity generation and cogeneration systems (taxable entity required).
- The Federal Accelerated Capital Cost Allowance 43.2 Program, which permits 50% capital cost deduction for tax purposes for certain renewable electricity generation and cogeneration systems (taxable entity required).
- The Federal Canadian Renewable Conservation Expense (CRCE) Program, which will allow accelerated deductibility for tax purposes of certain development expenses incurred in connection with Class 43.1 and 43.2 assets (taxable corporation required).
- The Federal Flow Through Shares Program, which will allow corporations to flow through deductibility of CRCE expenditures via the issuance of flow-through shares (taxable corporation required).
- The Nova Scotia Community Economic Development Incentive Program (CEDIF), which provides provincial tax credits of 35% to 65% to Nova Scotia residents investing in local companies. In certain

cases, these investments can be RRSP eligible as well. These Community Economic Development Corporations could in turn invest in renewable energy projects.

A complete list of the applicable funding programs, criteria, and links are included in Appendix A. An example of how these funding programs can be applied to a typical commercial building in ESC is provided in Appendix B.

Energy efficiency opportunities were selected on the basis of:

- the results and recommendations of energy audits provided by ESC municipalities;
- available funding programs; and
- project team experience.

Based on these criteria, a number of energy efficiency project types can be implemented in ESC to reduce energy demand in all sectors (municipal, commercial, industrial, institutional, and residential). While sector and location specific projects will vary due to the sector/location specific energy use, feasible projects are expected to be drawn from the following categories:

- Upgrade lighting to fluorescent lighting.
- Install energy efficient equipment.
- Building envelope improvements, e.g. windows, insulation.
- Install solar thermal hot water.
- Industrial process improvements.
- Retire Your Ride.
- Install ground source heat pumps.

3.2.2 District Energy and Renewable Energy

For the evaluation of both district energy and renewable energy opportunities, the potential opportunities were evaluated using the RETScreen pre-screen (http://www.retscreen.net/ang/home.php) methodology. RETScreen is a spreadsheet-based tool, which allows engineers, architects, and financial planners to model and analyze any clean energy project. With RETScreen, the users can conduct a five step project analysis, including energy analysis, cost analysis, emission analysis, financial analysis, and sensitivity/risk analysis.

RETScreen contains financial analysis features that provide calculations of a number of capital project analysis methodologies. Due to a simplistic approach and dependence on user provided inputs for inflation and discount rates, caution needs to be exercised in using this functionality and interpreting its outputs. That said it is a useful and expeditious tool for performing the quantitative analysis for evaluating renewable energy projects at a very early stage of project determination and analysis.

The following technology systems were included in the RETScreen assessment. These particular technologies were chosen based on the results of the project team's review of available renewable energy technologies as summarized in Table 3.1:

Renewable Electricity

- Wind Energy
- Wood fired Cogeneration

Renewable Thermal Energy

- Wood fired biomass
- Solar Thermal
- Wood fired District Energy

The larger energy users were chosen from each municipal unit as the user of the technologies for the purposes of the RETScreen assessment. Not all technologies can or should be included at one site because of the interaction of the various energy components and their effect on the economics of each system. Therefore the application of the most attractive technologies was included below as a proxy for its application elsewhere in the study area. Table 3-2 presents the summary of the technologies evaluated by municipality and technology type.

Table 3-2 RETScreen Technologies Evaluated

Technology	Wind Energy (NW 100; Vestas V82; Enercon 48)	Wood-fired Cogeneration (Entropic Energy HBC100)	Wood-fired Biomass (Viessman Group Pyrotec)	Solar Thermal (Solar Dynamics G32)	Wood-fired District Energy (Viessman Group Pyrotec)
Municipality of the District of Shelburne					
Roseway Hospital	✓	✓	✓		✓
NSCC Fisheries College			✓		✓
Shelburne DHS	✓		✓		
Town of Shelburne					
Fire Hall				✓	
Town of Lockeport					
Clearwater	✓				

The following technologies were selected for RETScreen analysis:

<u>Small Wind System – Northern Power Systems – NW 100 (Wind Turbine)</u>

This system in made in the United States and was chosen as an example of a small wind energy system because it has been installed in Nova Scotia within the last 3 years. The nearest NW100 is located in Porters Lake, Nova Scotia and serves the Atlantic Superstore. The other NW100's have been installed within the Atlantic Provinces, three of them located at a Newfoundland Hydro site and one located at a wastewater treatment facility in Kensington, Prince Edward Island.

The NW100 installed in Porters Lake is projected to produce 0.25 GWh per year at an estimated annual average wind speed of around 6.6 m/s. The wind turbine has a design life expectancy of 20 years and an approximate installed budget cost of $500,000 or $ 5,000 per kW.

Enercon E-48 800 kW (Wind Turbine)

This system has been installed at seven sites in Nova Scotia. The closest site is Digby. The oldest machines have been in service since 2005 at Lingan, Glace Bay and Donkin. This is a proven technology.

Large Wind System – Vestas V82 – 1.65 MW (Wind Turbine)

This system information was based on a recent installation in Ontario and is used as an example of a large wind energy System. Vestas V82's have been installed in the Province of Ontario at 5 sites. Four of the Ontario sites have each installed at total of 6 Vestas V82's. Each of these sites has a total installed power of 9.9 MW and has an estimate production of 24 GWh per year. The other one site in Ontario has installed a total of 5 Vestas V82's for a total installed power of 8.25 MW and an estimated production of 20 GWh.

The installed budget cost is estimated at approximately $4,500,000 per Vestas V82 based on estimated costs from a 2005 feasibility study for the town of Fairhaven, Massachusetts. The installed cost is $ 2,700 per kW. This is a proven technology.

Thermo Dynamics – G32 (Solar Collector)

This information was provided by Thermo Dynamics, a local Nova Scotian company which has manufactured solar systems since the mid 1980s, There are several local Nova Scotia sites with the G32 collector installed including: YMCA Yarmouth (40 Collectors); Kejimkujik National Park (8 Collectors); Berwick Firehall (34 Collectors); and Tideways in Wolfville (50 Collectors).

The installed cost is approximately $ 70 per square meter or $ 450 per kW installed. This is a proven technology.

Large Biomass System – Viessmann KOB Boilers

This system information was based a presentation provided by the national distributer of Viessmann KOB Boilers. The Atlantic Canadian sites include several schools in Prince Edward Island. The system has also been recently installed for a district energy system for four schools in Hay River, Northwest Territories.

Entropic Energy – HBC100 (Biomass Cogeneration system)

This system information was based on information provided by the manufacturer of the system. This is new system and is still at the prototype stage. Enquires were made to other manufacturers but the information was unavailable for this report.

This system is a 100 kW electrical system with the capability of providing up to 500 kW in thermal energy. The installed cost is estimated to be $ 4,400 per kW thermal.

Table 3-3 summarizes the specifications and key inputs of the RETScreen analysis for the technologies discussed above.

Table 3-3 RETScreen Analysis Summary

Technology	Manufacturer /Model	Type of Energy Supplied	Peak Size of System	Current System Fuel Usage	Future Potential System Fuel Usage	Annual GHG Savings	Capital Cost	Annual Cost Savings	Estimated Life Expectancy (Years)	Fuel Cost Escalation Rate[14]	Inflation Rate
Roseway Hospital - Municipality of the District of Shelburne											
Discrete Wind Energy and Biomass System	Enercon 48 - 800 kW - 50m	Power	800 kW	NSPI Elec. - 2,292 MWh	NSPI Elec. 610 MWh; Wind Elec. - 1,682 MWh	1,245 tCO2	$2,800,000	$141,824	30	3%	2%
	Viessman Group - Pyrotec 720 kW	Heating	720 kW	Diesel - 2,114 MWh	Diesel - 0 MWh; Wood pellets - 1,492 MWh	531 tCO2	$516,780	$130,727	25	3%	2%
Roseway Hospital + NSCC - Municipality of the District of Shelburne											
Discrete Biomass District Energy System	Viessman Group - Pyrotec 1250 kW	Heating	1250 kW	Diesel - 3,055 MWh	Diesel - 0 MWh; Wood pellets - 2,378 MWh	766 tCO2	$1,064,760	$177,481	25	3%	2%
Wood Based Cogeneration District Energy System	Entropic Energy - HBC100 100 Kwe, 500 kWth	Combined Heat & Power	100 kWe 500 kWth	NSPI Elec. - 2,512 MWh; Diesel - 3,707 MWh	NSPI Elec. - 1,636 MWh; Diesel - 1,261 MWh; Wood Pellets - 5,840 MWh	1,238 tCO2	$2,212,576	$402,899	25	3%	2%
Nova Scotia Community College (NSCC) - Municipality of the District of Shelburne											
Discrete Biomass System	Viessman Group - Pyrotec 300 kW	Heating	300 kW	Diesel - 941 MWh	Diesel - 0 MWh; Wood pellets - 886 MWh	235 tCO2	$305,250	$46,754	25	3%	2%
Shelburne Regional High School - Municipality of the District of Shelburne											
Discrete Wind Energy and Biomass System	Northern Power Systems - NW 100/20 - 30m	Power	100 kW	NSPI Elec. - 608 MWh	NSPI Elec. 430 MWh; Wind Elec. - 178 MWh	132 tCO2	$500,000	$21,653	30	3%	2%
	Viessman Group - Pyrotec 720 kW	Heating	720 kW	Oil - 1,122 MWh	Diesel - 0 MWh; Wood pellets - 1,122 MWh	228 tCO2	$516,780	$51,722	25	3%	2%
Community Centre (Fire Hall) - Town of Shelburne											
Solar Water Heater	Thermo Dynamics - G32	Heating	46.7 kW	Heating Oil - 54 MWh	Heating Oil - 19 MWh; Solar (DHW) - 29 MWh	9 tCO2	$49,900	$3,106	30	3%	2%

[14] For the purposes of the analyses, fuel cost escalation was conservatively assumed to be 1% greater than the rate of inflation.

Technology	Manufacturer /Model	Type of Energy Supplied	Peak Size of System	Current System Fuel Usage	Future Potential System Fuel Usage	Annual GHG Savings	Capital Cost	Annual Cost Savings	Estimated Life Expectancy (Years)	Fuel Cost Escalation Rate[14]	Inflation Rate
Clearwater Pierce Fisheries - Town of Lockeport											
Wind Turbine	Vestas V82 - 1.65 MW - 59m	Power	1650 kW	NSPI Elec. - 4,693 MWh	NSPI Elec. 1,075 MWh; Wind Elec. - 3,618 MWh	2,677 tCO2	$4,675,400	$302,165	30	3%	2%

3.2.3 Financial Analysis

Of the financial analysis methods computed within the RETScreen model, the focus was placed on three methods the project team considered most useful in evaluating financial feasibility and enabling ranking of the feasible projects. These are the Payback Period, Internal Rate of Return and Benefit-Cost Ratio. A description of each of these methods is provided in Appendix C. The results of the RETScreen evaluations are summarized in Table 3-4.

The three financial analysis methodologies yielded the same rankings for the projects analyzed.

The Viessman Pyrotec 720 kW biomass heating system at Roseway Hospital should be preferred over all other projects considered. The Entropic HBC100 combined heat and power biomass system at Roseway Hospital and NSCC, the Viessman Pyrotec 1250 kW biomass heating system at Roseway Hospital and NSCC and Viessman Pyrotec 300 kW biomass heating system at NSCC ranked 2nd, 3rd and 4th, respectively, although fairly close in their financial analysis results. The Viessman Pyrotec 720 kW biomass heating system at Shelburne High School was ranked 5th. The lowest rankings were held by the wind turbines and the solar water heater technologies. However, since these technologies may have an economic life exceeding 20 – 25 years, the longer payback period, lower internal rate of return and lower benefit cost ratio may be acceptable.

It should be noted that, although the Entropic system ranked second place, likely due in part to higher efficiencies generated by its combined heat and power output, its ranking ahead of some other technologies may not be significant enough to outweigh the potential risks associated with it. At this time, the science used by the system is proven, the system itself, however, is unproven because Entropic Energy does not have any customers who have purchased and installed its system.

Table 3-4 Results of RETScreen Evaluations

Technology	Manufacturer/Model	Type of Energy Supplied	Peak Size of System	Assumption Notes	Current System Fuel Usage	Future Potential System Fuel Usage	Annual GHG Savings	Capital Cost	Annual Cost Savings	Estimated Life Expectancy (Years)	Simple Payback (years)	Equity Payback (years)	Internal Rate of Return	Benefit Cost Ratio	Overall Rank
Discrete Biomass System – Roseway Hospital	Viessman Group - Pyrotec 720 kW	Heating	720 kW	1. Efficiencies - oil fired boiler 80 % - Biomass boiler 85 % 2. Biomass fuel used = Wood - pellets	Diesel - 2,114 MWh	Diesel - 0 MWh; Wood pellets - 1,492 MWh	531 tCO2	$516,780	$130,727	25	3.8	3.7	29.0%	3.0	**1**
Wood Based Cogeneration District Energy System – Roseway Hospital and NSCC	Entropic Energy - HBC100 100 Kwe, 500 kWth	Combined Heat & Power	100 kWe 500 kWth	Heat Rate - 24,2000 KJ/kWh 90% Heat Recovery Rate	NSPI Elec. - 2,512 MWh; Diesel - 3,707 MWh	NSPI Elec. - 1,636 MWh; Diesel - 1,261 MWh; Wood Pellets - 5,840 MWh	1,238 tCO2	$2,212,576	$402,899	25	5.4	5.0	21.5%	2.2	**2**
Discrete Biomass District Energy System – Roseway Hospital and NSCC	Viessman Group - Pyrotec 1250 kW	Heating	1250 kW	1. Efficiencies - oil fired boiler 80 % - Biomass boiler 85 % 2. Biomass fuel used = Wood - pellets	Diesel - 3,055 MWh	Diesel - 0 MWh; Wood pellets - 2,378 MWh	766 tCO2	$1,064,760	$177,481	25	5.7	5.4	19.8%	2.0	**3**
Discrete Biomass System - NSCC	Viessman Group - Pyrotec 300 kW	Heating	300 kW	1. Efficiencies - oil fired boiler 80 % - Biomass boiler 85 % 2. Biomass fuel used = Wood - pellets	Diesel - 941 MWh	Diesel - 0 MWh; Wood pellets - 886 MWh	235 tCO2	$305,250	$46,754	25	5.9	5.9	18.4%	1.8	**4**
Discrete Biomass System - SRHS	Viessman Group - Pyrotec 720 kW	Heating	720 kW	1. Efficiencies - oil fired boiler 90 % - Biomass boiler 85 % 2. Biomass fuel used = Wood - pellets	Oil - 1,122 MWh	Diesel - 0 MWh; Wood pellets - 1,122 MWh	228 tCO2	$516,780	$51,722	25	9.1	8.6	12.2%	1.2	**5**
Wind Turbine – Clearwater Pierce Fisheries, Lockeport	Vestas V82 - 1.65 MW - 59m	Power	1650 kW	Average Annual Wind Speed is 7.0 m/s	NSPI Elec. - 4,693 MWh	NSPI Elec. 1,075 MWh; Wind Elec. - 3,618 MWh	2,677 tCO2	$4,675,400	$302,165	30	15.5	12.3	8.5%	0.9	**6**
Solar Water Heater – Town of Shelburne Fire Hall	Thermo Dynamics - G32	Heating	46.7 kW	2000 L/day of Hot Water is Used @ 60 deg C	Heating Oil - 54 MWh	Heating Oil - 19 MWh; Solar (DHW) - 29 MWh	9 tCO2	$49,900	$3,106	30	16.1	13	7.8%	0.8	**7**
Discrete Wind Energy – Roseway Hospital	Enercon 48 - 800 kW - 50m	Power	800 kW	Average Annual Wind Speed is 6.0 m/s	NSPI Elec. - 2,292 MWh	NSPI Elec. 610 MWh; Wind Elec. - 1,682 MWh	1,245 tCO2	$2,800,000	$141,824	30	19.7	15	6.4%	0.7	**8**
Discrete Wind Energy - SRHS	Northern Power Systems - NW 100/20 - 30m	Power	100 kW	Average Annual Wind Speed is 6.0 m/s	NSPI Elec. - 608 MWh	NSPI Elec. 430 MWh; Wind Elec. - 178 MWh	132 tCO2	$500,000	$21,653	30	23.1	18	4.4%	0.5	**9**

Another risk-related consideration may be dependence on alternative fuel stocks. Although the biomass systems could be judged as good and preferred renewable energy projects from a purely financial analysis perspective, biomass feedstocks similar to other commodities are subject to complex supply and demand forces that could impact their availability and price over the life span of the biomass system. In contrast, the wind and solar technologies have no such dependency on alternative fuel feedstocks.

Although biomass systems are clearly leading prospective renewable energy projects, the foregoing risk-related considerations make it difficult to rule out wind and solar on the basis of purely financial analysis. Furthermore, wind and solar can play a role in a diversified energy supply strategy that reduces the risk associated with dependency on one or few energy technologies or energy sources. However, a project developer should consider ways to enhance financial returns as much as possible. One of the ways to do this is to consider increasing the scale of each installation, although this can lead to site related dependencies.

3.3 Summary of Opportunities

The preceding opportunities analyses have identified a number of opportunities in all sectors of ESC that can be implemented in the short, medium, and long timeframes. A majority of these opportunities are energy efficiency measures largely due to the availability of funding for the measures and the fact the most of the measures could be implemented in the short to medium timeframe. Biomass heat systems and eventually combined heat and power are recommended because these systems are attractive from an economic perspective and also rely on Nova Scotian based fuel source (wood pellets). As well, solar thermal hot water heating is an attractive opportunity largely because of its proven technology and funding availability. Solar photovoltaic, however, is not economically viable at this time in the absence of a feed-in-tariff due to high capital costs. While ESC has ample wind resources, especially between the coast and Highway 103, capital cost requirements, long payback periods, and the need for a private developer mean that wind development is considered a long term opportunity. The economic attractiveness of the wind power opportunities, however, is expected to improve once community feed-in-tariff rates are established in spring 2011.

The recommended opportunities to be pursued in ESC, the respective timeframes and funding programs are summarized in Table3-5.

Table 3-5 Summary of Opportunities

Opportunity	Project-Type[15]	Timeframe	Funding Program (Appendix A)
Municipal			
Fluorescent Lighting Upgrades	EE	S	EE8, EE10, EE11, EE12
Equipment Upgrades	EE	S	EE8 (Lighting, HVAC upgrades), EE10, EE11, EE12
Municipal COMFIT wind	RE	S	Community Feed-In-Tariff
Building envelope improvements	EE	S-M	EE1, EE12, EE13
Solar Thermal Hot Water – Fire Hall	EE	M-L	EE1, EE5, EE6
Energy Efficient New Construction	EE	M	EE13
Commerical/Industrial			
Fluorescent Lighting Upgrades	EE	S	EE8, EE10, EE11, EE12, EE14
Solar Thermal Hot Water	EE	S	EE1, EE5, EE6
Equipment Upgrades	EE	S	EE8 (Lighting, motor, refrigeration, compressed air, HVAC upgrades), EE10, EE11, EE12, EE14
Building envelope improvements	EE	S-M	EE1, EE11, EE12, EE13, EE14
Industrial Process Improvements	EE	M	EE11, EE12, EE14, DE1, DE2. Will require process specific data to identify areas for improvement.
Energy Efficient New Construction	EE	M	EE13
1.65 MW Wind Turbine – Clearwater/Lockeport	RE	L	RE1, RE2, RE5 , Community Feed-in-Tariff
Harbour cooling projects	RE	L	DE3 – DE7 or RE1 – RE5. Further study required to identify feasibility.
Institutional			
Fluorescent Lighting Upgrades	EE	S	EE8, EE10, EE11, EE12
Solar Thermal Hot Water	EE	S	EE1, EE5, EE6
Equipment Upgrades	EE	S	EE8 (Lighting, motor, refrigeration, compressed air, HVAC upgrades), EE10, EE11, EE12

[15] EE = Energy Efficiency; DE = District Energy; RE = Renewable Energy

Opportunity	Project-Type[15]	Timeframe	Funding Program (Appendix A)
Building envelope improvements	EE	S	EE1, EE5, EE6
Biomass Heating System – Roseway Hospital	RE	S	DE1, EE11, EE12
Biomass Heating System - NSCC	RE	M	DE1, EE11, EE12
Biomass Heating System - SRHS	RE	M	DE1, EE11, EE12
Biomass Heating System – Roseway Hospital and NSCC combined	DE	M	DE1, EE11, EE12
Biomass Combined Heat and Power System – Roseway Hospital and NSCC	DE	M	RE1, RE2, RE5
Energy Efficient New Construction	EE	M	EE13
100 kW Wind Turbine - SRHS	RE	L	RE1, RE2, RE5
800 kW Wind Turbine – Roseway Hospital	RE	L	RE1, RE2, RE5, Community Feed-in-Tariff
Residential			
Replace incandescent lights with compact fluorescent	EE	S	EE7
Solar Thermal Hot Water	EE	S	EE1, EE5, EE6
Retire Your Ride	EE	S - M	See http://www.clean.ns.ca/
Ground Source Heat Pump	EE	M	EE1
Convert oil heat to wood pellets	RE	M	n/a

4.0 Greenhouse Gas Reduction Targets

Greenhouse gas reduction is an important outcome of increased energy efficiency and employment of renewable energy technologies. Participation in the Partners for Climate Protection program requires municipalities to set greenhouse gas reduction targets based on the program recommendations or to develop targets based on inventor information and the estimated reductions from implementing various reduction initiatives.

Greenhouse gas reduction targets can be established or adjusted at any time in the Partners for Climate Protection (PCP) program. The targets proposed in this report are based on estimated reductions in greenhouse gas emissions from three categories of action:

- Municipal corporate actions recommended by the Energy Audits conducted in 2009;
- Energy efficiency measures undertaken in the community; and
- Large scale projects (public, private and public/private partnerships) recommended in Section 3 of this report.

It is recommended that the targets be revisited after any significant changes in municipal infrastructure have been implemented (e.g. the construction and commissioning of new water or wastewater treatment infrastructure).

Table 4-1 below summarizes the results of implementing recommendations for corporate greenhouse gas reduction strategies and energy management opportunities from the Energy Audits conducted on the three municipal unit operations in 2009, compared with 2007 emissions and 2020 'Business as Usual' (BAU) forecast emissions.

Table 4-1. Summary of Municipal Corporate Emissions and EMO Reductions

Municipal Unit	2007 GHG Emissions (T eCO_2)	2020 BAU GHG Emissions (T eCO_2)	GHG Reductions from Identified EMOs (T eCO_2)	Percent Reduction
Town of Shelburne	1035.4	1094.5	152.6	14.7%
Town of Lockeport	352.6	355.5	61.6	17.5%
Municipality of Shelburne	843.2	869.3	172.1	20.4%

Based on this analysis and the opportunities available, corporate targets are recommended for the three municipal units as follows:

- Town of Shelburne: 15% by 2020
- Town of Lockeport: 17% by 2020
- Municipality of Shelburne: 20% by 2020

Several opportunities for greenhouse gas emission reductions from the wider community, including commercial, industrial residential sectors, have been explored in Section 3 of this report. Table 4-2 summarizes the greenhouse gas reductions from each of the opportunities identified and discussed. Table 4-3 summarizes current emissions, the 2020 Business As Usual forecast and the possible reductions to help define a greenhouse gas reduction target for the community.

Table 4-2 Summary of greenhouse gas emissions and reduction opportunities

Opportunity	Municipality / Sector	Potential GHG Reduction (T eCO_2) (Optimistic)	Minimum GHG Reduction (T eCO_2)
Energy Efficiency Programs	All / Residential	5,017	2508
Wind Energy (SRHS)	Municipality of Shelburne / Commercial	132	132
Biomass Heat (SRHS)	Municipality of Shelburne / Commercial	228	228
Biomass Heat or CHP (Hospital / NSCC District)	Municipality of Shelburne / Commercial	1,238	766
COMFIT Wind Energy Development	Municipality of Shelburne / Industrial	2,960	1500
Wind Energy (Clearwater / Lockeport) (COMFIT)	Town of Lockeport / Industrial	2,677	1500
Solar Hot Water (Shelburne Fire Hall)	Town of Shelburne / Commercial	9	9
TOTAL		**12,261**	**6,643**

Table 4-3 Greenhouse Gases - Current, Business As Usual, and Potential Reductions

Community Sector	2007 GHG Emissions (T eCO_2)	2020 BAU GHG Emissions (T eCO_2)	Potential Emissions Reduction (T eCO_2)	Percent
Residential	41,805	35,421	2,508 – 5,017	6.0% - 12.0%
Commercial	17,501	17,501	1,135 – 1,607	6.5% - 9.2%
Industrial	17,364	17,364	3,000 – 5,637	17.3% - 32.5%
Transportation	24,076	20,399	0	0%
Waste	2,268	2,268	0	0%
TOTAL	**103,015**	**92,954**	**6,643 – 12,261**	**6.4% - 11.9%**

The Business As Usual forecast for 2020 includes the effects of population decline, and therefore shows without any action a reduction in community emissions of 9.8%. In addition, there are opportunities presented in this report which would further reduced emissions by 6.4 – 11.9%. Based on this analysis and the opportunities available, the recommended community greenhouse gas emission reduction target is 18.0% from 2007 (absolute) levels by 2020 or 8.2% per capita by 2020. It is recommended that these targets be revisited each time census data are released and population effects can be better estimated.

5.0 Engagement

5.1 Stakeholder Communication

A strong and cohesive education program to develop and foster awareness and support from stakeholders is key to the success of ESC's energy goals. These stakeholders include, but are not limited to, councillors, and municipal staff in ESC, Municipality of the District of Shelburne Sustainability Committee, local businesses, manufacturers of energy efficient or alternative energy generation products, local utilities, local related community groups, the general public,. One method to engage and to keep the stakeholders aware of the objectives of the energy strategy is to broaden the role of the Integrated Community Sustainability Plan Advisory Committee to act as a vehicle to help communicate the key elements of the energy strategy. Engaging these stakeholders in project developments, milestones, and initiatives will ensure greater participation and therefore a more successful implementation of the energy strategy.

Information on the energy strategy should be disseminated to stakeholders via the following methods:

- Information Sessions: An important initial step is to share the energy strategy with stakeholders and allow open discussions to take place. These informational sessions can be targeted to a particular stakeholder sector or a broader audience. It is proposed that the information sessions consist of open houses to promote understanding of the strategy, how the public, businesses, and institutions can participate, and what measures are already underway. The open houses can seek to inspire a sense of the bigger picture, while providing an environment that encourages two-way communication about education on energy efficiency, energy sources, actions that can be taken, costs, cost savings, GHG savings, and the available funding programs and financial incentives.

- Workshops: The next step in the engagement process should included targeted workshops. These provide a more focussed and interactive form of communication with the stakeholders. These workshops should be tailored to each stakeholder group.

- Informational pamphlets: Are useful to relay information about the scope and goals of the energy strategy and specific measures proposed. These would also provide guidance to relevant web based information and contact information. These can be distributed individually by mail drops or added as an insert in local newspapers.

- Demonstrations: The concepts of energy efficiency, district energy, and renewable energy can be very technical for most stakeholders; therefore, a demonstration of the concepts can be helpful for understanding and acceptance. For example, the municipal websites could include a real time monitoring system that shows the energy production of a solar hot water heater. Another possibility would be to have showcase building before and after energy evaluations. This will show the actual costs and energy savings.

- Online Resources: The creation of a web page dedicated to the energy strategy accessible via the websites of the municipalities similar to what is in place for the ICSPs. This web site can include applicable documents, links to funding programs and other resources, and Frequently Asked Questions (FAQs). A sign-up list can be provided at each event and on the websites to enable follow-up contact and distribution of information. This information can include tips about energy efficiency, new energy efficiency resources and information about renewable energy. This would also be an opportunity to inform stakeholders about existing and new programs to improve energy efficiency or to fund district and renewable energy.

- Communication of Stakeholder Commitment: Have stakeholders commit to their role in the strategy. This has been shown to be an effective way to ensure long-term participation in programs, particularly when the commitment is made in writing and/or in public. The commitment can be communicated through any of the means described above but this will likely be most effective if published in the information pamphlets and webpage.

5.2 Educational Plan

Ultimately, the success of the energy strategy depends on the ability of the municipalities to inspire the community at large, businesses, and industry. Public consultation on the energy strategy is integral to communicating the strategy and obtaining community feedback. Thus, there are opportunities for stakeholders to explain the reasoning behind the goals and to answer any questions that may arise.

The proposed education strategies are based on Community Based Social Marketing (CBSM) theory through which barriers are assessed and solutions are developed based on previous experience in the municipality or elsewhere. When barriers are identified and appropriate programs are designed to address these barriers, the frequent result is that individuals adopt more sustainable decisions, which are the corner stone of healthier, more sustainable communities.[16]

CBSM is a tool that can be used to educate stakeholders and the community at large. In terms of the Eastern Shelburne County Energy Strategy, there are several directions that can be explored depending on the behavioural changes that are desired.

Steps in the CSBM process include:

1. Identification of relevant audiences (homeowners, businesses, staff, institutions). It is important to tailor CSBM approaches to the needs of a specific audience to achieve optimal results.

2. Identify what will engage the audience. This step involves identifying those stakeholder strategies summarized in the preceding section that will work best with a particular audience or sector. For example, based on ESC's experience through the ICSP process, a combination of workshops and open houses supplemented with one-on-one or small group meetings may be the preferred means of engaging stakeholders.

3. Identify the "good news" message is for the audience. The good news message associated with the energy strategy includes: cost savings, less reliance on imported energy sources, economic development, and sustainability.

[16] McKenzie-Mohr, Doug and William Smith, 1999. Fostering Sustainable Behaviour: An Introduction to Community-Based Social Marketing. Gabriola Island, British Columbia. New Society Publishers.

4. Communicate. There are a variety of CSBM tools that can be used to assist desired behavioural change, including:

    - Communication: It is important to communicate the problem and desired goal before offering a solution. In order for people to change their behaviour, they need to understand what the problem is and what ESC's goals are. It is important to use captivating information that is easy to remember and is from a credible source. This will help to provided motivation for the success of the program.

    - Prompts: These can be an important tool in the implementation of the energy strategy. Prompts are to remind people to adopt a more sustainable behaviour (not idling, closing the fridge door, not letting the water run). Prompts should be noticeable, self-explanatory and in close proximity to where the action will take place. An example of this would be to have idle-free signs where parents pick up their children at school.

    - Incentives and Social Norms: Acknowledge people, municipal departments, and businesses for making sustainable choices. By advertising what individuals or businesses are doing to become more sustainable, it can encourage others to adopt more sustainable practices. This acknowledgement could be via print media or ESC municipalities' websites.

    - Commitments: Similar to incentives and social norms, public ccommitments have been shown to help involve residents and businesses in the energy strategy by bringing the issues down to the level of personal/corporate action.

5. Evaluation of the success of the program. An assessment of the effectiveness of the program, its materials, messaging, and tools will demonstrate where the program is successful, and where it faces challenges. Evaluation of the program can be measured in terms of number of projects implemented and documented energy savings.

5.3 Dissemination of Information

To maintain support from the public, it is important to keep them engaged and aware of project implementation as well as the overall benefits for the community. This is much more likely to result in a successful project. Using multiple methods of information dissemination also ensures greater engagement. Information can be disseminated through the following means:

- Media attention: The media can be engaged and encouraged to feature the program. Positive messaging that focuses on the longer term sustainability goals of the community and demonstrates ESC's leadership in the province will be promoted. Community newspapers could offer sustainability articles to offer readers tips about how to reduce their energy consumption (energy efficiency tips). This information could be channelled through the Shelburne Coast Guard, ShelburneCountyToday.com and/or Eastlink Shelburne and Barrington Passage.

- Social Marketing (Twitter, Facebook, blogs): This is a great way to engage youth in the conversation about the energy strategy. This tool is probably best used as a means to update stakeholders and the public on the progress of implementation and success stories.

- Personal Interaction: People engaged one-on-one in conversation retain information better than those exposed to a brochure or awareness campaign. The municipalities can set up information booths and displays at public events (e.g. Shelburne County Lobster Festival, Wood's Harbour Days, Lockeport & Area Canada Day Festival, Founder's Day, Shelburne County Pumpkin Festival, etc.) to interact with members of the general public. This also gives the public an opportunity to voice any concerns or questions that they may have.

- Reference Information: Useful reference information should be available to the public and stakeholders in print and electronic formats. This information should be easy to access from public places (municipalities, libraries, businesses). The public and stakeholders can be notified about new additions to reference information through the print media, email, and social marketing.

- Partnerships: Take advantage of existing community organizations to build on the work that has already been done (e.g. develop a network of highly concerned citizens, utilize existing volunteer bases, and work with schools to get the youth in the community involved). Develop new partnerships with local contractors/home renovators, real estate agents and builders to deliver the information to homeowners, renovators or homebuyers.

- School Education: There are various teaching resources and presentation that teachers can take advantage of to learn about energy efficiency, climate change, renewable energy and other environmental topics.

6.0 Recommended Actions

This strategy highlights that in order to meet the goals and objectives of the municipalities' Integrated Community Sustainability Plans with respect to energy, Eastern Shelburne County should: reduce energy consumption; replace electricity generated from fossil fuels with electricity generated by renewable sources; replace oil consumption for heating with efficient forms of biomass (e.g. wood pellets). This strategy demonstrates that there are several opportunities available to Eastern Shelburne County that can be implemented in the short to long term that will achieve the goals of the ICSPs by: reducing overall energy use; improving energy security by utilizing locally available energy assets, such as wind and wood; and by providing projects that can support and encourage local economic development. The following actions are recommended to implement the energy strategy. Note that these actions are based on current energy pricing and the economic viability of the recommended opportunities/projects. Depending on the price of energy, and the upcoming COMFIT rates, some future projects such as wind and biomass conversion may become more viable short term projects.

Table 6-1 Actions for the Next Two Years

Action	Timeframe	Responsibility
Resource Requirements		
Implementation of the Energy Strategy in the short to medium term may exceed capacity of existing staff to be fully engaged with the process. The short and medium term is seen as the most critical as residences, businesses, municipal departments, and institution will require assistance with knowing what programs are available and how to access funding. As a result, it is recommended that there is dedicated additional staff resource for implementation of the Energy Strategy.	This role should be confirmed following approval of the Energy Strategy by the municipal Councils.	Municipal Councils
Stakeholder Engagement		
Implement recommended awareness and engagement programs (Section 4) to inform businesses, institutions, and residents about the Energy Strategy and ways to access programs. The programs should commence with information	Programs to start following approval of the Energy Strategy by the Councils of the Municipality of the District of Shelburne, the Town of Shelburne, and the Town of Lockeport. Awareness and education programs to be on-going	Energy Strategy Coordinator

Action	Timeframe	Responsibility
sessions followed by targeted workshops.	throughout the implementation phase of the Energy Strategy.	
A key component of the success of the energy strategy will be the engagement of the institutional sector, e.g. Roseway Hospital, NSCC, as these represent major energy uses in ESC and could be early adopters. One-on-one meetings recommended.	As with the general engagement program above, discussions with institutions to commence following approval of the Energy Strategy by the Municipality of the District of Shelburne.	Energy Strategy Coordinator with Council representative (e.g. Warden).
Funding Programs		
Encourage businesses, institutions, and municipalities to apply for the available Nova Scotia Power Inc. incentive programs and other relevant funding programs detailed in Appendix A. Funding programs and applicable web site links are provided in Appendix A and should be made available through the municipalities. To help encourage the uptake of the programs it is recommended that staff be available to answer questions, assist in preparing applications, and to provide direction to applicable resources such as RETScreen.	Concurrently with engagement recommendations.	Energy Strategy Coordinator
Projects		
Implement short term, short payback energy efficiency measures such as lighting conversions and building envelope improvements.	Within the first year of the Energy Strategy.	Municipalities, businesses, institutions, residences; Energy Strategy Coordinator to inform.
Implement solar thermal for municipal buildings (see Appendix B) and residential.	Following initial engagement and communication of funding programs.	Municipalities, residences to implement; Energy Strategy Coordinator to inform.
Businesses and institutions to take advantage of NSPI funding and implement equipment upgrades.	Within the first year of the Energy Strategy.	Businesses and institutions; Energy Strategy Coordinator to inform.
Biomass heating system for the Roseway Hospital.	Study to commence following initial engagement with Southwest District Health Authority.	Southwest District Health Authority.
Retire Your Ride	Following initial engagement and communication of funding programs. Uptake of the program will depend on residents' circumstances.	Residents; Energy Strategy Coordinator to inform/encourage.
Encourage industry to complete energy and process audits in order to implement process improvements.	Following initial engagement and communication of funding programs	Industry; Energy Strategy Coordinator to inform/encourage.

Action	Timeframe	Responsibility
Initiate feasibility study for a biomass district heating and combined heat/power system for Roseway Hospital and NSCC.	Study to commence following initial engagement with stakeholders.	Southwest District Health Authority and NSCC; Energy Strategy Coordinator to inform.
Research; identify; and engage power producers that may participate in COMFIT and market wind potential/acceptability.	Initial contacts to be made prior to COMFIT rate hearing (April, 2011). Follow up when program details are available.	Energy Strategy Coordinator, Municipal representatives
Identify potential locations and engage Nova Scotia Power Inc. to better assess capacity for both distribution and transmission connected renewable energy. This may require submission of interconnect requests to facilitate the assessment.	Identification of potential locations and engagement with NSPI should start in advance of COMFIT rate hearing.	Energy Strategy Coordinator
Provide information to residents on ground source heat pumps.	Within the first year of the Energy Strategy.	Energy Strategy Coordinator
Initiate study to determine cold requirements for current industrial park industry and feasibility of harbour cooling system.	Study to be implemented following initial engagement and communication of Energy Strategy and funding programs.	MDS, Town of Shelburne; Energy Strategy Coordinator
Other		
Adopt R-2000 Energy Efficiency Standard for New Residential Development	Adopt standard within first two years of the Energy Strategy.	Municipalities
Adopt Model National Energy Code for Buildings Standard for New Commercial, Institutional and Industrial development	Adopt Code within first two years of the Energy Strategy.	Municipalities
Implement recommendations of wind energy development plan	Prior to marketing ESC to wind energy companies.	Municipalities; Energy Strategy Coordinator
Strategy Evaluation		
At the end of the first two years review the status of Energy Strategy projects including: effectiveness of public/stakeholder engagement; number of projects initiated; energy use and GHG reductions. Based on the results of the evaluation make recommendations regarding next steps of the strategy.	On completion of the first two years of the Energy Strategy.	Energy Strategy Coordinator

Table 6-2 Future Actions

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Action	Responsibility
Engagement	
Maintain regular community and stakeholder updates. Communicate success stories. Provide updates on funding and financing programs.	Energy Strategy Coordinator
Funding Programs	
Monitor utility, provincial, and federal funding and financing programs. Maintain funding database.	Energy Strategy Coordinator
Projects	
Implement industrial process improvements based on results of process and energy audits.	Industry
Biomass heating system for NSCC.	NSCC
Biomass heating system for SRHS	Tri-County Regional School Board
Biomass heating system for the Roseway Hospital.	Southwest Health Authority.
100 kW Wind Turbine - SRHS	Tri-County Regional School Board
1.65 MW Wind Turbine – Clearwater/Lockeport	Clearwater; Lockeport or MDS COMFIT
800 kW Wind Turbine – Roseway Hospital	Southwest Health Authority; MDS COMFIT
Residents to install ground source heat pump systems as circumstances warrant.	Residents; Energy Strategy Coordinator to inform.
Residential conversion to wood pellets for heating.	Residents
Monitoring	
Monitor funding opportunities and technology advances with respect to potential projects that are not financially or technically viable at this time including (but not limited to): solar photovoltaic; district heat from Clearwater/Pierce Fisheries; wave energy; butanol production/use.	Energy Strategy Coordinator

Appendix A
Funding Sources

					Energy Efficency Improvements					Industrial Process Improvements			
	Program Name	Incentive	Target Market		Building Envelope	Lighting	Motor	Boiler	Chiller	Fish Plants	Ven-rez Plant	Website	Program Life
EE1	ecoEnergy Retrofit for Buildings	$ 10 per GJ saved or 25 % of net eligible costs or max of $ 50,000	(less than 20,000 sq. ft.) All buildings except manufaturing, federally owned or residential in part 9 of Nat. Build. Code	Residential & Commercial	✓	✓	✓	✓	✓			http://oee.nrcan.gc.ca/commercial/financial-assistance/existing/retrofits/index.cfm?attr=0	Deadline March 31, 2011 or until all funds are allocated, whichever comes first.
EE2	ecoEnergy Retrofit for Industry	$ 10 per GJ saved or 25 % of net eligible costs or max of $ 50,000	Companies with existing buildings registered with CIPEC	Industrial	✓	✓	✓	✓	✓	✓	✓	http://oee.nrcan.gc.ca/industrial/financial-assistance/retrofit/index.cfm?attr=0	Deadline March 31, 2011 or until all funds are allocated, whichever comes first.
EE3	EnerGuide for Multi-Unit Residential Buildings (MURBs)	Up to $ 4,500 per building	Up to 20 Unit Apartment Building, Less than 3 stories, Maximum area of 600 m2 or 6,458 ft2	Residential	✓							http://www.conservens.ca/energuide/murbs/	-
EE4	EnerGuide for New Houses/ R-2000	Rebate up to $ 1,000 available	New House	Residential	✓	✓	✓	✓	✓			http://www.conservens.ca/energuide/new-homes/	-
EE5	Solar Hot Water Heating Rebate	Installed cost of the total system (up to $20,000 per installation or 15% of total cost whichever is less)		All Building Types				✓				http://www.ec.gc.ca/financement-funding/default.asp?lang=En&n=EF8AE9FC-1&offset=6&toc=show	Systems must be purchased and installed after January 1, 2008 and must appear on NRCan's list of approved systems
EE6	ecoEnergy for Renewable Heat - Solar Hot Water	Solar Thermal - $275/m2		All Building Types				✓				http://www.ecoaction.gc.ca/ecoenergy-ecoenergie/heat-chauffage/index-eng.cfm	April 1, 2007 to March 31, 2011
EE7	Low Income Homeowners Program	Up to 5 CFL and LED exit lights	Low Income Housing using electric heat	Residential	✓	✓						http://www.nspower.ca/en/home/energysavings/programs/lowincome/default.aspx	-
EE8	Powered Right Program	Up to 5 CFL and LED exit lights	Small Businesses using incandescent lighting	Commercial		✓						http://www.nspower.ca/en/home/energysavings/programs/poweredright.aspx	-
EE9	Environmental Home Assessment Program	Rebates on septic systems, water conservation advice and septic system repairs. Up to $3,000 per building.	Single family houses with Private water supply and septic system	Residential				✓				http://www.clean.ns.ca/content/EHAP_Overview	-
EE10	Small Business Lighting Solutions	80 % of the entire lighting conversion costs (Fluor. Lighting upgrade)	Small Businesses using fluorescent lighting	Commercial		✓						http://www.nspower.ca/en/home/energysavings/programs/smallbusiness/default.aspx	-
EE11	Business Energy Rebates	Direct rebate to customer -if less than $ 2000 per application no pre-approval. If over $ 2,000 pre-approval required	All customers of NSPI	Commercial & Industrial		✓	✓	✓	✓	✓	✓	http://www.nspower.ca/en/home/energysavings/programs/businessrebates/default.aspx	-
EE12	Commercial & Industrial Custom Energy Efficiency Program	$ 1,000 for preliminary audit, $ 15,000 for pre-feasibility study and $500,000 or 50 % of eligible costs for implementation	All customers of NSPI with electrical peak demand above 250 kW (kVa) New facilities (2,000 m2) or more in design or construction phase	Commercial & Industrial	✓	✓	✓	✓	✓	✓	✓	http://www.nspower.ca/en/home/energysavings/programs/cic/default.aspx	-
EE13	Commercial & Industrial New Construction Program	$ 1,000 for preliminary audit, $ 15,000 for pre-feasibility study and $500,000 or 50 % of eligible costs for implementation	All customers of NSPI that are constructing a new building.	Commercial & Industrial	✓	✓	✓	✓	✓	✓	✓	http://www.nspower.ca/en/home/energysavings/programs/cic/default.aspx	-
EE14	CME Leaf	75% of cost of energy efficiency and cost savings opportunities	Manufacturers	Industrial	✓	✓	✓	✓	✓	✓	✓	http://www.cme-leaf.ca/english/about-cme-leaf/about-cme-leaf.html	

District Energy

	Program Name	Incentive	Target Market		Cold Energy from Harbour for the Shelburne Industrial Park	Waste Heat from Hospital Air Conditioning System	Waste Heat from Hockey Arenas	Cold water opportunity for Clearwater at Government Wharf	Clearwater plant in Lockeport and immediately surrounding area	Website	Program Life
DE1	ecoEnergy Retrofit for Buildings	$ 10 per GJ saved or 25 % of net eligible costs or max of $ 50,000	(less than 20,000 sq. ft.) All buildings except manufaturing, federally owned or residential in part 9 of Nat. Build. Code	Residential & Commercial	✓	✓	✓	✓	✓	http://oee.nrcan.gc.ca/commercial/financial-assistance/existing/retrofits/index.cfm?attr=0	March 31, 2011 or until all funds are allocated, whichever comes first.
DE2	Commercial & Industrial Custom Energy Efficiency Program	$ 1,000 for preliminary audit, $ 15,000 for pre-feasibility study and $500,000 or 50 % of eligible costs for implementation	All customers of NSPI with electrical peak demand above 250 kW (kVa) New facilities (2,000 m2) or more in design or construction phase	Commercial & Industrial	✓	✓	✓	✓	✓	http://www.nspower.ca/en/home/energysavings/programs/default.aspx	-
DE3	Accelerated Capital Cost Allowance Class 43.1	Acc. Capital Cost Allow. 30% instead of 4%	Renewable Energy and Power developments (requires private partner)		✓	✓	✓	✓	✓	http://oee.nrcan.gc.ca/corporate/statistics/neud/dpa/policy_e/details.cfm?searchType=default&sectoranditems=all%7C0max=10&pageId=1&categoryID=1&regionalDeliveryId=all&programTypes=4,5&keywords=&ID=977&attr=0	New Measures for district energy systems after March 4, 2010
DE4	Accelerated Capital Cost Allowance Class 43.2	Acc. Capital Cost Allow. 50% instead of 4%	Renewable Energy and Power developments (requires private partner)		✓			✓		http://www.budget.gc.ca/2010/pdf/budget-planbudgetaire-eng.pdf OR http://www.ic.gc.ca/eic/site/fte-fte.nsf/eng/00004.html	For assets acquired on or after March 4, 2010, Class 43.2 includes heat recovery equipment used in a broader range of applications.
DE5	Canadian Renewable Conservation Expenses	CRCE can be deducted in the year incurred or carried forward indefinately	Renewable Energy and Power developments (requires private partner)		✓	✓	✓	✓	✓	http://oee.nrcan.gc.ca/corporate/statistics/neud/dpa/policy_e/details.cfm?searchType=default&sectoranditems=all%7C0max=10&pageId=1&categoryID=1&regionalDeliveryId=all&programTypes=4,5&keywords=&ID=974&attr=0	
DE6	Flow-through Shares	Transfer of deductions	Renewable Energy and Power developments (requires private partner)		✓	✓	✓	✓	✓	http://www.cra-arc.gc.ca/tx/bsnss/tpcs/fts-paa/menu-eng.html	
DE7	Community Economic Development Investment Program	This program encourages investment in local businesses with tax incentives of up to 50 % of the investment cost	Province of Nova Scotia	District Energy and Green Power Developments	✓	✓	✓	✓	✓	http://www.gov.ns.ca/econ/cedif/	-

Renewable Energy Generation

	Program Name	Incentive	Target Market	Small scale Hydro renewal	Photovoltaic Rooftop	Photovoltaic Utility	Wind Energy Residential	Wind Energy Utility	Biomass Electricity Generation	Run of River Hydro	Wave Energy Utility	Website	Program Life
RE1	Accelerated Capital Cost Allowance Class 43.1	Acc. Capital Cost Allow. 30% instead of 4%	Renewable Energy and Power developments (requires private partner)	✓	✓	✓	✓	✓	✓	✓	✓	http://oee.nrcan.gc.ca/corporate/statistics/neud/dpa/policy_e/details.cfm?searchType=default&sectoranditems=all%7C0max=10&pageId=1&categoryID=1&regionalDeliveryId=all&programTypes=4,5&keywords=&ID=977&attr=0	New Measures for district energy systems after March 4, 2010
RE2	Accelerated Capital Cost Allowance Class 43.2	Acc. Capital Cost Allow. 50% instead of 4%	Renewable Energy and Power developments (requires private partner)	✓	✓	✓	✓	✓		✓	✓	http://www.budget.gc.ca/2010/pdf/budget-planbudgetaire-eng.pdf OR http://www.ic.gc.ca/eic/site/fte-fte.nsf/eng/00004.html	For assets acquired on or after March 4, 2010, Class 43.2 includes heat recovery equipment used in a broader range of applications.
RE3	Canadian Renewable Conservation Expenses	CRCE can be deducted in the year incurred or carried forward indefinately	Renewable Energy and Power developments (requires private partner)	✓	✓	✓	✓	✓	✓	✓	✓	http://oee.nrcan.gc.ca/corporate/statistics/neud/dpa/policy_e/details.cfm?searchType=default&sectoranditems=all%7C0max=10&pageId=1&categoryID=1&regionalDeliveryId=all&programTypes=4,5&keywords=&ID=974&attr=0	-
RE4	Flow-through Shares	Transfer of deductions	Renewable Energy and Power developments (requires private partner)			✓		✓			✓	http://www.cra-arc.gc.ca/tx/bsnss/tpcs/fts-paa/menu-eng.html	-
RE5	Community Economic Development Investment Program	This program encourages investment in local businesses with tax incentives of up to 50 % of the investment cost	District Energy and Green Power Developments		✓	✓		✓	✓	✓	✓	http://www.gov.ns.ca/econ/cedif/	-

Appendix B
Energy Efficiency and Renewable Energy Example

Appendix B - Incentives Example: Town of Shelburne - Community Centre (Fire Hall)

There are various incentive programs presently available. The following Fire Hall case is an example of how available incentives can be applied to this building and used as a guide for implementation.

Applicable incentives were chosen based on the building description and the listed renovations in Table B-1

The Fire Hall has the following building firmographics:

- Constructed in 1994,
- Floor area of 2,400 m^2 with insulation levels of RSI 2.11 wall and RSI 2.81 roof,
- Consumed 396 GJ of electricity at a cost of $ 11,500 producing 92.3 tonnes of GHG,
- Consumed 1,004 GJ of oil at a cost of $ 17,300 producing 73.4 tonnes of GHG,
- Energy Index of 0.583 GJ per m^2 (15 kWh per ft^2)

Table B-1: Fire Hall Renovations *(Town of Shelburne Municipal Operations Energy Audit, June 23,2009)*

Building/ Operation	Renovation Description	Cost	Saving Area	Electricity Savings		Savings Fuel Oil		Total Savings	Simple Payback (Years)
				kWh	$	Litres	$		
Fire Hall	Lighting	$7,350	Electricity	11,380	$1,340	-	-	$1,340	5.5
	Reset Controller	$10,000	Heat	-	-	3,947	$3,592	$3,592	2.8
	Solar Thermal	$50,000	Heat	N/A	N/A	N/A	N/A	N/A	N/A

Table B-1 shows the potential renovations under consideration for the Fire Hall as energy management opportunities. This data comes from an energy audit report produced by AMG Inc. The suggested renovations included a lighting retrofit of all lighting, a reset controller for the furnace and lastly radiant in-floor heating using a solar thermal system to provide the heated water. The table presents the renovation costs, energy savings and the number of years for payback per each renovation. Please note however only retrofit cost data was available for the solar thermal system.

The following notes are applicable to all incentives:

1) Bullet point notes are the values for which the incentive was calculated and based on.
2) The Boxes shows the basic equation or basis for which the incentive was calculated.
3) The Boxes also show the resultant maximum incentive.

Incentive Program: ecoEnergy Retrofit for Buildings

- Lighting Energy Savings = 11,380 kWh = 41 GJ = $ 4,045 — Retrofit Cost is $ 7,350
- Reset Controller Savings = 42,628 kWh = 153 GJ (Oil) — Retrofit Cost is $ 10,000

Incentive - $10/GJ Saved =	*Lighting -*	$ 410
	Reset Controller -	$ 1,535
	TOTAL -	**$ 1,944**

Incentive Program: ecoEnergy Renewable Heat - Solar Hot Water

- Assuming a performance factor of 0.66 and collector area of 1.98 m^2 and assuming $2,000 per collector installation.
- Number of Collectors = 25 saving 104 GJ or $ 1,800 Retrofit Cost is $ 50,000

Incentive = Performance Factor x Incentive Rate x collector area =	**$ 8,984**

Incentive Program: Small Business Lighting Solutions

- Assuming the Fire Hall is considered a small business
  - Lighting Conversion Costs = $ 14,293 from NSPI audit
  - Lighting Energy Savings = $ 4,071 from NSPI audit

Incentive - 80% of lighting conversion costs =	**$ 11,435**

Incentive Program: Solar Hot Water Heating Rebate

- Solar Thermal Cost = $50,000

Incentive - 15% of total Cost =	**$ 7,500**

Summary

Original Lighting Retrofit Cost is $ 7,350. NSPI Updated Funding-Assisted Retrofit Cost is $ 14,294 - $ 410 - $ 11,435 = $ 2,449
Simple Payback is 7 months as compared to 5.5 years in the original audit

Original Oil Controller Retrofit Cost is $ 10,000. Updated Funding-Assisted Retrofit Cost is $ 10,000 - $ 1,535 = $ 8,465.
The annual savings are $ 2,400. Simple Payback is 3.5 years as compared to 4.2 years in the original audit

Original Solar Retrofit Cost is $ 50,000. Updated Funding-Assisted Retrofit Cost is $ 50,000 - $ 7,500 = $ 42,500
The annual savings are $ 1,800. Simple Payback is 24 years as compared to 28 years in the original audit.

Based on implementing all recommendations with payback less than 5 years the new energy consumption would be:

- 263 GJ of electricity at a cost of $ 8,400 producing 61.4 tonnes of GHG and
- 853 GJ of electricity at a cost of $ 19,761 producing 63.0 tonnes of GHG

Without the energy savings the electricity costs would have been 396 GJ costing $ 12,660 and the oil would have been $ 23,166 per year.

Appendix C
Financial Evaluation Methods and Other Considerations

The financial tools used to evaluate the potential project opportunities identified in Section 3.2.2 included: Payback Period, Internal Rate of Return, and Benefit-Cost Ratio. These tools, limitations, and other financial considerations are described below.

Payback Period

Payback Period is one of the most common and basic investment evaluation methodologies. This method computes the number of years required for a prospective investment's cash flows to pay back the initial investment. The shorter the period, the better the project. Its positive features include: (a) simple to compute; (b) easy to interpret; and (c) useful measure of investment risk (because dollars received further out construe greater risk). Its negative features include: (a) ignores time value of money; and (b) ignores all cash flows after payback has been reached.

For each potential project, the Payback Period is determined as the number of years that it takes for the net cash flow stream to become a positive amount. The Payback Period is determined from time zero (which is the time of the capital expenditure, which is assumed to occur all at once at the inception of the project).

What is considered to be a good Payback Period? This depends on the risk of not realizing a return of capital. Better durability (i.e. reliability) and longer expected life would allow longer payback periods to be acceptable. All of the renewable energy projects evaluated are long lived assets, generally exceeding 20 years, so payback periods in the range of 5 to 10 years should generally be considered acceptable. Even longer periods may not be unacceptable, depending on consideration of other factors.

Internal Rate of Return

Internal Rate of Return ("IRR") is a very popular investment evaluation methodology. This method computes the rate which discounts the prospective investment's cash flows to zero. The higher the rate, the better the project. Its positive features include: (a) recognizes declining value of future cash flows associated with inflation; (b) recognizes increasing uncertainty (risk) with respect to distant cash flows; and (c) recognizes opportunity cost (i.e. what would be the expected return on alternative investment opportunities). Its negative features include: (a) cash flows over the investment horizon are assumed to compound at the IRR, which may or may not be the case depending on where such cash flows can be reinvested from various points in time over the investment horizon; (b) all cash flows are discounted at the same rate, which may or may not be appropriate or desirable from an analytical perspective; (c) insensitive to the scale of investment; and (d) may not yield reliable results where a prospective project's cash flow stream has negative cash flows after the positive cash flow stream has commenced.

Computing an investment's IRR is an iterative process of computing the present value of a stream of cash flows using different rates until a rate is found that discounts the cash flow stream to zero. Caution must be exercised where a cash flow stream contains alternating positive and negative. In such cases it may be necessary use an alternative discounted cash flow methodology, such as the Net Present Value ("NPV") method; however, this will require additional considerations with respect to selection of an appropriate discount rate. It has not been necessary to use the NPV method in this study because RETscreen's economic modeling has not generated alternating positive and negative cash flows for the potential projects identified.

For each potential project, the IRR is determined from time zero (which is the time of the capital expenditure, which is assumed to occur all at once at the inception of the project).

The challenge with the IRR methodology is that, when an IRR has been computed, one then needs to consider: What is the minimum acceptable internal rate of return? The minimum required return is often referred to as the "hurdle rate". The answer lies in a risk assessment of the proposed investment (relative to competing investment opportunities) and the cost of capital available to fund the project. This is discussed in greater depth in the following sections in which the IRR is analyzed for each potential project.

What is considered to be a good IRR? The answer to this generally lies in the risk adjusted cost of capital that can be provided by the project owner. The project IRR must exceed the project owner's risk adjusted cost of capital. The term "risk adjusted" is important, because not all investments should necessarily have the same cost of capital. The riskier the investment is in terms of execution, technology, performance, cash flow variability, etc., the higher the cost of capital should be expected to be. The mix of capital (equity versus debt) enters into the computing Weighted Average Cost of Capital ("WACC"). Equity capital is generally higher cost and higher risk capital, while debt financing is generally lower cost and lower risk capital. As such, the more debt financing a project can attract, the lower its cost of capital may be, all other things being equal.

The project owner and project attributes contribute to the determination of a minimum acceptable IRR for each project. Because of the variability in these attributes, the minimum acceptable IRR can vary widely. Whereas one project owner may require 15% to 20%+ to pursue a project, another owner may be satisfied with 5% to 10%. While government agencies often enjoy a lower cost of capital by virtue of their credit rating, this should not necessarily lead them to pursue high risk projects for low returns, although nonfinancial policy reasons may justify such projects.

Benefit-Cost Ratio

Benefit Cost Ratio is a less well known method of investment evaluation that is useful where financial constraints necessitate ranking of projects. It is given by the following formula:

Benefit Cost Ratio = present value of cash inflows / present value of cash outflows.

Its positive features include: (a) recognizes time value of money; and (b) useful for capital rationing situations to rank mutually exclusive projects by providing an indicator of return per dollar invested (i.e. "bang for the buck").

The Benefit Cost Ratio is conceptually a very different project evaluation tool than Payback Period or IRR. While Payback Period and IRR attempt to evaluate and rank based on returns, the Benefit Cost Ratio aims at evaluating and ranking projects in the context of limited financial resources.

Limitations to Financial Analysis

As the form of ownership structure and possible capitalization strategies is not known at this early stage, the financial analysis ignores tax considerations and leverage (i.e. debt financing). The financial analysis presented in this study therefore uses pre-tax cash flows to the project or entity. Tax considerations and judicious use of leverage may enhance returns to equity sponsors of the projects. Due to these limitations, it would ultimately be advisable to undertake a more detailed economic analysis to confirm conclusions presented in this study when there is more certainty concerning the governance model and form of ownership.

Other Considerations

The following topics are raised as potentially important for further consideration depending on the direction taken by ESC in regards to development of one or more renewable energy projects.

Form of ownership: The form of ownership has a significant impact on the capitalization strategies, cost of capital and tax consequences for the project. Alternative forms of ownership range from (a) entirely financed, developed, owned and operated by ESC as a department or division of municipal operations, to (b) entirely financed, developed, owned and operated by private, profit-seeking entities. A variety of combinations are possible, as well as different forms of legal entity. All of these different forms of ownership impact access to government grants and tax incentives. For example, certain grant programs are only available to government agencies, while certain tax incentives are only available to corporations, while yet other tax incentives are only available to taxable entities. These various incentives impact financial returns in different ways and can materially impact the decision-making process with respect to which projects to pursue and by which ownership strategy.

Government incentive programs: There are a variety of government programs that provide financial incentives to induce the pursuit of energy conservation and renewable energy development. These financial incentives range from subsidies of capital costs to payments based on energy produced or saved. Some are funded up front, while others are paid after the costs are incurred or the energy produced. Some are repayable, while others are not. Some are only available to government agencies, while some are available to all organizations. All of these could positively impact certain renewable energy projects analysed above. Non-repayable grants for capital cost reduce the initial investment, which improves all financial analysis measures. Similarly, subsidies of energy produced or saved improve all financial analysis measures, but these are often time limited, so care must be taken in analyzing the positive financial effect of these. Repayable grants have the potential to impact financial returns but do so in the form of reduced cost of capital. Because repayable grants are not permanently retained by the project developer, they constitute an alternative source of financing (i.e. part of the capitalization strategy) that must eventually be repaid from cash flow or alternate financing sources.

Income tax incentives: The federal government has provided a number of incentive mechanisms in the income tax act to induce taxable entities to undertake renewable energy. The two principal federal tax incentives available to taxpayers developing renewable energy projects are the accelerated capital cost allowance ("CCA") deductions available on renewable energy property described in Class 43.1 or 43.2 of Schedule II to the Income Tax Regulations (the "Regulations"), and the immediate write-off available for development expenses related to renewable energy projects (known as Canadian Renewable and Conservation Expenses ("CRCE")). There are approximately 20 types of energy systems that qualify for these tax incentives, and include systems that incorporate waste fuels, efficient use of fossil fuels, and forms of renewable energy sources used to produce electricity and/or heat. The list of eligible energy systems expands periodically as new technology is reviewed by Natural Resources Canada ("NR Can") and approved for inclusion in this list. To the extent a project developer is able to utilize these incentives; the after-tax cash flow profile of the renewable energy project will be enhanced, which will positively enhance financial returns to equity holders in the enterprise.

Capitalization Strategies: Leverage is often used to enhance equity returns. The appropriate degree of leverage depends on the risk return profile of each asset. Excessive debt may introduce significant financial risk, such that the incremental returns on equity are eroded. Thus financial analysis of capitalization strategies may be warranted to determine an optimal range of Weighted Average Cost of Capital ("WACC").
Working capital requires investment: Working capital associated with operating the renewable energy facilities has been ignored in the foregoing analyses. To the extent that inventories of biomass feedstock are required, or credit terms extended to recipients of the heat and/or power generated by the renewable energy facilities, these give rise to cash flows associated with working capital requirements. Generally, most enterprises require that positive working capital be maintained, which translates into a cash outflow from an investment perspective. Thus, a net working capital requirement represents an incremental investment or cash outflow, which may impact the returns of the different renewable energy projects in different ways. For example, the biomass systems requiring feedstock on hand will generally be more adversely impacted by working capital requirements than solar or wind powered systems.

Equity versus entity cash flow analysis: The foregoing analyses have focused on cash flows to the entity or project, rather than cash flows to equity holders in the entity or project. This "entity cash flow" approach was the most appropriate at this preliminary stage of analysis. Ultimately, the "equity cash flow" approach is more appropriate where annual cash flows can be more accurately estimated, tax calculations made, and where capital structure is known and changing over time. In such a case, one would model the after-tax after-debt cash flows (to equity) and then compute the returns to equity holders after taking into consideration the cost of debt capital. However, this more detailed analysis is not practicable based on limited information available at this time.