

# Energy self-sufficiency for PEI

The Province of Prince Edward Island has no hydro power and no natural gas distribution. It primarily uses heating oil for space heating and domestic hot water and it imports most of its power from New Brunswick. However it does have sufficient resources of renewable energy to meet its total residential energy demand of 6.1 petajoules. If it implemented a plan to utilize those resources the Province would become energy self-sufficient, it could save a lot of money and it would eliminate its GHG emissions. Only the residential uses are considered in this note because the NRCan Office of Energy Efficiency tables do not break out the other numbers for PEI.

The existing sources of energy are (2010):

Electricity	0.6 PJ
Natural gas	0.0
Heating oil	4.8
Other (coal & propane)	0.2
Wood	0.5
<b>TOTAL</b>	<b>6.1 PJ</b>

The existing applications are (2010):

Space heating	4.0 PJ
Water heating	1.6
Appliances	0.4
Lighting	0.1
Space cooling	0.0
<b>TOTAL</b>	<b>6.1 PJ</b>

The proposed new mix of energy sources are:

Air-heat	2.7 PJ
Wind	1.3
Solar thermal	1.6
Solar PV	0.5
<b>TOTAL</b>	<b>6.1 PJ</b>

The buildings would use air-heat exergy storage systems that incorporate dual-function solar collectors that collect solar heat to provide the heat for the water and that also generate the electricity needed for appliances and lighting. Although the totals add up to the numerical totals needed for the applications the supply and demand would not always be concurrently matched so the existing power link would be used to balance supply and demand. That link presently supplies 0.5 PJ of electric energy to the island so its average supply would drop to 0.0 but it would occasionally operate at nearly the same power level as it presently handles.

In this proposal the heat for water heating (1.6 PJ) is provided by the solar thermal panels. The space heating requires 4.0 PJ so if the effective COP of the exergy heat pumps is 3.0 their drive energy will be 1.3 PJ and that defines the amount of energy needed from the wind turbines. The exergy heat pumps would only operate when the wind is blowing. The balance of 0.5 PJ would be generated by the solar

PV component of the panels.

In such a system 5.6 PJ of the 6.1 PJ total energy consumption is stored in the ground or in the water tanks so only the small electric component needs to be balanced. The simplest way to do that is to use the existing NB link but there are potential alternatives such as pumped hydro storage, or the existing standby power generators could be used. There are 57,500 households in PEI so if each heat store serves an average of 100 homes a total of 575 heat stores would be needed. The number of stores being charged at any time would depend on the current output of the wind turbines. They would operate at all times of the year but the ground temperatures would go through an annual cycle in response to the heating demand variations.