A Review of NSPI's Solicitation for Renewable Energy 100KW to 2 MW on Distribution

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28 September 2004

Abstract

In mid-September 2004, Nova Scotia Power Incorporated (NSPI) released its *Solicitation for Renewable Energy – 100 kW to 2 MW on Distribution*, a call for up to 20 megawatts of electricity from renewable energy sources. The Solicitation includes the rules and regulations that NSPI expects Independent Power Producers (IPPs) to follow if they are to interconnect to the provincial electricity grid. The Solicitation also lists the prices that NSPI will pay to IPPs for electricity generated; the payment is based upon the location of the generation facility in the province.

This paper examines the prices in terms of the net present value (NPV) calculations used by NSPI in their Green Power Rider application of late 2001. The paper shows that the pricing formulae developed for this Solicitation will not allow IPPs to generate sufficient revenue to cover their costs. Several alternative prices and pricing arrangements are then discussed. Finally, the paper considers ways in which the provincial government could act to ensure the development of a viable renewable electricity sector in Nova Scotia.

1 Introduction

When the Nova Scotia Energy Strategy was released in December 2001, it stated that Nova Scotia Power Incorporated (NSPI) would be required to meet (NSDOE, 2001):

> *… a short-term, voluntary, renewable energy target for new IPPs totalling 2.5% of NSPI's generation capacity, or approximately 50 MW. The government and NSPI will monitor the voluntary process for three years and then establish a longer-term renewable energy portfolio standard (RPS) target.*

Subsequently, the members of the provincially appointed Electricity Marketplace Governance Committee (EMGC) made a number of recommendations for NSPI

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to follow in order to increase its use of renewables. In the EMGC's Final Report, Recommendation 43 proposes that a Renewable Portfolio Standard[2] be adopted between 2006 and 2010 (EMGC, 2003):

> *The EMGC recommends that the province of Nova Scotia require each LSE to obtain RPS tags certifying that the fraction of its electric energy from renewable sources by 2010 is equal to the actual base of renewable electric energy at 2001 plus 5.0%.*

In short, what the Energy Strategy and the EMGC are attempting to do is encourage NSPI to increase its use of renewables for the generation of electricity. By 2010, the amount is to be equivalent to five percent of NSPI's 2001 generation or about 545 GWh[3]; this target is to include all renewable generation obtained by NSPI since 2001[4].

To date, NSPI has failed to meet the "*short-term, voluntary, renewable energy target*" of 2.5 percent called for in the 2001 Energy Strategy. In fact, the EMGC's Final Report refers to the voluntary target as being 1.2 percent (the expected generation from NSPI's two wind turbines and the 30 MW windfarm at Pubnico Point); as a result, NSPI is expected to obtain another 3.8 percent (5.0 – 1.2) from renewables between 2006 and 2010.

NSPI's recently released *Solicitation for Renewable Energy – 100 kW to 2 MW on Distribution* (referred to as the Solicitation in the remainder of this report), calling for up to 20 MW of generation capacity from small scale Independent Power Producers (IPPs), is an attempt at meeting part of these targets. Although not explicitly stated, the underlying assumption is that most IPPs will be installing wind turbines.

The Solicitation states that NSPI is "committed to facilitating new renewable generation to be added to the Nova Scotia electrical grid". This review of the Solicitation considers one question: Will the Solicitation facilitate the addition of new renewable generation to the grid?

2 Pricing

Although not the sole deciding factor, the price paid per unit of energy by NSPI is one of the key determinants of whether an IPP's project is commercially viable and can proceed. The Solicitation lists three prices that NSPI will pay to IPPs,

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[2] A Renewable Portfolio Standard or RPS is legislation that requires an entity, such as a utility, to meet a certain fraction of its electrical generation from renewable sources by a certain date.

[3] In 2001, NSPI's total generation was 10,906 GWh (Emera, 2003). Five percent of this is 10,906 x 0.05 or about 545 GWh.

[4] NSPI's "*short-term, voluntary*" period runs from 2001 until the end of 2005. The RPS runs from 2006 until 2010.

depending upon the location; the prices (energy rates) are listed in the following table:[5]

	Eastern	Central	Western
Base Cost	$68.00	$68.00	$68.00
Location Adjustment	-$2.73	$0.00	$2.73
Energy Rate	$65.27	$68.00	$70.73

The actual revenue obtained by an IPP from NSPI will depend upon a number of factors, including the number of hours the turbine is in operation during the year and the site's wind regime. For example, consider a one megawatt (MW) turbine that is available throughout the year (8,760 hours) with a capacity factor of 35 percent. This turbine would generate about 3,066 MWh of electrical energy; the revenue from such a turbine would be:[6]

	Base Cost	Location Adjustment	Energy Rate	Revenue
Eastern	$68.00	-$2.73	$65.27	$200,117.82
Central	$68.00	$0.00	$68.00	$208,488.00
Western	$68.00	$2.73	$70.73	$216,858.18

The viability of a project (such as the installation of a wind turbine) can be determined using Net Present Value (or NPV), a calculation of the present value of an investment's future net cash flows minus the initial investment. The value of the future cash flows is discounted to a predetermined interest rate. Net present value can be defined as:

Net Present Value = Sum of discounted annual cash flows - initial investment

If the NPV is positive (that is, the sum of the discounted annual cash flows are greater than the initial investment), the investment should be made (unless a better investment exists), otherwise it should not (Investorwords, 2002).

In order to determine the NPV of a project, it is necessary to have the following information:

- The cost of the initial investment (including the purchase of the equipment, data collection, legal fees, and so forth).
- The annual expenses and revenues.
- The discount rate.
- The length of the contract.

[5] Although not specified in the Solicitation, it is assumed that the values in this table are expressed in terms of $ per MWh.

[6] The revenue is determined first from the energy: 8760 hrs x capacity factor (35%) x 1 MW or 3,066 MWh, then from the energy rate (one of NSPI's three rates).

In late 2001, NSPI approached the UARB with its Green Power Rider, using NPV to justify their 4 cents per kilowatt-hour premium surcharge (UARB, 2001). The next section reviews NSPI's data and calculations used in their 2001 application. This is followed by an application of NSPI's calculations to the energy rate offered in the Solicitation.

2.1 NSPI's Green Power Rider Net Present Value Calculations

Cash flows are a necessary feature of any business plan, as they allow the proponent to decide whether the project will lose money, break even, or make money. In NSPI's Green Power Rider, the annual cash flows were determined as follows:

$$\textit{Annual cash flow} = \textit{cash inflow} - \textit{cash outflow} - \textit{tax}$$

where:

Cash inflow: revenue from residential customers.

Cash outflow: expenses from the project. These are positive if money is spent and negative if money is saved. NSPI lists three cash outflows:

- Avoided variable generation costs: by operating the two wind turbines, NSPI avoids generating (notably, purchasing fuel) or purchasing electricity from other sources. This represents a saving to NSPI.
- Avoided capital generation costs: by operating the two wind turbines, NSPI also avoids or postpones the construction of new generating assets. This represents a saving to NSPI.
- Generation operating costs: the annual costs of running the wind turbines; this starts at $51,000 in 2002 with an annual 2 percent escalator.

Tax: the tax rate is 44 percent of the net cash flow (*cash inflow – cash outflow*).

NSPI's initial investment consisted of the following, both of which occurred in the first year (2001) only:

- Marketing and promotion: the Green Power programme budgeted $48,000 for marketing and promotion. Although the programme was to run for 20 years, marketing and promotion occurred in the first year only.
- Capital expenditures: the costs of establishing the project; in this case NSPI listed only one, the cost of two turbines ($2,954,240).

NSPI's Green Power Rider was intended to run for 20 years. The two turbines had a combined maximum capacity of 1.2 megawatts, an annual energy output of about 3.9 GWh, and a capacity factor of 35 percent. In their application to the UARB, NSPI presented two scenarios: in the first, no revenues were generated from the sale of electricity, while in the second, revenue of 4 cents per kilowatt hour was used. The following table shows the data and the resulting NPV (Hughes, 2002):

Revenue (cents/kWh)	Annual revenue	Discount rate	Net Present Value
0	$0	6%	($837,104)
4	$152,000	7.05%	$1,031

2.2 Application of NSPI's NPV to NSPI's proposed pricing

This section considers the application of NSPI's NPV Green Power Rider calculations (i.e., the same turbines, the same annual energy generation, and the same discount rate) to the Solicitation's proposed energy rates for each location. The initial capital expenditures are limited to the cost of the turbines ($2,954,240), all other initial expenditures are omitted. The annual cash flow is determined from the following:

Cash inflow: revenue from NSPI and is based upon the location; the three cash inflows are as follows (based on 3.9 GWh annual energy production):

Location	Energy rate (per MWh)	Cash inflow (annual)
Eastern	$65.27	$240,141
Central	$68.00	$250,186
Western	$70.73	$260,230

Cash outflow: expenses from the project; the three cash flows used by NSPI are:

- Avoided variable generation costs: this is not applicable to the IPP.
- Avoided capital generation costs: this is not applicable to the IPP.
- Generation operating costs: the annual costs of running the wind turbines (starts at $51,000 in the first year with an annual 2 percent escalator); this is applicable to the IPP.

Tax: the tax rate is 44 percent of the net cash flow (*cash inflow - cash outflow*); this is also applicable to the IPP.

The length of the contract is 15 years rather than 20.

The results of the three NPV calculations are listed here:

	Sum of discounted annual cash flows	Initial investment	Net Present Value
Eastern	$994,891	($1,654,374)	($659,484)
Central	$1,049,560	($1,654,374)	($604,815)
Western	$1,104,228	($1,654,374)	($550,146)

In each case, the NPV is negative, meaning that an IPP using the same turbines, discount rate, and capacity factor used in NSPI's Green Power Rider should not proceed with the project. It is important to note that a number of potential expenses are not included in the NPV calculations, including local taxes, land rental charges, certification costs, and ancillary expenses. If these costs were

included, the NPV would be *more* negative, making the project even less attractive.

3 Improving the Net Present Value

The previous section showed that, by using the method NSPI employed to calculate net present value for their Green Power Rider and the energy rate offered by NSPI, most IPPs would be forced to abandon the project.

Although the annual cash inflow is less in the Green Power Rider ($152,000) than what is being offered to the IPPs (between $240,141 and $260,230), the fact that the Green Power Rider includes NSPI's avoided variable generation costs and avoided capital generation costs ensures that the Green Power Rider will have a positive NPV. By including these avoided costs, the Green Power Rider's annual net cash flow is between 76 percent and 96 percent higher than the cash flows for the Solicitation's Western and Eastern locations, respectively (this is discussed further below).

Clearly, to make the NPV more attractive, something must be done; the following are a number of different scenarios that could be adopted by the IPP, NSPI, or both:

Obtain a higher capacity factor. The higher the capacity factor, the more electricity generated, hence the more revenue. The NPV calculations used a capacity factor of 35 percent, which is a reasonably good capacity factor for wind turbines. Raising the capacity factor to 40 percent does improve the NPV for all locations; however, it is still negative. It is not until the capacity factor reaches about 53 percent (Eastern location) or 49 percent (Western location) that the NPV becomes positive. Since these numbers are next to impossible to obtain on an annual basis for a wind turbine, an IPP would be forced to adopt another technology with a higher capacity factor, such a biomass cogeneration.

Obtain lower cost turbines. The turbines selected by NSPI cost approximately $3 per watt. A positive NPV can be obtained from a turbine costing about $1.80 per watt (Eastern) or $1.95 per watt (Western).

Zero costs. In the unlikely event that both the annual cost of maintenance and the discount rate are kept at zero, better NPVs can be obtained, as shown in the following table:

	Sum of discounted annual cash flows	**Initial investment**	**Net Present Value**
Eastern	$1,588,788	($1,654,374)	($65,587)
Central	$1,673,159	($1,654,374)	$18,785
Western	$1,757,530	($1,654,374)	$103,156

Higher energy rate. NSPI could offer a higher rate for the electricity generated. Using NSPI's Green Power Rider presented in the previous section, a rate of $98.21 per MWh would give an NPV of about zero, assuming the annual

growth in maintenance remains 2 percent. This includes no other IPP expenses.

Yearly price escalator. In some jurisdictions, IPPs are granted a yearly increase in the energy rate by the utility. NSPI has chosen not to do this, claiming that the price offered includes this amount. An escalator of about five percent would enable the Western location to have a positive NPV.

Emissions Credits. In addition to claiming the energy produced by the turbine, NSPI also requires the IPP to:

- Obtain certification that it is a renewable generator. Certification means that the generator will receive Emissions Reduction Credits (ERCs) for each kWh of electricity generated. To be certified, the IPP must pay a certification body for an initial audit (Terrachoice[7] charges $1,500), an annual license fee ($1,080 plus 10 percent of the audit charges or $1,230[8]).
- Sign over any Emissions Reduction Credits (ERCs) produced by the facility to NSPI. ERCs are based upon the energy generated and the amount of CO_2 avoided; each kWh of electricity generated from wind is estimated to displace about 0.78kg of CO_2 from a coal-fired thermal station.

  ERCs can usually be sold. For example, the two Green Power Rider turbines can be expected to generate about 3.9 million kWh per year; at 0.78 kg per kWh, the turbines displace about 3,000 tonnes of CO_2. At $3.00 per tonne[9], the IPP could earn about $9,000. Unless the value of the ERCs was to increase dramatically, they would have little impact on the overall NPV.

The Solicitation requires the IPP to pay for certification and then to supply the credits to NSPI without compensation – an action that NSPI tries justifies by claiming that certification is required by the provincial government (NSPI, 2004). Certification of facilities may be required by the government, but certification does not mean that NSPI has claim on the ERCs.

Applying avoided costs. The Green Power Rider tacitly admitted that NSPI would be avoiding both generation and capital costs, thereby raising the net cash flow. For example, in the 20 years of the Green Power Rider, the average net cash flow is almost $90 per MWh, which is close to the $98 breakeven point described above.

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[7] Terrachoice is the company chosen by Environment Canada to have exclusive rights to certify facilities that meet the Ecologo criteria.

[8] These are 2003 figures taken from (Hughes, 2003).

[9] This is the figure used by the EMGC when discussing net metering. The Federal government uses $10 per tonne (see www.dal.ca/~lhughes2/environment/nm.pdf).

4 Concluding Remarks

The objective of this report was to consider whether NSPI's *Solicitation for Renewable Energy – 100 kW to 2 MW on Distribution* would meet their expressed commitment of "facilitating new renewable generation to be added to the Nova Scotia electrical grid".

This report has shown that, by using data from NSPI and NSPI's method of calculating Net Present Value, without a significant increase in the price NSPI is willing to pay for energy generated, few IPPs will be able to afford such a venture.

In short, NSPI's intransigent attitude, stating that "the price is the price" (Herald, 2004), will do little to facilitate the addition of new renewable generation to the Nova Scotia electrical grid.

At first glance, it might have been assumed that NSPI would do all it could to facilitate new renewables for two reasons:

- The EMGC's Renewable Portfolio Standard.
- Greenhouse gas emission reduction.

The first of these, the proposed RPS target of five percent new renewables by 2010, although somewhat laudable, can be safely ignored by NSPI as there are no penalties associated with failing to meet the target.

The second, greenhouse gas emission reduction, would require NSPI to embark upon a major adoption of renewable energy (at least twice the proposed rate[10]). NSPI, like most utilities, is reluctant to include more than a few percent of a renewable technology such as wind in its energy mix because of the intermittent nature of wind. Since NSPI recognizes that it will be required to take steps to reduce its greenhouse gas emissions, over the next few years it will begin a major switch to natural gas.

NSPI's renewable solicitations are being done because it is good public relations: the public is meant to see NSPI as wanting to help the environment and to meet government regulations. However, NSPI can argue that if no IPPs are willing to take the price offered, there is little that NSPI can do.

It is possible to create an independent renewable energy industry in Nova Scotia that adds generation to the grid; however, to do so will require a commitment from NSPI to purchase energy generated from renewable sources. Given the price offered by NSPI in the Solicitation, it is clear that this can be done only by implementing an RPS with a definite target and significant penalties associated with failing to meet the target.

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[10] To reduce about 1 megatonne of CO_2 and CO_2-equivalent emissions, NSPI would have to replace about 1,000 GWh of coal-fired generation with electricity from renewables. This is about 10 percent of its total 2001 generation. For a description of how this could be achieved, please visit www.dal.ca/~lhughes2/environment/rps.pdf.

One way this can be done is to require NSPI to have an annual request for proposals, calling upon potential IPPs to submit competitive bids (as opposed to NSPI dictating the price) for a set amount of electricity[11]. NSPI would select the best bid and the winning IPP would proceed to construct its facilities; if there were no winning bids, NSPI would be allowed to construct its own renewable facilities. If NSPI failed to meet the annual target, it would be subject to a penalty; for example, its rates could be reduced by the avoided costs that would have been associated with the renewable facilities[12].

By stating that it will adopt all the recommendations in the EMGC's Final Report, the Minister of Energy and the provincial government have admitted that they are interested in seeing the development of a renewable energy sector in Nova Scotia. This being the case, the Minister of Energy should be willing to make the necessary changes to the proposed Energy and Electricity Acts to ensure that NSPI:

- Meets a provincial RPS of at least five percent, ideally ten percent by 2010 (see footnote 10).
- Issues annual calls for new renewable generation through competitive bidding.
- Is subject to penalties resulting from non-compliance.

References

EMGC, 2003. Electricity Marketplace Governance Committee, *Final Report*, Province of Nova Scotia, 2003.

Herald, 2004. Myrden, J., *NSP rate too low – advisor*, Chronicle-Herald, 18 September 2004.

Hughes, 2002. Hughes, L., *An Examination of Nova Scotia Power Incorporated's Green Power Rider*, submitted to Nova Scotia Utility and Review Board, July 2002. Available from www.dal.ca/~lhughes/environment/nm.pdf.

Investorwords, 2002. Net Present Value definition from http://www.investorwords.com. Accessed 12 July 2002.

NSDOE, 2001. Nova Scotia Energy Strategy, *Seizing the Opportunity*, volume 1, December 2001.

NSPI, 2004. Nova Scotia Power Corporation, *Solicitation for Renewable Energy – 100 kW to 2 MW on Distribution*, September 2004.

[11] For example, the EMGC states that the uptake of renewables by NSPI is expected to be 0.75 percent per year between 2006 and 2010 (EMGC, 2003). 0.75 percent of 2001 generation is about 80 GWh.

[12] For a detailed discussion on the limitations of and alternatives to the EMGC report, please visit www.dal.ca/~lhughes2/environment/priir.pdf.

UARB, 2001. Nova Scotia Utility and Review Board, “In the matter of an Application of Nova Scotia Power Incorporated for Approval of an Optional Green Power Rider to be added to all existing Domestic Service Rates”, UARB-319, 12 December 2001.