Green Bonds:

A Public Policy Proposal

A government-backed financial instrument designed to engage the public by raising capital to accelerate renewable energy production.

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Green Bonds – Executive Summary

Canadians now rank the environment as the single issue with which they are most concerned in this country, trumping health care and security. The Government of Canada has responded by committing itself to ensuring a prosperous yet sustainable economy by 2050, with an interim goal of 20% reduction in greenhouse gases by 2020. Achieving these laudable goals will require significant changes to the way in which we produce and consume energy.

To that end, we propose the creation of a Canadian Green Bond: *a government-backed financial instrument designed to engage the public by raising capital to accelerate renewable energy production.* By addressing a significant temporary market gap and accelerating deployment of low-carbon technology, we argue that Green Bonds would contribute to the broader goal for 2050 and the interim goal set for 2020. Ancillary benefits of job creation and economic competitiveness are also expected.

A key deliverable of this proposal is a cost-effective way of reducing carbon emissions. This policy proposal can provide incremental (to business-as-usual) Greenhouse Gas (GHG) emission reductions well in excess of 25 Megatonnes/year (Mt/year) of CO_2 equivalent (CO_2e) by the year 2020, at an estimated cost[1] to the government of between $1 and $13 per tonne.

Green Bonds directly involve the Canadian public in a positive way on the climate change issue. In a recent poll[2] conducted by Nanos Research, 81.8% of Canadians support the Green Bond initiative and 62.2% say they would purchase Green Bonds with an interest rate similar to a Canada Savings Bond.

This proposal leverages the resources, creativity and incentives of the private sector in managing the funds raised. Its efficiency, measured as the cost to government per unit of $C0_2$ reduction, compares very favorably to other initiatives such as tax credits and direct subsidies. The funds raised are to be provided as low-cost debt capital to producers of renewable energy, accelerating renewable energy production and creating demand for renewable technology.

This proposal complements the larger regulatory framework of a long-term carbon emission price signal, as recommended by the National Roundtable on the Environment and the Economy (NRTEE). Nevertheless, our proposal is neutral with respect to whichever long-term carbon emission policy is adopted (carbon tax, cap and trade, etc.), although under a purely regulatory scheme, this proposal is capable of providing additional incentives to increase renewable production that regulations cannot.

There is a precedent for this sort of initiative. The European Investment Bank issued a Climate Awareness Bond[3] in 2007, which is used to finance up to 75% of European renewable energy projects.

*- see over for **Policy Proposal Summary** -*

[1] See **Market Size, Cost of GHG Reductions and Bond Issue Size.**
[2] See **Appendix A**.
[3] See **Appendix B**.

Greens Bonds - Policy Proposal Summary

Temporary Solution: Green Bonds are a temporary measure, designed to bridge a market gap until the long-term regulatory framework provides a clear market signal for carbon emissions. In the shorter-term, there is an unambiguous point defined as to when technologies drop off this subsidy.

Low-Cost Capital: Many renewable energy producers cannot gain access to low-cost capital. We recommend that funds raised through the sale of Green Bonds support low-cost capital loans to energy producers. Since capital costs are a significant portion of production costs for renewable energy, this will reduce total energy production costs. While this is our recommendation, the specifics of deploying the capital are fungible.

Targets "Threshold" Technologies: 'Threshold technologies' are defined as those with minimal technology risk that would become price competitive with their fossil-based counterparts given access to low-cost capital. Initially the focus is to accelerate deployment of those technologies that can immediately deliver emission reductions to help reach the interim goals set for 2020. Later stages of the policy proposal will focus on providing market pull on higher-risk technologies, with the longer-term benefit of helping to build the Canadian renewable energy technology economy. Although this proposal focuses on energy production, we also recommend that energy efficiency technologies and process are included.

Private Sector Engagement: We recommend that the bond be issued and the funds be managed by an arms-length private financial institution, overseen by a Board of Directors composed of private sector experts in renewable energy and government representative(s). This approach would leverage the considerable resources of the private sector, and compensation can be geared toward specific Fund performance measures, particularly the unambiguous efficiency measure of cost to the government per tonne of emissions reduction.

Risk-Mitigation Options: Risk appears primarily as defaulted loan and is principally mitigated through sound governance and oversight, a limited bond issue size, capital matching from borrowers and liens on assets. Management fees can be linked to loan default rates to provide the proper incentives.

Government Cost and Liability: Total costs to government include defaulted loans, management fees, cannibalization of Canada Savings Bonds and promotional costs. The most significant cost exposure is defaulted loans. Liability appears as a *contingent liability*, represented by a percentage of the total bond issue. Our upper-bound estimate of total cost to the government is capped at 25% of the bond issue, but the actual rate should be much lower[4]. Total cost per tonne of CO_2e is estimated at between $1 - $13.

Efficiency: As the only significant cost to the government is in the form of defaulted loans – the rate of which can be controlled by a good risk mitigation strategy and incentives to the private sector – the ratio of dollars generated as renewable infrastructure capital to dollars cost to the government is quite high – higher than either tax credits or other direct subsidies can provide.

Complements Existing Government Approaches: Green Bonds complements government incentives provided in the form of R&D tax credits and SDTC funding. Green Bonds provides market 'pull' for technologies that get 'pushed' by these sorts of incentives.

[4] See **Government Liability** section for an analysis that indicates the loan default rate should be less than 10%.

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I. The Problem: The Temporary Market Gap

Canada's Goal and Stated Commitment

The Government of Canada committed itself to ensuring a prosperous and sustainable economy by 2050. Getting to this overarching goal will require notable reductions in Greenhouse Gas (GHG) emissions, and significant structural changes to the way in which Canadians produce and consume energy. Green Bonds is designed to accelerate Canada's transformation to a sustainable economy by addressing a significant market gap.

To reach this overarching goal, the Government of Canada has committed to deep, long-term greenhouse gas emission and air pollutant reductions. This commitment was outlined in the *Turning the Corner* regulatory framework with calls for GHG emission reductions of between 60-70% below current levels by the targeted year of 2050. In addition, to this long-term strategy, the framework includes an interim goal of a 20% reduction below 2006 levels by 2020.

According to the recent National Round Table on the Environment and the Economy (NRTEE), two key enabling conditions are necessary to achieving this goal: *an economy-wide emissions price signal* and *widespread low-carbon technology deployment*.[5] Bringing about these two interrelated conditions will not, however, occur overnight, as the cost associated with carbon emissions is priced slowly over the long term. An economy-wide carbon emissions price signal will eventually enable large-scale renewable energy technology deployment, but this price signal will take time to rise to the level required for the cuts committed to by the government. For example, the NRTEE estimates that in order for deep reductions to be made, the required price signal for carbon emissions must be quite high (in order to attain carbon reductions of 45% and 65% by 2050, carbon must be priced at $160 and $270, respectively). The primary reason carbon cannot be priced in any more aggressive a fashion is due to the reasonable reluctance to shock the economy. Given this anticipated slow-rising long-term trajectory for the price of carbon in Canada, it is necessary that the uptake rate of renewable energy infrastructure be expedited by other means.

Accelerating the deployment of low-carbon energy production can deliver additional CO_2 reductions well in excess of 25Mt (MegaTonnes) annually by 2020[6] – thus providing a significant and concrete contribution to the governments stated policy goals.

[5] See *Getting to 2050: Canada's Transition to a Low-emission Future.*
[6] See Market Size, Bond Issue Size and Potential CO_2 Reductions for details. We understand the Clean Electricity Task Force is seeking just this amount.

Temporary Market Gap

The long-term, gradual nature of these changes to the price of carbon means that energy production infrastructure today will be built during a time when the market signal for carbon is not sufficient to allow for energy producers to make a rational economic choice of renewable production. While energy producer responses are likely to vary, the lack of market incentives and the presence of a gradual trajectory suggest energy producers will respond as follows:

- *Large-scale, single-source energy producers* (such as those who operate power plants) are the most likely to respond immediately to a long-term carbon emission pricing signal due to the long time horizon over which capital investments are viewed – but even their response is not guaranteed.
- *Smaller-scale energy producers* will be reluctant to respond because the time-scale required to benefit from the high price signal is relatively long . Without significant operating capital they cannot afford to wait for the benefits associated with that price signal.
- *"Early-adopter" energy producers* will not respond because there is no immediate financial benefit from entering the marketplace with newer technologies.

Requirements for Filling the Gap

What is needed to fill this gap is an incentive for energy producers to choose renewable production over traditional fossil-based production, prior to a high long-term emissions price signal. These producers include the large-scale producers who may respond immediately to a long-term carbon emission pricing signal, but most pointedly, those smaller scale producers and "early adopter" producers who are hesitant to view capital investments over a long term period. To be effective the market incentive must target all three groups of energy producers.

By providing immediate incentives for existing large- to small-scale energy producers to rely on renewable as opposed to traditional fossil fuel production, changes in our existing emissions will occur more quickly. This fast start approach will, as the NRTEE notes, "mean that the overall additions to the stock of atmospheric carbon will be less… relative to a slow start."[7]

[7] NRTEE, p.19.

In addition, by providing incentives to “early adopter” producers, the government will enable faster adoption rates of relatively new low-carbon technology. This strategy will also contribute significantly to the broader goal over the longer term as such technologies become more widely deployed. The Green Bond incentive will act to 'kick start' these technologies.

Most low-carbon technologies (geothermal heating/cooling, geothermal electrical production, wind, tidal, wave, solar) can be characterized as “high capital cost, low operating cost.” Yet these technologies, by virtue of being newer than traditional sources of energy, are subject to higher risk-rates when borrowing from commercial financial institutions. Thus, when producers are in the process of “adding the next megawatt”, it is rational for them to select carbon-based production over renewable. *As such, a suitable and effective incentive to accelerate the deployment of low-carbon technology is the immediate provision of low-cost capital to producers of renewable energy.*

II. Recommended Solution: Green Bonds

The solution proposed, Green Bonds, provides an incentive for the energy producer to invest in renewables rather than traditional technologies. The Green Bond facilitates this change by decreasing the rate for borrowing capital: lowering the energy producer's *cost of capital* and thus total cost.[8] This is made possible by Canadians, the bond holders, who are willing to accept a (low) government-guaranteed rate of return in exchange for participating in the provision of a public good.

Table 1: Green Bonds, Properties and Impact

	Green Bonds at a Glance
Function:	**Provide incentive to energy producers to deploy low-carbon technology today**
Properties:	Engagement of the Canadian public
	Government-backed rate of return
	Independent management by private sector
	Provision of low-cost debt capital to renewable energy producers
Primary Impact:	Achieve carbon reduction policy goals
Secondary Impacts:	Export renewable energy to USA
	Develop renewable technology industry in Canada

In the short-term, the focus of the Green Bond will be to reduce carbon emissions. Proven technologies with a low-technology risk will be initially targeted as the primary goal will be to quickly reduce emissions. Over time, in subsequent bond issues, that primary goal may be supplemented by other goals - such as to increase the demand for Canadian renewable equipment

[8] Energy producers, those who build infrastructure to produce the next megawatt of energy, have several options in making their investment decision. The electricity producer wants to maximize profit, which is the price of selling a megawatt of electricity minus the costs of producing that megawatt (summed over the life of the plant). In the electricity market, however, producers are price-takers – the market determines prices. As such, the energy producer simply needs to consider cost (we will ignore subsidies for now). *Total cost* is generally determined by the sum of *cost of production (*That is, the capital costs plus operating costs such as labour and fuel*),* the *cost of capital*, (That is, the cost of borrowing capital required to finance start-up) and, in the future, the *cost of carbon* emission per kilowatt-hour.

and technologies, helping Canada become a leader in the renewable energy sector, and selling renewable energy to the United States and renewable technology to the world. Please see Next Steps for a longer-term view of the potential goals of this policy proposal – the details of this document shall assume that it is direct emissions reductions that is the primary goal.

In the short-term, Green Bonds will change the market conditions for renewable energy, accelerating the rate at which renewable energy comes into production, thereby reducing GHG emissions.

Figures 1 and 2 (below) depict how Green Bonds enable this change. In a), the high cost of capital and the low-cost of carbon mean that renewable energy production will not be market viable for a long time. Given the immediate need for renewable energy (from both an environmental and competitiveness perspective) this is considered to be a *market failure*. In b), the lowered cost of capital accelerates the time at which market viability for renewable production is achieved.

The technologies that are targeted by this proposal in the initial stages are those renewable energy technologies that would benefit from the provision of low-cost debt capital and have proven themselves to be of minimal technology risk. In other words, technologies that are – from an engineering perspective – fully functional and robust, are capital intensive, and face the financial difficulty of not having low-cost capital made available to them by the commercial banks. We call these *threshold technologies*. It is also recommended that technologies related to *efficiencies* also be included, but for the sake of simplicity we are focusing the analysis on energy production.

Commercial banks are quite conservative, and normally need to see a technology in commercial-scale operation for upwards of a decade before the lending rates they make available drop to near-prime. It is the inherent conservatism of the commercial banks – which *prohibits* them from playing this early-stage, supportive role – that this proposal is meant to overcome.

For a case study illustrating the effect of the provision of low-cost capital in the solar thermal market, and the development of the financial profile of a 'threshold technology', please see Appendix C.

To address the market failure illustrated in (a) below, government-backed Green Bonds would accelerate Canada's ability to be a sustainable and profitable economy by raising capital for green infrastructure and reducing the risk for capital investment. Green Bonds are designed to reduce the total cost of producing renewable energy today, ensuring that renewable generation becomes price competitive in the near term.

There is a precedent for this sort of financial instrument. For details of the European Climate Awareness Bond, issued in June 2007, please see Appendix B.

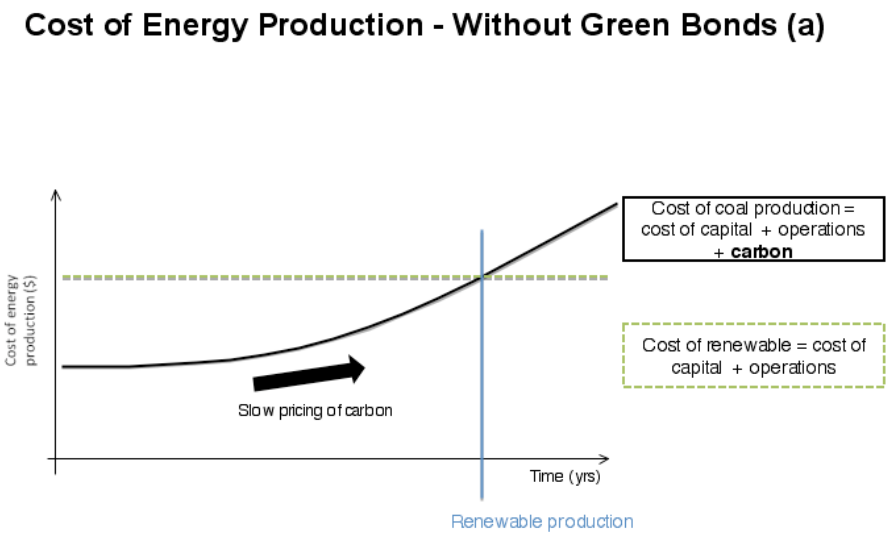

***Figure 1: Cost of Energy Production (a)*: Note that the cost of energy production will slowly rise over time as the cost of carbon emissions must eventually be factored into the cost base. The cost of renewable production is currently higher than that of competing fossil-based sources, and this situation will not change for many years.**

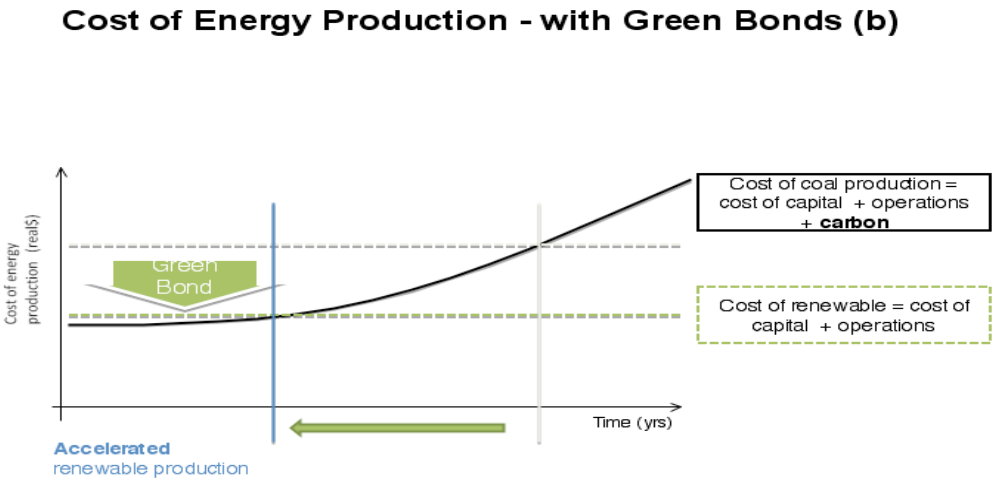

***Figure 2: Cost of Energy Production (b)*: The lowered cost of debt capital lowers the cost of renewable production such that it is competitive over the near term with competing fossil-based sources.**

Proposed Structure and Mechanics

We envision Green Bonds being issued by one or more private financial institutions ("Managers') to the general public and institutional investors ('Bond Holders'), with the capital generated placed in a Green Bond Fund (the 'Fund'). The Federal Government ('Government') will guarantee some portion of the bonds and provide the mandate by which the Fund is managed. While we recommend this specific structure and management framework, Section V assesses other possible approaches.

Those funds are issued to qualified borrowers ('Borrowers') for the express purpose of purchasing approved renewable energy equipment. Sustainable Development Technology Canada (SDTC), as will be discussed at greater length in Section V, shall provide a screening role for approved technologies – although it is not the case that all approved technologies are to come through the SDTC pipeline. Monies are lent to Borrowers at an appropriate spread to cover overhead (management fees, for the most part), but the spread is minimized.

Amortization payments are made to the Fund, which provide on-going cash flows to account for interest payments to Bond Holders. The amount of interest charged can vary, technology to technology, dependent on need and risk factors. All loans to Borrowers come with a lien on equipment (or other assets – see Risk-Mitigation Strategy, below) to help reduce default rates.

Since the Green Bonds are a marketable security, will be actively promoted by the government, and have the sort of popularity revealed by our poll[9], the redemption rate is expected to be met by further uptake by Bond Holders. That is – unlike Canada Savings Bonds – the sales rate is expected to equal or surpass the redemption rate. In addition, the cost of interest payments is to be borne by the annuity provided by the Borrower. Hence, the long-term liability the government is expected to finance is only that portion of the Fund associated with defaulted loans. Current liability may vary year-to-year as uptake and redemption may be out of balance.

In addition to providing amortization payments, we recommend that Borrowers – in exchange for the lowered risk-rate – sign over to the Fund all or some future carbon credit revenue. Such revenue would be used to provide for the variable upper rate of return. However, carbon credits will not be derived from any project funded by the Green Bond until that loan is fully repaid to the Fund. This stipulation safeguards against problems of double subsidies.

[9] See Appendix A.

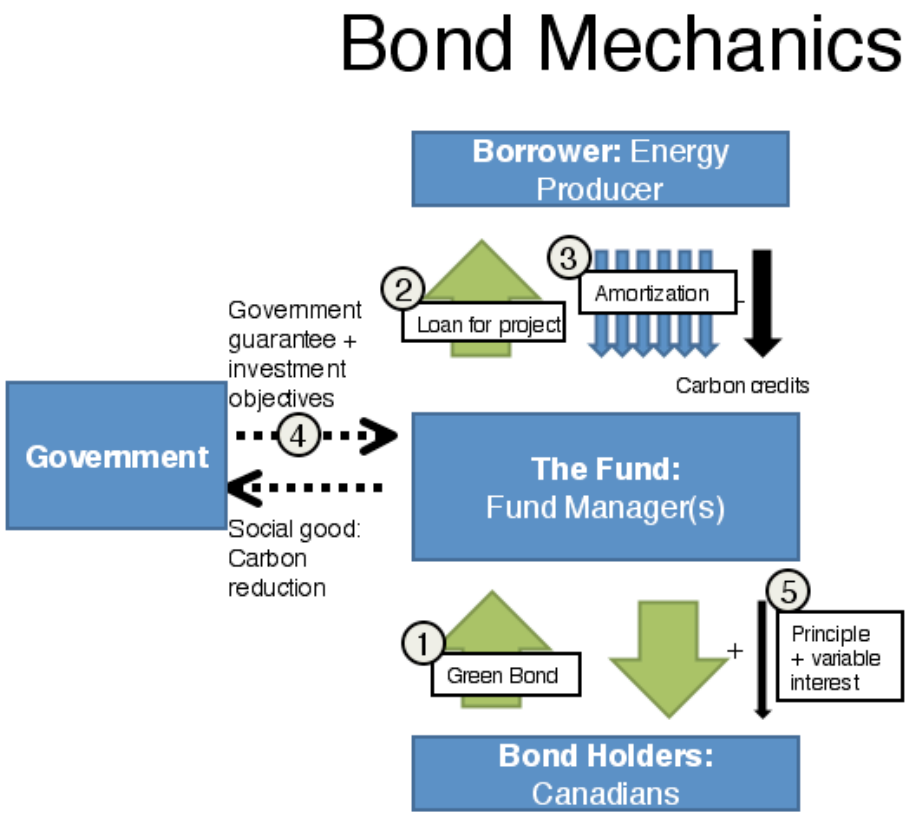

Figure 3: Bond Mechanics*: How it works: 1) Canadians buy Green Bonds. 2) Fund manager lends funds to renewable energy production projects. 3) Borrowers earn profit and repay loans (with some default rate) to fund. 4) Government guarantees return to "lenders". 5) Fund repays lenders. *Green Bonds can offer a variable upper rate of return by including carbon credit swap in Step 2.

For an example of a loan transaction for a solar thermal energy provider, see Appendix C.

Aside from these basic mechanics, our recommended policy points are as follows:

Rate of Return

The rate of return on the bond shall be variable, with a lower rate and the principal guaranteed by the Federal Government. The reason for the variable upper rate is to attract large institutional investors. It is our recommendation that the variable upper rate be linked to the price of carbon, or to other measures of the Fund performance.

Governance

We recommend that the fund be governed by a Board of Directors comprised of members representing both the private sector and the government; a majority of which shall have experience in the renewable energy space and be selected by the private financial institution charged with managing the fund, and a minority assigned by the Federal Government. The Fund

shall adhere to standard corporate governance standards of disclosure and fiduciary duty. Management fees should be in the industry standard range, starting 0.75% - 1.0% of total funds disbursed and rising based on Performance Metrics (see below).

A number of sub-committees are to be established, at a minimum with the following roles and responsibilities:

a) Investment Committee: To develop and establish policies and procedures by which investments are chosen, and monitoring adherence to those policies and procedures; to provide recommendations regarding both long- and short- term investment policy, including the role of carbon emissions revenue, the technology-specific lending rate, the technology-specific class of lien against assets.

b) Audit Committee: To assist the Board in overseeing the financial reporting processes of the Fund; to monitor Fund's compliance with all applicable regulatory and statutory requirements.

c) Risk-Management Committee: To provide continuous feedback and recommendations regarding the Risk-Mitigation Strategy (outlined below); to provide policies and procedures by which loans are associated with assets and how those assets are recouped in the face of a default.

Fund Mandate

The Mandate for the Fund shall be provided by the Government. The degree of specificity of the Mandate is variable, and we recommend that the Mandate be provided in as general terms as possible. For example, the Mandate might specify specific technologies, eligible Borrower profiles and target lending rates. On the other hand, the Mandate may simply provide for general performance metrics and parameters, and incentives to maximize those metrics and parameters. We recommend the latter.

It is our recommendation that the Mandate be limited to the Performance Metrics provided below, which are designed to ensure the Fund maximizes its contribution to reaching the government emissions reduction targets and minimizes the cost to government, while fully leveraging the resources and ingenuity of the private sector. The particular technologies targeted, for example, can change over time at the discretion of the Fund Manager in response to evolving market conditions.

If the right balance is struck between a clear, measurable and relevant Performance Metric and a general but clear Fund Mandate, the full creativity of the private sector will be brought to bear on maximizing the efficiency and effectiveness of this proposal.

Performance Metrics

The key metric of the Fund is as a measure of the cost to government per tonne of CO2e emissions reduced[10], which we will call the Efficiency Metric. Since this proposal has a primary objective of reducing emissions, and since the cost to government should be minimized, this overall metric represents directly the success of the proposed policy and so is the metric by which success is to be measured. Our estimation[11] of the Efficiency metric is between $1 and $13.

Since the cost to government consists largely in defaulted loans, this metric implicitly takes that into account, and the incentives to the Fund Manager can be aligned with this metric. However, since it is the *total* amount of emissions reductions that directly contributes to the governments stated policy goal, then a secondary metric of the *total* amount of emissions reductions shall also be adopted and used by the Government as another measure of success of the proposed policy.

Given such a general Performance Metric, the private sector will be able to imaginatively and creatively source the most efficient ways to maximize that metric, including technology choices, appropriate lending rates and risk mitigation strategies.

Fund Management Fees and Incentives

Fund management fees vary, but typically start at around 0.75% of funds under management. It is our recommendation that the management fees for the Fund be offered at a minimum of 0.75%, but vary upward depending on the degree to which the Performance Metrics are met, particularly with regard to the Loan Default Rate, reaching a maximum of 4% if that rate is brought below 5%. These rates are to apply to the amount of monies that are currently outstanding as Loans to Borrowers, rather than as a percentage of the total Funds under management, in order to minimize the incentive to be so conservative as to simply hoard the monies.

The Role of the Private Sector: Separation of Risk and Control

The separation of risk (government) and control (the private sector) is a considered choice and will lead to better performance of the fund and greater support for the proposal as a whole. There are a number of reasons for this structure.

a) There is significant opposition, across the political spectrum, to the idea of the government "picking winners". Here, it is the private sector, working within the Fund Mandate, deciding which technologies are to be supported - and "picking winners" is something the private sector does all the time and is without controversy. Indeed, it is part and parcel of doing business.

[10] Note that secondary rounds of bond issues may have different metrics – such as the emergence of key Canadian renewable energy technology industries. Please see Next Steps.
[11] See Market Size, Bond Issue Size and GHG Reductions.

b) The private sector is in a much better position to be offered the proper incentives to ensure the Fund is managed effectively. While it is normal procedure to offer financial incentives for performance in the private sector, such incentives are not par for the course in the public service. These incentives are key to delivering an efficient subsidy.

c) The degree of expertise in the private sector with respect to these sorts of technologies is significant and can be assumed to already be in place. Any financial institution that would take on the role of Fund management will be capable of accessing a depth and degree of experience and know-how that does not currently exist in government, and can bring that expertise to bear in performing due diligence on companies and technologies.

d) The ability of the private sector to make use of financial mechanisms such as liens on equipment or Power Supply Agreements (see Risk Analysis and Mitigation, below) means that it is much more able to mitigate risk and generate value in the face of adverse loan conditions, hence increasing the performance of the Fund.

Issuance

We recommend that the Bond be issued by a private institution(s), and backed by the Federal Government. Any one bond issue should be small relative to the total market, to ensure that only projects that fulfill high standards of diligence are targeted and to ensure that – relative to market size – further bond issues remain viable. Given the large bond size required, it is recommended that there be many private institutions competing in this sector, each generating their own Performance Metric and given further bond issues based on their performance relative to other firms.

Target Lending Rate

The Fund Manager provides low-cost debt capital. However, further to the Mandate being provided in general (rather than specific) terms, the actual rate at which the Fund is to provide that capital may be open to changing market conditions. It is up to the Fund Manager to determine the optimal lending rate, and again – the full ingenuity of the private sector may be brought to bear on setting this rate. For example, it may be that the Fund Manager holds an open 'auction' from various energy producers, and that auction allows the market to set the right combination of technologies and lending rates.

Target Borrowers

In order to minimize overhead, it is expected that the Fund target single-source, large-impact Borrowers. It is not expected that the Borrower be households, for example, but rather large aggregators of equipment installations and power production or commercial-scale energy producers. It is not recommended that Funds be lent on a project-by-project basis but spread over several projects and aimed at companies with a diversified installation base.

As noted earlier, the specific target Borrowers will likely be comprised of a mix of *large-scale, single-source energy producers* (such as those who operate power plants), *smaller-scale energy*

producers who aggregate the production of dispersed technologies (such as the solar thermal example in Appendix C) and *early-adopter energy producers* who are first to market with proven, but early-stage commercial, technologies.

A Temporary Solution – Deciding When the Subsidy Ends

Green Bonds fits well within the larger evolving economic and regulatory environment. Green Bonds is a temporary solution to alleviate what will (ideally) be a temporary problem or market gap. Green Bonds accelerate the demand for renewable energy by rendering the installation of the necessary infrastructure more economical. This form of government intervention will, however, one day no longer be necessary. As carbon is priced, renewable energy will become more cost effective, leading to greater demand and an increase in economy of scale. Green Bonds will eventually be phased out.

The capacity to both define the moment a particular technology becomes ineligible for that subsidy and to gently hand the fate of that technology over to the private sector are key characteristics of any subsidy. In this case, a clear indicator that a technology is no longer a "threshold technology" and that its market uptake is to be handled without subsidies is the coming into existence of a commercial lending rate that is comparable to the Fund lending rate. In other words, the commercial banks are free to step in and compete with the Fund at any time, and the moment that they begin to make capital available at a rate that is within some range of the Fund lending rate for that technology, then that technology quite naturally drops off the subsidy. Over time, the Fund should become irrelevant in the face of commercial banking activity.

III. Comparison of Green Bonds to Other Financial Mechanisms

In order to achieve the stated medium- and long-term emission reduction targets of the federal government, a number of financial instruments and incentives will be required in addition to the economy-wide price signal recommended by the NRTEE. This may include, but not be limited to, tax credits and direct subsidies. Green Bonds is not meant to replace or displace any of these alternatives. It is meant to be complementary to them.

That said, it is important to analyze the efficiency of the Green Bond incentive relative to these other financial instruments, particularly with respect to the stated target of smaller and early-adopting renewable energy producers. In this section we analyze the effectiveness of the Green Bond instrument relative to both tax credits and direct subsidies, and also in terms of a Final Metric: the amount by which a $1 cost to the government is multiplied into a final dollar amount deployed to the production of renewable energy. We also compare Green Bonds to more traditional labour-sponsored funds.

Tax Credits

Tax credits come in the form of a reduced tax liability to profitable companies. According to the Conference Board of Canada, a key supporter of this proposal, "As part of the climate change and sustainability policy agenda, governments should be prepared to help firms accelerate the adoption of more environmentally friendly technologies. The Conference Board of Canada recommends the introduction of a targeted environmental investment tax credit for green technologies ... an environmental tax credit would be available to firms that actually spend cash on investments in green technologies."[12] While we accept that tax credits may be an effective mechanism to induce large, profitable companies to shift to renewable sources of energy production, they are not as effective in inducing smaller startups and "threshold technologies."

An example of this sort of business model is the early adopter of wind technology, VisionQuest. The Company was later acquired by TransAlta, who then – given their financial resources – scaled up the production of wind power, and continue to do so. The case of VisionQuest demonstrates that newer renewable technologies will be driven to the marketplace by smaller, faster-moving companies only to be later adopted by large, more established and profitable companies. While flow-through tax credits are a way of generating a benefit for newer startups, they do require that the share structure of the company be restricted in such a way that the shares

[12] Using Green Taxes and Market Instruments to Reduce Greenhouse Gas Emissions, Conference Board of Canada, Briefing, February 2008

are owned by existing and profitable entities. This restricts the effectiveness of the mechanism to only a portion of the entrepreneurial and business community.

The table on the next page compares Tax Credits to Green Bonds, from five different perspectives: the final cost to government per $100 of low-carbon technology deployed; risk mitigation; the financial effect of the instrument; the sorts of businesses that are targeted; and the type/degree of public engagement. Green Bonds has two modes of comparison, one in which the loans fund an entire low-carbon project, and another in which matching funds are required by the project owner.

Tax credits can be seen to be less effective in terms of the **Efficiency Metric**. That is, how the direct cost to the government is multiplied by the form of the financial investment. Green Bonds has an **Efficiency Metric** of between 4 and 8 (each $1 the government spends results in between $4 and $8 spent on deployed low-carbon technology), while Tax Credits multiply that cost by only 2.5. Green Bonds targets established producers, start-ups or early adopters, while Tax Credits target a small range of companies - namely only those that are established and profitable. Green Bonds involves the public in a voluntary way, while Tax Credits require obligatory public participation through government revenue (granted, loan defaults – the cost to government in the Green Bond scenario – do entail expenditure of government monies). The total risk can be capped with both Green Bonds and Tax Credits. However, Green Bonds offers additional potential risk-mitigation strategies, aimed at reducing the overall cost to government (see ***Section V***).

It is important to note there are no guarantees with either Tax Credits or Green Bonds that the cost to government will result in actual renewable energy production – both mechanisms only guarantee that money will be spent on certain capital equipment. However, with the Green Bond mechanism those monies spent come with a commitment to repay the loan – and hence an additional and more direct incentive to actually produce revenue with the capital outlay.

Table 2: Tax Credits compared to Green Bonds

	Tax Credits	**Green Bonds**	**Green Bonds Loan Matching**
1.Cost to government			
Cost to government for $100 investment	$39 [*2]	$25 [*1]	$12.50
Investment in renewable per cost to govt (multiplier effect or **Efficiency Metric**)	100/39 = **2.5**	100/(100*default rate) = **4**	(50 + 50)/(50*default rate) = **8**
Max cost to govt	$39	$100	$50
Min cost to govt	$39	0	0
Account on governments books	Expense	Contingent liability	Contingent liability
2. Risk Mitigation			
Risk mitigation measures	Cap on total	Cap on total bond issue + due diligence	Cap on total bond issue + due diligence + shared risk
3. Effect of Instrument			
Effect to Recipient	DECREASED cost of capital *if profitable*	DECREASED cost of capital	(same)
4. Target market			
Stage of business life cycle	Established energy producer	**Start-up** OR established energy producer	(same)
Stage of innovation adoption	Late adopter	Early or late adopter	(same)
Risk tolerance	Lower	Higher	(same)
Size and profitability	Large Companies	Small or Large Companies	(same)
5. Public			
Public involvement	Obligatory	Voluntary	(same)
Return on investment	Negative - pure subsidy	~5% less default rate	(same)

Assumptions:

- [*1] Cost to government in Green Bonds is limited to loan defaults. The loan default rate is pessimistically estimated at 25% (see ***Finding the Right Risk-Return Balance***)
- [*2] Corporate Tax Rate of 39%

Direct Subsidies

Subsidies come in several forms.[13] Direct subsidies provided for renewable energy production are of particular relevance to Green Bonds. There are two types of these direct subsidies – *Capital Subsidies and Production Subsidies*.

> *Capital Subsidies*: EcoAction subsidies exist for a number of technologies, and operate as a form of capital return (or payback) generated at the moment of technology capital investment. When one purchases a solar-thermal panel, or retrofits a building with geothermal heating/cooling there is a direct subsidy in the form of a cash payment from the government. The Final Metric for these subsidies varies with the amount of the subsidy as percentage of total capital outlay.
>
> *Production Subsidies*: Production Subsidies operate directly at the point of energy production (e.g., $.01/kwh direct subsidy for wind energy). Here, the Efficiency Metric is more difficult to compare directly with the Green Bond proposal since the cost to government may be represented as a fraction of the total energy produced rather than as a total of the capital outlay.

Compared to direct subsidies, Green Bonds is more adaptable. A key differentiator of the fiscal portion of this proposal is that – given a Mandate in general terms, and a Performance Metric that focuses on emission reductions *tout court* – the ways in which that Mandate is fulfilled is dynamic and open to all of the innovation that the private sector Manager can bring to bear. Essentially, the expertise and incentives of the private sector, combined with a clear but general Mandate and a clear Performance Metric, can act as a sort of 'lever' to increase the efficiency of the proposed policy in a way which in unavailable to direct subsidies. Hence, the Green Bonds proposal is more adaptable to changing market conditions and has a much more dynamic structure than direct subsidies.

A key distinction between direct subsidies and the Green Bond is that the notion of repayment is central to the Green Bond proposal. Moreover, with a strong risk-mitigation strategy, the fraction of loans that default be minimized. In that sense, although the lending of the government's risk-rate can indeed be characterized as a subsidy, it is not a direct subsidy in the same way as those described in this section. The Green Bond proposal is designed to incentivize companies to operate efficiently as profitable enterprises, whilst allowing these same companies to choose which particular methods of energy production they adopt.

[13] We ignore those subsidies that focus on technology *development* (eg. R&D tax credits), since the Green Bond is more concerned with technology *deployment*. It should, however, be noted that by stimulating deployment, the Green Bond policy complements those subsidies that target development (as noted in the previous section).

Labour-Sponsored Funds

Labour–sponsored funds have been used in the past by various governments, in order to direct private capital toward particular industries, with varying degrees of success. Normally, the incentive provided is some sort of tax break on contributions to the funds, which are run by the private sector with varying degrees of specificity in the mandate.

The uptake of such funds has generally been limited to sophisticated investors capable of making high-level investment decisions. As such, they have not been embraced by the public at large. This is a key differentiator of the Green Bonds proposal. Our poll results (see Appendix A) suggest that Green Bonds would be a significantly more popular policy choice. If public engagement is a criterion for evaluation, Green Bonds are clearly better positioned to achieve this goal.

The other key differentiator is that the fiscal side of this proposal is not aimed at the provision of venture or equity capital, which is the standard objective of labour-sponsored funds. Green Bonds provides market uptake for technologies, it does not compete with venture funds for the provision of venture capital. Indeed, there is no lack of venture capital available in the renewable energy sector; the provision of more venture capital in the form of a labour-sponsored fund strikes us as much less relevant to achieving real, measurable emission reductions than the provision of low-cost debt capital to energy producers. It is the market gap faced by those who deploy renewable energy technology that needs to be addressed. Hence, the fiscal portion of this proposal is much more focused on filling an existing and important market gap.

IV. Green Bonds and Existing Government Programs

Green Bonds integrates well with – and provides positive feedback for – existing government initiatives. Here, we outline the *Renewable Energy Production Pathway*: the current economic cycle that encompasses both the initial suppliers of new renewable energy technologies *into* the marketplace and the subsequent uptake of those technologies *by* energy producers in the marketplace. See Fig.4 below for details.

Sustainable Development Technology Canada (SDTC) is principally concerned with the first part of the cycle in what SDTC has been identified as the Innovation Chain. SDTC has highlighted two funding gaps at the pre-commercial stage of the development of new technologies: the Pre-Commercial Gap and the Pre-IPO Gap. These gaps, sometimes referred to as the "Valley of Death", are bridged for clean technologies through SDTC's two funds, the SD Tech Fund and the NextGen Biofuels Fund. Both of these funds are complementary in nature and designed to help sustainable technologies reach market. These funds can be thought of as the initial phases of funding to push clean technologies towards the market, with the SD Tech Fund, which occurs earlier in the Innovation Chain, being considered Phase I funding, and, the NextGen Biofuels Fund being a Phase II funding.

Green Bonds, principally concerned with phase II of the cycle – the uptake of these technologies *into* the marketplace – would integrate with SDTC in a number of ways. SDTC – equipped with top notch engineering and economic expertise – has offered, in the context of initial consultations, to provide the Green Bond Fund with a 'screening' function, acting to approve technologies that pass muster. In addition, Green Bonds picks up where SDTC leaves off in this pathway, by providing demand for technologies that may have demonstrated feasibility with SDTC support. As such, Green Bonds sends a market signal to technology producers to increase production capacity.

For example, currently there are tidal power pilot projects happening in the Bay of Fundy and off the West Coast of the country. When these pilot projects are complete, Green Bonds will stimulate demand for the technology, speeding up the transition from a nascent pilot project to a large commercial platform.

Please note, however, that approved technologies must have a commercial life-span and reliability level commensurate with the long-term lending model. Approved technologies may or may not come from the SDTC 'pipeline', but for those that do, there is the added benefit that the Green Bond Fund reinforces investments that the federal government has already made in previous SDTC funding.

V. Finding the Right Risk-Return Balance

Alternative Structures

As mentioned in the section outlining the details of the instrument, there are several ways to structure the issuance and management of the Green Bond. As such, there are a number of possible ways to adjust the government's risk, liability, cost and social return.

Specifically, there are three general ways in which the Green Bond can be issued and managed. In each case, the investment objectives of the fund are established by the government as an integral component of the Green Bonds proposal. We recommended that the first method be adopted.

- Option 1: The bond is issued privately but is guaranteed by the government. The funds are managed privately. In this scenario, the private sector is charged to do what it does best, and the government's role is limited to providing a guarantee on the bond – shouldering much of the risk in lieu of the public. Moreover, the private fund manager takes on full control of the risk mitigation strategy.

- Option 2: The bond is issued by the government, but then can could be sold or auctioned to a bank at a discount to the face value issued. This discount would account for the risk the bank would assume and would allow the government to contain its potential liability to a fixed number, eliminating any uncertainly as to the size of the loss that could be incurred. The bank would then be free to make investment decisions as it sees fit provided they fall within the guiding principles created by the government.

- Option 3: The bond is issued publicly, as if it were a Canada Savings Bond special issue. The funds are managed privately. In other words, the funds are raised by the government, but issued to the private fund manager. Here, the overhead associated with a private bond issue is avoided, but the liability sits directly on the government books as a loan to the fund manager. Also, there is an additional risk to the government that a special issue will cannibalize on-going sales of Canada Savings Bonds.

A table comparing these alternative structures is shown on the next page.

Table 3: Three Issuance Structures

	A Bond Issues by a Private Fund	**A Bond Issued by a "Merchant Bank"**	**A Bond Issued as CSB Special Issue**
Description			
Amount invested in low-carbon technology per dollar cost (or liability) to government	$4-8 (see above)	Negotiated, set by bank.	$4-8 (see above)
Cost to government	Contingent liability	Fixed expense	Liability
Issuer of bond	Fund	Fund	Government
Bearer of project risk	Government	Fund manager	Government
Manager of fund	Fund	Bank	Fund
Investment objectives	Set by gov't	Set by gov't	Set by gov't

Risk Analysis and Mitigation

All funds have risk management strategies, and the Green Bond Fund would be no different. The risk associated with the bonds will be mitigated through a Risk-Mitigation Strategy, primarily through sound governance, oversight and a limited bond issue size. The risks associated with the Green Bond and the associated Fund, along with the relevant risk mitigation strategies are listed in the table below.

Direct risks are associated with the government backing and any related financing requirements – defaulted loans and premature bond redemptions are included here – as well as risks associated with the technology itself. Indirect risks are related to the relative efficiency of this financing mechanism within the larger context of federal government finances. The risks as well as the countermeasures associated with the technology, defaulted loans and premature redemptions are explored in greater depth in the following three sections.

Table 4: Risks and Countermeasures

	Specific risk	**Countermeasures**
Project risk	Recovery rate	Lien
	Default risk exposure	Dollar for dollar matching
Management risk	Mismanagement	Independent board, clear investment objectives
	Government interference	Independent board
	Misuse of funds	Clear investment objectives
Technology risk	Failure of technology to perform	Target proven technologies with engineering screening function

Technology Risk

The risks associated with the technology are minimized (at least during the initial stags of the Green Bond, see **Next Steps**) by targeting those technologies that are currently operational and technically viable on a commercial scale, but that have not been deployed mainly due to a lack of low-cost capital . While it is true that the commercial banks tie their lending rates to the perceived risk, and hence the technology risk cannot be assumed to be zero, there is a clear gap in funding due to the normal fiscal conservatism of those commercial banks. As noted, a bank typically waits for a technology to be deployed on a commercial scale for a decade or more before the technology risk is perceived to be minimized.

Sound engineering due diligence (highly selective technology targeting), a function offered by SDTC, can minimize the technology risk in the initial rounds of bond issues. Technologies are chosen that are currently operational, producing energy and reducing emissions in a reliable manner. In other words, the priority in technology selection is in ushering large amounts of *proven* technologies into the marketplace, not in providing an initial market for those that are more cutting-edge. Geothermal, solar thermal, wind and solar photovoltaic, for example, are all technologies that have clear, proven engineering track records.

Defaulted Loans

The rate by which loans default is to be minimized in a number of ways. First, note that the governing Board can be motivated to limit this risk, even in the presence of a government guarantee, by having the management fee tied to the loan's performance – the higher the default rate, the lower the management fee. As noted, it is our recommendation that management fees start at 0.75% of funds deployed and rise to a maximum of 4% if defaulted loans are reduced to below some threshold (say 5%).

Second, all loans are associated with some sort of lien. Here, the lien will be appropriate to each technology (technology-specific liens). While most liens will be against the equipment itself, some may be against the Power Production Agreement associated with the equipment.[14] It is relevant that all Equipment is directly revenue generating, and loans are not made for general capital expenses.

Third, the equipment will be vetted by Sustainable Development Technology Canada (SDTC), and as such will have passed through rigorous engineering diligence before they are associated with a loan or lien.

Fourth, good management at the Board level should be able to provide assurance that each project to which financing is provided passes basic financial diligence, and the Borrower can present a financial plan in which the revenue being generated from the Equipment can provide sufficient cash-flows to pay the associated amortization payments.

Fifth, it is our view that Borrowers be required to match any funding coming from the Fund, in order to ensure that they have a significant vested interest in the project's ongoing viability.

Sixth, we recommend that - whatever form the overall carbon regulatory scheme takes – the Borrowers temporarily assign or forfeit whatever form of carbon upside the project makes available. For example, in a cap-and-trade scenario, the carbon credits generated are not assigned to the Borrower until such time as the Loan is repaid. This provides further incentive to quickly repay the loan.

For an estimation and analysis of the expected loan default rate, see **Government Liability and Cost**, below.

Premature Bond Redemptions

As noted earlier, Green Bonds are a highly-marketable financial instrument. While it is possible to eliminate this risk by locking the bond-holder into long-term commitments, any long-term commitment is normally rewarded by a higher basic rate of interest. This runs counter to the need to provide low-cost capital to the Borrowers.

To ensure that there is a long-term influx of new Lenders to account for any bond redemptions it is recommended that the market for the Green Bond remain as liquid as possible. Although a secondary market in Green Bonds may provide some of this liquidity, it is also recommended that the liquidity issue be addressed primarily by three strategies:

[14] Because Power Production Agreements are signed for large-scale production to the grid they are not applicable for geo, solar thermal, or other small-localized production. They may, however, be applicable to tidal power, or bio-gas plants.

- Any Bond Issue should be small compared to the existing 'threshold technology' market size, and small compared to the perceived public demand (which is enormous, please see Poll Results).
- - An upper variable rate should ensure that large institutional investors remain a primary source of investors.
- Green Bonds is accompanied by a national marketing campaign. This recommendation supports the public engagement side of the proposal and should be considered a cornerstone of the proposed policy itself.

Although there may be short-term liabilities associated with premature bond redemption, these cash-flow requirements can be minimized (and the government shielded from these short-term fluctuations) by requiring the Fund to maintain a percentage of monies in some form of liquidity (money markets, GICs, etc.).

Government Cost and Liability

The most significant cost and liability associated with this proposal comes in the form of defaulted loans. There are other costs – management fees, cannibalized Canada Savings Bond sales, promotion and overhead - but these are considered to be well understood by the government and less significant and hence less of a concern than the issue of the defaulted loans. It is on defaulted loans that we focus our attention.

Although Canada Savings Bonds appear as an *outstanding liability*, the Green Bond does not. Given the government backing on the Bonds, they appear as a *contingent liability*. That contingent liability is linked to the risk factors associated with loan defaults, and those risk factors are minimized by the Risk-Mitigation Strategy outlined above. The total amount of the long-term liability is a probabilistic statement of the loan default amounts, and this amount is expected to always remain less than the total bond issue.

Taking these risk-mitigation factors into consideration, Green Bonds proves to be a highly efficient way of stimulating demand for renewables with minimal liability or expense to the government. For example, if we assume a very pessimistic 25%[15] default rate on loans, with a 50% recovery rate on liened assets, this leaves 12.5% cost or liability[16] to government. In other words, to provide $1 of capital in the marketplace, the government only takes on an actual liability of 12.5 cents. Even with very pessimistic interpretations of the default rate, the ratio of

[15] This is a conservative estimate, see below.

[16] For example: If $1M is lent to Borrowers, and there is a 25% default rate, the liability to government is $250,000. If half of that defaulted amount is recovered through the liens, then that amount is reduced to $125,000. Therefore, the total liability to the government on the original $1M is $125,000, or 12.5%.

liability to capital provision is very high. The government's maximum, worst-case risk (on total default) is limited to the size of the bond issue.

It is expected, however, that the actual loan default rate will be significantly lower than this pessimistic default rate. Two factors contribute to this analysis.

First, the existing commercial lending rates in the range of 8-12% indicate that the risk associated with these technologies is approximately 5-8% above the risk-free lending rate. Judging by the commercial banks open market signal, the expected loan default rate should be well below 10%. Providing for even a 10% default rate on loans associated with these technologies assumes a higher risk than the commercial banks currently assign – hence, this number is conservative and we expect the actual number of defaulted loans to be less.

Second, given the incentives that can be associated with the management fees the Fund Manager can be directly motivated to leverage their full resources and creativity in reducing the loan default rate and recovering value when defaults occur. The costs associated with the management fees increasing to 4%, if it brings about significant reductions in loan default rates, is a very efficient way to bring down the total costs to government. For example, if it assumed that the loan default rate would be 25% on a straight-out government guarantee, and an increase in fees to 4% reduces that number to 5%, there is an overall cost savings to the government of (roughly) 21%.

VI. Market Size, Cost of GHG Reductions and Bond Issue Size

Market Size

The total market size for renewable energy and infrastructure is enormous. Given a government commitment to reduce carbon in the order of 65% by 2050[17], and given that Canada's total energy need steadily increases with our population, it is for all practical purposes open-ended – particularly if we take the view that Canada could be a net energy exporter to the United States.

Some points to consider regarding market size:

- The market in Canada for solar thermal alone is estimated at $3.6 billion for multi-residential units and $8.9 billion for health care and socially assisted housing[18].
- Estimates for tidal power in the Bay of Fundy can easily be seen to be of a similar magnitude – at a very low estimated $1000-$2000 per kw, the potential easily runs into the billions.
- Geothermal, on new buildings alone, is estimated at $7-8 billion annually[19], and the retrofit market is significantly higher.
- Biomass is also emerging as a multi-billion industry.
- The technically realizable potential of renewable electrical energy production by 2012, in terms of emissions reductions, is in the order of 38Mt CO2e, but it is only expected (under a business- as-usual scenario) to contribute16 Mt[20]. This statistic hits the key '***additionality***' issue head-on. Hence, 18 Mt of *additional* CO_2e reductions, in electrical production alone, can be realized upon the introduction of this proposal.
- The Canadian grid is capable of accepting a 20% load[21] from distributed wind power, which also equates to many tens of billions of dollars.

For all intents and purposes, the amount of capital that could be directed at renewable energy production has no practical upper limit in the immediate future. This says nothing of technologies aimed at efficiencies (arguably, geothermal can be categorized as such), higher-risk technologies and renewable energy infrastructure projects – see ***Next Steps***.

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[17] T*urning the Corner: An Action Plan to Reduce Greenhouse Gases and Air Pollution,* April 2007.
[18] Source: Mondial Energy's commercial internal review.
[19] Source: Clean Energy Developments and Canada Mortgage and Housing Corporation. Residential is $3.5 billion annually, Commercial is $800 million, Light Industrial is $220 million and Municipal Buildings, Universities, Schools and Hospitals is estimated at between $3-4 Billion –total market annually is $7-8 Billion.
[20] See SDTC Business Case, Renewable Electricity, January 2006.
[21] Ibid.

Cost of GHG Reductions

In terms of carbon emissions, a general rule of thumb is that $1 billion in capital investment will produce 2-3 Mt CO_2e, per year for 20 years. In the industrial sector, that number is in the order of 3-4 Mt, in the consumer sector it is 1-2 Mt, and when applied to energy efficiencies it rises to 6+ Mt annually[22]. There are a number of variables that affect these numbers - two of the most significant are:

- What energy source is being displaced (natural gas, oil, coal are all of increasing carbon intensity per unit of energy)?
- What would the estimated mass-manufacturing costs be, if a technology was to be heavily supported in this way? Given the governments targets are set for 2020, it can be assumed that *there is sufficient time for industry to respond* to this initiative and set up the required mass-production capacity.

These numbers hold up under scrutiny[23], but only assuming that large-scale production efficiencies are enabled and/or a worst-case energy displacement factor (eg. coal-generated electricity, see footnote [24] below). At current technology costs, and an average energy displacement factor, the amount of carbon displaced per billion dollars is less.

The parameters that affect the cost to government of GHG emission are:

1. Loan Default Rate (ranges between 10 - 25%)[24], affected by Borrower dollar-matching[25].
2. Overhead and Management Fees (ranges between 0.75% - 5%)[26].
3. Defaulted loan asset/value recovery rate (ranges between 0 - 50%)[27].

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[22] Source, Corporate Knights quantitative analysis on GHG Emissions Reduction, Urbanization Issue 2007.

[23] **Geothermal**: capital costs of $20,000 will displace 13 tonnes of carbon annually (Source: Caneta Research, 1999), in a residential installation in Toronto as compared to a mid-efficiency oil heat and electric a/c. This equates to 0.65 Mt per billion dollars – this is without any large-scale installation efficiencies. Expected costs will go down significantly if large-scale installations occur simultaneously. Greater carbon reductions will be found in jurisdictions like Alberta with their heavy reliance on coal - if coal is used to generate electricity, and that electricity is used to heat a home, the total carbon reductions will increase by the efficiency factor of the generating plant, or by a factor of 3 (to 1.95Mt). Commercial applications displace much higher amounts of CO_2 and are project-specific. **Solar Thermal**: the example in Appendix C translates to approximately 0.35 Mt per billion dollars in the residential market, and this is at a time when there are no mass-production cost reductions taken into account and the energy being displaced natural gas. Carbon reductions will increase by a factor of 6 (to 2Mt) if it is coal-generated electricity used for heating (double for natural gas to coal, and triple to account for generating efficiency). **Wind**: The TransAlta/ENMAX project in Alberta reduces 20kt per year, based on 7.2 MW of installed capacity. (source: Canadian Wind Energy Association). With installation costs of $1M per MW of capacity, this translates to 2.78 Mt per billion dollars.

[24] See **Government Cost and Liability**.

[25] See **Risk Analysis and Mitigation** – this is the amount the Borrow much put up in matching funds.

[26] See **Fund Management Fees and Incentives**, 1% added for promotional costs.

[27] See **Risk Analysis and Mitigation** – this will affect the Management Fee.

4. Mt of emissions reduction per $1B invested (ranges between 1 - 2.5 Mt annually for 20 years).

From these parameters, we generate 3 scenarios by which the government may estimate the cost of this program, on a per-tonne of CO_2e basis.

Table 5: Emissions Reduction – Cost per Tonne

Scenario	**Pessimistic**	**Moderate**	**Optimistic**
Loan Default Rate	25%	20%	10%
Dollar Matching Amount	0%	0%	100%
Overhead and Mgnt Fees	0.75%	2%	5%
Asset Recovery Rate	0%	25%	50%
Total Cost as Percentage of Bond Issue	26%	17%	10%
Emissions Reduction per $1 B investment (Mt/yr)	1	2	2.5
Total Cost per Tonne of CO2e reduction	**$ 12.88**	**$ 4.25**	**$ 1.00**
Total Capital Investment per Dollar Cost (Multiplier)	3.9	5.9	10

Note that these cost figures do not include the indirect benefits to the government of job creation, economic competitiveness, etc.

As a percentage of total bond size, the total cost to government ranges from 10% - 25.75%. The total capital deployed per dollar cost to the government varies between 4 and 10. Translation of these total costs to an annual figure is dependent on the rate at which the Bond issued and the monies disbursed.

Bond Issue Size

Taking a figure of 2.5 Mt per $1 billion of capital investment, and a target of 25[28] Mt/year CO_2e reduction slated for 2020, then the total bond issue should be in the order of between $5 and $10 billion (depending on the dollar matching amount) issued between now and that date. If it is assumed that the first issue occurs in 2010 and is equally spread over 10 years ($500 M to $1B per year), the average annual cost is estimated to be between $50M - $260M (costs are 10-26% of bond issue, see above).

[28] We understand this figure is the amount that the Clean Electricity Task Force is seeking.

VII. Next Steps

The initial phase of Green Bonds is to focus on achieving GHG emission reductions directly, by accelerating the wide-spread adoption of existing, low-risk technologies. This initial phase acknowledges that there is a clear and immediate need to reduce emissions over the short term.

However, later stages of the proposed policy may be fashioned to focus on longer-term emission reduction targets by providing a market pull for higher-risk technologies, technologies that are closer to the development stage and further from the commercialization stage. In so doing, the policy can be focused not only on the immediate need to deploy low-carbon technologies, but can also focus on developing Canada's renewable energy technology industries and enhancing our economic competitiveness. This expanded role will complement the investments the government has already made in renewable energy research and development, in R&D tax credits, in our universities and in the education of our workforce, by helping to generate a market right here at home, to usher those higher-risk technologies into the marketplace.

Canada is currently playing catch-up with many other countries – particularly the Europeans – not just in terms of our actual emissions, but also in the competitiveness of our renewable energy technology sector. Germany, for example, has taken a clear lead in the solar PV field, Spain in solar thermal and the Danish in the production of wind turbines. Canada has fallen behind these competitors, and Green Bonds can help narrow the gap and establish Canada as a leading player.

In terms of which technologies are to be targeted at which times, others have performed the research required to generate a good picture of technology risk, potential contribution to emission reductions and the path to commercial development. There is no need to repeat that work in detail here. See, in particular, the SDTC Business Report Renewable Electricity Generation. Here, we provide a rough synopsis of technology risk levels. It is meant as a conceptual guide only - to indicate the way in which this proposed policy might evolve over time to play a greater role in the evolution of both Canada's energy production path and our renewable energy industry.

Low Risk:

- Solar thermal, solar photovoltaic, geothermal, wind and biomass.

Higher Risk:

- Next-generation wind turbines (larger off-shore turbines, higher-efficiency materials as well as efficiency and load-balancing technologies)
- Next-generation solar photovoltaics (higher efficiencies, advanced materials, thin-film, etc.)

- Next-generation biomass (cellulose-based, lower-grade feedstocks).
- Wave Power
- Small-scale tidal power.

Highest Risk:

- Large-scale tidal power
- Renewable energy enabling *infrastructure* (high-efficiency DC line to remote regions, enabling wind power production in Hudson's Bay, for example)[29]
- Large-scale hydrogen production and fleet conversion.

[29] " A Northern Green Power Corridor grid system developed for a post-2012 timeframe could tap 100,000 MW of baseload wind and hydro", Corporate Knights, 2007, pg. 58.

Appendix A- Poll Results

		Question - Do you support, somewhat support, somewhat oppose or oppose, the concept of a Government of Canada backed Green Savings Bond the proceeds of which would be used to support the development of renewable energy sources such as wind, solar or tidal energy, in Canada?					
		Total	Support	Somewhat support	Somewhat oppose	Oppose	Unsure
		Responses	Percentage	Percentage	Percentage	Percentage	Percentage
Region	Canada 200711	1003	62.3	19.5	2.6	8.6	7.0
	Atlantic	101	67.7	22.1	.0	5.7	4.6
	Quebec	248	64.1	18.9	3.2	7.7	6.0
	Ontario	307	62.3	19.3	1.7	8.7	7.9
	West	347	59.5	19.4	3.6	10.0	7.5
Gender	Male	500	62.4	18.8	2.0	10.2	6.6
	Female	502	62.2	20.2	3.1	7.1	7.3
Age	18 to 29	197	62.8	24.1	1.4	4.1	7.6
	30 to 39	192	59.5	22.6	2.4	9.5	6.0
	40 to 49	217	69.3	16.2	1.7	7.1	5.8
	50 to 59	173	67.4	15.0	4.0	8.8	4.8
	60 plus	224	53.6	19.5	3.6	13.2	10.0
Home	Own	744	64.2	18.8	3.0	8.5	5.4
	Rent	259	56.9	21.5	1.3	9.0	11.3

		Question - Would you personally purchase or not purchase a Green Savings Bond if the interest rate was similar to that of a regular Canada Savings Bond?			
		Total	Yes, would purchase	No, would not purchase	Unsure
		Responses	Percentage	Percentage	Percentage
Region	Canada 200711	1003	62.2	27.0	10.8
	Atlantic	101	69.6	18.0	12.4
	Quebec	248	60.3	26.4	13.2
	Ontario	307	65.8	23.6	10.6
	West	347	58.1	33.1	8.8
Gender	Male	500	60.9	28.8	10.3
	Female	502	63.4	25.3	11.4
Age	18 to 29	197	66.9	20.7	12.4
	30 to 39	192	69.6	20.8	9.5
	40 to 49	217	66.0	22.4	11.6
	50 to 59	173	61.2	31.3	7.5
	60 plus	224	48.6	39.1	12.3
Home	Own	744	63.8	27.2	9.0
	Rent	259	57.6	26.4	16.0

Appendix B – The European Climate Awareness Bond

The **Climate Awareness Bond** is issued by the European Investment Bank (EIB) and offers investors a financial instrument that has the following characteristics:

They allows funds to be raised for disbursement to future EIB lending projects within the fields of renewable energy and energy efficiency. More specifically, the EIB normally finances up to 50% of the cost of a project. On June 5th 2007, EIB's Board of Governors endorsed a reinforced contribution of the EIB to cleaner energy for Europe, authorizing the Bank to increase from 50% to 75% the maximum share of the EIB in the financing of individual renewable energy projects (notably in emerging renewable energy technologies and energy efficiency projects resulting in a reduction of energy consumption by at least 20%).

The return on the bond is linked to the performance of the FTSE4 Good Environmental Leaders Europe 40 Index, especially created by FTSE for this transaction. The index consists of large European companies with leading environmental management practices, allowing investors to participate in the performance of a new equity index with emphasis on corporate environmental responsibility. The index consists of the (up to) 40 largest European constituents of the FTSE4 Good Index Series that obtain the highest rating ("5" or "best practice") in an environmental assessment of their management practices, weighted by free float adjusted market capitalization. Ratings and index calculations are independently performed by FTSE twice a year, based on publicly available criteria. The data used for the assessment is provided by the Ethical Investment Research Service (EIRIS) Ltd, a subsidiary of the EIRIS Foundation, a charity that supports ethical investment.

The proceeds of the issue flow to EIB projects and there is no direct financial advantage for the constituents of the Index. There is no link between the return on the projects the EIB finances via the proceeds of the bonds, and the return on the bonds.

Due in 2012, the bonds are issued in denomination of EUR 100 and pay no coupons. At maturity, investors receive the full amount of their principal (full capital protection) plus a return equal to a [75-85%] participation in the increase of the Index over the five-year period. If the equity-index linked return is lower than 5%, a minimum amount of 5% will be paid once at maturity (i.e. minimum redemption of 105%).

At maturity, investors have the option – not the obligation – to use a portion of their return to buy and cancel carbon dioxide EU allowances (EUAs) in a simple and transparent way. More specifically, if the amount due to investors over and above face value at redemption exceeds 25%, investors have the right to elect for the excess to be paid to a "Carbon Allowance Purchase Agent" (acting as agent of the bondholders) in order to apply such excess to purchase carbon allowances for cancellation (the "CO2 Option"). Carbon allowances are defined as allowances

"to emit one ton of carbon dioxide equivalent during a specified period which shall be valid for the purposes of meeting the requirements of Directive 2003/87/EC of the European Parliament and the Council, as amended from time to time".

It is the first bond to be publicly offered to investors across the 27 E.U. member countries.

The European Bond differs from the Green Bond primarily in that it is managed as part of a much larger investment portfolio. As such, the risk management strategy is different as is the link to the variable upper rate.

Appendix C - A Case Study: Solar-Thermal Energy Production

This case study showcases one of many renewable technologies. It should be noted that each technology has its own distinct financial profile. However, the basic point brought to light by this example is consistent across technologies, regardless of their financial profile: lower-cost capital can push energy production for a renewable "threshold" technology into profitability. Green Bonds promote *threshold technologies*.

The data for this case study has been supplied by a commercial-scale solar-thermal provider *(confidential, available upon request)*, and the project is characterized as follows:

Technical Specifications:	60 Flat Plate Solar Thermal Panels, 178 sq m.
	134000 kW/h per year energy production
Financial Specifications:	$134,000 gross cost; less 25% ecoAction subsidy,
	$105,000 net cost
	20% gross profit required for overhead
	$0.075/kWh natural gas competitive pricing
Green Fund Assumptions:	20 year amort. period, 5% interest rate
Carbon Reduction:	40 tonnes/year.

The potential market size for such solar thermal products is colossal. The total multi-residential market is estimated at $3.6 billion and the total health care and socially assisted housing is estimated at $8.9 billion.[30]

Fig. 4 shows the cost of energy production as a function of the risk-rate of borrowed capital, both in terms of debt-payments only, and total cost of production (20% gross margins assumed). As the figure shows, this company is competitive with the carbon-based equivalent energy production only when the cost of borrowing is reduced from 10% (the current commercial rate on this equipment) to around 5% (a reasonable target lending rate[31] for Green Bond Fund lending). Ultimately, the presence of the lowered risk-rate from the Green Bond Fund addresses the barriers to procuring this equipment.

[30] Market estimates provided by commercial-scale solar-thermal provider. Additional markets include food services and industrial production. They are, however, much more difficult to quantify.

[31] This is an estimated rate based on the approximate Federal risk rate and an approximate 1% spread for overhead. Note that each technology will have its own unique financial profile, and this lending rate is used as an example only, to show the real decrease in energy production cost as a function of the interest rate.

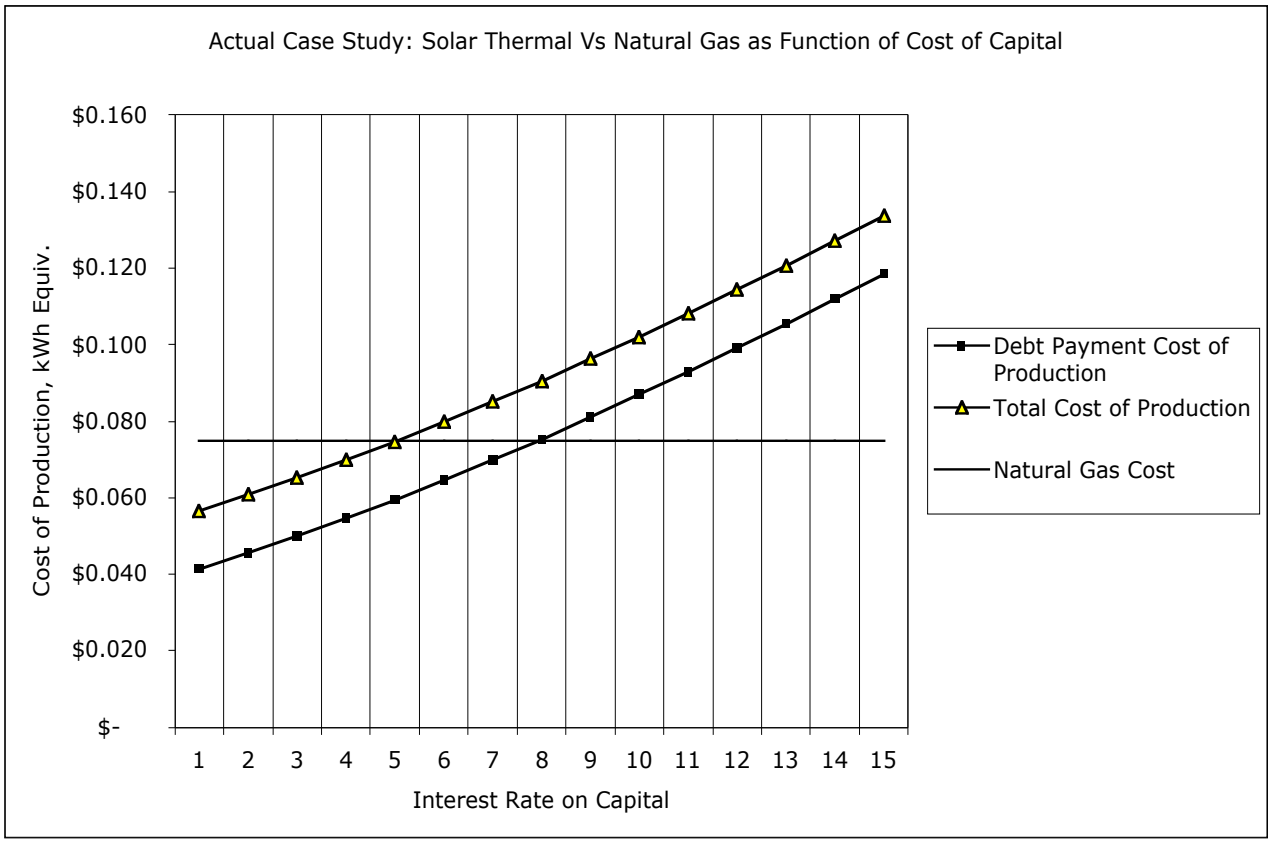

Figure 4: Solar Thermal Case Study: Note the drop in total cost of energy production as a function of the interest rate charged on capital debt.

Mondial Energy is an example of a smaller-scale producer of energy who aggregates the demand for multiple smaller installations, thus playing the role of a single-source, large-impact Borrower. In this case, the example provided above is only one of many installations that Mondial has undertaken as an aggregator.

The Loan would be provided to Mondial – the Borrower- and revenues generated from the production of the renewable energy provides a revenue stream that enables Mondial to repay the Loan. Liens would be placed on the equipment itself, and Mondial would forego any future carbon credits (if applicable) until the Loan is repaid. Mondial would be obligated fulfill whatever due diligence requirements that the Fund Manager would see fit to put in place, and would also be obligated to put up half of the capital cost of any installation (on the dollar-matching risk mitigation strategy). This solar thermal technology would remain an eligible threshold technology until such a time as the commercial banks signal a willingness to lend at a rate comparable to the lending rate set by the Fund.

Appendix D – Who We Are

We are five Action Canada Fellows (www.actioncanada.ca) committed to a clean, green Canada.

Ben Fine

Ben Fine is co-founder and executive director of STAND Canada, a national student organization dedicated to mobilizing a critical mass of Canadian students, citizens and decision-makers to end the crisis in Darfur and respond to future threats of genocide. The organization is represented on 25 university campuses and 40 high schools, and its voice continues to grow. Ben learned about Darfur's plight in summer 2004. It reminded him of the Polish concentration camps he visited in high school and he decided to act, founding STAND in February 2005. In his advocacy for Darfur, Ben has met with MPs, cabinet ministers, senators and former Prime Minister Paul Martin, authored op-eds in the Toronto Star and National Post, spoken at rallies and appeared on MTV Live. Ben completed his first-year of medicine at the University of Toronto in 2007. In 2006 he earned a MSc in chemical engineering practice from the Massachusetts Institute of Technology. He recently began summer work in provincial planning at Cancer Care Ontario, and previously worked on engineering projects at Cabot Corp. near Boston and Novartis in Basel, Switzerland. In 2005, Ben received a gold medal from the Faculty of Engineering at the University of Western Ontario, where he earned his undergraduate degree. In 2004 he was a semi-finalist in Magna International's As Prime Minister competition. While in Boston, Ben rowed for MIT's lightweight crew and now keeps fit with morning runs. Ben says he enjoys nothing more than a good laugh.

Oliver Madison

Oliver Madison is president of Me to We Style Inc., a social enterprise committed to providing ethically manufactured, quality apparel for socially-conscious consumers. It also financially supports a charity partner, Free the Children. Oliver was previously a principal at Octavian Capital, a Toronto-based, boutique corporate finance firm specializing in small to mid-size enterprises. His responsibilities included business development, raising equity and debt capital, and advising management on growth opportunities and business strategy. Prior to Octavian Capital, Oliver worked in corporate finance at Brown Brothers Harriman's New York office, where he advised the principals of private and closely held public companies about mergers and acquisitions and analyzed potential investments for the firm's mezzanine and private-equity funds. Oliver graduated cum laude from Harvard College with an AB in economics and a citation in German. He completed his Level III Chartered Financial Analyst (CFA) exams in 2004.

Emily Paddon

Emily Paddon is a graduate student in international relations and Trudeau Scholar at St Antony's College, University of Oxford. Her interest in international relations, and specifically, Canada's role in the world, stems from a concern for human security and its relationship with social, political, and military power in the modern world. Her current research explores the limits and validity of the principle of impartiality in UN-authorized interventions. Emily is the former managing director of The St Antony's International Review, Oxford's graduate journal of international affairs, and a tutor of international relations at Exeter College's Oxford Academy. She holds a BA from Brown University where she concentrated on the history of art and architecture, and international relations. In addition to her studies, she has worked at Goldman Sachs, the International Crisis Group, The Watson Institute for International Relations, and World Affairs Television. Her interest in human security and development also led to research projects and volunteer work in West and North Africa. In September 2007 Emily will begin a year at McGill University in Montréal as a Sauvé Scholar.

Andrew Sniderman

Andrew Sniderman co-founded the Washington-based Genocide Intervention Network (GI-Net) to provide citizens with tools to prevent and stop genocide. GI-Net aims to change the way the United States and the international community respond to genocide by creating an active and powerful political constituency. While working for GI-Net, Andrew delivered speeches across the United States and helped oversee a national lobbying, mobilization and fund-raising effort. In the fall of 2005, Andrew interviewed executives of private military firms and researched the option of private intervention in Darfur. Andrew was born and raised in Montréal and graduated with a BA (highest honours) in philosophy and political science from Swarthmore College, Philadelphia. Andrew is also a two-time provincial badminton champion, an avid Argentinean tango dancer, and a balloon artist. In 2007/08 Andrew will work in Ottawa as a Fellow in the Parliamentary Internship Programme.

Tom Rand

Tom Rand is the founder of an interactive voice response (IVR) software company, Voice Courier Inc. (VCi). He led its expansion to 100 employees in three countries, with revenue in excess of $20 million US annually. In 2004, he founded Voice Courier Mobile Inc. to move into short message service (SMS) software. The VCi Group of Companies was profitable for each of the 12 years it was under Tom's control. He sold both companies in 2005. Tom holds a B.A.Sc in electrical engineering and applied mathematics from the University of Waterloo, a M.Sc. in philosophy of science from the London School of Economics and a M.A. in philosophy from the University of Toronto, where has just defended his Ph.D thesis. In 2005 Tom founded VCi Green Funds to provide angel and venture capital to companies developing emission-reduction technologies. He is Director, Sustainable Development for Planet Traveler – a commercial development project in downtown Toronto that aims to be the lowest carbon-emitter of its class - and sits on the board of Clean Energy Developments Inc., a geo-thermal energy provider.