



Submissions received by the Government of the Northwest Territories to the Climate Change Strategic Framework

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CLIMATE CHANGE AND ENERGY

Comments for the 2016 Government of the Northwest Territories Energy & Climate Change Consultations

Presented

by



Alternatives North

Introduction

Alternatives North is a social justice coalition operating in the Northwest Territories.

Within our ranks are representatives of churches, labour unions, environmental organizations, women and family advocates and anti-poverty groups. Individual citizens are important participants in our work.

This document was produced entirely by volunteer members of Alternatives North and is a result of a collaborative process. The writing style is not always consistent, but that simply reflects that many people have contributed.

We start with what we all agree on:

- that climate science demands that we all must rapidly switch to renewable energy,
- that NWT targets should be 80% renewable energy by 2025 and 100% by 2050,
- that renewable energy credits / carbon offsets offer a temporary way to rapidly take action, and should be considered “the right thing to do” in the same way that recycling is viewed by many people,
- that GNWT energy initiatives must be rigorously evaluated to prove that they are the most cost effective way of achieving the transition to renewable energy

We finish with a large list of policy and program suggestions and acknowledge that we do not have the resources to evaluate all the options. We expect, however, that these options will be evaluated as part of the GNWT’s energy plan and climate change strategic framework.

The Science of Climate Change

The science behind climate change is clear; burning fossil fuels is causing the global climate to warm with largely negative impacts. It is possible that there are already

enough greenhouse gases in the atmosphere that virtually irreversible global warming feedback loops have been triggered. Examples of such feedback loops include:

- melting permafrost - which releases greenhouse gases (especially methane), which themselves cause more warming,
- melting arctic sea ice - which leaves a darker planet surface which absorbs more heat from the sun, causing more ice to melt,
- rising temperatures - which stimulate the net loss of soil carbon to the atmosphere in a similarly continuous cycle.

It is clear that the faster greenhouse gas emissions are reduced, the less severe the total warming effect will be. World leaders agreed in November 2015 to try to limit warming to 1.5 degrees C. Global temperatures have already risen 0.8 degrees C from pre-industrial norms and climate models show that even with the most aggressive emission reduction scenarios, the planet will warm beyond 1.5 degrees C. The hope is that, by eliminating greenhouse gas emissions by 2050, the planet will cool back down to 1.5 degrees total temperature rise by 2100. This will only happen if every jurisdiction unreservedly commits to meeting or exceeding the science-based targets.

Be the change we want to see in the world

Climate change is perhaps the largest “tragedy of the commons” that humanity has ever faced. According to this concept, no single individual can make a difference if the rest of the community does not cooperate. Some form of collective commitment is needed. A specifically northern example of this phenomenon would be efforts to save the caribou herds. If everyone doesn’t play his or her part in the solution, failure is virtually guaranteed.

For climate change – all individuals, businesses, organizations, and governments share a collective responsibility to work together to ensure that greenhouse gas emissions are reduced to a level that will allow global temperatures to return to normal. In such a situation the saying, “*Be the change you want to see in the world*” applies. If everyone adopts the attitude that solving climate change is a mutual concern, the potential “tragedy of the commons” will instead have a happy ending.

The NWT is made up of individuals, businesses, industry, organizations and several layers of government. All have an opportunity to “*be the change that is required*” by adopting policies to switch to renewable energy, and to encourage positive action by other actors. At an ethical level, individuals can see what is required and make the changes voluntarily, assuming they have viable options and the resources necessary to allow them to make the right choice. Organizations and corporations must also be able to “be the change that is required”. Under current law, publicly traded corporations are required to operate in such a way that they must seek to return maximum financial value to their shareholders. They are somewhat constrained, therefore, to only take actions that do not unduly reduce their short term bottom–line, despite the ethical standards of the individual

members of boards of directors and shareholders. Governments, as legislative bodies that can write laws and set regulations and standards, bear a large responsibility to help enable, encourage and demand responsible action from all stakeholders, including from organisations and corporations. This is in addition to the action they can take within their own operations to also “be the change.”

The change we need – A just transition to 100% renewable energy

Individuals, businesses, organizations and governments need to create and implement plans to transition to renewable energy. These plans should:

- Include “SMART” goals (Specific, Measurable, Attainable, Relevant and Time-based)
- Include goals to exceed global science-based targets for limiting global warming to 1.5 degrees C:
 - 80% Renewable Energy by 2025 (based on the ‘80/20 Rule’ – 80% of the goal will take 20% of the time)
 - 100% Renewable Energy by 2050
- Be rational and evidence based
- Look at all aspects of energy use – in particular heating, transportation and electricity
- Prioritize projects that provide the largest increases in renewable energy use over the shortest period of time. Twenty years ago, the popular approach was to improve efficiency first and consider renewable energy options later. There is no longer enough time – the switch to renewable energy needs to happen immediately – even at reduced efficiency. For example, replacing a 90% efficient fossil fuel fired boiler with a 96% efficient fossil-fuel boiler is no longer an adequate response. An 80% efficient renewable energy boiler (wood pellet) would reduce more greenhouse gas emissions.
- Consider the lifespan of infrastructure and prioritize projects that will give the longest renewable energy return on investment. For example, installing renewable energy systems in new buildings should take priority over retrofitting old buildings that will be replaced in a few years.
- Include the purchase of *Gold Standard* carbon offsets / renewable energy credits as a rapid but temporary measure to achieve a 100% renewable energy portfolio. Gold Standard emissions can be purchased at Planetair <http://planetair.ca/en/index.sn>. The website includes calculators to help figure out how many offsets to purchase.

What can individuals, Organizations and Privately Owned Businesses do?

Individuals (who are not living in poverty), organizations and privately owned businesses should:

1. Go “100% renewable” / “carbon neutral” by purchasing carbon offsets for their share of non-renewable energy use. Going carbon neutral is the first priority because it is the fastest way to make change. There are renewable energy projects ready to be built in other parts of the world as soon as funding is received. 100% renewable / carbon neutral living should be considered as “the right thing to do” in the same way that recycling, composting and not littering are. Purchasing 25 tons of offsets per year per person (~\$625) will more than cover most NWT residents.
2. Do as much as can be afforded to switch from fossil fuels to renewable energy, and to invest in energy efficiency. Investing in biomass technology for heating would be a northern priority action.

What can publicly traded corporations do?

Publicly traded corporations should:

1. Adapt their business models to include 100% renewable energy / carbon neutrality as part of their normal operations. At this point in time (and probably more so going forward), carbon neutrality will be acceptable to most shareholders as adding value to a corporate brand. Furthermore, doing so will be preparing the business for inevitable carbon pricing that will be imposed by regulations.
2. In emissions intensive industries where purchasing offsets might not be accepted by shareholders, an internal carbon price should be included in all investment decisions so that corporate investments account for future carbon pricing that will be coming. For example, the calculation on the payback of a renewable energy system should include a \$50 per ton price on carbon, even if the price has not been legislated yet.
3. Take every economic opportunity to switch from fossil fuels to renewable energy, and to invest in energy efficiency.

What can the Territorial Government Do?

The GNWT has the mandate and responsibility to protect the environment as a whole, while also dealing with its own emissions.

The GNWT should accelerate its transition to 100% renewable energy. It should:

1. Continue investing in renewable energy and efficiency. The GNWT has been steadily investing in wood pellet heating and solar electric generation, and it should do much more of this.
 - a. The GNWT should commit to converting all its remaining fossil fuel–heated facilities to biomass (wood pellet or wood chip) heat. Over 40% of the buildings in downtown Yellowknife are owned or occupied by the GNWT and that percentage is often higher in smaller communities. The GNWT has developed the expertise and oversight capacity to do this conversion efficiently, typically with financial savings, so it could be done at modest extra cost. Converting GNWT facilities to biomass heat would provide the renewable energy anchor-customer that is required in each community to enable a viable delivery infrastructure and potential district heating systems that involve other community entities.
 - b. The GNWT should go “100% renewable” / “carbon neutral” by purchasing Gold Standard carbon offsets for their share of non-renewable energy use. Requiring all departments to operate carbon neutrally through the purchase of offsets would make renewable energy investments comparatively more financially attractive.

2. Focus on a Rapid Transition to Renewable Energy

As previously mentioned, incremental improvements in energy efficiency do not result in the rapid reductions in Greenhouse Gases that are now needed. NWT goals should exceed global science-based targets for limiting global warming to 1.5 degrees C, as follows:

- a. 80% Renewable Energy by 2025 (based on the ‘80/20 Rule’ – which states that 80% of the goal will take 20% of the time/effort)
 - b. 100% Renewable Energy by 2050
3. Ban fossil fuel development in the NWT and re-allocate the resources now committed to Oil and Gas (O&G)

The GNWT has jurisdiction over the extraction of fossil fuels in most of the territory. Whether in the Territories or elsewhere, fossil fuels that are extracted are destined to be burned and will therefore contribute to global warming. As of December 2016, investors world-wide have divested or pledged to divest \$5.2 trillion from fossil fuel investments, a doubling from the previous year. Considering this trend, GNWT investment in the O&G industry is very risky and undermines climate change mitigation and adaptation efforts. As the rest of the world is doing, the GNWT must recognize that the science and physics of climate change demands a reduced reliance on fossil fuels; the majority of fossil fuel resources simply must stay in the ground. Since scientific studies have concluded that the cost of development of NWT resources makes them among the least attractive for development, **expending resources to plan for them to be extracted is effectively betting that the world is going to fail to take action on climate change.** Doing so is participating in the

making of a tragedy, one that will severely impact the NWT. Assuming that the world will take action on climate change means that our expensive oil and gas resources will not be needed until several generations from now, if ever. The GNWT must pursue other more promising sources of economic development and employment. In point of fact, the GNWT must ban all fossil fuel development, and re-allocate funds currently spent regulating and promoting fossil fuels towards development of a robust renewable energy infrastructure.

4. Separate 'Carbon Pricing' Policy from 'Energy Cost of Living' Policy

“Cost of Living” and “GHG Emissions” need to be viewed and handled separately. Current GNWT policy and programming mix the two issues together, making it difficult to focus (set clear targets and achieve results) on either issue. The smaller, remote communities, where the costs of energy are the highest, are also the lowest absolute sources of greenhouse gas emissions. Carbon pricing raises concerns because of fears that a carbon price would drive up the cost of living in small communities. If the two policies are viewed separately, small communities can be exempted from carbon pricing, a policy option fully justifiable due to the higher cost of living they face. As the NWT switches over to 100% renewable energy, the GNWT must always help those who cannot afford their heating and power bills.

5. Use Cost of Living Policy to reduce impact of Renewable Energy Transition

As the GNWT switches to 100% renewable energy, there will be opportunities to reduce the cost of living. Energy efficiency, hydro, wind and solar all cost more up front but offer lower and more stable cost energy once the investment has been paid off – a sound investment opportunity. Wood chips and wood pellets are also typically cheaper than fossil fuels. Such efforts often provide jobs and other economic development within communities, as the generation of energy is localized, helping both to stimulate local economies and residents to be better able to meet their energy costs.

While these energy sources and actions are all win-win opportunities and should be included in any cost benefit analysis, they are not sufficient to meet all needs or to get the NWT to 100% renewable energy. In some cases, such as aircraft transportation, it may be more affordable to continue purchasing carbon offsets while new technologies are developed. Over the next few decades, as the rest of the world switches to renewable energy, gold standard (reliable) carbon offsets will, in theory, become harder to find and more expensive. If the cost of offsets begins to negatively impact the cost of living for those in smaller communities or for low-income people generally, income assistance programs should be adjusted.

The cost of living discussion is often framed in terms of the prices per unit of energy (\$/kWh or \$/litre), but the total energy bill that people are paying (heating, power, transportation fuel) should be the basis of how policies are judged. Efficiency measures do not reduce the price of energy, but they do reduce the total energy bill.

The GNWT spends at least ten times more every year on subsidies for fossil fuel energy than it does on energy efficiency investments. The recent emergency funding to buy fuel for the Jackfish power plant is a typical example. The GNWT spent tens of millions of dollars on diesel fuel while investing only an extra few hundred thousand in energy efficiency.

Investments in efficiency are closely tied with capacity (technical, administrative and financial know-how) issues - particularly in small and remote communities. Because of this, even if larger financial subsidies were made available, capacity issues may prevent people, small businesses and communities from accessing them. The GNWT should focus on communities that generate their power with fossil fuels (diesel, propane/natural gas) and are therefore subsidized. It should implement an aggressive energy efficiency strategy in these communities. A great example is the recent LED light bulb replacement program that demonstrated a 1.5 year payback to ratepayers on a GNWT investment of \$450K.

6. Adopt a “Barriers and Incentives”- based approach to the Renewable Energy Transition

The GNWT’s energy policy should focus on encouraging investments that have the highest potential to increase the use of renewable energy. The most cost effective combination of barriers and incentives should be put in place to bring about this change. Policies should:

- a. Eliminate barriers to renewable energy use
- b. Create incentives to renewable energy use
- c. Increase barriers to fossil fuel use
- d. Eliminate incentives to fossil fuel use

Many GNWT programs are focused on providing financial incentives, which assumes that the barriers are only financial. In many cases a financial incentive does not address the key barriers. For example, a financial incentive to purchase pellet stoves does not address the barrier that there are very few certified pellet stove installers. In other cases, regulations or carbon pricing mechanisms can be more cost effective at bringing about change.

7. Rigorously evaluate all renewable energy programs annually

Current GNWT energy initiatives appear to be a mish-mash of policies and programs developed without clear renewable energy related criteria. Further, it is rare to see program evaluations comparing costs to realized outcomes. Financial incentives and investments vary wildly from program to program without any consistent relation to potential for GHG or financial savings. All energy and climate change projects and programs should be screened and evaluated based on their cost effectiveness and ability to rapidly increase the use of renewable energy, with the results feeding back

in to modify or adjust the program to better achieve overall goals. The following is a sample template for completing such evaluations:

	Total GHG Reduction Potential	Barriers & Incentives Addressed	Effectiveness of Measure (%)	Program Impact	Cost per ton to GNWT
33% rebate on EPA wood stoves up to \$750; installation cost not eligible	50% of heating energy; 4,000 privately owned homes; 4t per year per home. 10% of homes already use a wood stove. 14,000 t potential.	Reduces capital cost, but home owner must pay up front so does not address cash-flow barrier. Does not address insurance issues, lack of trained installers.	35 stoves per year = ~1% of homes per year. ~100 years to achieve potential.	35 x 4t = 140 t/yr	\$175/t/yr
33% rebate on Solar PV panels up to \$5,000; installation cost is eligible	Limited impact in hydro communities. 5 kW system; 5 kWh per house; 2,000 privately owned homes in thermal communities. Potential to save 1.5t per year per home. 3,000 t potential	Reduces capital & installation cost, but home owner must pay up front so does not address cash flow barrier. Does not address lack of trained installers.	2 systems per year = ~0.1% of homes per year. ~1,000 years to achieve potential.	2 x 1.5t = 3 t/yr	\$3,333/t/yr
Free LED Light bulb Replacement - \$450 K total program cost	64,000 bulbs in 4,000 homes in thermal communities 2,000 t potential	Bulbs directly distributed – assume 100% are installed, although previous studies show that free bulbs are often not installed by owners	11,000 bulbs = 17% per year. ~6 years to achieve potential.	350t/yr	\$1,300/t/yr
\$10/t carbon price; revenue neutral	Total NWT emissions: 1,500 kt	Increases barriers to fossil fuel use by \$0.02/litre. Does not remove barriers to renewable energy	Market fuel prices go up and down by \$0.20/litre so impact is low – 0.1% per yr ~1,000 years to achieve potential	0.1% x 1,500 kt = 1,500t/yr	Revenue neutral

<i>\$200/t carbon price; revenue neutral</i>	<i>Total NWT emissions: 1,500 kt</i>	<i>Increases barriers to fossil fuel use by \$0.40/litre. Does not remove barriers to renewable energy</i>	<i>Similar to price increase in 2007 – 2% per yr ~50 years to achieve potential</i>	<i>2% x 1,500 kt = 30,000t/yr</i>	<i>Revenue neutral</i>
<i>Numbers in these examples are for <u>illustration purposes only</u> – these are not precise calculations and should not be used to determine policy!</i>					

Potential renewable energy measures

Different policies and programs based on addressing different barriers and providing appropriate incentives are called for in different parts of the NWT society. Following are suggestions of policies and programs that could be combined to create an NWT energy plan and climate change strategy. As mentioned above, these suggestions should be rigorously evaluated and then combined to create an effective plan that demonstrates how it will meet the NWT goals of 80% renewable energy by 2025 and 100 % renewable energy by 2050.

Financing Renewable Energy Systems through Local Improvement Charges (LICs)

Heating is a large part of fossil fuel use in the NWT and wood pellets are a form of renewable energy that is cheaper than heating oil. Many home-owners have already had a pellet stove installed and businesses are also installing wood pellet boilers. Analysis of barriers and incentives suggest that while some home-owners are installing pellet stoves, others find that the payback on the investment is too long (if they plan on selling their house before the stove is paid for and the housing market does not recognize the additional value of a pellet stove). A local improvement charge (LIC) loan – provided by municipalities, could be paid back through the property tax system, allowing the debt to be transferred to future home-owners. Using the LIC funding model allows the costs to be paid through energy savings over time. This mechanism could be used for other energy measures too, such as re-insulating homes, adding solar panels in thermal communities, and so on.

An LIC program may not have much impact on rental properties where landlords have little financial incentive to put in pellet stoves or boilers because their renters pay the heating bills. Depending on how many privately owned homes install pellet stoves, and how many rental units exist, a policy focused on requiring property owners to install pellet stoves might be called for.

Communities have repeatedly and for years called for legislation enabling LICs but the GNWT has failed to act. This needs to be remedied immediately.

Require large industry to use renewable energy

Industry, which produces more than half of all NWT greenhouse gas emissions, requires a different analysis than do home-owners and communities. Different barriers and incentives, including renewable energy standards, are required to bring about the switch to renewable energy. For example, Diavik Diamond Mine has demonstrated the technical and economic feasibility of wind power generation at mine sites with their 9.3 MW facility and less than 8-year payback. Through transparent and predictable regulatory schedules, new mines must be required to provide an increasing proportion of their

energy needs from renewable sources and new and existing mines must account for their carbon energy use through the purchase of carbon offsets.

Increase renewable electricity generation and electrify local transportation

Abundant evidence shows that energy demand across the country currently being met with fossil fuels is shifting to being met with clean electricity. Significant expansion is now forecast to be likely by as early as 2020. While it may be longer for the NWT to see this change, there are many cases where electricity is already replacing fossil fuels, such as for heating infrastructure in Ft. Smith, and solar power production in thermal communities. Energy storage technology is also developing faster than predicted only a year or two ago. This is similarly the case with ground transportation. Given all this, the GNWT should be developing and implementing evidence-based plans for more renewable electricity generation throughout the jurisdiction, and establishing electric charging stations beginning in the southern centers.

Put a price on carbon

Greenhouse gases are clearly a source of air pollution and the GNWT has the mandate to regulate air quality. The GNWT air quality regulations framework that is currently under development and scheduled for enactment by the current Legislature should include a price on greenhouse gas emissions. This legislation is being designed to target the larger sources of emissions and will not impact people living in smaller communities who already pay very high prices for fossil fuels. The carbon price should be the same as that suggested by the federal government, but continue escalating at \$10 per ton per year until it reaches \$200 per ton. Revenues from the levy should be directed towards investments in renewable energy generation and energy conservation. In addition, emitters who choose to offset their emissions by purchasing Gold Standard carbon offsets should be exempt from the carbon price or have it rebated to them.

A second mechanism that should be considered is available under the *Petroleum Products Act*, under which regulations set tax rates according to fuel type. Currently there is no correlation between carbon content and tax rate, and there is no tax at all on natural gas and propane. This needs to be remedied, and could support a carbon tax approach, with revenues allocated to areas of highest sensitivity.

Develop a Territorial Energy Building Code and the capacity to enforce it

The GNWT, like all provinces and territories, has jurisdiction over building codes. In the rest of Canada, building codes are provincial - not municipal. While Yellowknife has its own building permitting and inspections system and has created its own energy related

building code, no other community has the capacity to do this. The GNWT should develop a territorial energy building code including:

- EGH-80 for homes
- MNECB plus 40% for buildings
- 50% of a building's energy requirements be met with renewable energy
- EnergyStar appliances
- Low-flow toilets & showers
- No electric water heaters in diesel communities
- District heat with mandatory connection
- GNWT taking responsibility to inspect and enforce building codes throughout the NWT

Pursuant to energy charrette recommendations, the GNWT committed to implementing an *Energy Efficiency Act*, and these and other measures should be addressed in such overdue legislation. The GNWT should require all GNWT-funded building infrastructure, including all new municipal government infrastructure—to exceed the territorial energy standard and to use 100% renewable energy.

Invest in Renewable Energy infrastructure

The GNWT should also create an investment strategy to switch the entire territory to 100% renewable energy by 2050. It is an opportune time to establish green infrastructure considering current Government of Canada infrastructure funding programs. However, despite their potential to contribute to cost of living and permanent employment challenges, the GNWT has a consistent record of passing up on green infrastructure in favour of transportation infrastructure. This is wrong-headed. Options for how to switch to 100% renewable energy, beginning with technology now available, are outlined in the Alternatives North research paper “100% Renewable Energy NWT by 2050” (available at www.alternativesnorth.ca). Some examples include:

- Build district heating systems in all communities to make use of waste heat from generators that burn wood pellets or wood chips.
- Develop a program to encourage installation of EPA certified wood pellet, and wood stoves (and dramatically cut heating costs).

Make GNWT Technical Capacity available to everyone in small Communities

The GNWT has the most technical capacity in small communities. This capacity should be made available to people, local businesses and communities on a cost recovery basis (especially where it is not available from private enterprise). For example, technical staff at NWT HC should be made available to inspect new construction, and to tune pellet boilers throughout the communities.

Create an Energy Revolving Fund

Create a revolving fund that people and small businesses can borrow from to finance the cost of converting to more energy efficient homes and operations. The loans can be repaid with savings in costs. The fund could be financed through government issued, RRSP-eligible, investment grade bonds available to NWT citizens.

Create Renewable Energy Cooperatives

An NWT renewable energy cooperative could provide a mechanism to harness private capital, encourage private investment and enhance participation of residents and businesses if supported with appropriate policies. Such policies have been documented and developed by the Toronto Renewable Energy Cooperative. Details are available on their web site at www.trec.on.ca.



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January 19, 2017

Hon. Robert C. McLeod
Deputy Premier
Minister of Finance
Minister of Environment and Natural Resources
Minister of Human Resources
Minister with Lead Responsibility for Infrastructure
Robert_C_McLeod@gov.nt.ca

RE: Climate Change Policies and Carbon Pricing in Canada's North

Dear Minister McLeod,

The purpose of this letter is to make recommendations regarding the development of climate change policy in the Northwest Territories that we hope will be useful in discussions with the Federal Government.

Avalon Advanced Materials Inc. ("Avalon") is a recognized sustainability leader in the mineral exploration and development sector. To our knowledge, Avalon is the only company in the exploration sector to publically report our performance as part of the Mining Association of Canada's "Toward Sustainable Mining" as well as to "Global Reporting Initiative Level 4" standards.

Avalon is committed to reducing its environmental impact and carbon footprint in all areas of our business. This has become an economic imperative in the North because energy and regulatory burdens in the NWT are already a major competitive disadvantage when compared to most other jurisdictions. This incentivizes Avalon to optimize its operations to be as energy efficient as possible. These efforts recently led to an award for leadership in the use of solar energy at the Nechalacho project. Further, the mineral products that Avalon seeks to produce at Nechalacho are critical materials in clean technology that will enable the transition to low carbon economy and increase energy efficiency.

The reality facing Avalon and other aspiring mineral producers in the North is that there are no available low carbon technologies that can be economically applied to mine scale requirements in the harsh climatic conditions of the NWT. Thus, the Nechalacho project will have to rely on expensive and carbon intensive diesel power. Diesel costs alone are more than double that of our competitors in southern Canada and most other places in the world, and total energy costs can be six times higher or more when compared to other jurisdictions.

The project economics for Nechalacho, like most mining projects, are particularly sensitive to up front capital costs. This coupled with the lack of infrastructure, unavailability of low carbon energy, high wage costs, inefficient and expensive permitting processes, and ever increasing regulatory burdens, have made most new mineral development projects in the North, economically unattractive. Furthermore, critically needed exploration and development investment in the NWT will continue to disappear if these issues are not addressed as exploration is also becoming too expensive to finance in the North. Even exceptional quality mineral development projects cannot afford the additional millions of dollars associated with

constructing two energy systems. An additional burden of a \$50/tonne carbon tax at the relatively small Nechalacho Project would add approximately \$80 million dollars of additional operating costs for diesel alone over the first 20 years of the project.

With the ever-increasing cost of doing business causing a rapid decline in investment in new resource development the North, Avalon submits the following recommendations with a view to mitigating the negative impact of the new carbon pricing regime on NWT resource development.

- 1) **Phase in the carbon price on a different schedule in the North.** Only once the anticipated benefits of Federal programs have produced economically safe and reliable low carbon technologies that can be implemented in the north (or when hydroelectric or other clean energy and associated infrastructure are available for use in the NWT), should carbon pricing begin to be introduced.
- 2) **Permit the opportunity for a made-in-the-North carbon price,** that, in accordance with MAC's Principles for Climate Change Policy Design, implements a carbon price that is both sensitive to changing economic conditions, geography and recognizes the particular economic challenges of financing new projects.
- 3) **Ensure that any northern carbon pricing plan be revenue neutral in each sector.**
- 4) As recommended by MAC, in cooperation with the Federal Government, **establish a targeted northern business innovation and development fund designed to accelerate improvements in energy and fuel efficiency, as well as drive the scalability, deployability, capacity and storage capabilities of renewable energy generation assets in Northern Canada.** Consistent with harnessing the power of the market to the maximum extent possible, the fund should be designed to support companies at both the exploration and the operational level in ways that meet site-specific energy challenges and opportunities. A part of the proposed creation of the Canada Infrastructure Bank (CIB), the GNWT should promote the creation of a pathway for northern projects that provides for project-selection criteria reflecting northern realities and broader government social, economic and indigenous development priorities. It should also support the appointment of an experienced northern business professional to a leadership role in the CIB to ensure an understanding of northern realities informs the institution's operational culture and practice.

Transformative, Nation Building Infrastructure Investment

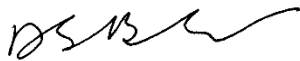
The funding committed in the Federal Government's Fall Economic Statement has the potential to address the industry's infrastructure needs in northern Canada in a manner that helps with the transition to a low carbon economy. Recognizing northern infrastructure realities, the following recommendations are made:

- 1) Establish an infrastructure program designed to expand deployment of reliable and economically viable renewable energy and storage technologies that reflects the high upfront capital cost and associated financing costs inherent in new mine development
- 2) The "public use" criteria should be excluded or re-evaluated to reflect northern cost, emissions mitigation, competitiveness and broader economic and social realities for infrastructure investments.

- 3) Territorial access to infrastructure funding envelopes should not be limited to per-capita funding formulas, but assessed in light of broader criteria, including balancing climate change priorities with social economic and indigenous reconciliation policy objectives.

Thank you for your consideration of these recommendations. Avalon looks forward to working with the GNWT and would be pleased to discuss these issues further at your convenience to assist in the development of a Made in the North Climate Change Strategy that meets mutual goals of promoting a strong, viable and environmentally leading industry

Yours sincerely,
AVALON ADVANCED MATERIALS INC.



Donald S. Bubar
President & CEO

Cc: Premier Bob McLeod
Hon. Wally Schumann
Michael V. McLeod, M.P.
Gary Vivian, President, NWT & Nunavut Chamber of Mines
Tom Hoefler, Executive Director, NWT & Nunavut Chamber of Mines
Richard Morland, President, NWT Chamber of Commerce
Mike Bradshaw, Executive Director, NWT Chamber of Commerce
Mark Wiseman, Vice President, Sustainability

16 December, 2016

To Whom It May Concern,

As a leader in territorial conservation, CPAWS-NWT is committed to working toward solutions that protect the land, water, and wildlife of the Northwest Territories. We are pleased to submit this letter as our feedback and recommendations to the NWT Climate Change Strategic Framework, as we urge you to recognize within the framework ***the important role of Canada's northern terrestrial and marine ecosystems in reducing emissions, and helping all species, including humans, adapt to a changing climate.***

The Paris Agreement on climate change specifically states that parties should act to conserve and enhance, as appropriate, sinks and reservoirs of greenhouse gases as referred to in Article 4, paragraph 1(d), of the Convention, which refers to forests and oceans as well as other terrestrial, coastal and marine ecosystems. As the NWT Framework is intrinsically linked to the Pan-Canadian Framework, which is steered by the Paris Agreement, they must all be aligned in principle.

Recognizing the important role of Canada's northern ecosystems in mitigating climate change within the Pan-Canadian and NWT Frameworks would provide significant opportunities for our territorial government to use cost-effective nature conservation and restoration strategies to protect and enhance our carbon sinks and stores, and contribute to both our international commitments on climate change and Aichi targets on conserving biodiversity. Working to protect land in partnership with Indigenous peoples in ways that respects their rights and interests could also contribute to reconciliation efforts in Canada.

Here in the NWT we have a tremendous opportunity to truly make a difference in one of the three key pillars of the NWT Framework: Resilience & Adaptation. Conservation measures like expanding protected areas systems, restoring and conserving habitat and protecting species at risk would contribute to climate change mitigation by sequestering and/or avoiding the loss of carbon stored in ecosystems. An ecosystem focused component of the climate plan would complement the necessary deep reductions in fossil fuel emissions required to avoid catastrophic impacts of climate change.

Conversely, we are concerned that by overlooking northern ecosystems as an important part of the solution, the Frameworks will fall short of achieving their intended climate outcomes.

We recommend that the NWT Framework be fully developed in accordance with the Paris Agreement to support our federal commitments, and affirm both Framework's commitments to ecosystems' conservation and enhancement as an important part of Canada's developing climate mitigation and adaptation strategy.

Thank you for supporting the important role of Canada's northern ecosystems in mitigating the impacts of climate change. We very much look forward to your response.

Sincerely,



Kris Brekke
Executive Director
CPAWS-NWT



Shannon Moore
Conservation Outreach Coordinator
CPAWS-NWT

DE BEERS

GROUP OF COMPANIES

December 14, 2016

Mr. Robert C. McLeod
Minister Environment and Natural Resources
Government of the Northwest Territories
P.O. Box 1320
Yellowknife, Northwest Territories
X1A 2L9
Fax: 867-873-7401

DEPUTY MINISTER
ENVIRONMENT
AND NATURAL RESOURCES

DEC 15 2016

RECEIVED

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BF DATE Jan 5, 2017

Attention: Minister of Environment and Natural Resources

Dear Minister McLeod

RE: Climate Change Policies and Carbon Pricing in Canada's North

De Beers Canada Inc., (De Beers) recognizes the complex global challenge posed by climate change and the necessity to take action to address its causes and protect our employees, assets and host communities against its potential impacts. We are committed to working in partnership and consultation with all relevant stakeholders to help address the causes and impacts of climate change globally.

De Beers in conjunction with our parent company Anglo American, in a response to the challenges posed by climate change, actively address our own carbon footprint through operational excellence and our Program Terra energy efficiency program. Each Business Unit has Energy and Carbon Champions that guide our operations to lower their energy profiles.

De Beers will:

- Continue to measure and report on direct, indirect and product-related emissions;
- Reduce our own carbon emissions and energy and water use, and investigate new technologies to support carbon and water neutral mining operations in the future (e.g carbon sequestration in kimberlite mine tailings);
- Continue to invest in alternative and renewable, low-carbon energy technologies including solar, fuel cells, waste heat recovery, biomass and biofuels;
- Continue to implement appropriate climate adaptation measures at our operations and support our host governments and communities to adapt to the local consequences of climate change;
- Use scenario planning to inform our view on climate and energy risks and opportunities, and continue to evaluate any future investments with climate risks in mind, including carbon pricing;

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- Proactively seek partnerships to adapt to the impacts of climate change and to reduce the emissions from fossil fuel combustion, in particular through Carbon Capture Sequester and Reuse (CCSR) Technology; and
- Continue to update our Board, investors, host governments and other relevant stakeholders on our own progress in reducing carbon emissions.

Carbon Pricing in Canada's North:

De Beers is supportive of the use of fair and well-designed market-based instruments such as carbon pricing. As the three Premiers of the Northern Territories of Canada (Yukon, Northwest Territories and Nunavut) have suggested, any taxation on carbon will ultimately result in costs to industry and tax payers in an already cost prohibitive jurisdiction. This will inhibit economic growth, and is counterintuitive to capacity building in the North. Diesel forms the basis of emissions at both De Beers operations in the NWT with no access to renewable or alternative energy sources. This is a common concern for our community partners. While De Beers actively pursues alternative energy options, and ways to improve efficiencies of existing equipment, De Beers concurs with our Northern Leaders and suggests that carbon pricing not be imposed upon the Northern Territories at this time until infrastructure (roads and transmissions lines) and technology (renewable or nuclear power) can facilitate a low carbon economy. Impeding growth in Canada's North does a disservice to Canada and the northern economy.

In the event that carbon pricing is imposed on the Northern Territories regardless of our concerns and a lack of alternatives, De Beers respectfully suggests that the tax revenue that is generated from this program be revenue neutral. In addition funds should be allocated transparently to programs dedicated to delivering Innovation, Infrastructure, Research and Development of Energy Systems and Energy Corridors (inclusive of Transmission Lines) to promote a low carbon economy.

De Beers requests that the Minister(s) in their decision to develop carbon pricing:

- Pursue mechanisms to delay the carbon pricing until the Northern Territories have the infrastructure (roads and transmissions lines) and technology (renewable or nuclear power) to facilitate a low carbon economy to ensure continued growth of the North.

If the Minister(s) are unable to postpone Carbon Pricing in the North, De Beers respectfully suggests:

- Recognize actions already taken by industry to reduce overall emissions in determination of baselines;
- Provide mechanisms or incentives for industry to invest in the development of lower emission technologies that are applicable to current operations and to neutralize to the extent possible the cost implications to industry and taxpayers of a carbon tax;
- Tax revenue that is generated from this program be dedicated transparently to Innovation, Infrastructure, Research and Development of Energy Systems and Energy Corridors (inclusive of Transmission Lines) to promote a low carbon economy.

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- Ensure treatment of Carbon Capture, Sequestration and Reuse (CCSR) on a comparable basis to other technologies that abate carbon emissions;
- Improved science-based understanding of physical climate risks, and for investment in adaptation measures, in particular to help build resilience in developing countries.

De Beers strongly recommends that the Government of the Northwest Territories, the Government of Nunavut and the Government of the Yukon ensure that the decisions of today do not have negative long term impacts that may risk future mining projects impeding the economic growth of Canada's North.

De Beers thanks the Minister(s) for consideration of our position, we look to continue our partnerships while ensuring any taxation is appropriate, practical and fit for use for Northerners.

Yours truly,



Kim Truter
CEO – De Beers Canada Inc.

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From: [Robert Collinson](#)
To: [David Stewart](#); [Florence Heffernan](#); [Erin Kelly](#); [Evan Walz](#); [Lina Dobbin](#)
Cc: [Robert C McLeod](#); [Robert Collinson](#); [Sophie Hatto](#)
Subject: FW: Climate Change and Carbon Pricing
Date: Thursday, December 15, 2016 11:13:24 AM
Attachments: [De Beers Canada Letter to Ministers Climate Change Policies and Carbon P....pdf](#)
[ATT00001.htm](#)

David/Erin – can I ask you to work on a joint response for the Minister to send.

Regards Robert

From: Robert Collinson
Sent: Thursday, December 15, 2016 11:12 AM
To: andrew.williams@debeersgroup.com; erik.madsen@debeersgroup.com
Cc: Robert C McLeod; Robert Collinson; Sophie Hatto
Subject: FW: Climate Change and Carbon Pricing

Mr. Williams, confirming receipt of your correspondence. We will respond in due course, thank you for taking the time to provide your views on this important matter.

Regards

Robert Collinson
Ministerial Special Advisor
The Honourable Robert C. McLeod
Deputy Premier, Minister of Finance,
Minister of Environment and Natural Resources and Minister of Human Resources

NOTE NEW PHONE NUMBER

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From: "Williams, Andrew" <Andrew.Williams@debeersgroup.com>
Date: December 14, 2016 at 4:02:24 PM MST
To: "robert_c_mcleod@gov.nt.ca" <robert_c_mcleod@gov.nt.ca>
Cc: "Madsen, Erik" <Erik.Madsen@debeersgroup.com>
Subject: Climate Change and Carbon Pricing

Dear Minister McLeod,

De Beers Canada Inc. would like to express to you our position with regards to climate change and carbon pricing for the Northwest Territories, which we have summarised in the attached letter.

While generally supportive of carbon pricing as a means to reduce global greenhouse gases, we feel that northern Canada has special challenges due to the lack of alternatives at the present time to the use of fossil fuels. We are also concerned on the impact of carbon pricing on our business in the absence of any offsetting measures.

If you require addition information or have questions, please do not hesitate to contact myself, Kim Truter (CEO) or Erik Madsen (GM Sustainability).

Best Regards

Andrew Williams

Environment and Permitting Manager
De Beers Canada Inc.

Andrew Williams P. Geo
Environment and Permitting Manager De Beers Canada

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Please note the updated contact details

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Climate Change and Energy –

Comments to the GNWT Energy & Climate Change Consultations

Ecology North

Ecology North is a charitable, non-profit organization, based in Yellowknife, Northwest Territories, that was formed in 1971 to support sound environmental decision-making on an individual, community, and regional level.

We focus on five priorities: climate change, environmental education, water, waste reduction, and local food production. A common thread throughout all of our programming is an emphasis on environmental, social, and community well-being.

Based on our mandate, Ecology North is positioned to contribute to help the GNWT transition to a sustainable future that fits our culture and our people. These comments reflect our strategic recommendations to achieve this vision.

Main points

- NWT should take a leadership position globally in alerting the world to the effects of climate change in the north. Reduced emissions can and will have a substantial global effect if we stand up and roar in national and international venues. We must be climate leaders!!
- Renewable energy is a viable and essential option that is well-suited to the north and to the people of the north
- A bold transition to 100% renewable energy with today's technology is feasible in the NWT by 2050
- GNWT has a critical role to provide regulatory, know-how, and subsidy support to lead and ensure the transition across the NWT
- Ecology North fully supports a carbon tax in the NWT to help transition off fossil fuels and protect vulnerable populations
- The oil and gas industry in the NWT is ready to be strategically phased out, and tax dollars should be reallocated to the innovative renewable energy sector
- Mitigation efforts will have the most impact when focused on heating, transportation, and industrial sectors in the NWT
- As infrastructure and assets turnover, and are built or replaced, the NWT must take the opportunity to invest in innovation using low carbon technologies

Important facts

- Climate science is indisputable – all societies need to rapidly switch to less carbon intensive energy sources in order to stop greenhouse gases from accumulating in the atmosphere
- Climate change is already affecting the world's environment, economy and social systems, and the NWT in particular is very vulnerable to impacts
- Employment and investment in clean energy are skyrocketing, while the opposite trend is visible with fossil fuels
- Solutions and adaptations to climate change create good jobs and provide lasting economic benefits: in 2014, the number of Canadians employed in clean energy surpassed those employed in the oil sands

A global picture

The climate science is clear and no longer disputable; burning fossil fuels is increasing the amount of greenhouse gases in the atmosphere, causing the global climate to warm at an unprecedented rate. We are experiencing the highest level of global atmospheric carbon seen in human history. This is causing negative impacts to delicate ecosystems, as the temperature is rising faster than most biological systems can adapt.

Because this change is unprecedented in human experience, there is much uncertainty about the effects this will have on climate dynamics, but scientists are clear that impacts on humans and the ecosystems that support them will be costly and severe. Ecology North recommends that the NWT take a precautionary and regulatory approach to ensure reduction greenhouse gas emissions throughout the NWT.

At the 2015 COP 21 meeting in Paris, world leaders agreed to focus on limiting warming to 1.5 degrees C. The most progressive climate models available show that even with aggressive emission reduction scenarios, the planet will warm beyond this target. The hope is that, by greatly reducing greenhouse gas emissions as quickly as possible, the planet will cool back down to 1.5 degrees total temperature rise by 2100. This scenario is only possible if every jurisdiction works together to meet the science-based targets for carbon emissions.

It is time for the world to act in unison to prevent climate change in order to ensure the survival of our species and others. The conditions are right for the north to be a leader - changes in climate are affecting the north much faster than the rest of the world. Because of that, our actions are being watched by the world. If we work together, we can set a positive example that will affect change across the globe.

Benefiting from a carbon tax

A carbon tax is a tax paid by those who use fossil fuels, according to the carbon content of the fuel and the amount consumed. It is a strategy that is proven (see British Columbia) to shift society towards innovative solutions, while simultaneously reducing negative behavior. The concept of pricing pollution fits well with the land-based culture of the NWT, as we can reallocate money spent on fossil fuels and development towards clean energy development- which will reduce CO₂ emissions. Ecology North believes that a progressive, escalating carbon tax is necessary if we are to make the transition to renewable energy. It is an elegant and simple way to generate funds that can then be allocated to the expenses of this transition. The tax needs to be levied in a way that protects people with low incomes, but this can be easily done.

The Government of Canada has recognized the importance of reducing greenhouse gases and stimulating energy innovation, and has acted by implementing a Pan-Canadian approach to pollution pricing. The NWT is well positioned to rise to the occasion and be proactive – leading the way in Canada. Every province and territory has the freedom to create their own plan and implement it before 2018 – at which point a plan will be provided to them. The price on carbon pollution is expected to start at a minimum of \$10 per tonne in 2018 and rise by \$10 a year to reach \$50 per tonne in 2022. Ecology North supports meeting or exceeding this suggested amount. Recent research by the Conference Board of Canada chief economist suggests that even a \$100/tonne carbon tax only will have a very modest 0.15% impact on annual economic growth (this is if the US does not implement a carbon tax).

Ecology North believes that the best fit for the north – both economically and culturally - is to use tax revenues generated to support local climate and energy substitution action initiatives. Vulnerable communities would benefit from this funding, to reduce dependence on diesel fuel and the high cost of energy. NWT businesses would also benefit from the upward price signal on fossil fuels and revenue from the carbon tax to fuel innovation. In this way, the NWT would be investing in our environment and our people - our most valuable assets. Given that recent fuel prices of two years ago were so high they had the equivalent of a 200 dollar carbon tax on them compared to today's prices, there is clearly economic room for a modest tax without detriment to our economy.

A carbon tax is a progressive tool that can contribute to a transition to a low carbon economy in the north – a transition that fits with northern values and culture, one that will serve us increasingly well in the future. Ecology North has developed a discussion paper on how to develop an NWT Carbon Tax, please review at <http://ecologynorth.ca/project/carbon-tax-nwt/>

Steps for northern success

Ecology North supports continuing a progressive transition to a sustainable future by addressing both mitigation and adaptation.

Mitigation efforts should initially be focused on the biggest emission sources in the NWT – heating, transportation, and industry. While there is financial motivation, The current over-emphasized focus on thermal communities' diesel generation of electricity is misplaced as a climate action, given that they only account for about 4% of GHG emissions.

As impacts multiply and become more severe, there will be increasing need to adapt to big changes. Ecology North supports consultations towards the identification of suitable actions of adaptation, but we stress the need to build community resilience. It is important to build and maintain communications, and to provide and support actions based on local knowledge. Improved communication between GNWT departments, communities and NGO's will improve coordination and reduce duplication of efforts.

Renewable energy and northern values

The NWT is in a unique position to benefit from the opportunity to invest in renewable energy and to lead the way by example.

The north is experiencing climate change impacts now and on a broad scale, and the high cost of conventional energy means substituting improved efficiency and renewable energy can mean short pay-back times and savings. With our experience of a changing climate the NWT public is supportive of new policies, legislation, and implementation measures that slow that change. In doing so, we would be supporting our people, our economy, and our planet.

In the Northwest Territories, we are people of the land. The population of the territory is 50% Indigenous, and so the worldview and traditional Indigenous way of life plays strongly into modern NWT culture. It has not been long since the people of the NWT lived nomadic lifestyles – there are Elders alive today that were born on the land. Our ties to the environment run deep, and even newcomers to the territory are quick to understand and adopt these values.

Renewable energy is relevant to NWT culture because it presents an opportunity to live modern life in harmony with the environment, it supports local economies, and it supports community and family self-reliance. Fossil fuel use is affecting our ecosystems (see: the global picture), while renewable energy investment offers an economic path forward that is sustainable and in keeping with traditional values. It is a way to be 'strong like two people' – a way to keep traditional values thriving in a modern economy.

The same principle applies for a carbon tax or for any other investments in sustainable living. People of the north understand how the wellbeing of humans is tied to the wellbeing of the ecosystems that sustain us. Investing in our environment aligns with distinct northern values, and taking a lead on sustainability has great potential to be empowering for our people.

Investing in renewable energy

Ecology North supports the bold vision of 100% renewable energy in the NWT by 2050, as outlined in the report by Alternatives North. We believe it is possible to reach this target and that it is of net value to pursue this goal. It will be a challenge, but the important thing is that we urgently act to implement an NWT-made plan that will benefit our environment and our people for many years to come.

The cost of living in the NWT is high. The main reason is that communities are isolated, so many of our basic needs are imported from afar, and getting supplies and energy adds to the cost of everything. Instead of flying or trucking in heavily subsidized and hazardous diesel fuel or other fossil fuels, our communities could be running on clean power, deriving more of our basic needs locally and regionally, and creating much-needed skilled jobs.

An important step is towards a low carbon economy is to implement a carbon tax that would increase annually in a transparent and predictable fashion. It would supplement the revenue needed for the transition, while creating a market mechanism to reduce high-carbon fuel use. New programs, and strategic investments in clean energy and climate change adaptation are also urgently required, with strategic decisions being made in the government reflecting a **triple bottom** line approach.

Renewable energy technology and development is spreading rapidly across the world while dropping in cost, providing an opportunity to invest in it now. The urgency of the issue requires re-allocation of GNWT resources and attraction of federal investments towards development of a robust renewable energy infrastructure.

The Arctic Energy Alliance is an arms-length institution that helps the NWT public deal with some of the energy-related challenges in today's world. This organization provides a vehicle for GNWT to increase its outreach and support to NWT residents and businesses as they turn to renewable energy to meet their demands, and as such, should receive greater government funding and support to promote and effect the transition.

Some specific areas that Ecology North believes that northern businesses and the GNWT could work on improving right away:

Food Systems

An often-overlooked contributor to climate change is agriculture. Internationally, this sector produces a third of all greenhouse gases, including almost all methane and nitrous oxide. The NWT is in the early stages of developing its agriculture sector, and science predicts continued warming and movement north of agricultural opportunities. In other words, with the NWT may gradually develop a thriving agricultural sector.

Given the early stage of development, and the potential and great need for growth, there is an opportunity to take steps now to ensure the NWT develops best organic/permaculture agricultural practices that sidestep the current industrial agricultural model, while avoiding the greenhouse gas emissions associated with conventional agricultural practices. Producing our own food reduces transportation emissions associated with shipping our food from the south. Developing truly sustainable agriculture in the NWT would further enhance our 'brand' as a pristine northern territory.

Transportation

Most products used in the NWT are transported by truck or plane. There is currently very little effort being made to reduce the fuel intensity of this huge sector of greenhouse gas emissions in the NWT. Fortunately, cars, trucks and planes have relatively short life spans, and the next generation of vehicles will by necessity have much lower carbon intensity.

NWT must position itself now as a leader in transportation infrastructure. Starting with electrifying transportation in the South Slave (where MWs of excess hydro spills over the Talston system daily). GNWT should invest in electric vehicles and recharging infrastructure, promote more efficient trucking options, mandate biofuels, and assess alternative transportation options (airships, etc.).

Investments in new roads are expensive, they are the responsibility of the Government of Canada, and they often do not provide significant benefits to NWT residents compared to the costs to the taxpayer, and given the escalating impacts of climate change they are rapidly leading to greater and accumulating long-term O&M costs. This capital and operational money could be better spent on renewable energy, and transforming and modernizing our transportation infrastructure.

Waste Reduction

Another sector worthy of discussion is the waste sector. There are many opportunities to reduce greenhouse gas emissions associated with landfilling waste in particular. Diverting organics (including cardboard and paper) from landfill reduces greenhouse gas emissions and produces valuable by-products (compost, recyclables). Composting is an inexpensive way to reduce greenhouse gas emissions, and communities are interested in the opportunity to divert their waste.

Mandating producer responsibility for end-of life materials (like the GNWT e-waste initiative) is another move forward, but often requires a national or federal/provincial/territorial action to be implemented. We urge GNWT to support the Federal/Provincial/Territorial ambitions to move forward with extended producer responsibility legislation across Canada.

In the short term, used fossil fuels, where available in sufficient quantity could be used to heat local buildings. This can be promoted in locations with large demand, where maintenance staff are well trained. Waste fuels otherwise end up stockpiled in very unsafe conditions, until they are transported to the south and disposed of (generally incinerated), which adds up to a lot of greenhouse gas emissions. Turn this liability into a benefit for our larger communities (it is important to note that capacity needs to be available to maintain these systems, used oil burners have been tried and failed in many communities due to lack of maintenance).

A great way to make projects like these happen is for communities that reduce greenhouse gas emissions through diversion get credit through a carbon tax.

Oil and Gas Divestment

There is a strong case to be made that the oil and gas industry is no longer a safe place to invest money. As of December 2016, investors across the world have divested (or pledged to divest) \$5.2 trillion from fossil fuel investments, a doubling from the previous year. Scientists suggest that much of the identified reserves worldwide cannot be extracted without reaching the 2°C warming that the science community and world leaders agree is a safe zone of climate change (it is now considered to be 1.5 °C, even more problematic).

Considering this confluence of economics, supply, and demand - along with concern for the Earth and its people - expensive, low return on energy invested, hard to reach NWT fossil fuels are not likely to ever be extracted. It is time to stop promoting, subsidizing and investing in a resource that has very little chance of ever getting to market. An immediate review of oil and gas industry subsidies and GNWT expenditures on the industry should be completed. Money saved should be re-directed to renewable energy installation and promotion.

Industry

Industry is the biggest source of GHG emissions in the NWT. A single project (e.g. mine development) can negate all other efforts unless it is managed to be done in a low-carbon way. Government has a role to provide industry with mandatory standards, including transparent and predictably ramped-up requirements for the installation of renewable energy to meet ever greater proportions of their energy demands (renewable energy portfolios). Industry should be given the opportunity to meet the requirements with carbon offsets, recognizing that the cost of those offsets will rise in an unpredictable but possibly steep curve.

Carbon Pricing Policy vs. Energy Cost of Living Policy

“Cost of Living” and “GHG Emissions” are not currently handled separately in GNWT policy and programming. From our standpoint, this makes it difficult to set clear targets and achieve results on either issue.

The smaller, remote communities where the costs of energy are the highest are also the lowest absolute sources of greenhouse gas emissions, yet they attract the most attention and funding. Some raise concern that a carbon price would drive up the (already heavily subsidized) cost of living in small communities. If the two policy areas were clearly separated, it would be clear that small communities actually have the most to gain from implementation of a carbon tax. As the NWT switches to renewable energy (partially underwritten by carbon tax revenue), the GNWT will be in a better position to help those who cannot afford their heating and power bills.

A Territorial Energy Building Code

Any new infrastructure built in the NWT should be built to the highest environmental and energy (efficiency) standards, including CO₂ emissions. New buildings, and energy infrastructure, will be around for a long time, and so will Northerners will get the most benefits if they are highly efficient and energy demand is met with renewable energy.

Yellowknife has its own building permitting/ inspections system and has created its own energy related building code, but no other community has the capacity to do this. A territorial energy building code should expand this capacity, and include:

- EGH-80 for homes
- Model National Energy Code of Canada for Buildings plus 40% for buildings
- 50% of a building’s energy requirements be met with renewable energy
- EnergyStar appliances
- Low-flow toilets & showers
- No electric water heaters in diesel communities
- District heat with mandatory connection

- GNWT taking responsibility to inspect and enforce building codes throughout the NWT

The GNWT has committed to implementing an *Energy Efficiency Act*. This is a way to implement many important changes to keep the NWT moving forward with innovations in building standards. Ecology North recommends that the GNWT require all GNWT-funded building infrastructure – including all new municipal government infrastructure – to exceed the territorial energy standard where possible, and rely on renewable energy to meet demand.

Encourage Wood Pellet Infrastructure through PPD

Biomass (chipped wood, hog fuel, wood pellets, logs) should be promoted for heating throughout the NWT with the possible exception of Sachs Harbour, Uluhaktok and Paulatuk (though even there, waste wood could supplement heating demands).

GNWT's [Petroleum Products Division now has a new name, reflecting its understanding of the need to incorporate other fuels like wood] currently, subsidizes the cost of fossil fuel infrastructure throughout smaller NWT communities.

Wood fuels can be stored much more easily, cheaply, and safely than heating oil. Fuel spills, barging and other environmentally liabilities would be eliminated. Millions previously spent annually in tank farm upgrades would provide for considerable wood fuel infrastructure in many communities (a silo costs \$30,000). The supply would enable community infrastructure to change over and the cost savings and greenhouse gas emission reductions would be large. Savings from reduced fuel costs and reallocated fossil fuel infrastructure costs, supplemented with carbon tax revenues, would pay for these system changes.

Carbon Offsets

The residential, commercial, institutional and industrial sector should go 100% renewable/carbon neutral by purchasing carbon offsets for their share of non-renewable energy use. Going carbon neutral will affect quick change! The way this works is that money from offset charges will be used to develop renewable energy projects in other parts of the world that are ready to be built, and just need funding. Purchasing 25 tons of offsets per year per person (~\$625) will more than cover most NWT residents.

Thank you for contemplating these ideas, we would like to conclude by reiterating the need for a voice from the North, strongly advocating for climate action. We must back up this voice with real and strong actions on climate change!



The Mining Association
of Canada | L'association minière
du Canada

June 30, 2017

The Honourable Catherine McKenna, P.C., M.P.
Minister of Environment and Climate Change Canada
200 Sacre-Coeur
Gatineau, Quebec, K1A 0H3

MAC Submission: Technical paper on the federal carbon backstop, and considerations on the government's broader climate change policy agenda.

Following the release of the technical paper on the federal carbon pricing backstop, the Mining Association of Canada (MAC) is pleased to provide comments on both this paper specifically, and more broadly on the federal climate change policy and related regulatory developments.

Mining is a significant engine of the Canadian economy, contributing 3.4% (or \$56 billion) to national GDP, and accounting for 19% (>\$91 billion) of the total overall value of Canada's exports. The sector employs 373,000 people directly and an additional 190,000 indirectly, supports one of the largest supply sectors in the world, and is a top employer of Indigenous peoples. The mining industry also supports many other important sectors of the Canadian economy, including the construction, manufacturing and transportation. For example, it is the single largest corporate customer group of Canada's freight railways, accounting for over half of the total rail-freight revenue generated annually. Mining is also the single largest private sector economic driver in Canada's North, accounting for one in every six jobs, with comparable contributions in the northern regions of the provinces.

MAC supports the Government of Canada in establishing a pan-Canadian carbon pricing framework to incentivize economy-wide action to reduce GHG emissions. To assist government in the development of an effective pan-Canadian climate change plan, MAC released *Principles for Climate Change Policy Design* in April 2016. In that document, in addition to supporting a revenue neutral price on carbon, MAC underscored the need for any climate change policy to ensure the competitiveness of emissions-intensive and trade-exposed (EITE) sectors, as well as the necessity of being sensitive to the geographical realities of remote and northern regions.

We believe that harnessing the power of the market through the broad-based pricing of carbon is the most effective way to incentivize meaningful reductions in GHG emissions while maximizing company flexibility in determining site-specific mitigation pathways. Given the number of federal climate change policy and regulatory consultations currently ongoing, MAC included a section in this brief outlining considerations in this space to underscore the need for efficiency, consistency and complementarity across proposed and existing federal and provincial climate change policies.

Finally, MAC believes the government has given itself valuable tools to support Canada's transition to a lower carbon economy, such as infrastructure, innovation and clean technology funding. Acknowledging that the mining sector is emissions-intensive and trade-exposed, price-taking (i.e., cannot pass the carbon price onto other sectors), and frequently operating in remote and northern regions with few economically-viable fuel switching opportunities, MAC urges industrial access to these programmatic supports to ensure operational competitiveness.

MAC remains committed to being a constructive partner to government in the development of meaningful, balanced, effective and efficient climate change policy. For the federal carbon pricing backstop to be effective in achieving the emissions reductions required to meet Canada's commitments to the Paris Agreement, we encourage decision makers to take the following into consideration:

I. Proposed Backstop Mechanism:

Backstop implementation timing:

1. MAC recommends that the carbon levy be delayed until the development and establishment of a robust, effective and efficient output-based pricing mechanism to protect EITE sectors (including mining). Furthermore, it should be simultaneously designed to consider the realities, sensitivities, and opportunities around remote and northern operations. An alternative would be to have a simplified OBP system in place while a more comprehensive and representative system is developed.

Backstop "top-up" function:

2. Ensure that the application of the backstop does not further distort carbon-cost competitiveness between Canadian jurisdictions.
3. Consult broadly, including with industry, on how best to reconcile equivalency of carbon price stringency across non-backstop, sub-national jurisdictions.
4. Avoid additional regulatory burden placed on facilities in jurisdictions that would be required to comply with both a provincial carbon pricing policy and the backstop in the case of a "top up".

Strict Sector-Level Revenue Neutrality

5. MAC recommends that backstop carbon revenue collected be revenue neutral at the company or sectoral level in a given backstop jurisdiction.

Output-Based Pricing (OBP) Mechanism:

6. OBP Performance Standards should be transparent, and include consideration of the following factors:
 - I. Sectoral emissions intensities;

- II. Degree of trade exposure and risk of carbon leakage;
 - III. Additional cost impacts associated with carbon cost pass-through; and
 - IV. Additional cost impacts associated with geographical remoteness and site-specific impacts (such as resource quality and viability of emissions abatement).
7. Apply the benchmark at the top quartile of a global performance index for globally marketed product categories.
 8. Determine OBP Performance Standards based on performance over the business cycle (5-10 years) while simultaneously being sensitive to the varying quality of mineral resources.
 9. Increase OBP Performance Standards to reflect the additional cost burden borne by the mining and smelting sectors as a consequence of carbon levy cost pass through from transportation providers.
 10. Facilitate a detailed discussion of flexible compliance mechanisms as part of the OBP System discussion to reduce compliance costs, including on carbon off-sets.
 11. Establish a five-year review period of the OBP Performance Standards.

III. The Federal Climate Change Regulatory and Policy Landscape: Cumulative Effects

12. The government should make carbon pricing the core of its climate policy, and this policy should be backed by robust protections for EITE sectors, and should also be sensitive to remote and northern regions.
13. The government should clearly demonstrate complementarity before adopting non-pricing climate change policies and regulations to avoid cumulative effects, and this demonstration should include a robust economic impact assessment.

IV. Transitioning to a Lower Carbon Economy: Innovation, Energy, Fuel, Process and Renewable Energy programs for the mine site, and Energy and Trade-Enabling Infrastructure Investments

Innovation

14. MAC recommends the government invest in the Canada Mining Innovation Council to implement the Towards Zero Waste Mining innovation strategy in support of the industry's transition to a lower carbon future, and/or a proposed mining supercluster.
15. The federal government should establish a targeted remote and northern business innovation and development fund that is designed to accelerate improvements in energy and fuel efficiency, as well as drive the scalability, deploy-ability, capacity and storage capabilities of renewable generation assets in northern Canada.

Transformative, Nation Building Infrastructure Investment

16. The “public use” criteria should be excluded from or re-evaluated in infrastructure funding programs to reflect remote and northern cost, emissions mitigation potential, competitiveness, and broader economic and social realities.
17. Remote and northern access to infrastructure funding envelopes should not be limited to per-capita funding formulas, but assessed in light of broader criteria, including balancing climate change priorities with social, economic and Indigenous reconciliation policy priorities and opportunities. The mining industry can be a powerful partner to government in attaining policy objectives in these areas.
18. Government should create a program that seeks to grow, expand and improve the performance, reliability and economic viability of renewable energy and storage technologies. Specifically, establish an infrastructure program across remote and northern regions to grow this opportunity, and ensure that the program’s design is reflective of the mining industry’s up-front and cost-heavy financing model.

Canada Infrastructure Bank (CIB)

19. Government should create a pathway for remote and northern projects in the CIB. Such a pathway would provide for project-selection criteria reflecting remote and northern realities, and broader government social, economic and Indigenous development priorities.
20. Government should appoint a successful northern business professional to be appointed to a leadership role in the CIB to ensure an understanding of northern realities informs the institution’s operational culture and practice.

Thank you for your consideration of the above recommendations and we welcome the opportunity to meet with you to discuss our submission at a time of mutual convenience.

Sincerely,



Pierre Gratton
President and CEO

Copy:

Mr. Jon-Paul Jepp, Environment and Climate Change Canada



The Mining Association of Canada | L'association minière du Canada

MAC Submission: Technical paper on the federal carbon backstop, and considerations on the government's broader climate change policy agenda.

I. Proposed Backstop Mechanism

Backstop Implementation Timing

On page 21 of the technical paper, MAC notes the following:

The carbon levy will come into effect in 2018.

The output-based pricing system will not come into effect before January 1, 2019.

For the interim period between when the levy and the output-based pricing system come into force, the carbon levy will apply fully to fuels used by all industrial facilities.

As proposed, the above makes provision for a phased implementation of the carbon levy (to come into force in 2018) and the output-based pricing system (to come into force in 2019). This proposed phased approach, if actualized, would subject EITE sectors (such as mining), in applicable backstop destinations (including several provinces and all three territories), to the carbon levy without recourse to protection for an interim period.

While decision makers have projected this interim period to be relatively short – up to a year – there are unpredictable variables¹ that could extend this interim period beyond the time horizon projected in the paper. Should a prolonged interim period between the implementation of the carbon price and the deployment of the output-based pricing mechanism occur, companies could be exposed to an escalating carbon price² with no protection. Finally, it is worth noting that even a \$10/tonne price on carbon can have significant and adverse impacts for certain mining operations, particularly those in remote and northern regions.³

¹ Such as the lengths of regulatory processes, and the complexity of developing and enacting a balanced, representative and dynamic output-based pricing mechanism that adequately represents the myriad complexity that exists across Canada's industries and regions.

² The proposed backstop has committed to escalating the price of carbon by \$10/t annually through to 2022.

³ See Appendix I for more context on this point.

Such an action would stand in contrast to MAC's *Principles for Climate Change Policy Design* which, while supportive of a price on carbon, simultaneously calls for robust protections for EITE sectors. Further, MAC's principles call for policies that are sensitive to remote and northern regions. While MAC appreciates that the extent to which the output-based pricing system will be sensitive to remote and northern realities is contingent on design considerations that have yet to be determined (and discussed below), a tiered approach that leaves companies exposed to the levy without protection could significantly impact their competitiveness.

Recommendation:

- 1. MAC recommends that the carbon levy be delayed until the development and establishment of a robust, effective and efficient output-based pricing mechanism to protect EITE sectors (including mining). Furthermore, it should be simultaneously designed to consider the realities, sensitivities, and opportunities for remote and northern operations. An alternative would be to have a simplified OBP system in place while a more comprehensive and representative system is developed.**

Backstop "top-up" Function

On page 5 and 21 of the technical paper, respectively, MAC notes the following:

The backstop will also supplement (or "top-up") systems that do not fully meet the benchmark. For example, the backstop could expand the sources covered by provincial carbon pollution pricing or it could increase the stringency of the provincial carbon price.

The backstop will apply in a province or territory that does not have a pricing system that aligns with the benchmark.

Our understanding is that this approach is being proposed with the intent of ensuring that all jurisdictions in Canada face equivalent stringency requirements with respect to carbon pricing, to ensure that carbon pricing is applied fairly and equitably throughout the country. MAC also appreciates that the details for determining equivalency with the federal carbon pricing backstop have not been developed. However, we would like to better understand how the "top-up" could apply in non-backstop jurisdictions, how it would work to reconcile carbon tax versus cap-and-trade pricing systems, and how it would interact with EITE sectors, including mining.

MAC appreciates that achieving a consistent set of stringency requirements across the country is desirable as it would "level the playing field" across all Canadian jurisdictions. What is doubtful, however, is whether and the extent to which newly-proposed and pre-existing climate change policy frameworks are reconcilable.

The potential for competitiveness distortion is two-fold: 1) in reconciling the distinct price-per-tonne definitions across respective existing and backstop-driven cap-and-trade and carbon tax systems; and 2) the potential for additional compliance burden when imposing one distinct pricing system onto another one, to "meet the [federal] benchmark".

With respect to carbon pricing, a carbon tax is a static cost, the burden of which only varies based on whether, how and to what extent relief provisions (either through EITE protections or other measures) apply to a particular emitter or sector. Of note here is that a carbon price is not influenced directly by market factors. Once the price is set in a carbon taxation regime, that price is only altered by policy change and is therefore static and insulated from market volatility.

In contrast to a carbon tax, the carbon price in a cap-and-trade regime is designed to respond to market forces. In this system, the extent to which the carbon cost is borne by the emitter is primarily contingent on how many allowances are distributed across the system, how they are distributed (by auction, grandfathering, etc.), and where the cap is set (i.e., the maximum level of emissions permitted by the system). These factors are intentionally taken together to establish a dynamic pricing mechanism whereby the cost per emissions permit fluctuates.

The notion that it is possible to reconcile an inherently static pricing system with an inherently dynamic pricing system on equivalency of stringency terms is problematic. Noting that one system is designed to continuously change necessitates that any determination of equivalency also be dynamic, iterative, and therefore reassessed and redefined periodically – an effortful and process-heavy approach that will require continual engagement from industry and will likely increase uncertainty among emitters about their carbon costs. Acknowledging that sub-national cap-and-trade and carbon pricing systems vary by design (as discussed above), and that these variations affect the extent to which the carbon price is felt by emitters in these jurisdictions, the level of complexity involved in achieving a measured outcome through this process is significant.

With respect to compliance costs, if achieving equivalency with the pan-Canadian requirements results in one company needing to comply with two distinct climate schemes – one provincial and one federal – with no assurance (despite best efforts) that reporting and other compliance requirements will be harmonized, competitiveness challenges (and associated costs) are likely to be exacerbated. When other supplementary climate change policies are factored in, such as the proposed clean fuel standard (discussed further below), the potential for duplication, overlap and compliance burden increases significantly with correlating reduction in business competitiveness.

Recommendations:

- 2. Ensure that the application of the backstop does not further distort carbon-cost competitiveness between Canadian jurisdictions.***
- 3. Consult broadly, including with industry, on how best to reconcile equivalency of carbon price stringency across non-backstop, sub-national jurisdictions.***
- 4. Avoid additional regulatory burden placed on facilities in jurisdictions that would be required to comply with both a provincial carbon pricing policy and the backstop in the case of a “top up”.***

Strict Sector-Level Revenue Neutrality

It is important that any carbon pricing plan be revenue neutral not just at the sub-national level, but at the company or sector level within a given province or territory. Further, and in the spirit of the harnessing the full power of the market, sufficient flexibility must be given to companies to balance competitiveness considerations with emissions mitigation in reinvesting these funds.

Recommendation:

5. MAC recommends that backstop carbon revenue collected be revenue neutral at the company or sectoral level.

Output-based Pricing Mechanism

On page 18 of the technical paper, MAC notes the following:

An output-based standard is an emissions-intensity standard for a type of activity or product (e.g., tonnes of CO₂e per megawatt hour of electricity). The output-based standard will be set at a level that represents best-in-class performance (top quartile or better) in order to drive reduced emissions intensity.

Given the mechanism as proposed in the paper is yet to be defined, MAC recommends the following be taken into consideration. :

6. ***OBP Performance Standards should be transparent, and should include consideration of the following factors:***
 - I. Sectoral emissions intensities;
 - II. Degree of trade exposure and risk of carbon leakage;
 - III. Additional cost impacts associated with cost pass through; and
 - IV. Additional cost impacts associated with geographical remoteness and site-specific impacts (such as resource quality and viability of emissions abatement).

Rationale: If the OBP system is meant to be a mechanism to address threats to competitiveness and the risk of carbon leakage to EITE sectors (including mining), the determination of OBP Performance Standards should reflect these issues.

7. ***Apply the benchmark at the top quartile of a global performance index for globally marketed product categories.***

Rationale: Good carbon policy should seek to incentivize and deliver on emissions reductions while maintaining the competitiveness of industry. Applying benchmarks based on solely domestic performance creates several challenges. First, a benchmark based on domestic-only (i.e. Canada) performance may under-incentivize sectors whose GHG performance lags that of international facilities. Conversely, in the case where a sector in Canada demonstrates best-in-class performance, a domestic-only benchmark may be overly stringent.

Finally, Canada is the second-largest landmass on the planet with some of the most frigid temperatures anywhere in the world. Companies operating in remote and northern regions, with no energy or trade-enabling infrastructure (literally, for hundreds of kilometres) are already disadvantaged by heightened costs. Limiting the scope of benchmark performance to Canada would unduly penalize these operations compared to the global average, distorting the outcome.

8. Determine OBP Performance Standards based on performance over the business cycle (5-10 years) while simultaneously being sensitive to the varying quality of mineral resources.

Rationale: To understand emissions performance on an intensity basis within the mining sector, one must understand 1) the relationship between operational efficiency and emissions intensities; and 2) the impact of the cyclical nature of the mining industry on emissions intensities.

Breaking and moving rock is expensive, and miners must move large volumes of both non-valuable (waste rock) and valuable materials (mineral product) during the mining process. A large portion of energy consumption and GHG emissions at a mining operation is related to the movement of these materials on site, frequently via haul truck. The ratio of non-valuable materials relative to valuable materials is known as the strip ratio. The higher a strip ratio, the greater the amount of non-valuable materials that need to be moved for every unit of valuable materials extracted, and therefore the less profitable the mining operation. As such, mining operations seek to maintain as low a strip ratio as possible throughout the life of the mine. However, despite best mining practice, the quality of the resource as found in the earth is the single largest determinant of the best attainable strip ratio. Different mineral deposits naturally contain varying levels of valuable versus non-valuable materials. This is referred to as the quality of the resource, and should be considered when determining commodity level categories within the mining benchmark.

The mining sector is also cyclical in nature. Commodity prices can fluctuate significantly over time, which in turn affects margins. The lower a commodity price, the lower margins become. This, in turn, reduces the ability for a mine to spend capital (in the form of fuel costs) to move waste materials. During such periods of low commodity pricing, mining operations will typically respond to market conditions by reducing their strip ratios (where possible) and costs to maintain profitability. When commodity prices are higher and mining operations have higher margins, strip ratios will typically increase to take advantage of the high price environment, and to compensate for financially difficult times and to ensure that product can be mined in future lower price environments.

One of the challenges of using a per tonne of product intensity benchmark for the mining sector is that this approach excludes the majority of the material being moved at a mine site, and is therefore not a true representation of operational efficiency. An intensity metric that is based on total material moved (i.e. waste materials + product) provides a much better reflection of operational efficiency. Product-based emissions intensities tend to be heavily impacted by variations in strip ratios and commodity prices, and do not accurately reflect operational efficiency.

With this context in mind, the Government of Canada should recognize that 1) emissions intensities on a per product basis are highly variable; and 2) that the sample of data, which an OBP Performance Standard is based upon, if not selected with appropriate consideration, may result in an

unrepresentative depiction of baseline performance. To ensure that OBP Performance Standards are set at an appropriate level that incentivizes improvements without being overly stringent, MAC recommends that GHG intensity benchmarks be determined based on performance over longer business cycles (e.g. 5-10 years).

9. *Increase OBP Performance Standards to reflect the additional cost burden borne by the mining and smelting sectors as a consequence of carbon levy cost pass through from transportation providers.*

Rationale: In addition to carbon costs incurred directly by facilities regulated under the OBP System, facilities in the mining and smelting sectors also incur additional carbon costs from transportation providers (e.g. rail providers) who pass on their carbon costs to their customers. As a price-taking industry, miners cannot pass on additional carbon costs to customers. Given the cost impacts of these additional indirect carbon costs, MAC recommends that the government increase the OBP Performance Standards to reflect this additional cost burden.

10. *Facilitate a detailed discussion of flexible compliance mechanisms needs as part of the OBP System to reduce compliance costs, including carbon off-sets.*

Rationale: An efficient price on carbon facilitates the greatest amount of real reductions in GHG emissions at the lowest cost. One mechanism for maintaining efficiency in reducing GHG emissions is the use of carbon off-sets. Off-sets provide an important tool to achieve emissions reductions at a low cost. When used, they also provide greater flexibility and liquidity within the market, and promote the economic benefit of developing a low-carbon industry and economy. To maximize efficiency, off-sets should be fungible amongst jurisdictions with comparable regulations, thereby broadening the market and driving down costs. Also critical is that a rigorous assurance system be adopted to ensure that carbon off-sets are credible and of the highest quality and integrity.

11. *Establish a five-year review period of the OBP Performance Standards*

Rationale: MAC recommends that the OBP System be reviewed every five years, taking into consideration GHG reductions, economic competitiveness, and carbon pricing and regulatory policy in other jurisdictions. Furthermore, MAC recommends this review cycle be synchronized with the five-year peer-review cycle of the Paris Agreement.

II. Climate Change and the North

With respect to the North, and consistent with the federal government's October 3, 2016 commitment to working with the territories to address their special circumstances, MAC understands that a federal-territorial consultation process is underway and will progress over the course of summer 2017. MAC will engage constructively through that process with the aim of ensuring remote and northern challenges, limitations and opportunities in the climate change space are both recognized and considered.

For decision makers' information, however, in the context of the current consultation, MAC has taken the liberty of including an annex (see Annex I) in this brief that describes the challenges that remote and northern companies face with respect to climate change.

Finally, MAC will take this opportunity to underscore again that the remote regions of the provinces face similar challenges as territorial mine operators, and that special consideration should be given to these near-North regions as well.

III. The Federal Climate Change Regulatory and Policy Landscape: Cumulative Effects

To date, MAC has participated and remains engaged in the following Environment and Climate Change Canada policy and regulatory consultations, all of which are happening concurrently:

1. Proposed Regulations for Coal and Natural Gas Fired Electricity Generation
2. Proposed Regulations for a Clean Fuel Standard
3. Proposed Regulations for Stationary Diesel Engines
4. Proposed enhanced GHG reporting requirements
5. The current technical backstop consultation

While each of these initiatives requires consideration independently of the others, it must also be assessed whether and how they interrelate. It is critical that all initiatives work harmoniously as a package to create a consistent, coordinated and complementary approach.

What concerns us is a potential scenario whereby existing or developing regulatory initiatives result in double regulation of the same emissions in one or more respects. We worry that some of these initiatives will duplicate or conflict with what provincial governments already are doing. This duplication would create additional reporting and compliance burden, frustrate private sector innovation, and generally blunt the incentive for corporations to take action, all without achieving significant additional GHG emissions reductions.

For example, recent research by Canada's Ecofiscal Commission illustrates this concern with respect to the proposed Clean Fuel Standard. Its report, *Supporting Carbon Pricing: How to identify policies that genuinely complement an economy-wide carbon price*, includes examples of how existing clean fuel standards in the transportation sector interact with both a carbon tax (British Columbia) and a cap-and-trade system (California). Both examples are highly relevant to federal decision makers who are proposing to embark on the same pathway.

a) carbon tax example:

"British Columbia has implemented a low-carbon fuel standard (LCFS) for transportation fuels, in addition to its carbon tax. The two policies overlap, in that they both apply to transportation emissions. Analysis from Wolinetz and Axsen (2014) suggests that the use of renewable fuels in B.C., as supported by the LCFS and renewable fuel mandate, reduced the province's annual GHG emissions by 0.9 Mt in 2012, over and above the effects of the carbon tax. These emissions reductions have come at a high cost—permit-trade data suggest that the costs of LCFS driven emissions reductions are as much as \$172 per tonne, well above the \$30 per tonne imposed by the carbon tax (Government of British Columbia, 2016b). Though these costs are very high, they are independent of the carbon tax."

b) cap-and-trade example:

“The case of California’s LCFS provides an example. It parallels the LCFS example from British Columbia discussed above, in that it also overlaps with the jurisdiction’s carbon pricing policy, but is different because the carbon pricing policy is a cap-and-trade system. From 2011 to 2015, the LCFS reduced emissions by 9.2 Mt cumulatively (Yeh & Witcover, 2016). But unlike the case in B.C., this mitigation was not additional—it displaced mitigation that would have otherwise occurred within the cap-and-trade system. Yet the combination of policies likely has greater costs—and the same level of abatement—than the cap-and-trade system would have had operating on its own. Indeed, the price of tradable compliance permits in the California LCFS, which approximates the per-tonne costs of emissions reductions, suggests that the emissions reductions were more expensive than those under the cap-and-trade system would have been. These LCFS permits traded at \$62 per ton in 2015—more than four times the price of emissions permits under the state’s cap-and-trade system at the time (CARB, 2016). If these higher costs are not justified by offsetting benefits, or by overcoming specific market failures, then the policy left the total quantity of mitigation unchanged while raising overall costs.”

The above examples illustrate that relative mitigation costs-per-tonne are inconsistent between both cap-and-trade and carbon tax regimes, and their respective overlapping clean fuel standards. In practice, for companies with limited capital to invest in mitigating emissions, a better cost-to-emissions-reduction ratio may be achieved via a different abatement pathway than a regulated one if companies have the freedom to choose. Regulations that limit this flexibility have significant potential to increase the cost-per-tonne of emissions reduction by forcing companies to act in a sub-optimal way. Ultimately, the goal of harnessing market power through carbon pricing is to reconcile, as effectively as possible, the elevated costs associated with the objective of reducing GHG emissions.

While the above example focuses on the interrelationship and disparity between overall costs of carbon pricing regimes and clean fuel standards, administrative burden is absent from the above discussion and increases proportionally for each new scheme to which a company must comply. For example, with the potential “top-up” provision proposed in the technical paper, it is conceivable that a company operating in a non-backstop jurisdiction with an existing carbon pricing policy could be subject to both provincial and federal systems, along with distinct compliance and reporting requirements for each. If that jurisdiction has an existing clean fuel standard, as British Columbia does for transportation, it is possible that a company operating in that jurisdiction would then also be required to participate in the proposed and distinct federal clean fuel standard, likely with distinct and separate compliance and reporting requirements.

In the growing patchwork of Canada’s climate change space, provincial and federal policies are increasingly likely to target the same GHG emissions. Doing so will increase overall costs, and may not drive additional emissions reductions. MAC maintains that carbon pricing is the simplest and most cost-effective way to lower GHG emissions, that it should do most of the heavy-lifting, and that any additional policies or regulations must complement—and not undermine—carbon pricing.

Recommendations:

- 12. The government should make carbon pricing the core of federal climate policy, and this policy should be backed by robust protections for EITE sectors, in addition to being sensitive to remote and northern regions.**

13. The government should clearly demonstrate complementarity before adopting non-pricing policies, and this demonstration should include a robust economic impact assessment.

Ensuring, however, that any broader energy and climate change-related regulations are complementary and consistent with carbon pricing theory and design is essential to maximizing the efficiency and effectiveness of the government's broader climate change agenda. If the goal of harnessing the power of the market – namely, to drive emissions reductions at the lowest possible cost – is undermined by regulation that limits company flexibility, the result will be an increase in industrial exposure to the price and lost opportunities for meaningful emissions reductions.

IV. Transitioning to a Lower Carbon Economy: Programs to Support Innovation, Energy and Fuel Efficiency, and Renewable Energy, and Energy and Trade-Enabling Infrastructure Investments

The government has committed to climate change policies that “should minimize competitiveness impacts and carbon leakage, particularly for trade-exposed sectors.” Acknowledging this, MAC proposes the following recommendations that will 1) support the mining sector's transition to a lower-carbon economy; and 2) enable the production of sustainably-sourced minerals and metals in Canada that support low emission technologies and infrastructure.

Targeted Innovation Funding

MAC welcomes the Government of Canada's commitment to invest \$1.2 billion to support innovation in mining and other resource sectors. The Canada Mining Innovation Council (CMIC), with the active support of industry, has developed the Towards Zero Waste Mining (TZWM) innovation strategy to fundamentally transform the industry through innovation. The TZWM strategy is directly aligned with the government's innovation, climate change and clean tech priorities. CMIC's TZWM strategy will stimulate mining technology innovation in Canada to achieve zero waste in mining and mineral processing within 10 to 20 years. This will lead to significant reductions in GHG emissions, water use and tailings discharge, and significant improvements in energy efficiency, environmental protection and operational productivity.

The mining industry is also preparing an application under the federal government's super-cluster program. This super-cluster would harness the mining “silicon-valley” that already exists across the country to accelerate the transition to a low carbon economy, among other objectives. With the anticipated backing of major Canadian and multinational mining companies and suppliers to the sector, this super-cluster would also complement the government's climate change objectives, whilst also enabling the development, deployment and export of clean mining technologies.

Further, the federal government should establish a targeted remote and northern business innovation and development fund designed to accelerate improvements in energy and fuel efficiency, as well as drive the scalability, deploy-ability, capacity and storage capabilities of renewable generation assets and enabling transmission infrastructure in remote and northern Canada. Acknowledging the objective is to

displace diesel reliance, it must be recognized that this is a longer-term goal, and that company reliance on diesel will persist until a substantial and viable fuel switching opportunity exists. As such, improving diesel fuel efficiency must be viewed as an integral component of any such program.

Consistent with harnessing the power of the market to the maximum extent possible, the fund should be designed to support companies at the operational level in ways that meet site-specific energy challenges and opportunities. MAC does not dismiss the importance of research in support of breakthrough technologies, but acknowledges that tangible progress is needed more immediately than the timing that such paradigm shifts typically require. Learnings and progress could be collected and shared with the aim of maximizing efficiency gains and emissions mitigation, for the benefit of northern and Canadian business competitiveness and climate change objectives.

Recommendations:

14. MAC recommends the government invest in CMIC to implement the TZWM innovation strategy in support of the industry's transition to a lower carbon future, and /or a proposed mining supercluster.

15. The federal government should establish a targeted remote and northern business innovation and development fund designed to accelerate improvements in energy and fuel efficiency, as well as drive the scalability, deploy-ability, capacity and storage capabilities of renewable generation assets in northern Canada.

Transformative, Nation-Building Infrastructure Investment

Core Infrastructure Funding

It is clear from all credible scenarios that the transition to effectively address climate change will require a systematic societal transition over several decades. Acknowledging this, MAC strongly underscores that strategically addressing the infrastructure deficit in remote and northern Canada is the most significant and immediately impactful means of facilitating the mining industry's transition to a lower carbon economy while simultaneously improving Canada's attractiveness as a destination for mineral investment.

In the past, per-capita allocation formulas have severely limited the ability of the territories to access funding in proportion to their infrastructure deficit, and "public use" funding criteria has excluded remote mining companies from eligibility for funding consideration. This has resulted in the northern infrastructure deficit persisting, ultimately prolonging territorial reliance on Ottawa. It has also resulted in companies absorbing the full cost of the infrastructure they require to operate, ultimately reducing the region's competitiveness for mineral investment, and slowing development opportunities from which many benefits are derived.

While MAC was pleased to see a specific reference to consulting with territorial governments and recognition of northern infrastructure realities in select envelopes, MAC recommends the following to ensure these funding targets achieve their intended effects:

- 16. The “public use” criteria be excluded from or re-evaluated to reflect remote and northern cost, emissions mitigation, competitiveness and broader economic and social realities;**
- 17. Remote and northern access to infrastructure funding envelopes not be limited to per-capita funding formulas, but assessed in light of broader criteria, including balancing climate change priorities with social, economic and Indigenous reconciliation policy priorities; and,**
- 18. Seek to grow, expand and improve the performance, reliability and economic viability of renewable energy and storage technologies through the establishment of an infrastructure program designed to grow this opportunity across remote and northern regions in a manner that is reflective of mining’s up-front and cost-heavy financing model.**

Canada Infrastructure Bank (CIB)

MAC applauded the government’s creation of the CIB, announced in the Fall Economic Statement and enacted through Budget 2017 legislation. MAC and several Indigenous and business groups, including the National Aboriginal Economic Development Board, the Kitikmeot Inuit Association and the Canadian Chamber of Commerce, have been advocating for the creation of an infrastructure bank that supports projects in northern Canada. Looking forward, MAC acknowledges that decision makers are actively developing the institutional blueprint for the governance, operation and functionality of the CIB. While there is great potential for this investment vehicle to help remote and northern regions transition to a lower carbon economy, much depends on the details currently being determined. In this regard, MAC strongly recommends:

- 19. The creation of a pathway for northern projects in the CIB. Such a pathway would provide for project-selection criteria that reflect northern realities and broader government social, economic and Indigenous development priorities; and,**
- 20. The appointment of a successful northern business professional to a leadership role in the CIB to ensure an understanding of northern realities informs the institution’s operational culture and practice.**

Annex I: Carbon Pricing in Remote and Northern Canada

To better understand the implications the carbon price will have on the current fleet of remote and northern mines⁴, as well as northern projects in the development stage, context is required around the following points:

- Mining in Northern Canada – Contributions, Opportunities, Costs and Challenges
- Northern Mining Energy Realities
- Northern Mining and Climate Change – Avenues for mitigation

Mining in Northern Canada

Mining is the largest private sector driver in Canada's North, employing approximately 8,500 people (1 in every 6 jobs) in 2015, or 8% of the total territorial population, according to the 2011 Census. Direct GDP contributions in the Yukon, the Northwest Territories and Nunavut are 11%, 24% and 19%, respectively, as of 2015. Mining also contributes significantly to other sectors such as real estate, construction and transportation, with the purchase of land, the construction and maintenance of roads and development of mine sites, extending the industry's economic contributions even further.

In a region with fewer private sector alternatives compared to southern Canada, the mineral industry has already demonstrated its capacity to support inclusive economic growth in the territories. Companies are also actively engaged with communities, and have invested in a myriad of programs and initiatives that have advanced territorial social development across a number of indicators.

As an example, the diamond mines of the Northwest Territories have generated significant employment and business development opportunities for northerners and Indigenous communities:

- 44,000 person years of employment
- A workforce that is approximately 50% northern and 25% Indigenous.
- Skills training for over 2,100 people – nearly 10% of total territorial working population in 2011.
- Capital and operational expenditures totalling \$14.8 billion, of which \$10.6 billion was directly spent in the North, and \$4.8 billion was invested in an entrepreneurial Indigenous business community.
- Community contributions and social investments in excess of \$100 million.

⁴ Note that for MAC, remote and Northern includes the northern regions of the provinces, and is not exclusively the three territories.

The opportunity that mineral development presents is most striking in Nunavut, where there are few economic alternatives to resource development, the population is booming, and human development outcomes on a range of measures are poor.⁵ The Meadowbank Mine, owned by Agnico Eagle Mines Limited, singlehandedly accounts for approximately 15% of territorial GDP, and has generated more than \$1 billion in investment over the last five years.

Proportionally, as the largest private sector employer of Indigenous Canadians, mining has had a transformative effect on Indigenous communities across the country. Mining companies generate employment, invest in skills training and, in some cases, pay royalty or direct equity shares, all while paying taxes and royalties to governments. Further, MAC and its member have taken progressive policy positions on government resource revenue sharing to help support greater participation of Indigenous people, communities, businesses and governments in the benefits generated by the mining industry.⁶

While these contributions are substantial, the potential is even greater given the right investment and regulatory environment. MAC research indicates that approximately 15 mines could start or restart production in the next decade, with total life-of-mine investment exceeding \$35 billion – nearly 4.5 times the size of all three territorial economies combined in 2015.

One of the largest factors influencing mineral investment decisions in Canada's North is heightened costs. Our research indicates that it costs 2 to 2.5 times more to build a base or precious metal mine off-grid in the Canada's remote and northern regions than in the south. Further, 70% of this northern cost premium is directly related to the infrastructure deficit. Companies frequently absorb at private expense the total costs of building all of the infrastructure the mine requires, despite components of that infrastructure serving a public good. In the south, however, the greater prevalence of trade-enabling infrastructure substantially increases the serviceability of mines either fully or in part, alleviating a company's balance sheet from these significant upfront costs. The implications of the heightened northern cost burden are poorer project economics, including reduced or marginal profitability pending market cycles, and in many instances, unviable project economics.

Northern Mining Energy Realities

Northern energy costs are compounded as a result of the infrastructure deficit. The extremely limited reach of transmission and distribution infrastructure means mines and development projects are off-grid and are, therefore, dependent exclusively on diesel with very few exceptions. Beyond the cost of fuel itself, the cost-per-unit of delivered fuel is inflated significantly as a result of associated investments essential to supporting the mine's energy supply chain.

For example, Nunavut's first mine, Agnico Eagle's Meadowbank, has an extensive energy supply chain. The company had to install a floating dock system at Baker Lake at a capacity large enough to receive annual fuel supplies by sealift during a narrow seasonal shipping window. A tank farm was constructed at Baker Lake with an annual re-supply capacity of 60 million litres of diesel to meet operational

⁵ The Nunavut Roundtable for Poverty Reduction, *Understanding Poverty in Nunavut*, August 31, 2012, http://makiliqta.ca/sites/default/files/anti-poverty_content_april18.pdf.

⁶ <http://mining.ca/news-events/press-releases/mac-issues-statement-government-resource-revenue-sharing>

requirements. Additionally, the company built a 110 kilometre all-weather road (including 4 bridges) – the longest road in the territory – at a cost exceeding \$100 million, to deliver fuel from Baker Lake to the mine site.

The diamond mines have similarly extensive energy supply chains, with diesel delivered by truck travelling over 1,800 kilometres from Edmonton and over seasonal ice roads that are constructed and are managed on an annual basis at company expense. Each stage of these processes – fuel procurement, delivery, storage and consumption – all add to the cost per-unit of delivered fuel to the mine site. In recent years, these costs have augmented the price of electricity at mine sites to as high as \$0.30 per kWh.

Northern Mining and Climate Change

In a normally functioning marketplace, where consumers have optionality, an effectively designed carbon price will incentivize a firm to make business decisions that lower GHG emissions. The theory operates on the basis that lower GHG emitting business practices are available at a firm's discretion, but for economic considerations, require a price signal to incentivize the firm's behavioural change. The purpose of pricing carbon is not to penalize the firm, but to price the pollution, and ultimately drive improved environmental performance in emissions reduction. Ultimately, the goal of harnessing market power through carbon pricing is to reconcile, as effectively as possible, the elevated costs associated with the objective of reducing GHG emissions.

In the mining sector, facilities produce GHG emissions primarily through the burning of fossil fuels for energy and, as such, emissions are controlled by managing energy consumption. Generally speaking, this is achieved through energy and fuel efficiency or fuel switching, or some combination of these two practices in tandem. A review of the options and scale of mitigation opportunities available to northern mining companies is important context for considering how the proposed carbon price maps onto northern mining realities.

Energy and Fuel Efficiency Opportunities and Limitations

To date, energy and fuel efficiency programs have been deployed universally at mine sites in the North from the outset of production. The highest energy costs in the country act as a de facto carbon price, and have served as a significant incentive compelling companies to manage their energy use. Underlying this reality is the fact that miners are "price takers", selling their products at prices set by international markets. This type of market exposure leaves process management as the primary tool companies have to control their operating costs.

Northern company performance in energy and fuel efficiency management attests to this fact. For example, in 2014, the Meadowbank Mine introduced a new fuel consumption control system that tracks and controls the consumption of each piece of equipment, which reduced overall fuel consumption from 69.8 million litres to 64.3 million litres – a reduction of nearly 8% in a year. From a junior mining standpoint, Avalon Advanced Materials won a sustainability award for best practices at its Nechalacho camp through the strategic deployment of solar panels, battery storage, and energy efficient heaters, reducing both diesel use and associated heating costs by 90%.

While companies will continue to improve energy and fuel efficiency, it must be recognized that such improvements will necessarily persist in diesel reliance for off-grid northern mines. Fuel inputs are required to produce power, and there is a limit to how much energy can be extracted per litre of diesel fuel. For example, while Agnico's displacement of nearly 8% of diesel is impressive, the fuel-saving practice does not replicate the diesel reduction on an annual basis; rather, at best, it maintains the initial gain. While there may yet be further gains to be made, they will be incremental and gradual and, therefore, not on a scale large enough or fast enough to prevent companies from absorbing the carbon price almost exclusively as a cost of business.

Northern Fuel Switching Opportunities and Limitations

Fuel switching opportunities in the North are limited due to the infrastructure deficit, and are contingent on multiple and complex variables. At the project development stage, companies undertake strenuous engineering exercises, often several times over, to ensure that project proposals maximize efficiency while minimizing environmental impacts. These studies review and assess the viability of the existing range of energy technologies available for deployment, both independently and in various combinations with each other, to meet the power needs of the mine.

While the feasibility of natural gas in the North is increasing, as Western Copper and Gold's Casino mining project in Yukon demonstrates, it is not economically viable for any existing northern mines. As such, while companies will continue to monitor the opportunities this fuel presents for both emissions reduction and cost savings in the future, it does not present an abatement pathway to displace diesel in the proposed timeframe for carbon pricing implementation.

Companies have also reviewed the possibility of deploying hydro power. While having been undertaken in the past, and being an emission free source of power generation, it must be underscored that several challenges are associated with this pursuit. First, not all projects are located proximate to a potential hydroelectric resource. Second, hydroelectric projects of the scale required to power a mine must proceed through permitting, with estimated process, construction and reservoir flooding times ranging from six to eight years. Additionally, social license to flood land has been called into question by several local communities in cases where companies have considered this option. Finally, with the expectation that a company will absorb development costs fully, and acknowledging that the life of the energy asset will extend beyond the mine life in most cases, projects of this scale have not been found to be economical in recent years.

Based on current technology, renewable generation for northern mining has predominantly meant wind power. Diavik Diamond Mine is the only operation to have successfully deployed a wind farm in the territories. While the company's efforts and success in this regard should be commended, important perspective on the extent to which wind generation is both accessible to mining companies in general, and effective as means to displace diesel, is needed.

With respect to accessibility, the following must be underscored: just as miners need to go where the viable mineral deposits are located, renewable energy generation is contingent on the strength and reliability of the renewable asset proximate to the mine location. MAC acknowledges that renewable

technologies continue to improve, and may one day enable accessibility that is presently beyond reach. At current levels of technology, however, this restriction prevents renewable generation from becoming an industry-wide energy solution for the foreseeable future.

With respect to the implementation of the carbon price, one key consideration is the extent to which a renewable asset is capable of displacing diesel fuel. As a benchmark, we can use the Diavik Diamond Mine's construction of four 2.3-megawatt wind turbines to evaluate prospects in this regard. Diavik has reduced annual diesel consumption by approximately 10%. While a benchmark, this example indicates the successful deployment of renewable generation to offset diesel still leaves 90% of a company's energy profile exposed to the carbon price, with very limited means for further diesel displacement.

While not located in the territories, Glencore's successful deployment of a wind turbine and accompanying wind storage facility at its Raglan mine in Nunavik, Quebec (1,800 kilometres from Montreal) was designed for Arctic conditions and is, therefore, of interest. Incorporating three energy storage technologies – a flywheel, batteries, and a hydrogen storage loop with an electrolyzer and fuel cells – the 3-megawatt wind turbine and storage unit is seeking to bridge the divide between intermittency and base-load capabilities. In its inaugural year, it saved 2.1 million litres of diesel and reduced GHG emissions by 5.85 kilotons. Looking forward, it is speculated the technology could reduce the mine's diesel consumption by up to 40%. Despite this success, however, the project was a private-public partnership between Raglan Mine, TUGLIQ Energy and the federal and provincial governments. Uneconomic to undertake solely by the company, the federal government contributed \$7.8 million, the Quebec government \$6.5 million, with the remainder of the \$18.9 million project cost split between Glencore and Tugliq. Despite the tremendous potential, the cost barrier remains significant.

For those companies that have access to a renewable energy source proximate to the mine, there are various intersecting considerations that will inform feasibility: safety, regulatory considerations, project economics, financing costs and energy reliability, among others. Detailed engineering studies would be required to assess project viability on a case-by-case basis in light of the carbon price, and in consideration of other important variables, including current market realities and individual site operational cost profiles.

Key Observations

After reviewing the options and scale of mitigation opportunities available to northern mining companies, the following observations are made:

- 1) The heightened price of energy in the North has long served as a strong incentive to maximize energy and fuel efficiency, and company commitment and performance in these areas suggest the proverbial "low-hanging" fruit are gone, meaning future improvements will be both incremental and gradual.
- 2) Fuel switching opportunities are limited by both technology type, scale of displacement potential and economics, and are contingent on geographical considerations. Therefore, these opportunities are not universally accessible.
- 3) Taken together, the infrastructure deficit and state of currently available technologies will not provide sufficient options to displace diesel (and associated emissions) in the timeframe

needed, nor on the scale required, to avoid companies absorbing the carbon price almost exclusively as a cost of business.

With exceptionally limited ability to displace carbon costs, northern businesses will be disproportionately affected from a competitiveness standpoint, with little benefit to the government's climate change objectives. The greater risk is a transition to carbon pricing in the North that reduces economic activity, ultimately jeopardizing the well-being of northerners and Indigenous communities, and broader federal social and economic development and reconciliation policy objectives. To further frame the dialogue on how the government can facilitate a smooth territorial transition to carbon pricing, the practical business implications of carbon pricing on companies is an important consideration.

Company Specific Implications

Dominion Diamond – Ekati Diamond Mine – Northwest Territories

Dominion Diamond's Ekati Diamond Mine employed 1,819 people in 2015. Of this total, 1,090 were direct employees, of which 422 were northern Indigenous Canadians. In the same year, the mine's business expenditure exceeded \$448 million, of which 57% was invested in the North. Of this expenditure, over \$97 million was invested in northern Indigenous businesses.

During 2015, Dominion's Ekati Diamond Mine reported 215,000 tonnes of GHG emissions. Projecting forward to 2022 with proposed carbon pricing of \$50/tonne, this equates to \$10.75 million annually which is, based on projected operating costs, 2.6% of Ekati operating costs in that year. With low commodity prices, the margins in diamond mining are very thin. In Dominion's last full fiscal year, 2016, it recorded an operating profit of 1.1%. Profit margins in this fiscal year, 2017, have been negative.

Dominion is currently beginning a major mine-life extension at Ekati, the Jay Project. The capital investment into Jay will be over \$800 million. The additional carbon pricing cost will be a difficult hurdle to overcome and will negatively affect the economic viability of the project.

Agnico Eagle – Meadowbank/Amaruq Gold Mine and Meliadine Project - Nunavut

Agnico Eagle currently operates the Meadowbank Gold Mine. This operation has accounted for \$90 million annually in payroll, \$30 million to 250 Inuit employees at an average salary of \$107,000. Annually, the mine supports \$280 million in contracts, \$90 million of which are directly in Nunavut and \$27 million in Baker Lake.

While this mine will close in 2018, the company is advancing the Amaruq deposit to seamlessly transition these mining operations. Additionally, the company is in the final stages of determining whether to develop a second mine at Meliadine, also in Nunavut. The company is prepared to invest more than \$2 billion (USD) over the next five years on the development of these projects pending the right investment and regulatory environment. Together, these new projects will provide an estimated 2,200 direct and indirect jobs, of which 600 will be held by Inuit.

**Estimated Impact from Federal Carbon Tax
to Agnico Eagle's Nunavut Operations**

	Meliadine*	Meadowbank- Amaruq**
2019	617,104 00 \$	1,671,660 00 \$
2020	2,012,938 00 \$	4,021,460.00 \$
2021	3,491,519 00 \$	6,107,040 00 \$
2022	5,109,768 00 \$	8,142,720 00 \$
2023	8,244,967 00 \$	10,178,400 00 \$

*Project has yet to be approved by Agnico Eagle's Board of Directors

**Project is currently in the NIRB permit review stage and has not been approved for development by Agnico Eagle's Board of Directors

Projecting forward to 2022 at \$50/tonne, the impact to Agnico Eagle will be approximately \$20 million per year. Given that the company has not yet been profitable in the territory, with its investments part of a long-term strategy, the additional carbon pricing cost negatively affects the economic viability of both expansion projects, located in a high-cost, low-margin jurisdiction.

Victoria Gold – Eagle Gold Project – Yukon

Located in Mayo Mining District, central Yukon, Victoria Gold's Eagle Gold project is permitted for operations and is in the development stage. Upon production, the mine projects creating 400 jobs and contributing \$85 million annually to Yukon's GDP over the course of the 12-year initial mine life.

As a junior mining company with no revenue stream, the company is reliant on capital markets and partnerships to finance the \$370 million initial capital cost. Forecasting production in 2018, and projecting forward to 2022 at \$50/tonne, anticipated carbon costs amount to \$3.27 million annually. The correlative reduction in revenue and anticipated profit that this represents has particular tax and financing implications for the project. Prior to generating power, emitting carbon and paying the carbon price, these represent an added business cost in an already high-cost jurisdiction:

- **Project Finance Implications:** The cost of capital for a junior developer is naturally higher than producers due to the relatively lower balance sheet capacity. Typically, some or all of new development costs for an existing producer come from existing free cash flow, low cost corporate bonds and/or an existing operating line of credit. This contrasts with a junior developer that is required to fully fund new development with external sources of finance (which is on top of the tens to hundreds of millions previously spent to get their asset to a shovel-ready state). The carbon price will have the effect of driving the cost of capital higher, requiring juniors to raise more capital to finance their projects. Further, any increase in operational costs associated with the carbon price will be fully captured in new project financing options and result in higher costs of borrowing, further dampening overall project economics.
- **Tax disadvantage:** With no revenue, the cost of the carbon price fully burdens the junior mining company. This contrasts with almost every other business sector in Canada, which offsets some of the cost through lower taxable profits. While it can be argued the tax benefit to a junior developer will be realized through accumulated tax pools, it remains highly punitive to the

company as the cost is felt at the company's most vulnerable time. This imbalance potentially creates a 30% additional burden on the junior developer.

The company is also currently seeking opportunities to connect to grid power which, if successful, would displace the mine's carbon footprint almost completely. It should be underscored that even at a distance of 45 kilometres from power infrastructure, the cost to upgrade the transmission line is quoted by the Yukon Energy Corporation at \$89 million. Acknowledging that the current line infrastructure is at the end of its useful life, and the region it services benefits Indigenous and northern communities, the company's proposal for the line upgrade to tie into the mine is one component of a broader public good infrastructure investment. While savings on fuel costs would justify the investment over the longer term, there is an increase in up-front capital costs that impacts project economics.

Key Observations:

After reviewing the above case studies, the following observations are made:

- 1) Affected by higher operating costs and current market realities, northern mining company margins are negative at present, meaning the absorption of the carbon price as a cost of business would have significant negative business implications.
- 2) Beyond operating mines, there is a cost borne by developing projects that translates into higher-cost financing and reduced investment competitiveness in an already high-cost jurisdiction.
- 3) Given the prominent economic contributions these companies make, or stand to make in their respective communities of interest and in their respective territories, the scale of risk extends well beyond business to broader social and economic considerations, including Indigenous economic reconciliation.



The Northern Way

Hybrid Micro-Grids: Improving Energy Security through a Northern Alternative to Carbon Pricing

Northerners suffer disproportionately from the impacts of climate change. Energy insecurity exists in too many Northern communities and industries because they are almost totally dependent on electricity that is generated through burning fossil fuels. The introduction of a carbon price intended reduce fossil fuel use will worsen that lack of security. Further, Northerners face an extremely high cost of living and a carbon price will only make that worse.

The solution is support for hybrid micro-grids in each diesel-powered community or industry site. Instead of pricing carbon out of the market, it is eliminated directly. These systems increase energy independence, reduce risk from climate impacts, cost much less, can be built quickly and will result in immediate reductions in carbon emissions.

September 2016

Image: Colville Micro-grid Installation Courtesy of AEC

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Authorship

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FACING REALITY: A PRICE ON CARBON IS HERE

The Status Quo

Context

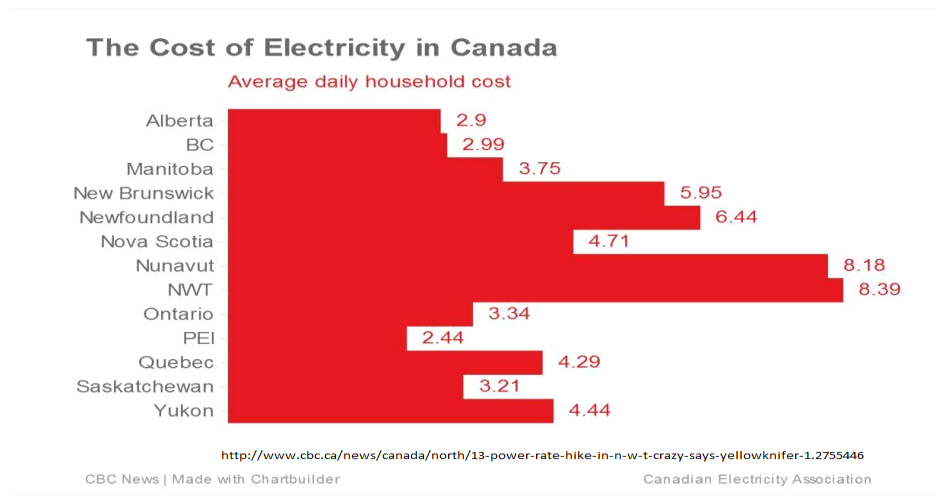
The NWT energy policy has been to provide a mix of reliable, affordable and sustainable energy that currently includes:

- 2 aging, high maintenance hydro micro-grids with diesel backup;
- 24 remote diesel-fuelled community micro-grids (with small amounts of solar photo-voltaic (PV) and natural gas);
- 1 solar-diesel-battery hybrid micro-grid (Colville Lake)¹; and
- 3 large diesel-fuelled micro-grids at remote diamond mines (one mine is supplemented by a wind farm that produces approximately 10% of its electricity).²

This mix is referred to as the “status quo”. This mix produces about 430 kilotonnes (Kt) of greenhouse gases from the electricity sector each year (out of an NWT total of 1500 Kt).

Energy cost is a major contributor to the crushing cost of living. Electricity generation contributes almost 30% of NWT greenhouse gas emissions.³ The other 70% of NWT greenhouse gas emissions are generated from transportation and heating.⁴ Breaking the dependency on diesel fuel has been a frequently stated objective for at least 15 years.⁵ However, the frequency of power outages, continuing reliance on diesel and the fact that customers in NWT pay the highest cost for electricity in Canada (a cost which continues to spiral higher) would suggest that the “status quo” policies have not achieved their goal.

Figure 1: Average electricity Costs in Canada



Dangerous climate change is being caused, in large part, by the burning of fossil fuels. In September 2016, “375 of the world's top scientists, including 30 Nobel Prize winners...report that the evidence is

¹ Toom, Paul. NTPC Power System Plan 2016. 281p.

² <http://www.pws.gov.nt.ca/pdf/EnergyCharrettePresentations/Diavik%20Wind%20Farm%20Project%20-%20Liezl%20van%20Wyk.pdf>

³ <http://www.enr.gov.nt.ca/state-environment/62-trends-electrical-generation>

⁴ <http://www.enr.gov.nt.ca/state-environment/63-trends-nwt-greenhouse-gas-emissions>

⁵ http://www.enr.gov.nt.ca/sites/default/files/strategies/greenhouse_gas_strategy_final.pdf

clear: humans are causing climate change. We are now observing climate change and its affect across the globe. The seas are rising, the oceans are warming, the lower atmosphere is warming, the land is warming, ice is melting, rainfall patterns are changing and the ocean is becoming more acidic."⁶ The impacts of this climate change are at crisis levels. Northern jurisdictions are already heavily impacted.⁷

All of this combines to decrease the energy security of NWT communities and industries. Examples of this already abound. In 2006, extremely warm weather drastically shortened the Tibbitt to Contwoyto winter road season, costing the diamond mines millions to airlift in fuel, freight and supplies.⁸ In 2014 and 2015, deliveries of dry goods and fuel were significantly delayed due to low water levels on the Mackenzie River.⁹ In 2015, GNWT paid \$29.7 M to NTPC so a 25% rate hike on electricity – due to low water levels on the Snare and Bluefish hydro system - could be avoided.¹⁰

The Global Commitment

To combat this, Canada has joined with governments around the world in signing the Paris Accord which sets a goal to limit the global average temperature rise to well below 2°C and pursue efforts to limit the increase to 1.5°C.¹¹

Along with the G7 and G20 partners, Canada has committed to eliminating "fossil fuel subsidies...that distort energy markets" by 2025.¹² On October 3, 2016, Canada announced a nation-wide price on carbon pollution starting at a minimum of \$10/tonne in 2018 and rising by \$10 a year to reach \$50/tonne in 2022.¹³ If successful, these measures will direct market forces to reduce and eliminate carbon emissions.

Unless NWT is exempt from contributing to the global effort (which it is not), the diesel-dependent electricity systems of the NWT are now obsolete. Displacing diesel-generated electricity with carbon neutral electricity is a clear opportunity to significantly reduce NWT greenhouse gas emissions.

The Fiscal Impact in the NWT of the Price on Carbon

In a normal year, the NWT emits a total of 1500 Kt of CO₂. Of this total, the diamond mining industry emits approximately 500 Kt. At \$10/tonne (2018 price) NWT carbon price would be approximately \$15M/year and the diamond mining industry share of the carbon price would be approximately \$5M/year. At \$50/tonne (2022 price) the NWT carbon price would be approximately \$75M/year and the Diamond mining industry share would be approximately \$25M/year. Over the five years (2018-2022), the NWT total cost of carbon pollution would be approximately \$225M and the diamond mining industry approximately \$75M. These revenues could be available to invest in emission reductions and these costs could be reduced with reduced emissions. If emission reduction targets are not being met, the price of carbon will likely increase after 2022.

While a price on carbon will achieve reductions of greenhouse gas emissions, it will also harm those who have no alternatives. Without the ability to choose any immediate alternatives, communities and businesses will be hit with increases to the cost of living and cost of doing business that may well be unsustainable.

⁶ https://www.theguardian.com/environment/climate-consensus-97-per-cent/2016/sep/21/375-top-scientists-warn-of-real-serious-immediate-climate-threat?CMP=share_btn_tw

⁷ <https://www.opencanada.org/features/north-americas-climate-action-plan-why-arctic-matters-beyond-its-borders/>

⁸ http://www.nnsl.com/frames/newspapers/2008-01/jan23_08rd.html

⁹ <http://www.cbc.ca/news/canada/north/ntcl-moves-berge-traffic-earlier-to-avoid-low-water-1.3170697>

¹⁰ <http://www.cbc.ca/news/canada/north/n-w-t-avoids-power-rate-hike-with-29-7m-to-cover-diesel-costs-1.3213456>

¹¹ <http://www.climatechange.gc.ca/default.asp?lang=En&n=24700154-1>

¹² <https://www.theguardian.com/environment/2016/may/27/g7-nations-pledge-to-end-fossil-fuel-subsidies-by-2025>

¹³ <http://news.gc.ca/web/article-en.do?nid=1132149>

Canada has acknowledged that other actions must be taken to address these issues, and achieve further emission reductions. A number of actions are proposed in this paper including:

- Eliminating fossil fuel subsidies;
- Avoiding mega-projects; and,
- Refining or addressing ineffective policy.

This paper also sets out an plan ("Plan B") focused on addressing the need for immediate, effective, lower cost solutions to reducing emissions while meeting the needs of vulnerable communities.

Current Fossil Fuel Energy Subsidies are Counter Productive

The purpose of putting a price on carbon is to make it less affordable to emit greenhouse gases. However, energy subsidies make diesel electricity much more affordable, and work directly contrary to the goal behind a price on carbon.¹⁴ This is why, along with its G7 partners, Canada has committed to eliminating "fossil fuel subsidies...that distort energy markets" by 2025. In NWT, the following are the types of energy market distortions that Canada has committed to eliminate in the next decade:

Benefits to Industry:

- Tax relief (non-motive diesel fuel gets a \$0.06/litre tax break) @300 M litres/year = \$18 M/year.¹⁵
- Business rates are set approximately 1/3 below full cost in the thermal (e.g. diesel) zone.

Benefits to NTPC:

- Publicly funded logistical support (i.e. Petroleum Products Division).
- The requirement for a regulated return on invested (ROI) capital has been removed for capital assets in the thermal zone.
- 2012-15 GNWT paid a direct subsidy to NTPC of \$35 M to offset a revenue shortfall caused by an unpredicted spike in diesel fuel price.
- 2014-16 GNWT paid a direct subsidy of \$50 M to NTPC to offset unpredicted fuel costs caused by low water in the Snare - Bluefish hydro systems.

Benefits to the Customers:

- Thermal zone customers pay no share of NTPC Headquarters costs.
- Residential rates in thermal zone are subsidized by public to Yellowknife retail rates for first 700 kWh in summer, 1000 kWh in winter. (e.g. >95% of residential sales in thermal zone are subsidized >50%).

The concept of **"affordability" is the product of policy choice and not the driver.** Diesel electricity is made "affordable" by subsidies. Without the current subsidy package, the price of residential diesel electricity could easily triple in the thermal communities and increase significantly at the mines. Adding additional cost by pricing carbon will make diesel electricity even less affordable. However, if carbon pricing and removal of fossil energy subsidies are successful, diesel electricity will no longer be an option. In the post - Paris Accord world, arguments about the relative affordability of high carbon energy are moot.

Mega-Projects will not Reduce Greenhouse Gas Emissions in the Desired Timelines

In the last forty years, investment in the NWT has focused on large-scale energy projects. Hundreds of millions have been spent on the proposed Mackenzie Gas Project; the NWT Hydro Strategy; the Deze

¹⁴ <https://www.theguardian.com/environment/2016/may/27/g7-nations-pledge-to-end-fossil-fuel-subsidies-by-2025>

¹⁵ <http://www.fin.gov.nt.ca/document/taxation-policy-and-rates-fuel-usage.pdf>

Energy project; and the promotion of a hydro development on the Bear River, none of which have been realized.

While hydro development can be considered renewable depending on the scale of the initiative, there is current interest in accessing Federal dollars to expand the Taltson hydro generation output and interconnect it with new transmission capability to Saskatchewan. This could also allow for other generation capability. The profits from the sale of Taltson (or new generation) power to southern customers would fund renewable energy projects in the NWT. However, while considering the feasibility of this mega-project, the following is worth noting:

- As Table 1 illustrates, major hydro projects in similar terrain in Canada are costing upwards from \$11/watt to construct. At that rate, the Taltson expansion to 200MW would cost upwards of \$2.2 B (more than the entire Federal \$2 billion Low Carbon Economy Trust created to fund projects across Canada that reduce greenhouse gas emissions).¹⁶
- Transmission lines in remote Canadian Shield terrain are estimated to cost \$1.0 million/km.¹⁷ Transmission from the half dozen or more generation dams to an interconnect point could easily cost another \$0.5 B.
- Paying for a project of that magnitude would add more than \$60,000 to the territorial debt load of every resident of the NWT. There would be little if any benefits generated along any timeline that would be important to meeting terms of the Paris Accord.
- The result would be a system exposed to the same climate change risks of drought and wildfire that are currently ravaging the Snare system.
- The reservoirs created to feed hydro dams may well become significant sources of new greenhouse gas emissions.¹⁸
- This huge capital outlay would do nothing to relieve the dependency on diesel - or reduce greenhouse gas emissions - in the thermal communities and the mines for the next decade or longer.
- The GNWT has no headroom in its debt limit so it cannot self-finance any part of these costs.

Table 1: Comparison of Affordability of Large Scale Hydro

Current Large Hydro Projects in Canada	Province	Capacity MW	Cost estimate	\$/watt installed	Reference
Muskrat Falls	NL	824	\$11.4B	\$13.8	http://www.theglobeandmail.com/report-on-business/rob-commentary/muskrat-falls-has-become-a-114-billion-boondoggle/article31165739/
Keeask	MB	695	\$6.5B	\$9.8	https://www.hydro.mb.ca/projects/keeyask/
Tazi Twe	Sask	50	\$630M	\$12.6	http://tthp.ca/
Site C	BC	1100	\$8.8B	\$8.0	https://www.sitecproject.com/
				\$11.1	

¹⁶ <http://www.climatechange.gc.ca/default.asp?lang=En&n=72F16A84-1>

¹⁷ NT Energy Directors Report Sept.16, 2014. p.3

¹⁸ <http://www.sciencemag.org/news/2016/09/hundreds-new-dams-could-mean-trouble-our-climate>

We Need to Move in the Right Direction

Consider how different the cost-benefit analysis would be if even a fraction of the subsidies currently applied to fossil energy were redirected to carbon neutral energy. Consider further what a difference it would make if energy development policies focused on distributed carbon neutral projects rather than costly mega-projects that do not clearly and immediately reduce carbon emissions.

GNWT energy policy decisions were heading in the right direction:

- Moving aggressively on conservation, improving building standards, moving to energy efficient appliances and lighting and setting up rebate and incentive programs to assist and encourage Northerners to move off fossil fuels and improve energy efficiency.
- Initiating a program to switch all the streetlights to LED lights.
- Developing progressive strategies for biomass¹⁹, solar²⁰ and reducing greenhouse gases²¹, and starting to demonstrate them.
 - A 105 kW array of solar PV was installed in Fort Simpson.²²
 - A solar-battery-diesel hybrid micro-grid was installed in Colville Lake.²³
 - A 35 kW solar array was installed in Lutsel K'e.²⁴ Wind studies were begun in Inuvik and Tuktoyaktuk.
- Studying small hydro potential at Lutsel K'e and Deline.
- Assessing grid interconnection of the Snare and Taltson system.
- Issuing a call for expression of interest in developing 10 MW of solar and/or wind for Yellowknife.
- Conducting two energy charrettes in Yellowknife.²⁵

As the same time, the mining industry installed a 9.2 MW wind farm development at Diavik.^{26 27}

Meanwhile, renewable solar and wind technologies have entered the North American mainstream.²⁸ The Northwest Territories Power Corporation (NTPC) expressed a clear, future-oriented and powerful vision:

¹⁹ http://www.grrb.nt.ca/pdf/forestry/NWT_Biomass_Energy_Strategy.pdf

²⁰ http://www.pws.gov.nt.ca/pdf/ParkingLot/Solar_Energy_Strategy_2012-2017_0.pdf

²¹ http://www.enr.gov.nt.ca/sites/default/files/strategies/ghg_strategy_2011-2015.pdf

²² <https://www.ntpc.com/smart-energy/how-to-save-energy/fort-simpson-solar-energy-project>

²³ <http://www.cbc.ca/news/canada/north/colville-lake-solar-power-1.3604310>

²⁴ http://www.bullfrogpower.com/wp-content/uploads/2015/09/Lutsel_Ke-Solar.pdf

²⁵ http://www.pws.gov.nt.ca/pdf/Energy/Charrette_report_fnl_web.pdf

²⁶ <http://www.pws.gov.nt.ca/pdf/EnergyCharrettePresentations/Diavik%20Wind%20Farm%20Project%20-%20Liez%20van%20Wyk.pdf>

²⁷ http://www.enr.gov.nt.ca/sites/default/files/final_4-nwt_greenhouse_gas_summary_report_2015.pdf

²⁸ <http://www.greentechmedia.com/articles/read/the-us-has-10-gw-of-utility-scale-pv-projects-under-construction>

http://www.progressalberta.ca/alberta_solar_boom

Excerpt from NWT Power System Plan Toom 2016.

NTPC envisions a sustainable energy future based on clean and renewable energy sources. The past practice of using diesel and other fossil-fueled prime generation will no longer be acceptable in a climate-changed world, particularly given the Paris 2050 carbon balance commitments, carbon pricing and the increasing accessibility or economical sustainable alternatives. New technologies are emerging and the cost of renewable energy is decreasing. Solar demonstration projects have provided valuable learning experience. Going forward, the opportunity to build a sustainable energy future for the NWT has arrived. Alternative energy prices have decreased, and technology has matured and become more robust and dependable. These generation options have been slow to emerge in the north for a number of reasons, yet the people of the north, community leaders, GNWT, the federal government and NTPC all have a desire to see this happen. New technology and renewable energy options can be integrated using a Hybrid Power Plant style of micro grid that includes storage. Page iii.

However, how and when the vision noted above will be implemented is still unclear. At the same time, a number of missed opportunities have been identified:

- Commit to decarbonizing energy in the thermal communities;
- Convene a meeting with NWT mines to plan how to reduce their reliance on diesel fuels;
- Build on successful demonstration projects and increasingly obvious external trends, and create a program to decarbonize the NWT electricity sector;
- Reinstate the call for Expression of Interest in developing a large wind and or solar project in Yellowknife;
- Reinstate the planned Battery Energy Storage System (BESS) designed to improve the reliability and efficiency of the Yellowknife grid; and,
- Commit to support for renewable solar and wind projects in hydro communities.

It is not a future-oriented strategy to maintain the “status quo” which has been identified as unsustainable. Efforts to decarbonize should be maintained.^{29 30} Status quo efforts, especially those that are mega-project related, will not result in a reduction of carbon emissions. Billions could be spent, without direct reductions. These large projects may create regulatory approval processes that alienate Indigenous peoples through impacting their rights, lands and waters. As a result, this is unlikely to be supported by federal funding.

A BETTER APPROACH: PLAN B

Making Renewable Energy Work

Carbon Neutral Electricity Opportunities in the NWT

Canada has targeted the electricity sector to be the first sector to decarbonize. “The basic recipe goes like this: cut energy waste as much as possible, and clean up your electricity supply so that it's as low carbon as possible. Then use that clean electricity as your source of energy for activities that we largely power with fossil fuels today”.³¹

By setting a price on carbon, the Federal Government will be creating a revenue stream for investment by provinces and territories as the revenue is returned to its original jurisdiction. This revenue could be

²⁹ <http://www.pws.gov.nt.ca/pdf/Energy/North%20Slave%20Resiliency%20Study%20Final%20Report.pdf>

³⁰ <http://www.cbc.ca/news/canada/north/diesel-wind-solar-backup-nwt-1.3628433>

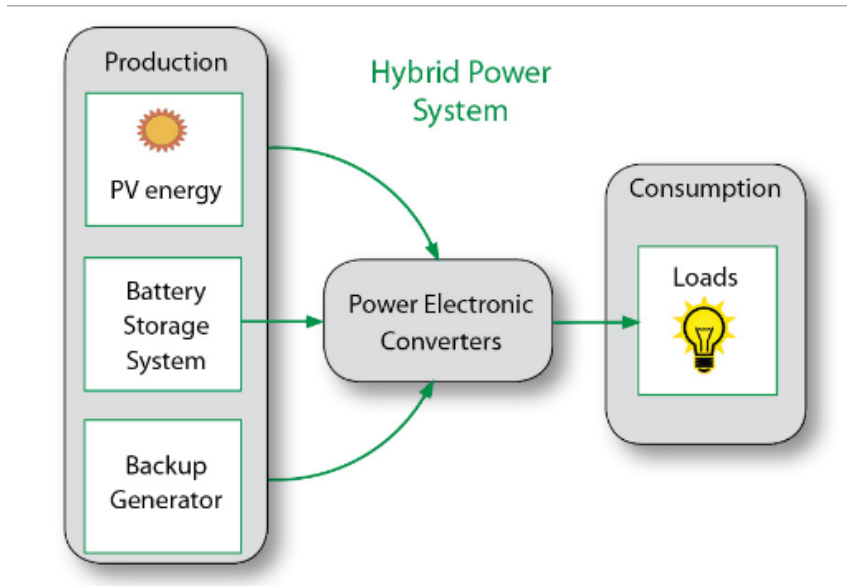
³¹ <http://cleanenergycanada.org/electrification-matters-now/>

used for renewables investments that are cost-shared with the provinces and territories.³² If the “status quo” is not an option, and mega-projects are unrealistic, then the NWT needs aggressive targets to decarbonize the electrical sector and to create a program of distributed carbon neutral energy opportunities.

The vision of reducing diesel use for electricity in NWT by 50% (e.g. reduction by 50% of 430 Kt = 215 Kt) has been identified by the NTPC.³³ Proven technologies are available for investment and they have been demonstrated as successful in NWT systems.

For example, Figure 2 below illustrates a simple solar-diesel-battery hybrid micro-grid.³⁴ Solar and diesel generators charge a battery bank that supplies power to the loads. This is the new paradigm for high penetration renewable electricity generation in remote off-grid locations, worldwide. This model has been demonstrated at Colville Lake and can be applied in all of the remote communities and mines³⁵ in the NWT that are currently relying on diesel generation. Well-designed hybrid grids using variable speed generators can achieve renewable energy penetration up to 90% of energy.³⁶

Figure 2: Solar-Diesel-Battery Hybrid Micro-Grid



As these hybrid micro-grid systems enter mainstream deployment they are becoming more modular, efficient and cost effective.³⁷

Increasing Energy Security in NWT Communities

Eliminating dependency on diesel in remote communities, replacing it with locally-produced and stored energy, increases that community's energy security. Increased local control and production can also

³² <http://www.climatechange.gc.ca/default.asp?lang=En&n=72F16A84-1>

³³ NTPC 2017 Corporate Plan.

³⁴ http://www.solarindustrymag.com/online/issues/SI1310/FEAT_03_Multiport-Converters-Enable-Grid-Integration-Of-Hybrid-Solar-Power.html

³⁵ http://www.huffingtonpost.ca/joseph-kirschke-/the-global-mining-industry-renewables_b_11459560.html

³⁶ <http://www.innovus-power.com/>

³⁷ <http://www.mining.com/web/a-new-cost-efficient-compact-hybrid-system-for-solar-diesel-microgrids-targets-the-mining-industry/>

decrease costs (as set out below) and protect a community from the vagaries of volatile markets. Recent reports from Alaska and Nunavut show that a strong business case can be made for displacing diesel generation with solar energy in hybrid micro-grid systems^{38 39}. Notably, these reports predict cost savings from renewable energy even without a price on carbon and in areas that have much less solar potential than the NWT. Even if cost savings were not attainable (which is highly unlikely), the increase in energy security that could be realized through local systems (as described in this paper) is a critical climate adaptation strategy.

Net Metering

The cost of electricity is so high that some people and businesses are abandoning their community grid and supplying their own electricity. Many independent "studies consistently show having solar on the grid is a net benefit to everyone"⁴⁰. Yet, an effective "net metering" program that would assist customers to self-generate their own renewable energy does not yet exist.⁴¹ The following challenges continue:

- There is no need to insist on a maximum size limit (currently set at an arbitrary maximum 5 kW per application).
- There needs to be a clear long term commitment to the Power Purchase Agreement (currently there is no firm commitment to the length of the agreement with the utility) and self-generators need to be fully compensated for any surplus energy they contribute to the grid.
- The concept of "standby charges", where NTPC charges a net metering applicant an amount intended to address the costs of maintaining backup capacity needs to be removed from the application.⁴² It is a great disincentive to engaging in the net metering program.

In their 2012 Solar Strategy⁴³, the GNWT set a target of 20% of average generation in the thermal communities. This was a modest target that required only 2% of actual generation to come from solar PV. With less than a year left in the five-year strategy, the thermal communities have reached less than 10% of that target.⁴⁴

Quantifying Diesel Displacement Opportunities

In the following calculations, diesel generators at typical efficiency produce 3.5 kWh/liter of fuel and emit approximately 0.75 kg CO²/kWh.⁴⁵ Combustion of one liter of diesel fuel produces 2.66 kg of CO² emissions.⁴⁶ Total NWT greenhouse gas emissions average approximately 1500 Kt/year.⁴⁷

Mining Industry Opportunities

Mining industry estimates for a large underground diamond mine suggest annual generation of 170 GWh/year⁴⁸ emitting 127.5 Kt/year of greenhouse gas emissions. Two large underground mines (Ekati and Diavik) and one large surface mine (Gahcho Kue) could generate 425 GWh emitting 318 Kt/year of greenhouse gases (21% of NWT total).

³⁸ http://awsassets.wwf.ca/downloads/summary_and_prefeasibility_report.pdf

³⁹ <http://www.nrel.gov/docs/fy16osti/65834.pdf>

⁴⁰ http://www.renewableenergyworld.com/articles/2016/09/studied-to-death-solar-customers-don-t-harm-non-solar-ratepayers.html?cmpid=enl_REW_SolarEnergyNews_2016-10-01&jack.vancamp@gmail.com&eid=291172174&bid=1544165

⁴¹ <https://www.ntpc.com/customer-service/net-billing>

⁴² <http://www.ntpc.com/docs/default-source/default-document-library/ntpc-application-form-13-08-14.pdf?sfvrsn=2>

⁴³ http://www.pws.gov.nt.ca/pdf/ParkingLot/Solar_Energy_Strategy_2012-2017_0.pdf

⁴⁴ <http://www.ntpc.com/docs/default-source/default-document-library/net-metering-capacity-by-community-v1.pdf?sfvrsn=2>

⁴⁵ <http://www.ec.gc.ca/ges-ghg/default.asp?lang=En&n=ac2b7641-1>

⁴⁶ https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69554/pb13773-ghg-conversion-factors-2012.pdf

⁴⁷ <http://www.enr.gov.nt.ca/state-environment/63-trends-nwt-greenhouse-gas-emissions>

⁴⁸ <http://www.pws.gov.nt.ca/pdf/EnergyCharrettePresentations/Diavik%20Wind%20Farm%20Project%20-%20Liezl%20van%20Wyk.pdf>

In a normal year, the diamond mining industry emits approximately 500 Kt CO₂, which accounts for 34% of the NWT total.⁴⁹ Diesel electricity generation accounts for 75 - 85% of mine generated greenhouse gas emissions. The 9.2 MW wind farm installed at the Diavik Diamond Mine in 2012 generates 17 GWh/year and reduces diesel generation by 10%. It saves approximately 8.3 M litres/year and reduces carbon footprint by 12 Kt (6%). The project has already paid for itself in fuel cost savings. This was achieved without any storage.⁵⁰ Ekati Diamond Mine produces approximately the same amount of greenhouse emissions as Diavik but it has no installed renewable energy capacity. The Snap Lake closure and the Gahcho Kue opening will roughly offset their greenhouse emissions. Gahcho Kue represents another 25 MW (\$75 M) opportunity for wind generation.

Displacement of 50% of diamond mine diesel generation represents an opportunity to develop up to 200 MW of solar energy or 75 MW of wind energy or a combination of the two. At a cost between \$220 - \$580 M, diesel consumption could be reduced by 60 M litres/year and greenhouse gas emissions could be reduced by 159 Kt/year.

Utility Opportunities

Opportunities in Yellowknife Snare/Bluefish - Jackfish System

In a low water year, Yellowknife can require 20 M litres of diesel fuel to generate 70 GWh, emitting 53 Kt of CO₂, and adding approximately 3.5% to NWT total. Low water in the Snare-Bluefish hydro system can nearly double NTPC emissions from diesel generation. Yellowknife needs extra generation capacity and is a prime location for up to 30 MW of solar or 12 MW of wind or a combination of the two tying into the current hydro/diesel system, creating a sustainable, practical, and affordable hybrid system. At a cost between \$36 - \$95 M, diesel consumption could be reduced by 10 M litres/year and greenhouse gas emissions could be reduced by 26 Kt. Alternatively, imposing a low water charge for extra diesel, hoping for increased precipitation, and planning to spend potentially hundreds of millions of dollars on more dams and more diesel generators⁵¹ is not sustainable, either environmentally or financially.

Opportunities in the Large Thermal Communities

Inuvik

The second largest community in the NWT, Inuvik, is a 100% fossil fuel-powered community. It has excellent solar for eight months of the year and a world-class wind site. It is also a world-class location for burgeoning remote sensing industry, where affordable energy is critical. High Point, a site close to Inuvik, has been identified as the best site for a 9 MW wind farm. The wind is good and the location requires a minimal transmission line, greatly enhancing the affordability of the project. Inuvik is the premier renewable energy site in the NWT, where there will be the greatest impact in the reduction in diesel use, greenhouse gases and downward pressure on the cost of energy and living. To achieve a 50% reduction in fossil fuel use would require approximately 4 MW of wind or 11 MW of solar or some combination of the two. At a cost of between \$14 - \$34 M, diesel consumption could be reduced by 3.6 M litres/year and greenhouses gas emissions could be reduced by 9.5 Kt/year.

Fort Simpson

Fort Simpson has 100 kW of solar already installed. To reach the 50% reduction target, it would require an upgrade to 3 MW of solar or 1.4 MW of wind, plus storage to form a hybrid generation system modeled on the Colville lake demonstration. At a cost of \$3.7 - \$9.8 M, diesel consumption could be reduced by 1 M litres/year and greenhouse gas emissions could be reduced by 2.8 Kt/ year.

⁴⁹ http://www.ec.gc.ca/ges-ghg/donnees-data/index.cfm?do=facility_info&lang=en&ghg_id=G10101&year=2014

⁵⁰ <http://www.pws.gov.nt.ca/pdf/EnergyCharrettePresentations/Diavik%20Wind%20Farm%20Project%20-%20Liezl%20van%20Wyk.pdf>

⁵¹ <http://www.pws.gov.nt.ca/pdf/Energy/North%20Slave%20Resiliency%20Study%20Final%20Report.pdf>

Priority (Small) Thermal Communities

NTPC has identified diesel generators in the thermal communities that are old, inefficient and will require replacement in the coming years.⁵² Some of the thermal communities are in more urgent need of major maintenance or replacement and should be the first to be upgraded to hybrid generation systems. To reach 50% diesel reduction in these communities would require 2.5 MW wind or 6.5 MW of solar or some combination distributed among the priority communities. At a cost between \$7.5 - \$19.6 M, diesel consumption could be reduced by 2 M litres/year and greenhouse gas emissions could be reduced by 5.4 Kt/year.

Other Thermal Communities

In the rest of the thermal communities, at a cost of \$16 - \$42 M, diesel consumption can be reduced by 4.4 M litres/year and greenhouse gas emissions could be reduced 11.5 Kt/year.

Table 2 Solar and Wind Opportunities

Scale of Opportunities	50% of Current Diesel Generation GWh/year	Diesel fuel displaced Million Liters	Potential GHG reduction kT/year	Solar MW*	Cost of Solar \$M ***	Wind MW **	Cost of Wind \$M ***
Inuvik	12.6	3.6	9.5	11.5	\$34.4	4.8	\$14.4
Fort Simpson	3.6	1.0	2.7	3.3	\$9.8	1.2	\$3.7
Yellowknife Low Water	35	10.0	26.3	31.8	\$95.5	12.1	\$36.3
Priority Small Thermal Utilities	7.2	2.1	5.4	6.5	\$19.6	2.5	\$7.5
Other Small Thermal Utilities	15.3	4.4	11.5	13.9	\$41.7	5.3	\$15.9
Diamond Mines	212	60.6	159.0	192.7	\$578.2	73.3	\$220.0
total	285.7	81.6	214.3	259.7	\$779.2	99.3	\$297.8
* @ 12.5% capacity							
** @ 30% capacity							
*** @ \$3/watt							

Conclusion

A reduction of 214.3 Kt/year achieves the target of 50% reduction of electricity sector emissions in NWT, and costs less than other options under consideration. The “status quo” diesel fuelled electricity systems of the NWT are not sustainable. High cost, high risk, hydro-electric mega-projects are an unrealistic distraction in that they could cost at least three to ten times more than the solar and wind options discussed in this paper, but would still result in no reductions to carbon emissions in any meaningful timeline (if at all).

However, practical hybrid micro-grid opportunities can be found wherever electricity is now generated with diesel. Every GWh of diesel-fuelled electricity that can be displaced with carbon neutral

⁵² Toom, Paul. NTPC Power System Plan 2016. 281p.

alternatives eliminates 0.75 Kt/year of greenhouse gas emissions. As subsidies are redirected and the cost of carbon increases incrementally, the business case for diesel is weakened and the business case for renewables is strengthened.

Now is the time to aggressively transition to state of the art hybrid systems. There are opportunities to displace 50% of all diesel electricity generation in the NWT by developing up to 260 MW of solar or 100 MW of wind or a combination of the two. The scale of investment required is in the range of \$300 to \$780 M. This level of investment could reduce diesel fuel consumption by more than 80 M litres/year and reduce NWT greenhouse gas emissions by nearly 15%.

A STRATEGY FOR FUNDING CRITICAL RENEWABLE ENERGY INFRASTRUCTURE

The Federal government is firmly committed to implementing their election promises on protecting the environment, fighting global warming and climate change and has put a price on carbon. The GNWT is doing its part but has to do more with both the diamond industry and the thermal communities.

In the NWT, as the transition from diesel to renewable energy sources continues, there are a number of actions that can be undertaken to assist and help fund the transition even in a time of fiscal restraint. This requires the Federal government, GNWT, industry and municipal and Indigenous communities to work collaboratively to address Northern needs.

- The Federal government should commit to establish a \$500 M/year northern-remote hybrid micro-grid fund, to assist Northern communities to transition to this new technology over a five-year period. The fund could be topped up to \$700 M by the territories to achieve a 70%/30% federal/territorial cost-sharing. Through an agreed formula, each territory would be eligible for a certain amount of the Federal fund. It should be a Northern fund targeted at the NWT, Yukon, Nunavut and Nunavik. In the NWT, a share of this fund would allow the acceleration of the move to hybrid micro-grid technology, starting with Inuvik, followed by the other six priority thermal communities identified in this paper. This would also allow the planning work to be done on the other 13 thermal communities. The initial goal should be 50% displacement of diesel use for electricity, within five years.
- An industrial incentive program for large Northern emitters should be created to encourage the acceleration to hybrid micro-grid technology. The initial goal is 50% displacement of diesel use for electricity within 5 years. Achievements in emission reductions should be credited against their carbon payments. For example, if a diamond mine spent 2 M building a local renewable energy grid that displaced diesel use by 10%, an equivalent offset (e.g. depreciation, credit) should be granted.
- A working committee, comprised of representatives from the GNWT, the Federal government, Indigenous governments, industry and the NWT Association of Municipalities, should be created to advise within six months, on 1) the most efficient, effective and economical way to move forward on priority northern/remote hybrid micro-grids (e.g. Inuvik) and other strategies that increase remote community energy security and resilience, and 2) current subsidies for diesel, both federal and territorial that should be staged for elimination (as committed to by Canada) and transfer to support renewable energy sources that can demonstrate reduction of greenhouse gas emissions.
- GNWT should conclude negotiations with the Federal government on the definition of “borrowing” to have their self-financing debt accounted for separately from their operational borrowing limit. This will give the GNWT borrowing room to cost share renewable energy projects with the Federal

Government, as part of dealing with an NWT appropriate response to the national price on carbon initiative.

- GNWT should revamp NTPC's capital planning process to bring it in line with the GNWT process, making it more transparent and removing disincentives to renewables e.g. charging HQ operational costs to wind and solar capital projects.
- GNWT should remove the current restrictions and limits on the net metering policy to encourage the private installation of solar-wind across the NWT. This will greatly lessen the burden on NTPC of lack of capital dollars for renewable projects.
- GNWT should have NTPC actively pursue Power Purchase Agreements with the private sector to have hybrid micro-grid systems built in the diesel communities. For example, the Lutsel K'e model can be improved upon by fairer displaced cost of diesel that recognizes the significant subsidies for diesel artificially mask the true cost of diesel.

Who We Are



Michael is the principal of North Raven. His interests are water protection and governance, working collaboratively on environmental protection, renewable energy development, building efficient government, expediting land claims, and strategic planning. He works with Aboriginal and Crown governments, ENGO's, industry and the private sector providing strategic political advice. Prior to his current work, he spent 20 years as MLA in the NWT Legislature, 14 of those years as Minister of the Environment and Natural Resources, Minister of Finance, Minister of Health and Social Services and the Minister Responsible for the Northwest Territories Power Corporation. He is Metis and lives in Fort Smith, NWT.



Merrell-Ann Phare is a lawyer, writer and the founding Executive Director of the Centre for Indigenous Environmental Resources (CIER), a national First Nation charitable environmental organisation. She is the author of the book '*Denying the Source: the Crisis of First Nations Water Rights*' and '*Ethical Water*'. As Chief Negotiator for the Government of the Northwest Territories, Merrell-Ann lead the negotiation of transboundary water agreements in the Mackenzie River Basin and the creation of Thaidene Nene, a national and territorial park in the east arm of Great Slave Lake. She is legal counsel and advisor to a number of First Nation and other governments and organisations and regularly speaks on water issues and First Nations.



Jack VanCamp is an Environmental Scientist and Planner. His 45 year career began in 1972 as a research technician at Washington University St Louis, Center for the Biology of Natural Systems. His graduate studies at University Calgary included wildlife planning for Fish Creek Provincial Park, Bison research with Canadian Wildlife Service in Elk Island National Park and field work as a consultant on the CAGSL project during the Berger hearings. His career has included jobs with; Alberta (Kananaskis Country planning); GNWT (Wildlife Biologist - Hook Lake Bison / Wolf Project); Aurora College (Instructor and Program Coordinator - Renewable Resources and Natural Resources Technology Programs); and Canada (Executive Director- Mackenzie River Basin Board). He has also worked for an NGO (Nature Conservancy - NWT Protected Areas Strategy) and as a private consultant on mining projects and government policy development. He has a business interest in renewable energy (Stand Alone Energy Systems Ltd.). His public service includes appointments to the Mackenzie Valley Land and Water Board and recently the Board of Directors of the NWT Power Corporation. He understands that environmental problems are best solved by the people most affected. His career has focused on capacity building and the transfer of information and ideas to local and indigenous communities. He has four adult sons and lives in Fort Smith, NWT.

NWT Commercial Solar Case Study

Why we should allow 50 KW Grid Tied Renewable Energy Systems



Current Regulations

One of the biggest challenges facing businesses operating in the Northwest Territories is the high cost of electricity and until recently there were no meaningful ways to mitigate this challenge. However, the diminishing cost of alternative power sources, particularly solar with its low cost and modular applications, has exploded globally with consumers, businesses, and governments saving billions of dollars per year.

The Government of the Northwest Territories (GNWT) took a step in the right direction by launching the NWT Solar Energy Strategy which set a goal of reaching 20% solar grid penetration in thermal communities, with future plans of expanding this target up to 75%ⁱ. To support these targets, the GNWT introduced a net metering program to the territory which entered its first phase in January of 2014.

Net Metering allows consumers and businesses to install small renewable energy generation systems to accumulate credits on their monthly electricity bills during months when they produce more energy than they consume. These customers are able to use these credits during months when they consume more energy than they produce in order to minimize their electricity bills.

While the program has been successful in promoting the adoption of renewable energy on a small scale, system sizes are currently capped at 5KW. While this allows many residential users to offset roughly 50% of their current electrical needs, businesses, who traditionally consume much greater amounts of electricity than homeowners, benefit very little.

In order to give the NWT business community an opportunity to meaningfully participate in Net Metering, we propose that the Public Utility Board considers increasing the allowable system size to 50KW. This maximum is proposed based on the success of a similar program launched in the Yukon in 2014 which allows businesses to install renewable energy systems on a scale that will have a substantial impact on reducing their energy cost/consumption.

Yukon vs. NWT

The Yukon and Northwest Territories are perhaps the two territories with the most in common when comparing different electrical jurisdictions across Canada. As such, it only makes sense that we adopt the best practices from each other to provide best possible and affordable services for residential and commercial energy consumers.

The following table demonstrates the similarities between the two territories, including statistics from there two largest population centers: Whitehorse and Yellowknife.

	Yukon (Whitehorse)	Northwest Territories (Yellowknife)
Population:	37,642 (2016) ⁱⁱ	44,340(2016) ⁱⁱⁱ
Population (Major Community):	28,872 (2015) ^{iv}	20,300 (2013) ^v
Grid Types:	Majorly Hydro with Isolated Thermal (Diesel) Grids	Majorly Hydro with Isolated Thermal (Diesel) Grids
Average Annual Base Load:	~40MW (Yukon)	~20MW (Yellowknife)
Hydro Grid Capacity:	~92MW (Yukon) ^{vi}	~34MW (Yellowknife) ^{vii}
Peak Demand:	~78MW (Yukon)	~32.3MW (Yellowknife)
Generating Capacity	40MW Hydro (Whitehorse) 37MW Hydro (Aishihik) 15MW Hydro (Mayo) 8.8MW (LNG) .65MW Wind (Haeckel Hill)	33.9MW Hydro (Snare/Bluefish facilities) 30MW Diesel (Jackfish/Behchoko Facilities)
Net Metering:	Yes	Yes
System Size Limits:	Up to 50KW	5KW

Case Study

To illustrate the level of impact an expanded Net Metering program would have we have created a case study using 2016 Northern Canada Solar Installation figures and electricity costs from the NWT's most "affordable" jurisdiction: Yellowknife.

The following case study is representative of a small to mid-sized commercial operation located in Yellowknife and has been verified from utility bills collected from Northland Utility customers. In this example, our business uses 100,000 KWhs annually at a cost of roughly \$32,000 per annum. It is worth noting that the following results would be even more dramatic if this were set in a thermal community where electricity rates can be dramatically higher.

5KW – Current Max. System Size

As a reference point we have first modeled a 5KW solar system (the current maximum size) using the near ideal conditions of 12/12 roof pitch facing due south with no shading issues. Such a system would produce the following metrics:

System Size	5 KW
Total Cost	\$22,000 including GST
Cost per Watt	\$4.40
Current Power Used Annually	~100,000KWh
Annual Power Produced	6,388 KWh
Value of Power	\$1,572
Inflation	3%
Simple Payback	14.0 Years
Equity Payback	11.6 Years
Pre-tax IRR	9.5%

See Appendix A for power production analysis modeled using Retscreen.

As you can see, even under ideal conditions the maximum system size provides a proverbial “drop in the bucket” with a 6% reduction in annual energy consumption. By contrast if the same business was permitted to install a 50KW system, it would yield enough energy savings to make a significant difference to the business’s bottom line and ability to compete with competitors from lower cost jurisdictions.

50KW – Proposed Expansion

For a 50KW system we have modelled two different scenarios, one conservative and one using ideal “conditions,” to accurately depict the range of potential impacts an expanded program may have on a commercial operations.

The first conservative scenario represent a less-than-ideal building which has a shallow roof pitch roof pitch of 1/12 (4.5 degrees) facing 60 degrees off of due south. On the opposite end of the spectrum we modelled a building that has near ideal conditions of being oriented due south with a roof at a much steeper pitch 12/12 (45 degrees).

	Conservative	Ideal
System Size	50 KW	50 KW
Total Cost	\$125,000	\$125,000
Cost per Watt	\$2.50	\$2.50
Current Power Used Annually	~100,000KWh	~100,000KWh
Annual Power Produced	47,187 KWh	63,879 KWh
Value of Power	\$11,892	\$15,719
Inflation	3%	3%
Simple Payback	10.5 Years	8 Years
Equity Payback	9.0 Years	7 Years
Pre-tax IRR	12.3%	15.7%

See Appendix B & C for power production analysis modeled using Retscreen.

As you can see, our same medium sized enterprise would be able to offset between 47%-63% of their energy usage with a moderate investment, yielding a high and stable return with extremely low volatility.

Tax Benefits

With payback periods approaching the 7 year mark on an energy system that will last 35+ years there is already significant incentive for NWT businesses to consider adding solar to their operations. However, there are also significant Capital Cost Allowances which further improves the economics and viability for businesses owners. The rule is as follows:

“Under Classes 43.1 and 43.2 in Schedule II of the Income Tax Regulations, certain capital costs of systems that produce energy by using renewable energy sources are eligible for accelerated capital cost allowance. For renewable energy systems (including solar) acquired after February 22, 2005 and before year 2020 they may be written-off at 50 percent per year on a declining balance basis under Class 43.2.^{viii}”

Building on our 50KW case study from above our medium size business would be eligible for the following write offs:

Year	UCC (\$)	CCA (\$)
1	125,000	31,250*
2	93,750	46,875
3	46,875	23,437
4	23,437	11,718
5	11,718	5,859
Etc.		

Under the half-year rule only one-half of the CCA is allowed in year 1.

When combining the tax write offs and energy cost savings most businesses will recoup their initial Capital Expenditure by the end of Year 3 furthering the case for adding Solar to their operations.

Benefits to the community

While businesses certainly stand to benefit from an increased Net Metering program this would also yield numerous benefits to the Northwest Territories as a whole including:

- Help attract future investment by branding the NWT as a forward looking jurisdiction that is willing to implement new technology to continuously improve the costs of operating in northern Canada
- Increase (well-paying) jobs and investment in a burgeoning northern solar industry.
- Lower operating costs mean lower cost of goods to consumers (much needed relief for the NWT, which is one of the most expensive places to live in Canada).
- Lower operating costs frees up cash for investment in growth.
- Demonstrate to the rest of Canada that the NWT is committed to reduced GHG emissions in a meaningful way without having to pay a Carbon Tax

- Lower tax burdens (recently the GNWT had to commit up to \$29.7M^{ix} to cover the cost of running back up diesel generators).
- Lower GHG emissions, helping residents, businesses, and GNWT to get ahead of the potential for future carbon taxes.

Benefits to the Grid

Increasing solar capacity in the territory will also yield a number of benefits to the existing transmission structure, including:

- Bridge the gap in capacity between Hydro capacity and diesel generators in “Hydro Communities”.
- Allow for reduced Hydro usage during the summer and fall months and allow reservoirs to be kept at a higher level, reducing diesel use during the winter and spring months.
- Incentivise businesses in thermal generation communities to install solar capacity, allowing thermal communities to reach the initial Solar Energy Strategy target of 20% with less direct investment from governments.
- Provide long term, reliable and consistent energy generation with minimal operating costs.
- Increase grid capacity without further straining government budgets.
- Localized generation will limit the usage rate of major grid infrastructure.
- Lay a foundation for behind the meter storage to be added as energy storage technology prices drop further.

In Closing

While increasing the renewable energy system size to 50KW under the Net Metering program is not a “Silver Bullet” to the high cost of electricity, it can provide significant benefits to the business community and the Territory as a whole. For businesses, they would be able to significantly improve their bottom line, set a buffer against future increases in energy costs, and make the Northwest Territories a more competitive place in which to do business.

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Appendix A

RETScreen Energy Model - Power project

Show alternative units

Proposed case power system
Incremental initial costs

Analysis type: Method 1, Method 2

Resource assessment

Solar tracking mode	Fixed
Slope	45.0
Azimuth	0.0

Show data

Month	Daily solar radiation - horizontal kWh/m ² /d	Daily solar radiation - tilted kWh/m ² /d	Electricity export rate \$/MWh	Electricity exported to grid MWh
January	0.31	1.87	220.0	0.277
February	1.16	3.58	220.0	0.467
March	3.04	6.23	220.0	0.866
April	5.05	7.17	260.0	0.920
May	5.65	5.96	260.0	0.765
June	6.24	6.08	260.0	0.732
July	5.71	5.74	260.0	0.705
August	4.24	4.88	260.0	0.607
September	2.43	3.48	260.0	0.435
October	0.96	1.90	220.0	0.257
November	0.38	1.49	220.0	0.205
December	0.15	1.04	220.0	0.153
Ann	2.95	4.12	246.07	6.388

Annual solar radiation - horizontal: 1.08 MWh/m²
 Annual solar radiation - tilted: 1.50 MWh/m²

Photovoltaic

Type	mono-Si
Power capacity	5.00 kW
Manufacturer	
Model	
Efficiency	16.1%
Nominal operating cell temperature	45 °C
Temperature coefficient	0.40% / °C
Solar collector area	31 m ²
Miscellaneous losses	15.0%

Initial cost: \$ 22,000 [See product database](#)

Inverter

Efficiency	98.0%
Capacity	5.0 kW
Miscellaneous losses	

Summary

Capacity factor	14.6%
Electricity exported to grid	6.388 MWh

Emission Analysis

Country - region	Fuel type	GHG emission factor (excl. T&D) tCO ₂ /MWh	T&D losses %	GHG emission factor tCO ₂ /MWh
Canada - Territories	All types	0.047		0.047

Electricity exported to grid: 6 MWh, T&D losses: 0.047

GHG emission

Base case	tCO ₂	0.3
Proposed case	tCO ₂	0.0
Gross annual GHG emission reduction	tCO ₂	0.3
GHG credits transaction fee	%	
Net annual GHG emission reduction	tCO ₂	0.3

is equivalent to: 0.1 Cars & light trucks not used

GHG reduction income

GHG reduction credit rate	\$/tCO ₂	
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Financial Analysis

Financial parameters

Inflation rate	%	3.0%
Project life	yr	35
Debt ratio	%	

Initial costs

Power system	\$	22,000	100.0%
Other	\$	0.00	0.0%
Total initial costs	\$	22,000	100.0%

Incentives and grants: \$ 0.00%

Annual costs and debt payments

O&M (savings) costs	\$	
Fuel cost - proposed case	\$	0
Total annual costs	\$	0

Annual savings and income

Fuel cost - base case	\$	0
Electricity export income	\$	1,572
Total annual savings and income	\$	1,572

Financial viability

Pre-tax IRR - assets	%	9.5%
Simple payback	yr	14.0
Equity payback	yr	11.6

Cumulative cash flows graph

Appendix B

RETScreen Energy Model - Power project

Show alternative units

Proposed case power system
Incremental initial costs

Analysis type: Method 1 Method 2

Resource assessment

Solar tracking mode	Fixed
Slope	4.5
Azimuth	60.0

Show data

Month	Daily solar radiation - horizontal kWh/m ² /d	Daily solar radiation - tilted kWh/m ² /d	Electricity export rate \$/MWh	Electricity exported to grid MWh
January	0.31	0.40	220.0	0.612
February	1.16	1.30	220.0	1.763
March	3.04	3.26	220.0	4.690
April	5.05	5.20	260.0	6.840
May	5.65	5.71	260.0	7.446
June	6.24	6.27	260.0	7.636
July	5.71	5.75	260.0	7.158
August	4.24	4.32	260.0	5.472
September	2.43	2.51	260.0	3.216
October	0.96	1.02	220.0	1.418
November	0.38	0.44	220.0	0.630
December	0.15	0.20	220.0	0.305
Ann	2.95	3.04	252.02	47.187

Annual solar radiation - horizontal: 1.08 MWh/m²
Annual solar radiation - tilted: 1.11 MWh/m²

Photovoltaic

Type	mono-Si
Power capacity	50.00 kW
Manufacturer	
Model	
Efficiency	16.1%
Nominal operating cell temperature	45 °C
Temperature coefficient	0.40% / °C
Solar collector area	311 m ²
Miscellaneous losses	15.0%

Cost: \$ 125,000 [See product database](#)

Inverter

Efficiency	98.0%
Capacity	50.0 kW
Miscellaneous losses	

Summary

Capacity factor	10.8%
Electricity exported to grid	47.187 MWh

Emission Analysis

Country - region	Fuel type	GHG emission factor (excl. T&D) tCO ₂ /MWh	T&D losses %	GHG emission factor tCO ₂ /MWh
Canada - Territories	All types	0.047		0.047

Electricity exported to grid: 47 MWh, T&D losses: []

GHG emission

Base case	tCO ₂	2.2
Proposed case	tCO ₂	0.0
Gross annual GHG emission reduction	tCO ₂	2.2
GHG credits transaction fee	%	[]
Net annual GHG emission reduction	tCO ₂	2.2

is equivalent to 0.4 **Cars & light trucks not used**

GHG reduction income

GHG reduction credit rate	\$/tCO ₂	[]
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Financial Analysis

Financial parameters

Inflation rate	%	3.0%
Project life	yr	35
Debt ratio	%	[]

Initial costs

Power system	\$	125,000	100.0%
Other	\$	0	0.0%
Total initial costs	\$	125,000	100.0%

Incentives and grants

	\$	[]	0.0%
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Annual costs and debt payments

O&M (savings) costs	\$	[]
Fuel cost - proposed case	\$	0
Total annual costs	\$	0

Annual savings and income

Fuel cost - base case	\$	0
Electricity export income	\$	11,892
Total annual savings and income	\$	11,892

Financial viability

Pre-tax IRR - assets	%	12.3%
Simple payback	yr	10.5
Equity payback	yr	9.0

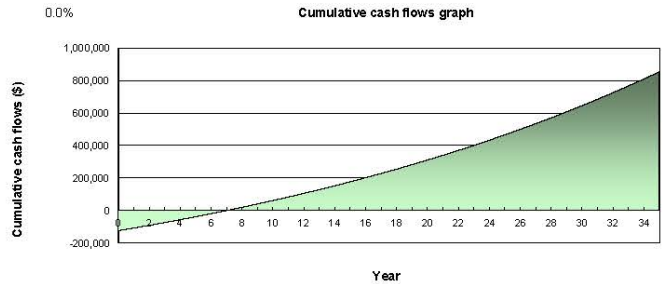
Cumulative cash flows graph

Appendix C

Proposed case power system		Incremental initial costs			
Analysis type		<input type="radio"/> Method 1 <input checked="" type="radio"/> Method 2			
Resource assessment					
Solar tracking mode	•	Fixed			
Slope	•	45.0			
Azimuth	•	0.0			
<input checked="" type="checkbox"/> Show data					
	Month	Daily solar radiation - horizontal - kWh/m²/d	Daily solar radiation - tilted - kWh/m²/d	Electricity export rate \$/MWh	Electricity exported to grid MWh
	January	0.31	1.87	220.0	2,765
	February	1.16	3.58	220.0	4,668
	March	3.04	6.23	220.0	8,662
	April	5.05	7.17	260.0	9,199
	May	5.65	5.96	260.0	7,649
	June	6.24	6.08	260.0	7,319
	July	5.71	5.74	260.0	7,045
	August	4.24	4.88	260.0	6,075
	September	2.43	3.48	260.0	4,953
	October	0.96	1.90	220.0	2,571
	November	0.38	1.49	220.0	2,046
	December	0.15	1.04	220.0	1,526
	Ann	2.95	4.12	246.07	63,879
Annual solar radiation - horizontal	MWh/m ²	1.08			
Annual solar radiation - tilted	MWh/m ²	1.50			
Photovoltaic					
Type		mono-Si			
Power capacity	kW	50.00		\$	125,000
Manufacturer					
Model					
Efficiency	%	16.1%			
Nominal operating cell temperature	°C	45			
Temperature coefficient	%/ °C	0.40%			
Solar collector area	m ²	311			
Miscellaneous losses	%	15.0%			
Inverter					
Efficiency	%	96.0%			
Capacity	kW	50.0			
Miscellaneous losses	%				
Summary					
Capacity factor	%	14.6%			
Electricity exported to grid	MWh	63,879			

Emission Analysis					
Base case electricity system (Baseline)					
Country - region	Fuel type	GHG emission factor (excl. T&D) tCO ₂ /MWh	T&D losses %	GHG emission factor tCO ₂ /MWh	
Canada - Territories	All types	0.047		0.047	
Electricity exported to grid	MWh	64	T&D losses		
GHG emission					
Base case	tCO ₂	3.0			
Proposed case	tCO ₂	0.0			
Gross annual GHG emission reduction	tCO ₂	3.0			
GHG credits transaction fee	%				
Net annual GHG emission reduction	tCO ₂	3.0	is equivalent to	0.6	Cars & light trucks not used
GHG reduction income					
GHG reduction credit rate	\$/tCO ₂				

Financial Analysis					
Financial parameters					
Inflation rate	%	3.0%			
Project life	yr	35			
Debt ratio	%				
Initial costs					
Power system	\$	125,000	100.0%		
Other	\$		0.0%		
Total initial costs	\$	125,000	100.0%		
Incentives and grants					
	\$		0.0%		
Annual costs and debt payments					
O&M (savings) costs	\$				
Fuel cost - proposed case	\$	0			
	\$				
Total annual costs	\$	0			
Annual savings and income					
Fuel cost - base case	\$	0			
Electricity export income	\$	15,719			
	\$				
Total annual savings and income	\$	15,719			
Financial viability					
Pre-tax IRR - assets	%	15.7%			
Simple payback	yr	8.0			
Equity payback	yr	7.0			



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- ⁱ http://www.pws.gov.nt.ca/pdf/ParkingLot/Solar_Energy_Strategy_2012-2017_0.pdf
- ⁱⁱ http://www.eco.gov.yk.ca/stats/pdf/populationMar_2016.pdf
- ⁱⁱⁱ <http://www.statsnwt.ca/population/population-estimates/>
- ^{iv} http://www.eco.gov.yk.ca/stats/pdf/populationMar_2016.pdf
- ^v <https://www.yellowknife.ca/en/doing-business/demographics-and-statistics.asp>
- ^{vi} <https://www.yukonenergy.ca/energy-in-yukon/our-projects-facilities/hydro-facilities/>
- ^{vii} <https://www.ntpc.com/smart-energy/how-we-supply-power/hydro>
- ^{viii} <http://www.nrcan.gc.ca/energy/efficiency/industry/financial-assistance/5147>
- ^{ix} <http://www.gov.nt.ca/newsroom/gnwt-contribution-ntpc-prevent-power-rate-increase>