# Rural Ontario Foresight Papers

## Energy Use and the Rural Homeowner & Northern Perspective

2019

RURAL ONTARIO INSTITUTE

# Energy Use and the Rural Homeowner

Don Eaton

## Introduction

If one can believe 97% of the world's scientists (and notice the weather), humanity will need to take stronger and stronger actions to address climate change. Governments are debating various measures such as carbon tax, fuel economy regulations, emission caps, building codes and so forth, but as the effects of climate change become more severe, the ability to make choices on these issues will become increasingly limited. Moving to a very low-carbon economy and lifestyle will no longer be a *choice* but an imperative.

Individuals and communities that have made the necessary changes will not only be in a better position to adapt to the inverse impacts from climate change, but will also be more economically resilient.

- The green energy sector is already a significant income and employment generator.
- Insulating your home or building saves money on heating and cooling, and can lower maintenance costs and enhance durability.
- Renewable energy systems that displace fossil fuel generated energy results in cleaner air.

As someone who has advocated for energy efficiency and green energy for several decades, I've always stressed the benefits of making these changes. Despite all these benefits, the reality remains that moving towards greater efficiency and less reliance on fossil fuels is not going to be cheap. It also means that communities will need to work together to address their own specific situations, using their own creativity.

When addressing the issue of energy use, rural Ontario communities are in the same boat as nearly everywhere else in Canada facing climate change and the need to move away from a fossil-fuel-based economy. At the same time, however, rural communities face unique challenges around energy availability, cost, generation and infrastructure.

It's difficult to discuss rural energy as if there were one type of rural Ontario community with one type of energy challenge. There are communities that have large agricultural areas surrounding small urban centres. There are communities that have large numbers of recreational properties that create a huge seasonal population change. There are communities that pivot around a single industry. There are communities with large areas of bush, and communities defined by their relationship to lakes or rivers. Finding common themes for energy in these communities is difficult. It's probably best to look at rural energy as a collection of energy profiles and needs with some unifying themes. Because of the variety of rural communities it's essential that strategies to combat high energy costs, reduce $CO_{2,}$ maintain biodiversity and preserve the character of the community

be locally developed. And while there are a lot of technologies available, the real issue is motivation and goals.

*It's difficult to discuss rural energy as if there were one type of rural Ontario community with one type of energy challenge.*

The one change that will benefit all of us is reducing the energy used in our homes and buildings. It's different than some of the larger changes that have been already made, such as closing the coal-fired generators or the introduction of electric cars, as it doesn't mean using cleaner energy, it means using less through energy conservation and energy efficiency.

## Current Energy Supply

Ontario's electrical energy supply (Independent Electricity System Operator, IESO – formerly Ontario Power Authority) is predominantly composed of non-polluting sources. In 2017, natural gas was down to 4% of Ontario's electrical generation mix, illustrating that electricity is primarily a non-emitting energy source in the province. However, 32 remote communities are not connected to the grid, 25 of which are recognized First Nation communities. These communities are generally diesel electric, which means high-GHG emissions, and 3 to 10 times the cost of grid electricity. Additionally, many of the remote communities primarily use wood for heating. Under the previous provincial government there was a wood change-out program for First Nations, but this has been cancelled. Replacing older woodstoves with modern EPA-approved high-efficiency stoves is still a good idea as a new stove will use less wood, emit less $CO_2$ and create less local air pollution.

Currently, our electrical system has a lot of capacity, but as we begin using electricity to replace fossil fuels in our cars, home heating and in industry we'll need to use that capacity as efficiently as possible.

## Rural Energy Generation

The Ontario government began the FIT/MicroFIT (Feed-In Tariff) program in 2009. Rural Ontario took advantage of this program in a significant way. Nearly 20% of Ontario farms have a FIT or MicroFIT contract for energy generation. These vary from rooftop solar to generation from the digestion of manure or other organic waste to micro hydro. The generation of electricity from the digestion of organic waste is especially important because it removes that waste from landfill. Landfills account for nearly 20% of our national methane emissions, which is caused by the breakdown of organic material. If that

**FIT Overview: What is the Feed-in Tariff Program?**

The Feed-In Tariff (FIT) Program was developed to encourage and promote greater use of renewable energy sources including on-shore wind, waterpower, renewable biomass, biogas, landfill gas and solar photovoltaic (PV) for electricity generating projects in Ontario.

As a standardized way to contract for renewable energy generation, Ontario's FIT Program was one of North America's first comprehensive guaranteed pricing structures for renewable electricity production, offering stable prices under long-term contracts.

material is removed from landfill, and the methane generated is burned to generate electricity, the emissions are $CO_2$. It's still a greenhouse gas, but not nearly as potent as methane, and it generates electricity.

With the success of the battery energy storage project in Australia and some pilot projects by the IESO, a new opportunity for rural energy is opening. The possibility of storing electrical energy both enhances the viability of non-continuous generation (non-dispatchable generation), and provides an opportunity for communities that are not on the grid or that experience intermittent power supply. While the IESO has been testing energy storage, the issue is complex. There are many ways of storing electrical energy such as flywheels, batteries, pumped hydroelectric and hydrogen, and choosing one that gives both short- and long-term storage effectively is still being weighed. There are also transmission hurdles to deal with. Despite these challenges, it seems likely that storage will provide some benefit to achieving a lower-emission electrical system. It's also likely that much of the storage will be in rural areas.

*Every community is unique, but this is both especially true and especially important in rural communities. Obviously a large city is not going to debate the virtues of 4-stroke versus 2-stroke snowmobiles or discuss woodlot management, biodiesel for farm equipment, seasonal population growth or many other issues that are unique to rural Ontario.*

## Community Energy Planning

Every community is unique, but this is both especially true and especially important in rural communities. Obviously a large city is not going to debate the virtues of 4-stroke versus 2-stroke snowmobiles or discuss woodlot management, biodiesel for farm equipment, seasonal population growth or many other issues that are unique to rural Ontario. While many rural communities have energy plans, in general, larger communities have been quicker in developing them. Some rural communities with common interests have banded together to create strategies that work for them. Most of these plans have goals for reducing greenhouse gas emissions and reducing energy use, while creating economic activity by taking advantage of the new "green" economy. Looking at plans that have been in effect for a while, communities are doing much better at reducing greenhouse gas emissions than at reducing energy use. Guelph, for example, has reduced its emissions by 35% over 10 years, but its energy use by only 2%. This is in large part because Ontario's electrical system has reduced its emissions, and many homeowners have switched from oil heat to natural gas. While this is a positive step, reducing energy use will require action by individual homeowners, businesses and municipalities.

A goal of many energy plans is to have retrofits of buildings and homes included. . Yet despite best intentions, this is a difficult goal to achieve. The difficulty is reflected in results like Guelph's, where they have been very successful with reducing $CO_2$ emissions but are behind on energy reduction.

Reducing emissions by fuel switching is not the complete answer. Rural areas that don't currently have access to natural gas will drop their $CO_2$ emissions when gas becomes available and homeowners switch from propane and oil, but that will only reduce energy use a small amount due to the availability of more efficient heating systems. Major building retrofits are required in order to see real benefits in the reduction of energy use. This will mean a market transformation, which will need to be preceded with significant public conversation. I think the most successful route to this will be local networking and rural ingenuity. The city of Kamloops in B.C. was an early "energy planner" and created an energy plan in 1997. Three years later they reported on their progress, and things had not gone as well as planned. They included a list of lessons that are useful for other planners. The first lesson was lack of personal engagement. They had failed to get the local population to be part of the plan. Because dealing with changes that we're facing in energy and climate are going to involve everyone, it's crucial that everyone is involved with the plan.

When the Elora Environment Centre began piloting the national EnerGuide for Houses program and delivering energy audits we naturally focused on rural areas. We were a community of 3000 with a strong connection to farming and some small manufacturing so those areas felt comfortable and familiar. We also knew that we had to go where the people were. The existing community networks, especially service organizations like the Lions, Rural Women's institute, Rotary and church groups were key to our success. It wasn't a case of inviting them to presentations; it was getting invited to present and engage with them. Naturally, talking to local councils and utilities was important, but the participation has to go beyond the institutional and reach the average citizen. The service organizations are already a group of people who know the importance of working for their community.

> *Conservation has always been a difficult sell. Even the word smacks of "doing without or with less."*

Additionally, many young people right now are galvanized around the issue of climate change. They realize that they will be the ones who will bear the consequences of inaction. Involving them in a community's energy planning and implementation may go a long way in increasing the engagement of the entire community.

## Adaptability and Ingenuity

Rural people in Canada have been extremely creative in dealing with energy needs both in the past and today. Traditionally, rural homeowners would bank snow, straw or even earth around their homes. This required some work, but it was effective. While doing energy audits of thousands of rural homes, Certified Energy Advisors (CEA) would often find homeowners with creative ways of dealing with energy costs. A homeowner with an older brick home would use studs and insulation batts to "wall off" large areas of their home. The dining room, living room, extra bedroom and half the basement would be walled off until late spring. They closed the heating ducts to those rooms,

and just supplied heat to the kitchen, bathroom and bedroom. The plumbing was in these areas so the pipes didn't freeze, and it significantly reduced their heating bill. Although housing size has doubled since the 1970's, family size has shrunk, so there is likely quite a bit of space that is not needed. I've seen houses where the homeowner had carefully saved Styrofoam plates and carefully filled the stud cavities in their basement walls with them. Perhaps not the most effective insulation system, but it did reduce their heat loss and made the basement much warmer. I'm not suggesting this as a climate change strategy, just as an example of how homeowners come up with clever ways to cut their energy costs.

Oftentimes, there's a spirit of doing it yourself or with a neighbor that exists in smaller communities. My CEAs found that many times, and I think this will be an important asset as we move to a more energy efficient future.

## Building Retrofits

Conservation has always been a difficult sell. Even the word smacks of "doing without or with less." Energy advisors always say "efficiency" to make the message more attractive. Improving a building envelope is often achieved by doing things that no one can see. Insulating, draft-proofing and properly ventilating will result in energy savings, improved comfort and a healthier home, but it has trouble competing for household budget with something that sits right out where everyone can see it like new countertops or a new dishwasher.

Canada really began to improve home energy efficiency after the oil crisis in 1973 and 1979. The cost of oil went up by 350% and 100% respectively. The federal government responded with the Canadian Home Improvement Program (CHIP). This program would rebate much of the costs of home insulation improvements. During the early 70's the building code required R-10 insulation in attics and R-8 in walls. These were raised in Ontario to R-12 and R-28. Lots of existing homes had their attic insulation increased (often from zero insulation) to R-28. The CHIP program was able to take advantage of two circumstances to achieve success. Oil and energy costs were in the news, and there was a sense of crisis. When this was combined with the federal government offering significant amounts of money it resulted in many homeowners taking advantage of the program, and lots of energy saved.

In terms of total and relative energy savings, older existing homes save more energy because they typically offer "low-hanging fruit" compared to new construction. For example, a 1970s house has more opportunities for reducing energy use than making improvements on a new house built to building code (because it's already energy efficient). https://www.nrcan.gc.ca/energy/efficiency/energy-efficiency-buildings/energy-efficiency-existing-buildings/retrofitting/20707

In 1997 the Canadian government signed the Kyoto Protocol to reduce $CO_2$ emissions and combat climate change. This brought new attempts to increase the energy efficiency of Ontario housing. The federal government developed an energy rating system for houses called EnerGuide for Houses. Homes would be

evaluated, tested and their energy use modelled with energy modelling software. An EnerGuide label would be attached to the heating system ranking the house from 0 to 100, and like school test scores, EGH80 (good) is an energy efficient home and a EGH40 (not good) is a very inefficient home. This was an attempt to raise people's energy efficiency literacy, better quantify household energy use and attach value to a home's energy efficiency.

The hope was that the marketplace would reward energy efficient homes and induce homeowners to upgrade as a way to increase the home's value. Some small success was had by programs like "R-2000", which was a new construction technique that featured what was cutting-edge energy efficiency, but rating systems on existing homes – while providing excellent advice to homeowners planning to upgrade their home – had limited impact on the housing market.

In 2003 the federal government began a "rewards" program to incent home energy retrofits. Homeowners would get their home assessed and rated by a Certified Energy Advisor (CEA). The CEA would provide a list of recommendations to improve energy efficiency. When the homeowner had completed some or all of the recommendations they would get a second assessment and be eligible for a grant towards part of the cost. The average grant was $1,200, but could be as high as $5,000 for measures such as Ground Source Heat Pumps. This program became very successful with many hundreds of thousands of homes upgraded. Insulators, window sales people, heating and cooling technicians, and CEAs were all promoting the program as a great opportunity. In the public's mind "what constituted a good house" was moving in a more energy efficient direction. Once at a meeting of SAWDAC (Siding and Windows Dealers Association) I asked "what was the main motivation for a customer buying new windows?", and the unanimous answer was "Their neighbour bought new windows." People's expectations for home comfort and efficiency were changing.

> *Even at the current building code requirements, a home built in 1920 likely uses three times the energy of a new home.*

At the same time the building code was changing as well. The R28 attic of 1980 had moved to R32 then R40. For a new home the code now requires R60 in the attic. The other components of a new house have changed as well – windows, mechanical equipment and all insulation areas must be much more effective than even a few years ago. The building code has traditionally considered two factors in determining insulation levels: winter temperatures and the cost of a home's fuel. This could mean that a home in North Bay would require higher insulation levels than one in Windsor. It might also mean that a home with electric resistance heat would require higher insulation than one with gas heat. The building code is a response to current conditions. Its goal has been a safe and affordable house to build and operate.

We've now reached a watershed in home energy efficiency. For years the insulation levels, mechanical systems and air tightness have been slowly moving towards greater efficiency. Now

we're at the point where the building code has something of a "final objective." This would be a "Net Zero" home. This is a home whose energy requirement is low enough so that a well exposed roof-top solar array would supply all the energy the home needs. Net Zero is already being talked about as the building code as early as 2030.

*If we wonder what the houses of 2030, or even 2050, will be like, we only need to look out the window. Most of them are already built. If we want to reduce our energy use, and make sure everyone has a comfortable and healthy house they can afford to heat and cool, it won't be by building better new homes*

While going to Net Zero is both necessary and commendable it's going to have the effect of moving existing homes farther away from the new energy efficiency standards. Even at the current building code requirements, a home built in 1920 likely uses three times the energy of a new home. Not only does this mean much higher $CO_2$ emission and higher costs, it also leaves the older home vulnerable to disruptions in the energy markets (i.e., price shocks). In 2008 when oil reached $160/barrel, homeowners on the South Shore of Labrador began switching from oil to electric heat. Electric heat was also expensive, but it was a regulated utility. With electric heat a homeowner wouldn't find that his fuel costs had suddenly doubled overnight; they would be able to budget for the winter with some level of confidence. Right now the price of natural gas is at very low levels. This might continue, but producers are actively working on international markets which will have a definite impact on what we pay in Ontario.

If we wonder what the houses of 2030, or even 2050, will be like, we only need to look out the window. Most of them are already built. If we want to reduce our energy use, and make sure everyone has a comfortable and healthy house they can afford to heat and cool, it won't be by building better new homes. We have a lot of home retrofits to do, and it's likely to cost a lot of money. The important thing to remember is that when installing insulation or new windows, that there is an expectation that they last for decades. It's necessary that they meet the requirements they'll need in 10 or 20 years, not just the day the installation is done.

**Existing Stock:** Rural housing is both older and has a higher incidence of needing major repairs than urban areas (census information). The need for structural and other repairs often precludes energy efficiency improvements or increases the cost of EE improvements.

## Programs that can Help

There are some programs available to help homeowners, tenants and apartment dwellers with retrofits and energy costs: they are mostly delivered through utilities. These provide rebates or funding directly to homeowners. Enbridge and Union Gas have merged, but are still working on merging their conservation programs.

### Union Gas Home Energy Reno Rebate

This requires an energy audit from a Registered Energy Advisor (REA) which comes at a cost, but the audit is not only useful for identifying where you are losing energy, but the cost is rebated by Union Gas if you complete at least two qualifying upgrades. The possible upgrades include: high efficiency heating system, wall-basement-attic insulation, air sealing, hot water tanks and windows. Up to $5,000 in rebates is possible. This is available to any Union Gas Customer.

### Union Gas Home Weatherization

This is income-dependent with the income requirements listed on the website. Your home must be built prior to 1975. It includes free insulation and air sealing. The income requirements don't require extreme poverty rather it is geared to a household that might have difficulty paying high energy bills.

### Enbridge Gas Home Energy Conservation

This program is similar to the Union Gas Reno Rebate, but for Enbridge Gas customers.

### Enbridge Home Winterproofing Program

This is an income-dependent program that provides free retrofits to qualifying homes. It is available for homes built prior to 1980. The income requirements don't require extreme poverty rather it is geared to a household that might have difficulty paying high energy bills.

### The Affordability Fund

This is an income-dependent program that also considers the size of the client's electrical bill when determining eligibility. It has three levels of support, with the first providing free LED light bulbs and power bars, the second includes appliances such as refrigerators, and the third level is only available for electrically heated homes and may include insulation and heating equipment.

### Property Assessed Clean Energy (PACE)

This is a program that is being adopted by some Ontario Municipalities. PACE has been used extensively in the United States, especially in California. The basic idea is that a municipality will seek investors and use that money to fund energy efficiency upgrades for homes and businesses. The cost of the upgrades will be added to the building's taxes over a long period of time. This would attach the loan to the building and not to the homeowner. It has the advantage of not requiring a large cash outlay by the homeowner, and not affecting their credit rating. Because the financing is through a municipality it is expected to be very secure, and consequently should have a very attractive interest rate. Some PACE programs require the homeowner's annual energy savings to be equal to or more than the increase in their property tax. This is much easier to accomplish in areas where natural gas is unavailable. Natural gas is currently very inexpensive so homeowners (and building owners) who heat with natural gas will have difficulty meeting this requirement. Fortunately, homeowners can take advantage of some of the retrofit programs offered by the fas utilities. This could help bring the cost down to where the savings will cover the amount that has been added to the tax bill. A PACE program can be especially helpful where a home needs significant upgrades that might involve opening the walls or removing the siding.

## Conclusions

The cost of reducing our energy use will be large, and will get more difficult as time passes. As we go forward the cost of climate change adaption may overwhelm our efforts to address energy use and greenhouse gas emissions. Flooding, fires, droughts and major weather events will place a heavy burden on Canadians. Overland flood insurance only became available in much of Canada in the last few years, because in most areas floods were rare. Unfortunately insurance is for unusual events such as a 100-year flood. If your home is going to have a 100-year flood on a regular basis, you won't be able to get or afford insurance. It's important that we start doing the work necessary to meet our energy and emission goals now, before that money is needed for adaptation. We don't want to be in a situation where we can't stop bailing long enough to fix the growing leaks in our boat.

Climate change, both reducing emissions and adaptation has to become the primary issue for communities. We need to start dealing with it in all aspects of our lives. The earth doesn't see governments or businesses; it sees humans. Of course we want government and business to take the right steps to deal with the problem, but ultimately it will be us, our families and our communities who do the necessary work.

# Northern Perspective: Energy Use and the Rural Homeowner

Amanjit Garcha

As Eaton emphasized, climate change is impacting everyone across Canada, irrespective of whether you live in rural, urban, remote or northern communities. Accordingly, it is necessary for communities to move away from fossil-fuel-intensive economies. As noted by Eaton, the move towards energy efficient sources is a unique challenge for rural communities because of the nature of "energy availability, cost, generation, and infrastructure" in these communities. A similar challenge exists for many communities in Northern Ontario.

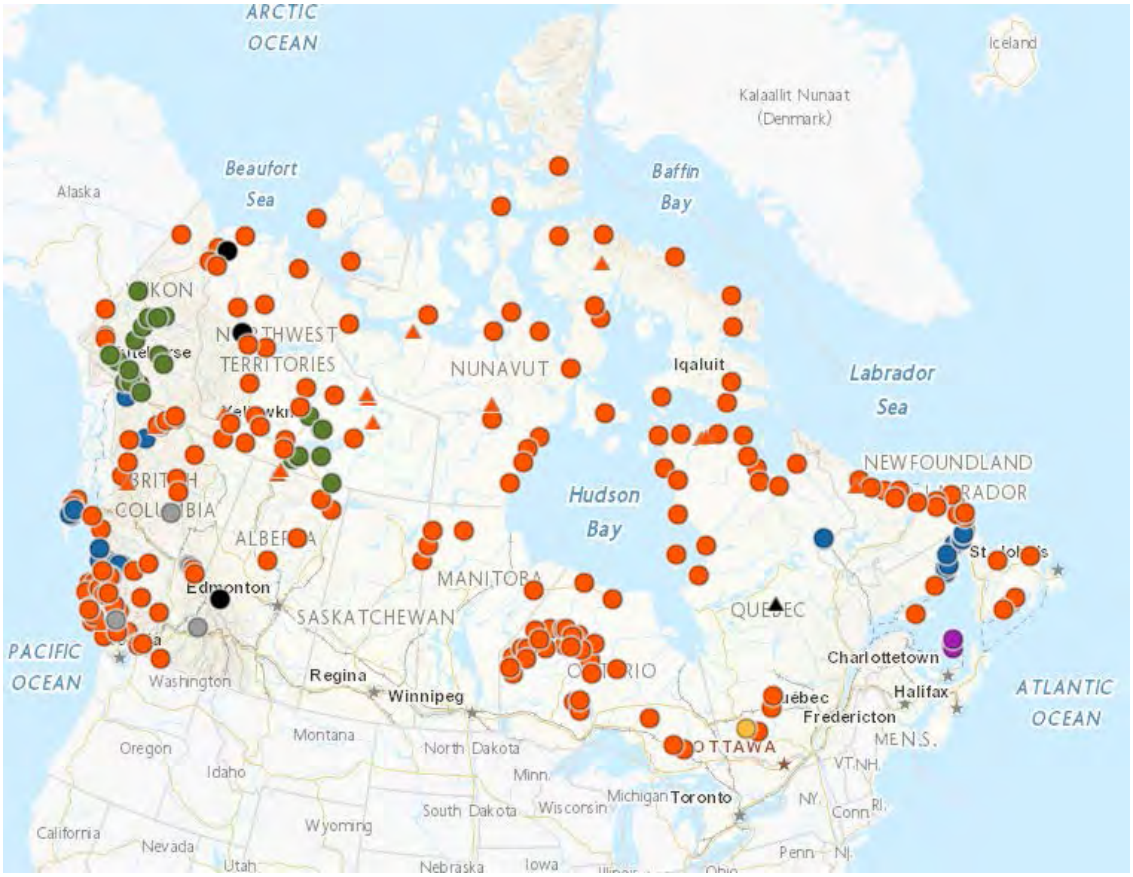
As of August 2018, the Remote Communities Energy Database recorded 200 single, active off-grid communities in Canada. Twenty-seven of these are found in Ontario with a total population of around 18,700; only three communities are non-Indigenous (NRC, 2018). Not surprisingly, all 27 are situated in Northern Ontario (Figure 1). Furthermore, all 27 are reported as running on diesel and the majority are classified as fly-in communities (NRC, 2018).[2]

As Eaton mentions, remote communities are generally diesel electric, and as such have high greenhouse gas (GHG) emissions and have three to ten times the cost of grid electricity. Additionally, these communities are faced with high costs associated with storing large volumes of diesel in storage facilities (Knowles, 2016). With storage of such large quantities, accidents that negatively impact the health of the community are not uncommon and are expensive to clean. Indigenous and Northern Affairs Canada states there are "over 250 sites at or near First Nations and Inuit communities that are contaminated with petroleum hydrocarbons and have yet to be fully remediated" (Knowles, 2016).

Communities that are not connected to the electric grid are disadvantaged in many aspects. These communities lose out on potential economic development opportunities as a result of being off the grid. Cost of electricity in off-grid communities is a deterrent for potential investors as it incurs additional costs if the industry consumes even moderate levels of electricity (Canada, 2011). The communities are also faced with substantial GHG emissions not only from burning diesel but also from the transport of fuel by trucks (Canada, 2011).

[2] Fly-in communities refer to those in which road access is not available.

**Figure 1 - Remote communities in Canada**




*Source: Remote Communities Energy Database, Natural Resources Canada*

Diesel that is transported to these communities is flown in, shipped in or driven in on winter roads; with such limitations the transport costs are high (Canada, 2011). These costs are bankrupting many First Nation communities in Northern Ontario, with one remote First Nation community "paying over $1.3 million dollars a year on fuel and transportation" (NCC, n.d).

In terms of electrical capacity, the north is not only smaller compared to the south, but less diverse in terms of fuel sources. The primary source of electricity within Northern Ontario is hydroelectric. Southern Ontario in comparison is varied in both electricity generation capacity and fuel sources (National Energy Board, 2017). As such, it is necessary to invest in infrastructure that supports alternative energy sources within communities across Northern Ontario.

There are four main renewable energy alternatives available for sustainable energy production and usage to off-grid communities currently reliant on diesel. Investments in hydro, biomass, wind and solar energy could bring significant economic benefits for remote and northern communities (Canada, 2011). Furthermore, Christopher Duschenes, director of the Center for the North at the Conference Board of Canada, states that "investing in clean energy solutions to reduce reliance on

diesel is a small but vitally important link to energy security, reconciliation and self-determination for Indigenous people" (NRC, 2019).

Indigenous communities in Northern Ontario are engaging in innovative renewable energy projects to reduce their reliance on fossil fuels. For instance, the solar micro grid in Gull Bay First Nation will be the first of its kind in Canada. The micro grid combines "solar photovoltaic power, battery energy storage and a micro grid controller connecting to the existing Hydro One Remotes diesel generating station to provide clean solar power and off-set diesel use" (Gull Bay First Nation, n.d). The switch from diesel to solar power will reduce diesel fuel usage by 25% or 110,000 litres (Gull Bay First Nation, n.d). Deer Lake First Nation is another community employing solar energy to reduce reliance on diesel which costs the community $2.7 million a year (Canadian Solar, n.d). The community installed a solar rooftop at Deer Lake First Nation Elementary school, introducing a renewable energy source to assist in satisfying the energy needs of the community (Canadian Solar, n.d).

Additionally, there is a need to support initiatives similar to the ecoEnergy for Aboriginal and Northern Communities Program, which was a five-year project that supported these communities in reducing GHG emissions. The program allocated $20 million to fund "renewable technologies such as residual heat recovery, biomass, geothermal, wind, solar, and small hydro" (INAC, 2015). An evaluation of the program found that there was a continued need to fund energy efficiency projects within Indigenous and northern communities, especially those communities not connected to the grid (INAC, 2015).

Support is also needed for programs that provide affordable electricity to remote communities already connected to the grid. For example, the Rural or Remote Rate Protection program (RRRP) provides rate subsidy to rural and remote residents who are faced with high distribution costs (Ontario Newsroom, 2017). Due to their location, most homes in Northern Ontario require additional insulation to withstand the winter and prevent heat loss in homes (Hydro One, n.d.). Programs like Home Winterproofing by Enbridge should be encouraged as they can have a significant impact on creating energy efficient homes in Northern Ontario (Enbridge, n.d.).

As Eaton established, climate change is happening, and measures need to be taken to create sustainable energy generation and usage. Investments need to be made for energy efficient fuel sources within remote and northern communities, especially off-grid communities.

## References


Canada. (2011). Status of Remote/Off-Grid Communities in Canada. Government of Canada. Retrieved from http://publications.gc.ca/collections/collection_2013/rncan-nrcan/M154-71-2013-eng.pdf

Canadian Solar. (n.d.). Remote Communities Gain Access to Real Power. Canadian Solar Inc. Retrieved from https://www.canadiansolar.com/thatcher/detail/160

Enbridge. (n.d.). Home Winter Proofing Program. Enbridge. Retrieved from https://energy-savings-programs.ca/winterproofing-program/

Gull Bay First Nation. (n.d.). Mashkawiziiwin Energy. Gull Bay First Nation. Retrieved from http://www.gullbayfirstnation.com/mashkawiziiwin-energy/

Hydro One. (n.d.). Your Guide to Home Insulation Savings. Hydro One. Retrieved from https://www.hydroone.com/saving-money-and-energy/residential/tips-and-tools/guide-to-insulation

Indigenous and Northern Affairs Canada (INAC). (2015). Evaluation of the ecoEnergy for Aboriginal and Northern Communities Program. Government of Canada. Retrieved from https://www.aadnc-aandc.gc.ca/eng/1465235699114/1465236134726

Knowles, J. (2016). Power Shift: Electricity for Canada's remote communities. Ottawa: *The Conference Board of Canada*. Retrieved from https://www.conferenceboard.ca/temp/109d5335-b003-4f02-af04-32cdd8c0d0d5/8249_PowerShift_RPT.pdf

National Energy Board. (2017). Provincial and Territorial Energy Profiles-Ontario. Government of Canada. Retrieved from https://www.neb-one.gc.ca/nrg/ntgrtd/mrkt/nrgsstmprfls/on-eng.html

Natural Resources Canada. "The Atlas of Canada – Remote Communities Energy Database." Dated modified August 3, 2018. Accessed September 19, 2019. Retrieved from https://atlas.gc.ca/rced-bdece/en/index.html.

Natural Resources Canada. (2019). Reducing diesel energy in rural and remote communities. Government of Canada. Retrieved from https://www.nrcan.gc.ca/climate-change/green-infrastructure-programs/reducing-diesel-energy-rural-and-remote-communities/20542

NCC. (n.d.). Solar Microgrid Systems. NCC. Retrieved from http://www.nccsolar.com/about/

Ontario Newsroom. (2017). Archived Backgrounder: Ontario's Fair Hydro Act, 2017. Ontario Newsroom. Retrieved from https://news.ontario.ca/mndmf/en/2017/5/ontarios-fair-hydro-act-2017.html