Delivering Fairness and Choice
LTEP 2017

Chapter 6. Responding to the Climate Change Challenge

Ontario is taking a leading role in Canada and internationally in the global fight against climate change - and energy plays a central role in the transition to a clean economy. At the same, we must prepare for the effects of a changing climate to ensure our energy infrastructure remains resilient.

Ontario's cap and trade program came into effect on January 1, 2017. The cap and trade program is a flexible, market-based program that sets an annual cap for greenhouse gas (GHG) emissions, with the targets becoming more stringent over time. The cap drops each year to enable Ontario to meet its GHG reduction targets of:

- 15 per cent below 1990 levels by 2020;
- 37 per cent below 1990 levels by 2030; and
- 80 per cent below 1990 levels by 2050.

Cap and trade creates a market and an incentive to reduce emissions. Large emitters must have enough permits to cover their emissions. Companies that emit more than their allowance can buy additional allowances through government auctions or from other companies that have surplus allowances.

The first cap and trade auction brought in more than $470 million for the Province. Under Ontario's 5-year *Climate Change Action Plan* (CCAP), proceeds from Ontario's cap and trade auctions will be used to reduce GHG emissions by helping Ontarians shift away from conventional fuels and reduce their energy consumption. Ontario intends to spend up to $8.3 billion to fight climate change, reduce greenhouse gas pollution and transition to a low-carbon economy.

Building on a Firm Base

In total, about 90 per cent of the electricity being generated in Ontario is now GHG-free, and includes emission-free sources such as water, nuclear, wind, solar and bio-energy. We have significantly reduced GHG emissions through investments in emissions-free generation as well as the elimination of coal-fired electricity generation. Thanks to these investments, our electricity sector emissions are forecast to be more than 80 per cent below 1990 levels in 2017.

Commented [CD(1]: Consider transitioning away from the 30Mt figure which relates to coal closure and instead citing the forecast 80% reduction in electricity sector emissions since 1990 (shows that the electricity sector has already achieved above noted province-wide 2050 target).

These actions mean that Ontario's electricity system is well positioned to help the province move towards a low-carbon economy. Our clean and reliable energy system gives us the strong

base we need to pursue increased electrification, the use of more electric vehicles and the development of renewable natural gas (RNG).

It will also allow us to combine different energy sources into integrated energy systems that provide new services for homeowners and businesses. Natural gas will continue to play a critical role, but we must use it as efficiently as possible and supplement it with the next generation of clean energy technologies. These are just the sort of technologies that will benefit from funding from Ontario's cap and trade auctions.

Renewable Energy Success

Ontario is Canada's leader in wind and solar power. There is more wind and solar capacity in operation in Ontario than in any other province or territory. When you add hydroelectric generation and bioenergy to the mix, renewables accounted for 40 per cent of Ontario's electricity supply mix in 2015, up from 26 per cent in 2005[1]. Currently, Ontario has over 18,200 megawatts (MW) of wind, solar, hydroelectric and bioenergy electrical generation capacity in operation or under development[2].

Commented [SE2]: Re-inserted language from Chapter 5 draft to demonstrate the extent of the build-out of the clean energy fleet over the last decade and showcase Ontario as a Canadian and North American leader in renewable energy.
Data from IESO supply reports and OPO

Ontario's commitment to renewable energy began with the launch of the Renewable Energy Supply program in 2004; however, the tremendous growth of Ontario's clean tech and renewable energy sectors was kick-started by the *Green Energy Act, 2009*.

A highlight of Ontario's renewable energy programs has been the opportunities that individuals, schools, churches, municipalities, co-operatives and Indigenous communities have had to participate in clean energy projects. From smaller home or farm-sized projects, to larger, community-scale projects, Ontarians use renewable energy projects to meet their community's power needs and reduce the demand on the province's transmission system.

Of the 936 successful applications to the 4th phase of the Feed-in Tariff (FIT) program, 74% had Indigenous, municipal, public sector or community participation.

Over 60 First Nation and Métis communities and groups are participating in over 550 FIT renewable energy projects.

More than 24,000 microFIT projects are feeding clean power to the grid.

Commented [CQ3]: Note that these types of participation statistics are only available for the most recent FIT program rounds – earlier rounds didn't track all of the same figures.

[1] From IESO Ontario Planning Outlook, Sept. 2016
[2] IESO Supply Data of December 31, 2016

Municipality of Chatham Kent

Chatham-Kent is a host community for a number of wind energy projects, which provide benefits for the community. Recent projects include:

South Kent wind

- The Municipality of Chatham-Kent supported the development of the South Kent Wind Project. Samsung and Pattern are providing multiple benefits to Chatham-Kent as part of this South Kent Wind Project, including $2.5 million for upgrades to the Chatham-Kent Municipal Airport plus community benefits of $11.5 million (calculated over the life of the project). In addition, Entegrus Inc. (which is 90% owned by the Municipality of Chatham-Kent) obtained contracts for maintenance for the South Kent Wind Project resulting in approximately $300,000 of services provided by local employers including Entegrus.

North Kent Wind

- The Municipality recently voted to approve spending $7.74 million to exercise its option to buy a 15% equity interest in the North Kent 1 Wind Turbine project.

Romney Wind

- The developer will provide an annual contribution to the municipality of $2,500 per megawatt of wind turbines to be located in Chatham-Kent.
- Property Taxes: It is estimated that the property tax revenue for the Project will be approximately $56,250 per year ($1,125,000 over the 20 year life of the contract).

Ontario's renewable energy policies have helped build a domestic industry, significantly clean our electricity supply mix, and provided real benefits for communities and municipalities. Recognizing this success, the 2017 LTEP is focused on outcomes instead of mandating targets and technologies. With a solid foundation of renewable energy online, we can focus on new opportunities for innovation, modernization and exporting our expertise.

But make no mistake. Ontario remains committed to an electricity system that includes renewable energy generation and supports the Province's *Climate Change Action Plan*.

Transitioning to a Low-Carbon Economy

Putting a price on carbon will have a significant impact on the operation of the electricity market in Ontario. Cap and trade will encourage a shift away from the use of fossil fuel-fired generation to emissions-free electricity generation and clean imports, as well as more efficient natural gas generation. As we move forward with Market Renewal, the cost of carbon will

become increasingly important in the economics of generating projects, and ultimately their success in a capacity auction.

Shifting to Renewable Natural Gas

Natural gas remains a reliable and cleaner option for many Ontarians, and will continue to play an important role in the province's energy supply mix. There were about 3.5 million natural gas customers in Ontario as of 2016.[i] Homeowners, businesses and industries use natural gas for space heating, domestic hot water, steam and process heat. Natural gas generated about 10 percent of Ontario's electricity production, as of 2015.[ii]

The government is looking at using renewable natural gas to lower the carbon intensity of the natural gas we burn. RNG is a low-carbon fuel produced by the decomposing organic materials found in landfills, forestry and agricultural residue, green bin and food and beverage waste, as well as wastes from sewage and wastewater treatment plants. Because it is from organic sources, the use of RNG does not add any additional carbon to the atmosphere. It can replace the use of conventional natural gas in today's stoves and furnaces and would use the existing natural gas distribution system.

Ontario is investing up to $100 million over four years from the proceeds of the cap and trade auctions to help introduce RNG in the province.[iii] The province's investment in RNG will reduce GHG emissions and help consumers with the cost of shifting to renewable natural gas, as RNG costs more than conventional natural gas.

Commented [AH(4]: JM wants to know what costs consumers face?

RNG can be an Ontario-made source of energy. Some types of RNG like biogas from landfills or agriculture are technically feasible today. RNG may be produced in the longer-term by biomass from forestry residue.

The *Fuels Technical Report* estimates that RNG could provide up to 73 Petajoules (PJ) of energy, or more than 3% of the demand for fuels energy forecast for Ontario for 2025. By 2035, RNG could provide up to 156 PJ of energy, or more than 8% of total forecasted fuels energy demand.[iv]

Commented [NA(5]: These figures are based on forecast RNG and total demand in the FTR Outlooks. If we want to reference the current LTEP, all of the numbers will change pending finalization of the fuels modelling.

The Minister of Energy confirmed the government's interest in adding RNG to Ontario's natural gas supply in a letter to the Ontario Energy Board (OEB) in December 2016. The Minister encouraged the OEB to move quickly to include RNG as a potential fuel, because it could help reduce GHG emissions in the supply portfolios of Ontario's natural gas utilities.

Soon after, the OEB began gathering input from stakeholders to assist in developing its Framework for the Assessment of Distributor Gas Supply Plans. The framework will allow utilities and the OEB to make informed decisions regarding the adoption of RNG.

Commented [NA(6]: The OEB has not yet released the framework. It is currently consulting with stakeholders and expects to release by year-end.

The Ministry of Energy will continue to work with industry stakeholders, the Ministry of the Environment and Climate Change (MOECC) and the OEB to introduce a requirement for renewable content for natural gas, fulfilling a commitment of the *Climate Change Action Plan.*

Shifting to Lower Carbon Transportation Fuels

The 2017 LTEP recognizes the CCAP commitment to introduce a Renewable Fuel Standard (RFS) for gasoline. This is an important step towards reducing GHG emissions from the transportation sector. Since it uses the existing fuels infrastructure, the RFS is likely to be among the more flexible and cost-effective ways to increase the use of renewable and low-carbon fuels.

Some of the opportunities to increase the use of renewable and low-carbon transportation fuels include:

- increasing the use of renewable liquid fuels by existing vehicles. "Drop-in" fuels such as ethanol can be mixed with gasoline to produce blended fuels and used the same way as regular gasoline;
- having the existing stations offer higher blends of ethanol and biodiesel;
- making renewable liquid fuels availability to more regions of the province;
- adding biomass fuels to the crude oil that Ontario refineries process; and
- lowering the carbon intensity of renewable fuels produced by Ontario manufacturers.

There are many different ways to transform the transportation sector and achieve deep reductions in emissions. While increased electrification is likely for light-duty vehicles and advanced bioenergy is likely to be important in long-haul road freight and aviation, technological innovation remains unpredictable. The technology-neutral approach of the RFS lets the alternatives compete on their merits.

RNG IN TRANSPORTATION – PILOT PROGRAM

Ontario's Climate Change Action Plan (CCAP) committed to increase the availability and use of lower-carbon fuel.

The Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) is now developing a pilot program that uses methane from agricultural materials or food wastes for transportation purposes. The program is expected to demonstrate the business models and technology that will allow agricultural and food sectors to produce RNG, and support businesses as they change their vehicles and fueling infrastructure to use RNG.

In May 2017, OMAFRA issued a discussion paper to gather feedback from businesses, stakeholder groups and the public to help guide the design of the program.

Commented [AH(7]: This makes more sense with chapter 6, since it's not really about flexibility. Can it be moved over?

ESP Response: Yes, it fits better with the fuels narrative in Chapter 6. We will import this section and tweak it to focus less on flexibility.

Integrated Energy Solutions

Power-to-Gas

Commented [HJ(8]: Re-ordered in an attempt to improve the logical flow of the chapter.

Electrolysis, also known as power-to-gas, uses electricity to breakdown water molecules into hydrogen and oxygen. This is considered "type 3 energy storage", which stores electrical power as a different fuel type. In this case, the hydrogen can be stored or transported in existing natural gas pipelines and used to heat homes, fuel vehicles, or to generate electricity at the time and place it is needed. The vast existing natural gas storage infrastructure Ontario has can be used to store the hydrogen for long periods of time.

Commented [SB(9]: Does this reflect how NG is used today, or is this speculative?

Power-to-gas could potentially become a new link between province's electricity system and its natural gas system. In fact, Hydrogenics – an Ontario-based manufacturer of electrolysis and fuel cell technology – was awarded a contract under the IESO's 50 MW energy storage procurement to use its electrolysis technology to provide electricity grid services while it makes hydrogen.

Ontario's electricity grid is predominantly served by clean, non-GHG emitting sources of power. Using this power to create hydrogen one way to help decarbonise the natural gas supply and the transportation sector as more natural gas vehicles reach the market. The Ministry of Transportation has recently committed to undertaking a feasibility study of using hydrogen fuel for Go Transit passenger trains, showing the potential versatility of this fuel source.

Heating and Cooling with Renewable Energy Technologies

Ontario aims to support its goals for reducing greenhouse gas emissions by increasing the use of low-carbon thermal technology to heat and cool Ontario homes and businesses.

This has the potential for a significant payoff in the fight against climate change. Space heating accounts for approximately 75% of the demand for fuels energy in Ontario homes[3], making it an important target area for reductions in GHG emissions.

Ontario's *Climate Change Action Plan* highlighted the importance of these technologies by indicating that solar thermal panels for air or water heating, as well as air-source and ground source heat pumps can significantly reduce or eliminate greenhouse gas emissions from conventional heating and cooling systems.[4]

Commented [CQ10]: Note that "Solarwall" is a trademarked term – suggest using alternative language.

The Ministry of Energy will continue to work with MOECC to encourage the development and deployment of these thermal technologies for residential, commercial, industrial and institutional buildings.

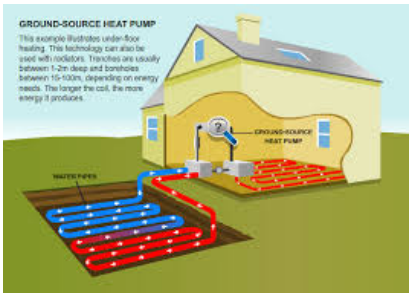
[3] Source: Fuels Technical Report: The State of the System: 10-Year Review http://www.energy.gov.on.ca/en/archive/fuels-technical-report/10year/#fn8a

[4] Source: http://www.applications.ene.gov.on.ca/ccap/products/CCAP_ENGLISH.pdf

Ground Source and Air Source Heating and Cooling

Commented [AH(11]: Perhaps just have one section on heat pumps.
JH – Section moved up to replace "Electrification of Space Heating" section which is now proposed for deletion.

Ground source heat pumps, also known as geothermal energy systems, use buried pipes to absorb heat from the ground and transfer it to a home or building. This is a source of renewable energy as the earth maintains a constant temperature throughout the year.



igshpa.org

Air source heat pumps use heat from outside air and transfer it to a home or building. In both cases, an energy pump, running on electricity, helps "concentrate" the heat, and move it to the rooms where it is needed. The same systems can also be used to cool homes or buildings in the summer.

Ground source or air source heat pump systems provide significant benefits for new buildings and residential developments. For homes that are currently electrically heated, a recent study by the IESO[5] reveals that residential heat pumps can help reduce electricity consumption by up to 60%.

[PLACEHOLDER: If Heating and Cooling Incentive program with heat pump incentives hits the market in June or sooner, this is a potential announceable in the 2017 LTEP and culmination of the Heat Pump Advantage pilots which Hydro One has led and which is highlighted in the Enhancing Conservation Commitment Chapter. **NTD: Need to reach out to IESO for content**].

District Heating and Cooling

District energy uses a combination of technologies to generate and supply heating and cooling, domestic hot water and electricity to blocks or neighborhoods in a community. Cities around the world are prioritizing modern district energy systems powered by renewable fuels as a key solution to integrating renewables and improving energy efficiency.

[5] An Examination of the Opportunity for Residential Heat Pumps in Ontario (IESO, February 28, 2017), http://www.ieso.ca/sector-participants/conservation-delivery-and-tools/conservation-first-framework

District heating and cooling can reduce GHG emissions, improve energy efficiency with combined heat and power applications and use of local energy resources, such as organic waste, locally available biomass and mechanical waste heat. Opportunities for district energy are greatest for new residential or commercial developments in un-serviced areas. District energy systems are also frequently more cost effective when compared to systems for each individual building, in areas where there is sufficient density of demand for heating and cooling.[v]

Commented [CQ12]: Suggest removing, since discussion of waste incineration may raise environmental concerns.

Solar Air and Hot Water Heating

Solar hot water and solar air systems can effectively supplement the conventional heating systems for buildings. Solar hot water systems can use the energy from the sun to heat 40 to 60 per cent[6] of a building's hot water needs, whether for domestic or commercial use. Solar air systems capture air warmed by the sun and circulate it to heat buildings.

Near and Net Zero Carbon Buildings

Commented [HJ(14]: Language modified to reflect CCAP: http://www.applications.ene.gov.on.ca/ccap/products/CCAP_ENGLISH.pdf

Commented [PZ13]: CRED - any update on this content ?

Ontario's *Climate Change Action Plan* (CCAP) aims to reduce emissions in the building sector by helping encourage the building of near net zero and net zero carbon emission homes and buildings. Existing programs and new programs offered through the Green Ontario Fund will encourage the adoption of high efficiency, low-carbon homes and buildings. Advanced efficiency standards will be set for products and appliances used in new and existing homes and buildings.

Minimizing energy use is an important element of transitioning to near and net zero carbon emission buildings. Generally, the most cost-effective strategy is to first pursue opportunities for energy efficiency. Once that has been done, some type of on-site renewable energy generation is generally required to achieve net zero status. The Ministry of Energy is taking steps to expand and enhance Ontario's net metering framework, which would provide increased opportunities for building owners to integrate renewable energy generation and energy storage technologies.

Case Studies [7]

Reid's Heritage Homes – Guelph

Reid's Heritage Homes built five net zero homes in Guelph in 2016. These homes were the first to meet new net zero home standards set up by the Canadian Home Builders' Association.

Key features include:
- air source energy pumps
- high efficiency water heaters
- higher efficiency insulation in exterior walls and basement
- a sealed house to avoid air leakage
- Installed solar panels

Evolve 1 - The Cora Group - Waterloo

Cora Group, in partnership with Sustainable Waterloo Region, is building evolv1, the first multi-tenant, net zero carbon building in Canada.

Key features include:
- Constructed to LEED Platinum principles
- Geothermal heating and cooling
- Adjacent to future LRT station
- EV charging stations
- Free solar carport and bicycle parking

parking

West 5 – Sifton - London

The West 5 development is Ontario's first sustainable, net zero community. It will have 2,000 condominium apartments and townhomes along with 400,000 sq. ft. of commercial space and a 1.6-acre park.

The construction of West 5 will create about 2,500 jobs over 10 years

Key features include:
- Solar panels and solar streetlights
- Solar carports
- Green roofs
- EV charging stations
- Community gardens

- Community gardens

Climate Change Adaptation

[Pictures of reports, extreme weather events etc.]

Commented [AH(15]: Pictures are tricky, unless a picture is super helpful, we may want to consider not including one.

Ensuring a Resilient Energy Supply

Ontarians need to have a reliable supply of energy, not just for for our economic prosperity but for our basic health and safety. Our electricity system must remain resilient and able to adapt to a changing climate in order to provide vital energy services to Ontarians.

The facilities and equipment that currently generate, transmit and distribute energy across the province are potentially threatened by the extended heat waves, high winds, severe rainfall and ice storms that come with climate change. Climate change may also change the flows of rivers, water levels of lakes and their temperatures, with possible effects on electricity generation.

Ontario's energy agencies are taking a number of actions to ensure the province's energy system is prepared to meet extreme weather events:

- The Independent Electricity System Operator published a study that found the transmission system is resilient enough to substantially withstand most extreme weather scenarios, but recommended continued monitoring and refinement of climate scenarios.
- More and more local distribution companies are making adaptation and system resilience a priority. Toronto Hydro and Horizon Utilities have both conducted vulnerability assessments of their systems. As part of its 2014 application for a five year rate plan, Toronto Hydro explicitly referred to climate change adaptation studies and the increased frequency of severe weather events - a first in Canada.[8]
- Local distribution companies such as Oshawa PUC, Veridian and Whitby Hydro are developing adaptation plans to match the adaptation planning done at the local level for transit, water and communications systems.

Building on activities currently underway, Ontario will strengthen the ability of the energy industry to anticipate the effects of climate change and integrate the impacts into operational and infrastructure planning:

- The Ministry and its agencies will meet with utilities and other stakeholders to share best practices and build their adaptation capacity. Since these activities are best

[8] Canadian Electricity Association (2016). Adapting to Climate Change: State of Play and Recommendations for the Electricity Sector in Canada https://electricity.ca/wp-content/uploads/2016/02/Adapting_to_Climate_Change-State_of_Play_and_Recommendations_for_the_Electricity_Sector_in_Canada.pdf

coordinated with other public services, the Ministry will also encourage utilities to work with municipalities and other public and private infrastructure operators.

Commented [WJ16]: Naming just these two would be too narrow (communications, natural gas, etc.)

- The Ministry will support the development of a vulnerability assessment of the energy distribution sector to help utilities develop state-of-the-art strategies to manage risk. This will complement the vulnerability assessment done of the transmission system in 2015.
- As part of its regulatory review, the OEB will provide guidance to utilities for pursuing cost-effective opportunities to further integrate the consideration of climate change adaptation into the regional planning, distribution system planning and rate filing process. The IESO will ensure that climate change adaptation is considered and integrated within bulk system and regional planning processes.

Box 1: *Horizon Utilities Adapts to Climate Change*

Now part of Alectra Utilities, Horizon conducted a vulnerability assessment and developed a long-term plan for adapting to climate change. The first five years of the plan focussed on monitoring and collecting data in order to establish further actions.[9]

Alectra now looks at the risk of flooding when planning infrastructure and is intending to use telephone poles that can flex in high winds.

Box 2: *Hydro Ottawa Storm Hardening Initiative*

Hydro Ottawa completed its "storm hardening" initiative in 2015.

By removing or trimming overhanging tree branches and changing the schedules for tree trimming, Hydro Ottawa decreased the vulnerability of its distribution system to damage from high winds and ice storms. Not only did this improve public safety, it also reduced the company's budget for vegetation management by $750,000.[10]

Box 3: *Connecting Remote Communities*

A number of remote First Nations communities rely on diesel generators for power.

[9] Chartered Professional Accountants of Canada (2015). Adaptation Case Study #5: Horizon Utilities Corporation https://www.horizonutilities.com/ourCompany/publications/Articles/2015/Climate-Change-Adaptation-Case-Study-5-Horizon-Utilities-Corporation-October-2015.pdf

[10] Hydro Ottawa (2015). 2015 Annual Report. At https://static.hydroottawa.com/documents/publications/annual-report/2015-Annual-Report-EN.pdf

Diesel fuel has to be trucked in on winter roads built on frozen lakes and rivers. As a result of climate change, winter roads aren't always available. That drives up the cost of diesel oil, which has to be flown in instead.

Ontario selected Wataynikaneyap Power (Wataay) in July 2016 to connect 16 remote First Nation communities to the province's electricity grid. Grid connection will replace diesel-fired electricity with clean power, reduce harmful greenhouse gas emissions and support jobs and economic growth.

Once completed, more than 10,000 people living in remote First Nation communities in northwestern Ontario will have a reliable, clean supply of electricity.

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[i] *2016 Annual Report of the Office of the Auditor General of Ontario*, pp. 89-90. Accessed June 29, 2017: http://www.auditor.on.ca/en/content/annualreports/arreports/en16/v2_107en16.pdf

[ii] *Fuels Technical Report*, pp. 7.
Ontario Planning Outlook, pp. 2. Accessed June 29, 2017: www.ieso.ca/-/media/files/.../ontario.../ontario-planning-outlook-september2016.pdf

[iii] News Release, *"Ontario Investing Up To $100M in Renewable Natural Gas"*, May 26, 2016. Accessed June 29, 2017: https://news.ontario.ca/ene/en/2016/05/ontario-investing-up-to-100m-in-renewable-natural-gas.html

[iv] These figures are for Outlook F. Total fuels energy demand in 2035 under Outlook F is 1843 PJ across all sectors. *Fuels Technical Report*, pp. 72-73.

[v] Why District Energy? UNEP. http://www.districtenergyincities.org/why-district-energy