CanSIA

CANADIAN SOLAR INDUSTRIES ASSOCIATION | L'ASSOCIATION DES INDUSTRIES SOLAIRES DU CANADA

The Role of Solar in Ontario's Climate Action Plan

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Introduction

CanSIA is a national trade association that represents the solar energy industry throughout Canada. CanSIA's vision for Canada's solar energy industry is for solar electricity to be a mainstream energy source and an integral part of Canada's diversified electricity mix by 2020. CanSIA is also targeting the solar energy industry to be sustainable, with no direct subsidies, and operating in a supportive and stable policy and regulatory environment within a similar time frame.

The Canadian solar industry has made great strides towards this goal due in large part to the policies and programs introduced in Ontario as a result of the *Green Energy Act*, 2009 (GEA). The GEA facilitated not only an increased focus on the procurement of renewable energy generation via the Feed-in Tariff Program, but also changes to a number of other pieces of enabling legislation. These changes were intended to bring efficiencies and remove barriers to the renewable energy project development process and encourage the expansion of energy conservation initiatives.[1] This is an arena in which climate policy can continue to make progress with regards to renewable energy in Ontario.

With the commitment to introduce a price on carbon via the Cap and Trade regulation, the province is continuing to show leadership in the transition to a less carbon intensive economy and build on the progress that has been thus far under the GEA. A price on carbon is a key piece of the strategy to address emissions, however, the Climate Action Plan will also be required to initiate programs, policies, codes and regulations that can support the Cap and Trade regulation in order to meet emission reduction goals. CanSIA has provided two submissions to the Ministry of the Environment and Climate Change (MOECC) regarding revisions to the GHG reporting requirements in O.Reg. 452/09 (EBR 012-4549), and the Cap and Trade high-level program design (EBR 012-5666) and is pleased to provide input for consideration in the development of complementary programs, policies, codes and regulations within the Climate Action Plan.

Through the Climate Strategy the MOECC has signaled to industry that it intends to include a focus on energy efficiency, net zero energy buildings, changes to codes and regulations, and prioritizing GHG reductions in the next Long Term Energy Plan (LTEP) in order to support the Cap and Trade regulation. The government of Ontario has also identified key areas in which GHG reductions may be funded with Cap and Trade auction revenues in The Climate Change Mitigation and Low Carbon Economy Act. Schedule 1 identifies these areas which include:

1. The production or installation of renewable, low-carbon, carbon-free and net zero alternative energy;
2. Distributed renewable energy generation and energy management technologies to support load-shifting, energy storage, net metering and other measures to eliminate the need for grid-based electricity during natural gas peaking;
3. Geothermal solutions, insulation, and other technologies that will reduce greenhouse gas emissions from buildings and neighbourhoods;
4. Support for increasing consumer demand for near-net-zero and net zero buildings, structures and communities; and
5. The design, construction and retrofitting of buildings and structures to reduce greenhouse gas emitting energy sources related to space and water cooling and heating.

[1] Green Energy Act, 2009, https://www.ontario.ca/laws/statute/09g12#BK0.

CanSIA supports these as areas of focus and has compiled this submission to provide the MOECC with specific policy recommendations to help ensure that the Climate Action Plan includes specific measures to allow solar energy to act as a strong tool to meet the government's emission reduction goals.

Solar Ready Buildings

A central focus of the Climate Action Plan should be on revisions to regulations and codes that can facilitate the transition to less emissions intensive forms of energy use for buildings. Generally, the changes recommended in this section would require that a conduit be included in new buildings that would enable the future installation of solar photovoltaic panels or solar hot water systems at a lower cost by allowing the wires and or pipes to travel through a pre-existing conduit to allow easy connection between the solar collectors, located on the roof of the building, to the utility room, generally located in the basement of the building. More detail on the specific approaches recommended for residential buildings vs. industrial/commercial/institutional buildings is available below.

In 2011 the Ministry of Municipal Affairs and Housing (MMAH) launched process E-B-12-03-04 to consider stakeholder feedback on a proposed revision to the Ontario Building Code (OBC) that would require at least one conduit to facilitate the future installation of a photovoltaic system or a solar domestic hot water system in dwelling units governed by Part 9 (of the OBC), to be effective as of January 1, 2017. The conduit would be required on residential units that and would link the roof of the unit to the utility room (often located in the basement).[2]

The suggested revision to the OBC specified:

12.3.2. Residential Solar Energy System Installation Preparedness after December 31, 2016

1. Except as provided in Sentence (3), every residential building within the scope of Part 9, shall have one or two conduits to facilitate future installation of a solar domestic hot water system.

2. The conduits required by Sentence (1) shall
    a. have a minimum nominal inside diameter of (i) 50 mm if two conduit runs are provided, or (ii) 100 mm if only one conduit run is provided,
    b. extend from the area adjacent to utility space to attic space or roof,
    c. be continuous, straight, identified by marking and accessible at both ends,
    d. be sealed at both ends,
    e. be terminated 150 mm above the insulation and 500 mm of vertical distance from the underside of the roof sheathing, where an attic space is available, or 150 mm above the roof, sealed and flushed around the roof penetration using a rubber or corrosion-resistant metal flange with a gasket around the conduit,
    f. be securely fastened at maximum 1.8 m intervals, and
    g. be constructed of pipe conduit materials such as PVC pipes conforming to ASTM D1785 - 06,, "Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120" that will withstand the maximum temperatures encountered in solar domestic hot water systems,

[2] Ministry of Municipal Affairs and Housing, OBC proposed revision, http://www.mah.gov.on.ca/AssetFactory.aspx?did=8822. Pg. 1.

3. *Buildings* that will be shaded for at least 50% of daylight hours because of trees, buildings or other obstructions need not meet the requirements in Sentence (1).

This proposed revision to the OBC included the following rationale:

> *"The Building Code Energy Advisory Council recommended that this proposal be included. The Green Energy and Green Economy Act, 2009 signaled a commitment to using the Building Code to support energy priorities. That legislation amended the Building Code Act, 1992 to clarify that conservation was a "purpose" of the Code, provided for regular reviews of the energy conservation provisions of the Code, and authorized the establishment of the Building Code Energy Advisory Council. This potential change discussed above would support Ontario's priorities related to:*
>
> *Reducing electricity consumption in support of Ontario's Long Term Energy Plan;*
>
> *Supporting the Province's climate change strategy by reducing the amount of greenhouse gases produced by the operation of buildings, and reduce greenhouse gas emissions through energy efficiency requirements; and*
>
> *Supporting the growth of a green economy by creating a market for energy efficient and renewable energy technologies.[3]"*

This change to the OBC was supported by the majority of submitters into the stakeholder feedback process, though, some commenters had additional questions regarding how to apply sentence 3 and thus recommended modifications to the suggested code change. The change was not, however implemented by MMAH and should be reconsidered in the context of code change processes initiated by the Climate Action Plan.

As with residential buildings, currently when solar photovoltaic panels or a solar hot water system is added to a pre-existing industrial/commercial/institutional (ICI) building the construction/retrofit costs required to install the systems can be prohibitive. In situations where the costs are non-prohibitive, they simply add to the project development costs of solar installation making the economics of project development for the customer less favorable. Tackling both types of buildings is important in order to implement a holistic solution for new construction in Ontario.

Similar changes were implemented in the California building code in 2013 (code reference 110.10(a)4) when the code was made to specify that buildings that were 3 stories or less must be "Solar Ready" for future additions of solar electric or solar hot water systems.[4] Requirements for new construction in California to be solar ready apply to more than just non-residential buildings that are three stories or less. The changes implemented in 2013 apply also to single family residences, low-rise multi-family buildings hotel/motel occupancies and high-rise multi-family buildings.[5]

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[3] Ministry of Municipal Affairs and Housing, OBC proposed revision, http://www.mah.gov.on.ca/AssetFactory.aspx?did=8822, pg. 2.

[4] Stanford University, https://lbre.stanford.edu/pmr/sites/lbre.stanford.edu.pmr/files/SCC%20Overview%202014%20California%20Building%20Code%20Changes.pdf, pg. 4.

[5] 2013 Building Energy Efficiency Standards – Reference Ace, http://www.energycodeace.com/site/custom/public/reference-ace-2013/index.html#!Documents/section11010mandatoryrequirementsforsolarreadybuildings.htm.

Solar ready, in the context of the California building code refers to a number of different features including: a minimum area on the roof (or surrounding area) maintained obstruction free for the future use of solar, the construction and maintenance of an interconnection pathway from the roof to the utility room, the inclusion of a main service electrical panel with a sufficient busbar rating of 200 amps, and sufficient reserved space for the interconnection of the solar system in the utility room of the building. The space reserved for the interconnection equipment must also be marked "For Future Solar Electric".[6] The MOECC should note that there are a number of exceptions for when the above mentioned requirements do not apply depending on site specific circumstances where either a solar system has already been installed, or, where the size/position of the building would make the incorporation of solar unfeasible.

In order to integrate design considerations that impact the feasibility of installing solar energy systems into the original design of new buildings, CanSIA recommends that the Climate Action Plan initiate an Ontario Building Code revision process that will incorporate a specific stream of revisions designed to make new constructed buildings solar ready, similar to what has been done in California. This process should include building code revisions that will be applicable to both residential and ICI buildings and focus on: ensuring sufficient space is available for the future installation of solar PV or solar thermal collectors, that the building can support the dead and live loads of solar installations, the installation of a dedicated conduit from the roof to the utility room, and sufficient space within the utility room for solar related equipment.

Net Zero Energy Buildings

A net zero energy building is defined as a building that produces as much energy as it consumes over the course of a year. These buildings achieve net zero energy status first through high levels of energy efficiency, and then through the addition of clean, on-site renewable power generation, typically solar PV.[7] From a sustainable development perspective, ensuring as much future building and community development as possible achieves net zero energy status should be one of the most important focuses of governments operating in a carbon constrained environment. In Ontario, approximately 17% of total GHG emissions come from buildings and 9% come from the electricity sector.[8] A building's emissions profile is largely made up of fossil fuel use for heating (space and water), and electricity use that can come from fossil fuel sources (the percentage of which changes depending on the time of day and how much generation is sourced from the natural gas fleet). Additional deployment of solar technology can reduce emissions from both sources.

Ontario's private sector is already taking steps to develop net zero energy communities. West 5 is a net zero energy community being developed in the London Area as a partnership between s2e Technologies, Sifton Properties Ltd. London Hydro, the City of London and a network of over 11 universities and colleges with access to over 100 graduate students. This 70 acre green field development will include 2,000 residential units (high rise, medium rise, and townhomes), 300,000 sq. ft. of retail/commercial space, and 100,000 sq. ft. of office space.[9] The community will

[6] 2013 Building Energy Efficiency Standards – Reference Ace, http://www.energycodeace.com/site/custom/public/reference-ace-2013/index.html#!Documents/section11010mandatoryrequirementsforsolarreadybuildings.htm.
[7] California Public Utilities Commission, http://www.californiaznehomes.com/#!faq/cirw.
[8] MOECC, Climate Strategy, https://dr6j45jk9xcmk.cloudfront.net/documents/4928/climate-change-strategy-en.pdf, pg. 25.
[9] West 5 Backgrounder, http://www.west5.ca/, pg. 1.

be net zero energy through the use of energy efficiency measures, distributed solar generation, and geothermal heating. These types of developments could be the future of community planning in Ontario if supportive codes and standards are put in place and targeted incentives are developed and implemented to support their construction.

As with building code requirements for making buildings "solar ready", California provides an ambitious test case to which Ontario can look for how to implement net zero energy policy. In California the Title 24 process is moving all new construction (and renovations above a certain threshold) towards being net zero energy. This process revises building codes to incorporate energy efficient design and performance standards that include on-site renewable energy generation. The state also has set goals that include: all residential buildings being net zero energy by 2020 and all new commercial buildings being net zero energy by 2030, providing incentives for owners and design teams, investing in new technologies and research for increased energy efficiency, and providing incentives for solar PV for new homes that meet high efficiency standards through the New Solar Homes Partnership.

CanSIA recommends that the MOECC have a strong focus on encouraging the development of net zero energy buildings and communities in the Climate Action Plan by setting forward looking standards for new residences and ICI buildings to be net zero energy. Similar to the approach adopted in California, this forward looking goal could be phased in over a number of years. In California, for example, when the Title 24 process was rolled out it phased in thresholds of residences to be net zero energy over 9 years (50% of new homes by 2011, 90% of homes surpassing Title 24 standards by 35%, and all new homes being net zero energy by 2020).[10] Providing incentives for buildings that achieve net zero energy status would be helpful as would standards and codes that support this goal. CanSIA also recommends that solar technologies, including ground and air-source heat pumps and solar photovoltaics, are counted as eligible capital costs for funding or other incentives that are made available for the construction of net zero buildings and communities.

Energy Efficiency Retrofits

While the above two recommendations on solar ready buildings and net zero energy buildings apply primarily to new building construction, it is important that the Climate Action Plan also include measures to address the existing building fleet in Ontario through energy efficiency retrofits. The MOECC has already announced $100 million in funding for an energy efficiency retrofit program to be delivered by Union Gas and Enbridge. It is expected, however, that this program will focus largely on retrofits that will reduce natural gas consumption, and so may not incorporate solar energy technologies.

The IESO, however, currently manages a slate of energy efficiency initiatives through its saveONenergy programs. These programs currently target both the residential and ICI markets through different offerings. For example, residential programs include a heating and cooling incentive and coupons for energy efficient products while the businesses stream includes lighting incentives, compressed air incentives, training and support, and a retrofit program (among others).[11] All of these programs receive their mandate under the Conservation First Framework and receive their funding from money allocated for use for Conservation and Demand Management (CDM) programs. Currently, neither solar PV nor solar thermal technologies are eligible under these energy efficiency programs. Each year, however, LDCs are required to update their plans regarding how they will meet their conservation targets.

[10] California Public Utilities Commission, CA Energy Efficiency Strategic Plan, pg. 11.
[11] IESO, saveONenergy website, https://saveonenergy.ca/.

These reviews provide an important opportunity in which the Climate Action Plan could target changes to existing conservation and retrofit programs that would enable solar to be eligible under these programs.

Behind the meter solar installations can support the province's Conservation First energy policy. Behind the meter solar can effectively lower the electricity demand of consumers throughout the day and during peak consumption periods. By making behind the meter solar eligible for CDM programming, the majority of the funding for a behind the meter project would be received from avoided electricity costs of at the consumer site, making the direct cost of the program far less than would otherwise be the case. Solar can be an effective and low cost option for LDCs to continue to meet the provincial target for CDM activities. For example, a customer receiving excess generation payments (i.e. payments for surplus power export to the grid) would be incentivized to conserve and manage their demand to increase revenue from grid export.

CanSIA recommends that the Climate Action Plan include retrofit programs focused on energy efficiency and that solar PV and solar thermal technology be eligible under these programs, especially in situations wherein the retrofits are for buildings with high electricity usage. Behind the meter solar should also be included as part of the conservation framework and made eligible for programs under that framework. To better utilize existing energy efficiency programs, LDC's should be permitted to utilize behind the meter solar within their service territory as CDM. Any assessment of behind the meter solar should only consider the portion of costs that is not funded by avoided energy costs to fairly compare to other CDM activities. CanSIA's Distributed Generation Task Force (DGTF) will be providing the MOECC with detailed recommendations on facilitating behind the meter generation as a conservation measure in March 2016.

Economic Impacts of Solar Development

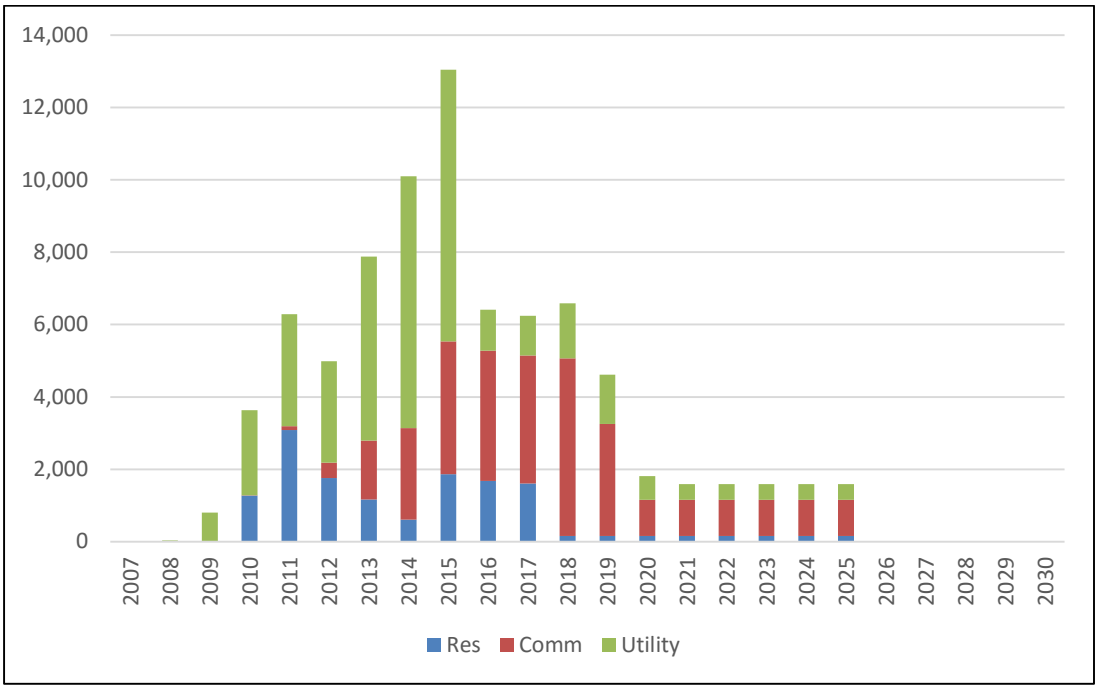
The Minister of the Environment and Climate Change has repeatedly signaled that spurring economic development, increasing investment in clean technology, and creating jobs are central goals of climate policy in Ontario.[12] In 2013, the rate of job growth in Canada's clean energy sector outpaced that of every other sector in the country. In 2014 approximately $265 billion was invested in clean energy globally. Investment in clean energy in Canada climbed 88% in 2014 to nearly $11 billion.[13] Thanks to the Green Energy Act, Ontario is attracting most of that investment, with more than half of the nation's clean power generation investment originating in the province. Facilitating the expansion of the use of solar energy by implementing changes to regulatory frameworks, and investing in net zero energy building construction and energy efficiency, as proposed in this document, will actively contribute to the Ministry's goals in this regard.

Every 150 MW of installed solar energy capacity represents approximately $310 million in private sector investment, 1,875 direct full-time equivalent construction jobs and 45 permanent direct jobs in operations. It also provides approximately $54 million in lease payments to site-hosts and $30 million in property tax payments to municipalities over a 20 year period. These impacts are already being felt in Ontario due to procurement under the Feed-in Tariff, and microFIT Programs. Based on modelling commissioned by CanSIA using the National Renewable Energy

[12] MOECC, Climate Strategy, https://dr6j45jk9xcmk.cloudfront.net/documents/4928/climate-change-strategy-en.pdf, pg. 3.
[13] Clean Energy Canada, http://cleanenergycanada.org/trackingtherevolution-canada/2015/?utm_source=TTRCAN2015&utm_medium=TTRCAN2015&utm_campaign=TTRCAN2015.

Laboratory's Jobs and Economic Development Model, within the solar sector alone these policies have resulted in over 2,400 MW of contracted electricity generation, $5 billion of private sector investment and the creation of between 30,000 and 45,000 person years of employment.[14] Figure 1 below illustrates the temporal distribution of those person years of employment across the different sectors of solar development (residential, commercial, and utility scale) based on currently contracted and directed solar projects in Ontario.

Figure 1: Person Years of Employment from Contracted/Directed Solar Development in Ontario



It is important to note that these strong investment and jobs impacts are predicated on MW of solar being developed in Ontario. The FIT, microFIT, and Large Renewable Procurement (LRP) programs are slated to end in the late 2017/early 2018 timeframe based on current direction from the Minister of Energy. The Ministry of Energy is, however, currently reviewing Ontario's net metering regulatory framework via the Net Metering/Self-Consumption Advisory Working Group (AWG). The AWG is comprised of representatives from the Ministry of Energy, Independent Electricity System Operator, Ontario Energy Board, Local Distribution Companies, and CanSIA. The goal of the AWG is to consider and recommend possible changes to the net metering regulation (O. Reg. 541/05) to create a long term framework for the development of small scale renewables in the province. The revised net metering regulation would take effect following the conclusion of the FIT and microFIT Programs in late 2017/early 2018.

In 2015 CanSIA also launched a concurrent group, the Distributed Generation Task Force (DGTF), which has been developing an industry led approach to net metering in Ontario for consideration by decision makers. An important implication of the analysis conducted by the DGTF is that, while grid parity is approaching in Ontario, some level of support will be required between the phase out of the FIT and microFIT programs and the stage at which economic viability is achieved from pure net metering. The DGTF will have specific recommendations on ways to bridge this gap which will be delivered to the MOECC in March 2016. Through the Climate Action Plan, however, the MOECC can contribute greatly to helping to bridge this gap by focusing on areas of climate policy that will reduce barriers to the deployment of solar technology. This will reduce the cost of project development and help move Ontario towards

[14] NREL JEDI model outputs, Compass Renewable Energy Consulting.

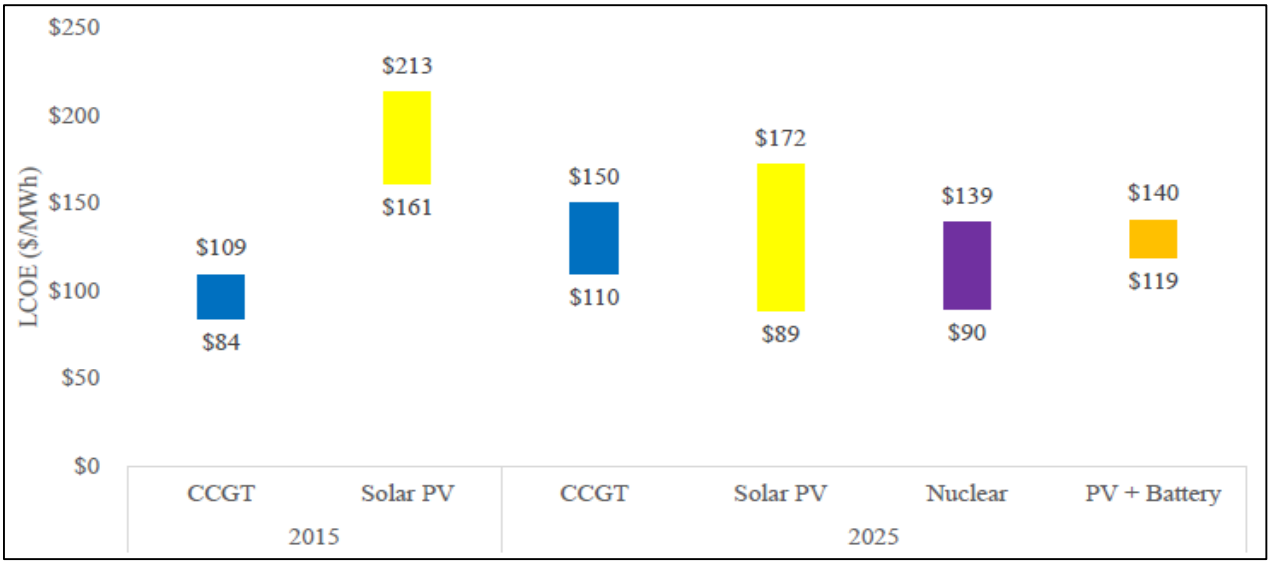
grid parity sooner than would otherwise be possible. Continuing to encourage the development of solar energy in Ontario will help ensure that these positive economic impacts continue to be realized.

Levelized Cost of Energy Considerations

Making changes to Ontario's Building Code, investing in energy efficiency retrofits and facilitating the construction of net-zero homes, buildings and communities that incorporate solar technology makes sense as these actions will directly correlate to reductions in the use of natural gas fired electricity generation, and natural gas for heating purposes. While reducing usage of natural gas reduces GHG emissions, it also has a high potential for cost savings over the lives of these assets. Research performed by Power Advisory LLC, on behalf of CanSIA, predicts continued decreases in the cost of solar PV and increases in the cost of natural gas combined cycle gas turbines (CCGT).[15] Continued increases in the cost of natural gas carries long-term risks for both individuals and businesses, as well as the electricity system as a whole.

Figure 2 below illustrates Levelized Cost of Energy (LCOE) ranges for Solar PV and CCGT in 2015 and a forecast of those same ranges in 2025. Cost increases for CCGT are largely assumed to be due to fuel costs (25-50% of total costs over a 25 year lifetime) and increases in the cost of carbon under the Cap and Trade regulation (12-25% of total costs over a 25 year lifetime).[16] Capital costs of solar PV are estimated using Natural Resources Canada data and assumptions are made for cell efficiencies improving, capacity factors increasing, and module costs continuing to decrease over time. The National Renewable Energy Laboratory estimates that the cost of solar PV has declined by approximately 20% per year since 2009, however, that cost declines will be more gradual/moderate moving forward. The analysis conducted by Power Advisory LLC assumes annual cost decreases of 10% for the low price case and 5% for the high price case.[17]

Figure 2: Levelized Cost of Energy by Generation Technology



[15] Power Advisory LLC, Levelized Cost of Energy Estimates 2015 and 2025, John Dalton. pg. 1.
[16] Ibid, pg. 5.
[17] Ibid, pg. 8.

While the forecast cost increases for CCGT assets are expressed as all-in costs on a $/kW basis for the purposes of comparing the levelized cost of new build projects, the ongoing fuel and carbon risks associated with the operation of CCGT and natural gas resources also exists for existing assets. In other words, even if no new natural gas facilities are constructed in Ontario, the fuel cost risk will remain for all existing natural gas generators. While the government of Ontario is not forecasting large increases to the cost of electricity due to the Cap and Trade regulation in the short term, as natural has becomes more expensive, so too will the electricity generated by those power plants. Limiting the extent to which the province is required to rely on natural gas fired electricity generation by spurring additional solar generation potentially allows the customers and electricity system planners to avoid both the GHG emissions from those assets, but also the increased costs associated with their fuel.

Non-Utility Generators (NUGs) are one category of existing natural gas fired assets which provide the province with an opportunity to avoid these ongoing cost and GHG risks by not signing contracts for their continued operation as those contracts expire. Additional detail on the NUGs and their contract expiry schedule is available in the section entitled "Ontario Electricity Sector Considerations", below.

Removing barriers that exist within the Ontario Building Code, setting standards and introducing incentives for net zero energy homes and enabling consumers to utilize solar within a slate of eligible energy efficiency retrofit technologies will help further reduce the future development costs of solar. Sending a strong signal that these are priority areas for the Province through the Climate Action Plan is an important first step in this process to provide Ontarians and electricity system planners with real options for meeting energy needs with cost effective renewable electricity.

Electricity Sector Considerations

Ontario has made significant progress towards reducing the emissions profile of the electricity sector through phasing out coal and introducing a larger share of renewables into the supply mix. Maintaining the gains that have been made in the electricity sector may become more difficult in the face of three factors. First, the MOECC's Climate Strategy identifies electrification of other areas of the economy as an important goal, including individual vehicles, mass transit, and heating (both space and water).[18] Second, risk exists that LDCs will not meet their conservation targets, or, that targets will only be met by relying on behind the meter natural gas generation. Third, the IESO forecasts that even without increases in electricity demand as a result of electrification driven by climate policy, that emissions from the electricity sector are expected in increase as of 2016 due to nuclear refurbishments at Bruce and Darlington and the eventual shutdown of Pickering in 2022 and 2024.[19] Each of these risks can be addressed in some measure by solar technologies.

Electrification

In research conducted on behalf of CanSIA, Power Advisory LLC identifies the impacts of climate change policy (and the extent of electrification) on electricity demand as one factor which could impact the IESO's current electricity demand forecast.[20] The MOECC has already announced funding under the Green Investment Fund for electrical

[18] MOECC Climate Change Strategy, https://dr6j45jk9xcmk.cloudfront.net/documents/4928/climate-change-strategy-en.pdf, pg. 28.
[19] IESO, Ontario Planning Outlook 2016: Overview, Status and Next Steps, pg. 44.
[20] Power Advisory LLC, Ontario Generation Outlook, pg. 53.

vehicle charging infrastructure as well as a bolstered incentive structure for the purchase of electric vehicles. The already released Climate Change Strategy also highlights that electrification of other sectors of the economy (transportation, industry, buildings) will be required in order to meet the 2030 emission reduction goals.

As discussed below, the IESO has already released data in their Ontario Planning Outlook 2016 scope document which forecasts an increase in GHG emissions from the electricity sector beginning in 2016. It is unclear at this time what assumptions the current IESO forecast includes for increases to electricity demand as a result of electrification of transportation and building heating. It can be assumed, however, that increases to electricity demand, especially increases that occur while nuclear units are being refurbished, would be met by stepping up production from Ontario's natural gas fleet. Increasing production from natural gas generators carries with it an increase in GHG emissions from the electricity sector as well as mid and long term cost risks associated with an increasing price on carbon.

Conservation

The province's conservation targets not being met are another contributor to relying on natural gas to meet supply adequacy requirements in the mid to long term. This has the potential to increase the emissions profile of the electricity sector.

Uncertainty exists across the electricity sector in regards to how emissions will change over the initial compliance period. For example, the current Long Term Energy Plan (LTEP) forecasts meeting a prescribed target for conservation of 7 TWh by 2020. Meeting those targets (or not meeting them) has implications for energy production in the province and thus the GHG profile of the electricity sector. Local Distribution Companies (LDCs) have already begun signaling possible difficulties in meeting these conservation targets using the usual energy efficiency measures available to them. For this reason some LDCs, in conjunction with the IESO, have funded behind the meter natural gas generation as a method of conservation. Meeting the conservation targets with behind the meter natural gas generation will increase GHG emissions.

Not meeting conservation targets could also increase GHG emissions if the IESO is forced to rely on natural gas peaking generation to meet demand due to the forecasted conservation not materializing. Research recently performed by Power Advisory LLC on behalf of CanSIA has identified considerable risk that LDCs will be unable to reach their long term directed conservation target of 30 TWh by 2032. A more reasonable level of 27 TWh was suggested by this research, and even this level has risks of not being achieved.[21] Recent information released by the Ontario Energy Board suggests that not meeting the provinces conservation targets is a real possibility. The 2014 Distributor Scorecard recently published shows that only 6 of 72 LDCs (8%) have met their Net Annual Peak Demand Savings target and only 41 of 72 LDCs (57%) have met their Net Annual Energy Savings target.[22] A lower than targeted conservation impact on gross electricity demand in the province would increase net demand and necessitate new generation, or, relying on existing natural gas generation to a larger degree.

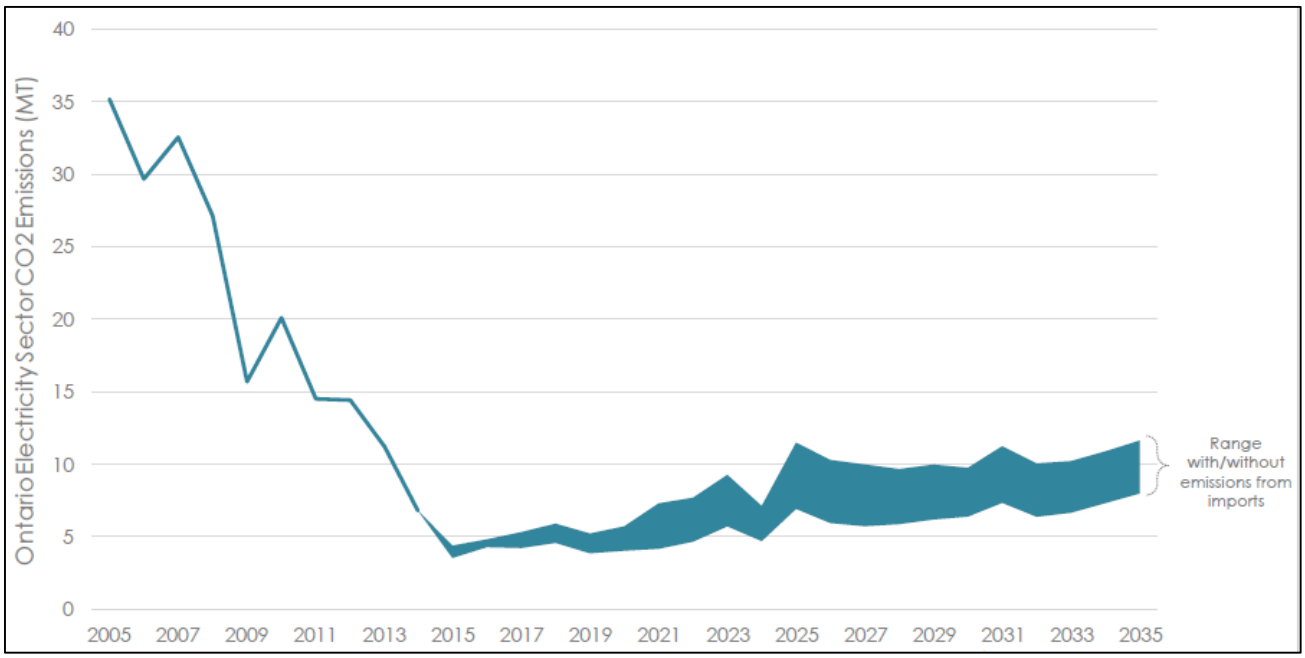
Nuclear Refurbishment and Shutdowns

The Ministry of Energy and the IESO have announced that refurbishment of both the Bruce and Darlington generating stations will be delayed, and that the Pickering generating station is slated to operate until 2024 (with two units

[21] Power Advisory LLC, Ontario Generation Outlook, pg. 43.
[22] Ontario Energy Board, 2014 Distributor Scorecard.

coming offline in 2022). These commitments effectively push out forthcoming supply gaps, however, given the current supply mix in the province, they also necessitate increased use of the natural gas fleet to fill in supply gaps as nuclear reactors are taken off-line for refurbishment between 2017 and 2033.[23] This will increase emissions from the electricity sector as a whole. Figure 3 below shows the IESO's current forecast of increases in emissions from the electricity sector.

Figure 3: IESO Forecast GHG Emissions from The Natural Gas Fleet



In the Climate Change Strategy the MOECC identifies specifically that it will establish GHG reductions as a priority in the next Long Term Energy Plan and that it will ensure a continuation of the positive trends in the electricity sector as well as continued improvement in conservation, efficiency and clean energy use to achieve deeper, long term GHG emission reductions.[24] Current forecasts from the IESO contradict with this goal, however, making changes such as those recommended within this submission will enable additional development of solar technologies in Ontario which will help mitigate these forecast impacts.

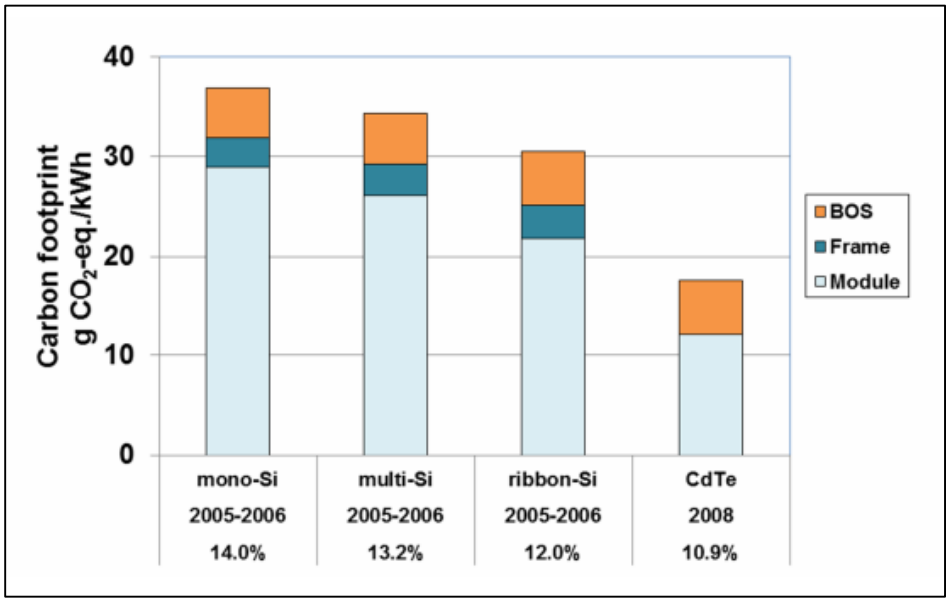
Life Cycle Greenhouse Gas Emissions from Solar PV

When tackling emissions within the electricity, buildings and transportation sectors it is important to understand the emissions profile of the solutions being implemented. Detractors of using solar PV as one of the solutions to addressing emissions point to the environmental impacts of solar PV itself, including waste management, water use, and GHG emissions as rationale for not encouraging its use. Understanding the extent of these impacts, in comparison to the impacts of other solutions, provides a firm base upon which to make decisions regarding which solutions to implement.

[23] IESO, Ontario Planning Outlook 2016: Overview, Status and Next Steps, pg. 43.
[24] MOECC, Climate Change Strategy, https://dr6j45jk9xcmk.cloudfront.net/documents/4928/climate-change-strategy-en.pdf, pg. 24.

The International Energy Agency's (IEA) Photovoltaic Power Systems (PVPS) Task 12, is a sub-group of the IEA PVPS focused on qualifying the environmental profile of PV electricity using a life cycle analysis approach to account for all environmental impacts of solar PV from the mining and manufacture of materials, to electricity production, through to the recycling and disposal of systems.[25] Using expertise and data from North America, Europe and Asia, the IEA PVPS Task 12 report, *Life Cycle Inventories and Life Cycle Assessments of Photovoltaic Systems* compared the environmental impacts of solar PV with the environmental impacts of electricity produced with other energy technologies, and evaluated trends in the environmental profile of PV.

Figure 4: IEA PVPS Life Cycle GHG Emissions of Solar PV



Writing in 2015, the IEA PVPS Task 12 found that the life cycle GHG emissions for solar PV is between 29-37 g CO^2-eq/kWh (this is shown in Figure 4, above).[26] Less than 4 years prior, data published by authors who contributed to similar analysis for the National Renewable Energy Laboratory (NREL) found a harmonized mean value of 52 g CO^2-eq/kWh for the lifecycle GHG emissions of solar PV.[27] Both analyses utilize what is known as a harmonized methodology. The harmonized approach disregards the impacts of studies that utilize data from projects with different parameters such as life of system, irradiance level, and system performance, all of which impact the GHGs per kWh calculations. The harmonized approach is thought to provide a more consistently accurate comparison across technologies than simply aggregating multiple project specific studies.[28] Both assessments of life cycle GHG emissions for solar PV are lower than all forms of natural gas, coal and nuclear.

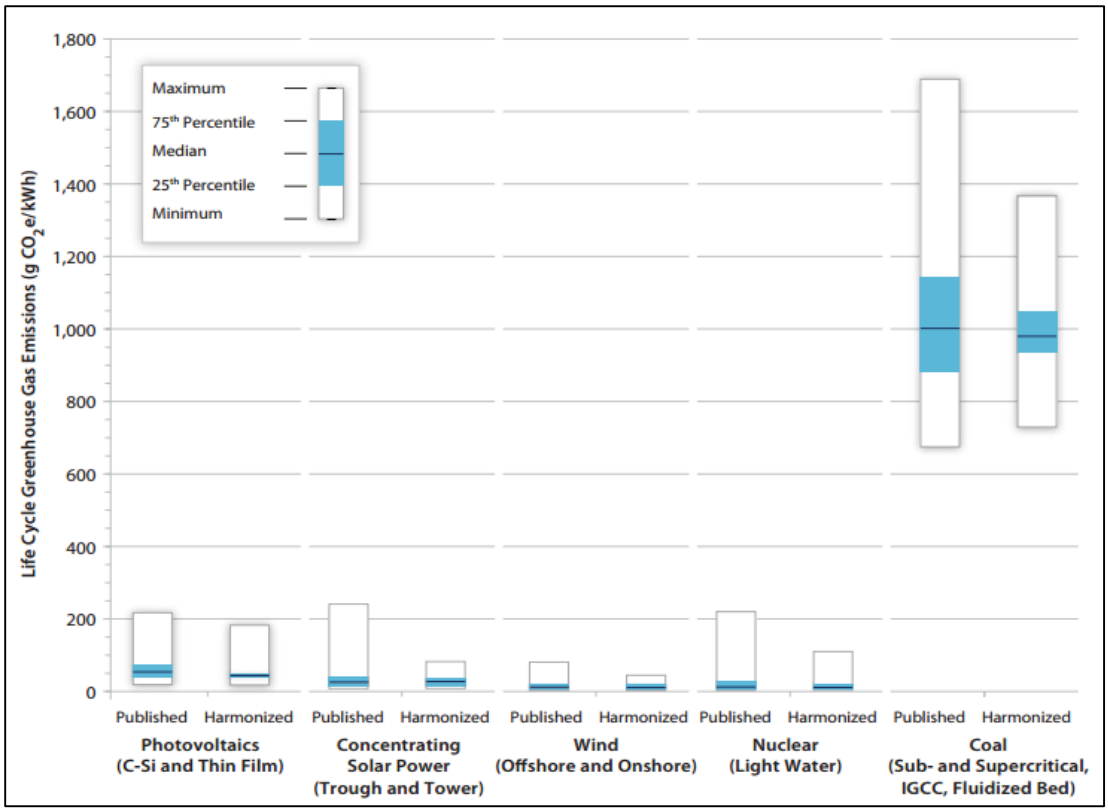
[25] IEA PVPS, Life Cycle Inventories and Life Cycle Assessments of Photovoltaic Systems, 2015, http://www.iea-pvps.org/index.php?id=9, pg. 4

[26] Ibid, pg. 10.

[27] Life Cycle Greenhouse Gas Emissions of Crystalline Silicon Photovoltaic Electricity Generation, Journal of Industrial Ecology, Yale University, 2012, http://onlinelibrary.wiley.com/doi/10.1111/j.1530-9290.2011.00439.x/epdf. pg. 129.

[28] Ibid, pg. 126.

Figure 5: NREL Life Cycle GHG Emissions by Technology



Source: NREL, Life Cycle Greenhouse Gas Emissions from Electricity Generation, http://www.nrel.gov/docs/fy13osti/57187.pdf

The European Photovoltaic Industries Association (EPIA), the US Solar Energy Industries Association (SEIA), and the NREL largely agree with the IEA PVPS Task 12 assessment, highlighting that while there are emissions attributable to solar PV, they are from processes other than electricity generation (such as materials mining and manufacturing) and the emissions profiles of those processes are improving over time.[29]

Conclusion and Summary of Recommendations

The forthcoming Climate Action Plan should implement a suite of complementary policies, programs, codes and standards that will support the Cap and Trade regulation in helping the province to meet its GHG emission reduction targets. Including a strong focus on solar PV and solar thermal technologies within the Climate Action Plan will allow individuals and businesses to simultaneously reduce natural gas used to generate electricity and natural gas used for space and water heating. Investing in solar technologies also carries significant positive economic impacts through

[29] National Renewable Energy Laboratory, Life Cycle Greenhouse Gas Emissions from Electricity Generation, 2013, http://www.nrel.gov/docs/fy13osti/57187.pdf and, European Photovoltaic Industries Association, Sustainability of Photovoltaic Systems: The Carbon Footprint, 2011 and, Solar Energy Industries Association, Solar Energy and Climate Change, 2013, http://www.seia.org/sites/default/files/Solar-Energy-and-Climate-Change_factsheet_june-2013.pdf.

direct investment and jobs and works to meet the MOECC's goal of building on past successes on decarbonizing the electricity sector in the face of forecasted increases to the sector's emissions profile released by the IESO.

Specifically, the MOECC should ensure that the Climate Action Plan:

1. Initiates revisions to the Ontario Building Code for buildings to be "solar ready";
2. Includes incentives and supportive policy to phase in requirements for net zero energy buildings and communities; and
3. Makes solar technologies eligible to receive funding under energy efficiency retrofit programs.

Thank you for the opportunity to provide this input into the development of the Climate Action Plan. We look forward to discussing these recommendations with you at your convenience.

Sincerely,

John Arthur Gorman
President, CanSIA