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Dr. David Wheeler,

Chair, Energy Efficiency Advisory Panel

Transmitted via email: energyefficiency@gov.ab.ca

Friday, September 30, 2016

Dear Dr. Wheeler,

RE: Promoting energy efficiency and community energy systems with solar electricity generation across Alberta

This submission presents the recommendations of the Canadian Solar Industries Association (CanSIA) (the national trade association that represents the solar industry throughout Canada) to Alberta's Energy Efficiency Advisory Panel (EEAP) on considerations that should be made when determining how to best promote local solar electricity generation[1] in the province in the most cost-effective and sustainable manner.

Many of these recommendations would not be implemented by Energy Efficiency Alberta (EEA) nor would they have implications for the EEA budget. However, we ask that you consider including our recommendations in the advice that you provide to Government as they are in our view, critical to enabling locally generated solar electricity to play a meaningful role in Alberta's electricity system and supporting the goals of the Climate Leadership Plan.

[1] For the purpose of this submission, "local solar electricity generation" refers to projects spanning the residential-, commercial-, institutional- to community-scales. In contrast to larger utility-scale electricity generation facilities, local solar electricity generation projects are located closer to load, connected to the grid at the distribution level and can be between 1 kW and 20,000 kW (upper limit defined by that which can be safely and reliably integrated at the point of interconnection, typically no more than 20,000 kW but frequently significantly less). There are two key applications for these types of projects: electricity customers who wish to offset their own electricity consumption (0 < 5,000 kW) called "load displacement"; and businesses or communities who wish to export all of the renewable electricity that they generate to the grid called "stand-alone generation" (1,000 < ~20,000 kW). (The upper limit of ~20,000 kW is explained as follows. The standard distribution voltage in Alberta is 25 KV and a typical substation has a 600 amp breaker. In a simplification, this combination results in sizing of lines to accommodate a load of 15 MW (25kV x 600 A= 15 MW). A double circuit system can also be used (2 overhead lines and 2 breakers) to effectively accommodate up to 30 MW. A direct connection in to a distribution substation can also be accommodated at industry standard collection system voltages of 35kV. With a standard 600 amp breaker, a 21 MW project can easily be accommodated (P= V x C) with a single overhead line. This voltage can then be stepped down to 25 kV at the substation and into two parallel breakers. There are also other considerations on Dx transmission lines such as continuous loads that can offset the generation on the feeders to accommodate a generation of over 15 MW with a transfer trip arrangement so no over-voltage scenarios occur).

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Achieving Alberta's target of 30% of electricity used from renewable resources annually by 2030[2] will deliver significant greenhouse gas emissions (GHG) reductions, economic development opportunities and position Alberta to achieve a leadership position in the low-carbon future that is fast approaching. In addition to the renewable electricity that will be procured through the Renewable Electricity Program (REP), locally generated solar electricity presents significant opportunities to support Alberta's Climate Leadership while creating jobs and attracting investment across the province.

Local solar electricity generation supports energy efficiency, energy conservation and demand-side management while modernizing the province's electricity system supply[3]:

- Energy Efficiency: Sited proximal to load and most productive when delivery of electricity most inefficient.
- Energy Conservation: Renewable energy thus displaces the consumption of non-renewable resources.
- Demand Side Management: Delivers significant reduction in electricity consumption and displaces load.
- Grid Modernization: Combined with smart-grid to provide greater system control and resilience.

In addition, it is important to note Alberta is already experiencing the impacts of climate change through hotter summers, milder winters and a higher frequency of extreme weather impacts which will put new strains on the electricity system as it relates to the availability of water for cooling thermal generation facilities, greater pressure on transmission and distribution networks during hot periods and the potential for outages during storms. A diverse electricity supply-mix that includes local solar electricity generation will also be more resilient and capable of adapting to these impacts of climate change.

CanSIA's six recommendations to the EEAP are summarized as follows:

1. ***Create a clear vision for the future of electricity in Alberta.***
2. ***Define "community" as electricity that is generated locally (not based on asset ownership).***
3. ***Enable local solar electricity generation to realize its true value through regulatory modernization.***
4. ***Reduce sizing and siting prescriptiveness to enable flexibility and economies-of-scale.***
5. ***Prepare the electricity system for future higher penetrations of variable generation.***

[2] Government of Alberta (2016) "Renewable energy target improves health, environment"
[3] As defined by: Government of Alberta (2016) "Energy Efficiency and Community Energy in Alberta Discussion Document"

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1. Create a clear vision for the future of electricity in Alberta

The electricity sector of 2030 will be very different from that of today for reasons including the increased penetration of local and utility-scale renewable electricity generation, the dramatic price declines of innovative "grid-edge" products and services and the proliferation of the "internet-of-things". ***CanSIA recommends that a clear new vision for electricity in Alberta in 2030 is defined and widely communicated with consideration for the following four characteristics: i) more energy efficiency, demand-side management and local electricity generation; ii) delivered by a cleaner and smarter grid; iii) greater choice for consumers; and iv) more resilience to the impacts of climate change.***

2. Define "community" as electricity that is generated locally (not based on asset ownership).

The EEAP White Paper[4] defines "community energy systems technologies" as "*includes both micro-generation and small-scale energy generation. Micro-generation is not intended to produce electricity beyond the owner's needs. Generated capacity is less than one megawatt from alternative or renewable sources of energy. Small-scale community generation refers to generation owned by a local community, co-operative or non-profit organization (including schools, post-secondary institutions and hospitals, etc.). Generation capacity from alternative or renewable sources of energy may be larger than a micro-generation site*".

CanSIA views this required ownership as a limitation to the attraction of investment in local solar electricity generation. For communities with an absence of capital there is a need to rely on third parties for finance or leasing arrangements if they were to become the owner of a local solar electricity generation asset. Many would prefer to receive property taxes or site lease payments from a third party rather than owning the asset. For communities where there is capital available, many do not have the time and mandate to allocate the capital for larger projects, nor would they opt to allocate the capital if appropriate financing was available, nor would any turn down performance and maintenance guarantees if offered at an appropriate cost. The key here is that options for financial structure and ownership enable broader participation independent of a community's access to capital or credit-worthiness.

Access to finance, the ability to manage technological risk and experience with asset management are in CanSIA's opinion the strengths that should be nurtured within Alberta's solar industry for it to grow and mature to the point that support and incentivisation are no longer required. A policy and regulatory framework that restricts the solar industry from providing or developing products and services that draw on these strengths will ultimately drive program costs up, adoption rates down and slow the solar industry from reaching maturity.

[4] Government of Alberta (2016) "Energy Efficiency and Community Energy in Alberta: Discussion Document"

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For example, it's assumed that in all solar electricity generation projects a solar supplier will deliver engineering, procurement and construction (EPC) and operations and maintenance (O&M) services. Many solar suppliers provide services beyond EPC and O&M to end-users in a variety of ways that could include lending funds, leasing equipment, third-party ownership and/or bilateral power purchase agreements or by leasing a rooftop or a site to situate the solar asset. In other words, the benefits of local solar electricity generation can be delivered to system owners, or system hosts and/or electricity and environmental attribute off-takers in a variety of ways.

The EEAP can also be assured that opening up the marketplace to a broader range of ownership models would simultaneously carry strong consumer protections along with it. In early 2016, CanSIA introduced a Solar Business Code of Conduct and Complaint Resolution and Disciplinary Process to provide clear guidelines to consumers and CanSIA's members on standards of conduct within the solar industry.[5] These standards are now in place across Canada and CanSIA's members in Alberta are bound by their provisions, helping to ensure that consumers receive a high level of service and integrity in the delivery of solar products and services.

To summarize, there are many benefits to allowing consumers the ability to choose the ownership model that best meets their needs:

- Benefits to Consumers:
  - More Choice: Less prescriptive requirements enable broader participation.
  - Less Risk: Onus is on provider to ensure optimal performance and to assume all development risk.
  - Less Liability: Adopters do not tie-up much needed debt or equity in assets for 15 years and more.
  - Lower Cost: Models that build scale and access new finance options drive down costs for consumers.
- Benefits to Government:
  - Broader and Deeper Capital Pool: More investment can be attracted thus more communities benefit.
  - More Bang for Buck: This approach costs less to Government.
  - Less Reliance on Government Funding: Models are preferred by adopters. Building capacity within Alberta's solar industry in Alberta will help end-users to avail of these options sooner.

CanSIA recommends that the concept of "community energy systems technologies" is amended such that the fact that they provide electricity within the community (i.e. connected at the distribution-level rather than at the transmission-level) is the qualifier and not exclusively community "ownership". Should there be a policy objective to financially incent communities to take an ownership position in a local solar electricity generation asset, CanSIA recommends that a minority stake in ownership can qualify as "community ownership" so as not to limit communities in their ability to benefit from partnership with the private sector.

[5] CanSIA Consumer Protection Resources, http://www.cansia.ca/consumer-protection.html.

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3. Enable local solar generation to realize its true value through regulatory modernization

Investment in local solar electricity generation is characterised by being capital-intensive upfront and having very low operating costs for the life of a project (as is the case with many other energy efficiency products and services).

Experience from other jurisdictions show that decisions to invest in these types of system are frequently determined by two key financial thresholds: i) revenue adequacy (whether or not the revenue streams and/or savings will provide a "payback-period" in the range of 5 – 7 years (or a specified "Internal Rate of Return" (IRR) based on their investor profile); and ii) revenue certainty (whether or not the perceived or real risk of the expected revenue streams and/or savings not being realized can be accepted by the prospective investor).

A policy and regulatory framework that delivers both revenue adequacy and certainty is necessary to attract investment from households, businesses, the public sector and communities in local solar electricity generation in Alberta. ***CanSIA recommends that EEA provide financial support to projects that do not benefit from economies of scale (i.e. residential and commercial) to compliment and support the success of the other measures presented herein which applies to all local solar electricity generation.***

Local solar electricity generation creates value through: i) financial benefits associated with savings on electricity use (for "load displacement projects") and/or revenues for electricity exported to the grid (for "load displacement projects" and "stand-alone projects"); ii) electric system benefits associated with the deferral of transmission and distribution and line losses; and iii) environmental benefits associated with the displacement of GHG emissions. The extent to, and means by which, these values are realized by local solar electricity generators requires modernization from the existing policy and regulatory framework to achieve revenue adequacy and certainty.

Recommendations for regulatory modernization for: i) electricity savings, export and system benefits; and ii) environmental attributes are presented in the following sub-sections.

Electricity savings, export and system benefits: Rate design[6] is the regulatory term used to describe the pricing structure reflected in customer bills and used by electric utilities. "*Rate design is important because the structure of prices — that is, the form and periodicity of prices for the various services offered by a regulated company — has a profound impact on the choices made by customers, utilities, and other electricity market participants. The structure of rate designs and the prices set by these designs can either encourage or discourage usage at certain times of the day, for example, which in turn affects resource development and utilization choices. It can also affect the amount of electricity customers consume and*

[6] The Office of the Utilities Consumer Advocate (UCA)'s initiative (AB-2016-05867) to benchmark electricity distribution for residential, farm and small business electricity consumers to "evaluate current rate design and evaluate consistency with the principle of cost causation compared to other jurisdictions" is a valuable initiative

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their attention to conservation. These choices then have indirect consequences in terms of total costs and benefits to society, environmental and health impacts, and the overall economy." [7]

Ensuring that rate design is "smart", encouraging electricity customers to incorporate energy efficiency and conservation into their behaviours and rate design is not a barrier to the adoption of innovative technologies, should be a starting point for the EEAP. For local solar electricity generation, smart rate design should target three areas: i) electricity generation and treatment of exports; ii) avoided "energy charges" and "non-energy charges" include demand transmission charges; and iii) supply transmission service charges.

Electricity Generation and Treatment of Exports: In this context, exports refer to electricity that is sold onto the grid. Electricity generated locally is exported to the distribution system by stand-alone generators and when load displacement systems generate more electricity than is consumed on-site[8]. Smart rate design will ensure that this electricity is valued appropriately relative to other electricity available in the market.

Analysis by the Market Surveillance Administrator (MSA) demonstrated that the average capture price of solar facilities historically in Alberta's wholesale electricity market could have earned a factor of 1.45 higher than the average pool prices during the same period.

However, under existing policies, regulatory framework, and rate design for local solar electricity generation, load displacement projects receive significantly less than the time-of-day value and stand-alone projects are subject to the uncertainty of the power pool. Under status quo, investment is not attractive for local solar electricity generation (especially under current power pool prices).

CanSIA recommends that load-displacement projects be compensated for electricity exported to the distribution system via bill settlement at a fixed rate of $150/MWh[9] that reflects the value associated with "time-of-generation" over the project lifetime. This rate design for exported power is termed "enhanced net-billing".

CanSIA recommends that stand-alone projects be compensated for electricity exported to the distribution system via AESO settlement at a fixed rate over the project lifetime. This mechanism for exported power is termed "standard offer program". In combination with the other measures in this report, a payment as low as $85 / MWh could begin to make the largest projects (~20 MW) viable.

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[7] Regulatory Assistance Project (2015) "Smart Rate Design for a Smart Future"

[9] A fixed payment of $150 /MWh for 20 years represents an annual compound annual growth of 2.1% over the average capture price 2008 to 2015.

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Avoided "Non-Energy Charges": In Alberta, electricity consumers are billed for the electricity services they receive by their retailer. Bills include "energy charges" and "non-energy charges":

- Energy Charges: Energy charges are per-kWh charges for electricity consumed. Energy charges are calculated by multiplying the amount of energy used in a billing period by the applicable energy rate. Energy charges constitute approximately 45 - 66% of a residential customer's monthly power bill.
- Non-Energy Charges: Non-energy charges comprise delivery charges, administration fees, local access fees, and adjustments over time. Delivery charges are fully regulated by the Alberta Utilities Commission (AUC) and are identified separately on the invoice. Delivery charges recover the cost of maintaining and expanding the electricity system for the utilities that make the investments.

Residential, and Small Commercial customers have non-energy charge calculations based solely on consumption (kWh). Peak load is a determinant of Non-Energy Charges for Medium Commercial and Large Commercial customers.

Load displacement with local solar electricity generation reduces the degree to which electricity is consumed and to which the electricity system is used by the generator. In addition, the local generation defers the need for transmission and distribution (T&D) system investment.

The value of the local solar electricity generated and consumed on-site in the deferral of investment for T&D upgrades and is captured through decreased non-energy charges. However, the value of deferred T&D investment is not captured for electricity that is exported to the grid under the existing policy and regulatory framework for local solar electricity generation even though there are benefits beyond the point of generation.

CanSIA recommends that residential local solar electricity generation for load displacement is also credited for the non-energy charges for electricity exported to the distribution system.

Due to the way that "peak load" is calculated for commercial customers to determine non-energy charges, (measured by kVA and defined as the maximum load over any 15-minute period in the previous 365 days), the T&D investment deferral resulting from local solar electricity generation by these customer classes is not valued.

CanSIA recommends that the province's approach to non-energy charges are reviewed so that non-energy charge management can support a non-residential electricity consumer's decision to invest in local solar electricity generation.

Supply transmission service charges: Local electricity generation provides "system benefits" in two ways: i) investment and strain on T&D facilities are deferred or reduced; and ii) line losses are avoided.

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Today, these system benefits are recognized through rate and tariff design, for example:

- **T&D Deferral:** The "Distribution Transmission Service" (DTS) Credit flows savings realised by a wire service provider (WSP) for their reduced strain on the transmission network through to local generators. The DTS credit is paid monthly on a substation basis (based on location of interconnection) and by how closely its profile matches the grid's coincident peak.
- **Line Losses:** FortisAlberta's "Option M" and Enmax's "Tariff D600" provide for the pass through of AESO charges and credits to the generator. For stand-alone projects that sell power to the grid and reduce line losses, the generator receives revenue.

However, there are no mechanisms such as the DTS Credit, Option M or Tariff D600 in place to enable local generation that serves as "load displacement" to be compensated for these system benefits. Under the current Alberta distribution tariff structure, much of the distribution tariff is composed of demand-based charges ($/kVA) and minimum daily service charges. A portion of these charges are reduced by local generation that is consumer on-site with a resulting decrease in the cost of purchasing electricity. Additionally, local municipalities, such as the City of Calgary, institute demand and consumption based user access fees, which are also not materially reduced. The current distribution tariff structure is a barrier to the deployment of local solar electricity generation. A new distribution tariff or revisions to existing distribution tariffs would support project viability.

Any generator that is connected to the distribution or transmission system is charged for supply transmission service (STS). The charge under Rate STS in a settlement period as the losses charge calculated as the sum, over all hours in the settlement period, of metered energy in the hour multiplied by pool price multiplied by a loss factor for the facility, where the loss factor is determined in accordance with section 501.10 of the ISO rules, *Transmission Loss Factor Methodology and Requirements*, and is available to market participants in the loss factors section of the AESO website[10].

STS is charged to the distribution facility owner and then passed through to the generator that is connected to the distribution grid. Some locations in Alberta have "negative" loss factors, and therefore result in a benefit being paid to the generators who are providing support to the grid in areas that would otherwise have high loss factors. This results in a revenue increase for these facilities. The calculation is determined on an annual basis.

[10] www.AESO.ca

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Local solar electricity generation that is stand-alone but not load displacement may benefit from an STS payment, depending on the location of the generation facility even though load displacement is located specifically at a load centre thus reducing line losses.

CanSIA recommends that load-displacement projects be compensated for system benefits (T&D and lossess) via bill settlement over the project lifetime. A value of $25 / MWh for all generation corresponds to an appropriate market price that (in combination with the other measures presented in this report) supports project economics to a meaningful degree.

CanSIA recommends that for local generation that is "stand-alone", additional clarity from the Government of Alberta and/or the Alberta Utilities Commission (AUC) is provided on the importance of system benefits from local generation with a commitment to the continuation of mechanisms such as the DTS Credit, Option M and Tariff D600 to provide investors with an added level of revenue certainty (thus lower costs of capital) and support the decision to invest.

Environmental Attributes: A simple and straightforward market-based mechanism for local solar electricity generators to realize the true value of the environmental attributes that they produce could contribute to revenue adequacy and attract investment.

There are two common market-based mechanisms for compensating renewable electricity generators for environmental attributes: "Offsets"; and "Renewable Energy Certificates" (REC's). Both RECs and Offsets can be sold and traded or bartered, and the owner can claim to have purchased renewable energy.

Carbon Offsets represents a one-tonne reduction or removal in greenhouse gas (GHG) emissions from an independently verified GHG project that compensates an equivalent amount of emissions made elsewhere. An offset is created when one party receives credits for reducing their greenhouse gas emissions and these credits can then be purchased by another party to "offset" their emissions levels.

In Alberta, one option for a large emitter to comply with reduction obligations defined under the Province's Specified Gas Emitters Regulation (SGER) is to purchase credits from non-regulated activities that have voluntarily created emission reductions. These offsets are commercialised at a rate that is approximately five to ten percent less than Alberta's alternative compliance unit pricing ($/Tonne CO_2e). This pricing will increase to $30 per tonne in 2017. There are two quantification protocols that are applicable to solar electricity generation projects[11]. However, no projects have been registered to date.

[11] The first protocol was published in 2008 to provide guidance for projects >1MW (Alberta Quantification Protocol for Solar Electricity Generation, Version 1.0, May 2008, Specified Gas Emitters Regulation). Projects <1MW have a different protocol published in 2013.

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Qualifying for offset credits is complex. Projects must follow strict government approved protocols that ensure emissions reductions are real, demonstrable, quantifiable, and "additional" to what would have occurred otherwise and registered on the Alberta Emission Offset Registry. Once registered, the offsets can be sold to Alberta's large emitters that have not met their provincially mandated reduction obligation. The level of regulatory rigour and administrative burden (i.e. project registration and verification, in addition to the legal and verification barriers associated with offset sales) is far in advance of that which can be expected to be manageable for individual residential, commercial and community renewable energy projects. (View Appendix for a series of recommendations for how to improve the existing protocols).

In Alberta, 1 MWh of renewable electricity is equivalent to 0.59 Offsets (i.e. 0.59 tonnes is displaced per MWh). Thus a typical residential solar electricity generator produces approximately 3 Offsets per year[12]. On an individual project basis, this is a small number of Offsets but an important revenue stream for that project nonetheless. In aggregate, many projects of this scale could contribute meaningfully to Alberta's climate change objectives and should be compensated for doing so.

Renewable Energy Certificates (RECs) (or "Solar Renewable Energy Certificates" (SREC's) when REC's are produced by solar electricity generators) are tradable, non-tangible energy commodities that represent proof that 1 megawatt-hour (MWh) of electricity was generated from an eligible renewable energy resource. As RECs are directly related to electricity generation (1 MWh = 1 REC) which is readily metered and settled, they can be a significantly more simple option than Offsets for residential, commercial and community solar electricity generation in Alberta. RECs were recommended as the means by which to procure utility-scale renewables in the Climate Leadership Report[13]. There has been no formal discussion to date of the implementation of RECs or SRECs for residential, commercial or community solar in Alberta (despite the fact that 1 REC has equivalent environmental attributes whether it is generated at the utility or residential scales).

CanSIA believes that an SREC is the most appropriate approach to enabling local solar electricity generation projects to realize the value of their environmental attributes in a simple and straightforward way.

CanSIA recommends that a central body (such as Energy Efficiency Alberta) purchases SRECs to compensate local solar electricity generation for the Environmental Attributes (EA) that they produce. That central body could then aggregate those SRECs. There are multiple opportunities for sales, conversion to offsets, retirement or banking. This approach would remove the complexity of verifying and commoditizing small volumes of SRECs/Offsets for local solar electricity generators. The central body provides a fixed-price payment (i.e. $35/REC or the amount that is equitable with the

[12] Assumes 5 kW_{DC} producing 6,000 kWh per year.
[13] Government of Alberta (2015) "Climate Leadership Report"

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Renewable Electricity Program) for the project life (i.e. 20 years). Funding for the Residential and Small Commercial SRECs can be from Energy Efficiency Alberta. Funding for the larger project SRECs can be from Large Scale Renewable Energy, Bioenergy and Technology Fund[14]. Alternatively funding for purchase of SRECs could come from the resale of the SRECs or Offsets. Payments could be settled in parallel to consumption and generation (i.e. for load displacement) or generation (i.e. for stand-alone generation). Above a specific threshold, revenue-grade metering is required and for smaller projects inverter-supported power production tracking could be used for measurement. This measure in combination with the other measures presented in this report will deliver revenue adequacy for larger projects. A higher value for smaller projects (and/or additional fiscal measures) is required.

In order for a central body (such as Energy Efficiency Alberta) to aggregate these environmental attributes, modifications to the existing offset protocols[15] is required to enable the central body to demonstrate emissions reductions, benefit from efficiencies of scale and minimize administrative and transaction costs. Under the existing offset protocol, the validation, verification and transaction costs of offset aggregation are excessive. Costs for a single offset project can typically run between $10,000 – $15,000 per verification (but are typically driven by the volume of offsets that have been generated or contractual requirements with potential buyers). Thus, the aggregation of emissions offsets from a number of projects is required before a volume of scale is reached to justify the cost of validation and verification process.

4. Enable sizing and siting flexibility to enable projects to realize economies-of-scale

Enabling projects to achieve economies-of-scale is critical to drive down costs. Driving down costs is essential to attracting investment in local solar electricity generation and reaping the environmental and jobs benefits.

The existing policy and regulatory framework for local solar electricity generation for load displacement prescribes maximum system sizes and locational requirements which limit the ways in, or extent to, project proponents can achieve

[14] Budget 2016 includes the Climate Leadership Plan (CLP), an economy-wide strategy for reducing greenhouse gas emissions. The plan will erase any doubt about Alberta's environmental record, and help us build the pipelines we need to safely and securely get our energy products to new markets. The CLP imposes a price on carbon emissions, implemented through a carbon levy that will act as the key tool to pay for a greener, more diversified economy. Over the next 5 years the carbon levy is projected to collect $9.6 billion, which will be reinvested into Alberta's economy. $6.2 billion will be spent on diversification of our energy economy and creating jobs, including: $3.4 billion for large scale renewable energy, bioenergy and technology; $2.2 billion for green infrastructure like transit; $645 million for Energy Efficiency Alberta, a new provincial agency that will support increasing energy efficiency for homes and businesses.

[15] The offset quantification Protocol for Distributed Renewable Energy Generation provides guidance on the quantification of offset credits from distributed, small-scale renewable energy generation projects that qualify under Alberta's Micro-Generation Regulation. The Distributed Micro-Generation Protocol is applicable to projects generating electricity from solar or wind technologies and displaces power on a local electricity distribution system. The Protocol for distributed generation differs from quantification methodologies for utility-scale wind and solar projects.

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economies of scale and invest in local solar electricity generation in a variety of circumstances including: i) presence of a large summer load but absence of a suitable roof/site; and ii) presence of a large summer load but distributed across multiple sites with separate meters; and/or iii) absence of a summer large load but presence of a suitable roof/site.

There are several project models that enable economies of scale to be achieved for electricity customers who wish to offset their own electricity consumption. However, these models are not eligible under the existing sizing and siting requirements in the Micro-Generation Regulation (as presented in the following table).

Table: Project Model Eligibility for Micro-Generation Regulation

	Term	Electricity Customers (#)	Sites (#)	Meters (#)	Example
1	Net-Billing/ Net-Metering (offsets net-to-grid load requirements)	1	1	1	House or Office
2	Basic Meter Aggregation (produce and take delivery at one site against multiple loads i.e. allow you to self-supply from multiple rooftops).	1	1	≥1	University Campus
3	Multi-Site/Meter Aggregation (produce at one site and take delivery of your production at another i.e.: allow you to self-supply from a solar garden or multiple rooftops).	1	>1	≥1	Municipalities, Commercial Property Managers, Manufacturing and Industrial
4	Virtual Net-Billing/Metering (produce at one site and take delivery of your production at another i.e.: allow you to self-supply from a solar garden or multiple rooftops).	>1	>1	>1	Community comprised of a variety of rate classes

Only the first option above is eligible under the existing policy and regulatory framework. These project models permit the value from electricity generation and reduced non-energy charges to be shared among several utility load accounts. The value of deferred investment is captured by reducing the non-energy charges on load accounts additional to the

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micro-generator. For example, residents in a multi-unit building, each with their own utility account, may share the value of a single solar installation on the roof of the building. Other examples that could benefit from virtual net metering include industrial parks that include multiple businesses within a single site, hospital and university campuses and companies with multiple locations within the same electricity service area. Virtual net metering enables a more cost-effective design of solar projects compared to an arrangement where each solar project is physically connected to a single utility account[16]. The virtual net metering policy will require changes to retailer billing systems to aggregate and analyse data across multiple accounts. Achieving economies of scale to minimize unit costs of electricity will be critical to developing Alberta's solar electricity market in the initial years.

Some retailers in Alberta currently "totalize" the consumption of their customers with multiple sites for the purpose of settlement and billing. Some industrial generation can be considered "behind-the-fence" despite not being on-site through the Industrial Systems Designation. While these practices demonstrate that similar approaches are enabled for some customers under the existing legislative framework, the Micro-Generation Regulation does not allow them for solar load displacement.

CanSIA recommends that "Enhanced" Basic, Multi-Site/Meter and Virtual Net-Billing are permitted in the revised policy and regulatory framework in Alberta so that electricity customers who wish to offset their own electricity consumption have sizing and siting flexibility and the projects that serve them can realize economies-of-scale. For settlement purposes, program design would specify requirements for the locational relationship of generation and load (i.e. fixed geographic zones, limitation to individual distribution feeders). CanSIA supports a program design that enables the maximum level of flexibility possible to maximize the ability to achieve scale (i.e. at a minimum limited to Distribution Facility Operator franchise areas).

For load displacement projects, the ability to optimize design based on the site's characteristics can have a large impact on project viability. For this reason, CanSIA recommends that the "rating of customer's service" (in s.1(1)(h)(iii)) of the Micro-Generation Regulation is interpreted to mean "rating of the service box on the customer's electrical panelboard" so as not to unnecessarily restrict project sizing.

[16] Virtual Net Metering Policy Background and Tariff Summary Report, Center for Sustainable Energy, 2015.

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5. Prepare the electricity system for higher penetrations of variable generation

Several jurisdictions are leading globally on the penetration of variable generation that they achieve in their electricity supply. Today, 20 – 30 countries meet >1% of their annual electricity demand with solar energy (Italy is ranked number one at 8.5%)[17]. Increasing penetrations of variable generation require new approaches and processes to system operation and management to ensure system reliability (i.e. balancing supply and demand and ensuring grid stability).

The contribution of electricity from solar (and the potential to contribute to system reliability issues) today in Alberta is minimal. In order to ensure system reliability as the province transitions toward 30% renewables by 2030, some solutions to high penetrations of variable generation being demonstrated by global leaders today should begin to be developed and advanced in the province including: i) smart grid; ii) flexibility of load; iii) ancillary services market renewal; and iv) access to neighbouring markets.

5.1 Smart-Grid: "The successful integration of a large amount of distributed generation located across the entire span of the AIES will require the intelligence, control and communications networks made possible by the deployment of smart grid technologies if distributed generation becomes larger and more widely deployed"[18]. In addition, the greater information that smart-grid technologies can provide empowers consumers with the capability to be more efficient in their electricity consumption and cost.

CanSIA recommends that a "smart-grid fund" for investment in the integration of hardware, software, computer monitoring and control technologies, and modern communications networks in the electricity distribution system be created within the $2.2 billion to be invested in green infrastructure in the province[19] to enable the province to integrate more variable generation and to ensure reliability as the province transitions toward 30% renewables by 2030.

5.2 Load Flexibility: Demand responsiveness and load shedding though voluntary price responsiveness and other approaches[20] currently support resource balancing and grid stability in Alberta. *"Independent system operators across North America are making increased use of demand response programs to meet a portion of their balancing and operating reserve requirements. These programs can be very responsive (available in seconds or minutes). These programs would*

[17] International Energy Agency (IEA) Photovoltaic Power Systems (PVPS) Task 1.
[18] Alberta Utilities Commission (2011) "Alberta Smart Grid Inquiry". Another valuable report on this topic is: Rocky Mountain Institute (2015) "The Economics of Demand Flexibility".
[19] Government of Alberta (2016) "Fiscal Plan: The Alberta Jobs Plan"
[20] Including those driven by Alberta Reliability Standard EOP-003-AB1-1 whose purpose is to ensure "plans are in place and plans are implemented to shed load when there is insufficient generation or transmission capacity, to mitigate the risk of an uncontrolled failure of the Interconnection".

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be attractive to large industrial and commercial customers if they can be structured as an ancillary service provided to the AESO in which the customers are financially compensated for curtailing their consumption"[21].

CanSIA recommends that the Government of Alberta direct the AESO to continue to pursue load flexibility as one of the means available to enable the province to integrate more variable generation and to ensure reliability as the province transitions toward 30% renewables by 2030.

5.3 Ancillary Services

The AESO is mandated through the Alberta Electric Utilities Act to procure Ancillary Services (AS). The Act defines AS as follows: *"those services required to ensure that the interconnected electric system is operated in a manner that provides a satisfactory level of service with acceptable levels of voltage and frequency"*[22]. The AS market design is required to ensure that electricity can be transmitted reliably, efficiently, and securely across Alberta's interconnected transmission system today, will undoubtedly be different to that which will be required as renewable resources increase and the balance of thermal generation shifts from coal to natural gas.

CanSIA recommends that the Government of Alberta direct the AESO to review the ancillary services market as one of the means available to enable the province to integrate more variable generation and to ensure reliability as the province transitions toward 30% renewables by 2030.

5.4 Access to Neighbouring Markets:

At this time the Alberta Interconnected Electric System has transmission interconnections or interties adjacent jurisdictions: i) British Columbia (rated capability of 1,000 MW for export and 1,200 MW for import); ii) Saskatchewan

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[21] Alberta Utilities Commission (2011) "Alberta Smart Grid Inquiry"

[22] These services include Operating Reserve (OR), Transmission Must Run (TMR), Black Start, and Load Shed Service for Import (LSSi). Operating Reserve (OR) unloaded generator capacity or curtailable load that can be dispatched on short notice to maintain system reliability when there is an unexpected imbalance between supply and demand, due to various system conditions or contingencies. Transmission Must Run Service (TMR) is generation required to be online and operating at specific levels in specific locations of the Alberta Interconnected Electric System (AIES) to compensate for insufficient local transmission infrastructure relative to local demand. The AESO contracts with generators in areas where TMR is required. Black Start Services is contracted by the AESO with generators that are able to restart their generation facility with no outside source of power. In the event of a system-wide black-out, black start providers are called upon to re-energize the transmission system and provide start-up power to generators who cannot self-start. The AESO contracts with generators in areas where black start services are required. Load Shed Service for Imports (LSSi) is provided by loads that agree to be tripped following the frequency drop caused by the sudden loss of imports coming across the WECC-connected interties (the AB-B.C. intertie and Montana-Alberta Tie Line or MATL) due to intertie contingencies. LSSi is used to manage frequency risk so that import intertie capability can be increased, allowing additional scheduled imports to access the Alberta market without compromising system reliability. The AESO uses a competitive procurement process to contract with loads providing LSSi. See http://www.aeso.ca/market/5093.html for further details.

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(rated capability of 150 MW for both export and import; and in the future iii) Montana (the Montana Alberta Transmission Line (MATL), a merchant line, with rated capability of 300 MW for both export and import)[23]. An increased level of interconnection to neighbouring markets could provide more options to support system reliability, provide opportunities for exports and make Alberta's electricity system more resilient to the impacts of climate change.

CanSIA recommends that the Government of Alberta direct the AESO to review the potential for increased access to neighbouring markets as one of the means available to enable the province to integrate more variable generation and to ensure reliability as the province transitions toward 30% renewables by 2030.

Thank you for your consideration and please do not hesitate to contact Patrick Bateman, Director of Policy & Market Development (pbateman@cansia.ca) should you require any supplemental information.

Best regards,

John Gorman

President & CEO, Canadian Solar Industries Association (CanSIA)

CC Energy Efficiency Advisory Panel:

- Michele Aasgard, Alberta Community and Co-Operative Association (ACCA)
- Desmond Bull, Councillor for the Louis Bull Tribe of the Maskwacis Nation
- Tanya Doran, Stantec
- Roni-Sue Moran, Industry Relations Corporation
- Jesse Row, Alberta Energy Efficiency Alliance (AEEA)
- Marc Huot, Municipal Climate Change Action Centre

[23] The actual operating capability of these interties is less than the rated capability in many cases due to reliability requirements and constraints on Alberta's transmission system.

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Appendix 1: Required Amendments to Offset Protocol to Enable SREC

CanSIA recommends that the following amendments are made to the existing offset protocols to enable the central body (such as Energy Efficiency Alberta) to minimize the validation, verification and transaction costs of offset aggregation and to benefit from efficiencies of scale:

A. Verification:

- **Accuracy of Measurement:** It is important that solar electricity generators are compensated for the environmental attributes of all the electricity that they produce. Current metering and settlement practices for solar electricity generators that displace load (i.e. "Micro-Generation") are only "revenue-grade" for electricity exported and not for electricity consumed on-site. Successful verification and offset serialisation can be achieved cost-effectively utilising less costly inverter-supported power production tracking. If precision of this approach is less than required, a factor could be applied to account for this (i.e. 95% of production tracked is compensated). Although the quantification protocol does identify inverter systems as a potential source of data, these inverter systems may not provide a production metering system with a level of accuracy that could introduce a risk of a "material" error in the quantification of offset credits. Materiality refers to a threshold for errors, omissions, or misrepresentations (discrepancies) in a greenhouse gas reduction assertion. Verifiers cannot issue a positive assurance statement with such discrepancies. The materiality threshold for compliance with the Alberta Offset System has been set at five per cent. As such, distributed generation projects would have to demonstrate a level of metering accuracy comparable to a revenue class metering system. This presents a risk to smaller scale projects, where, the installation of a secondary revenue-class metering system may present a financial barrier. Greater clarity on the accuracy requirements for metering of distribution-connected solar electricity generation projects are recommended in order to streamline the verification process and minimize costs.
- **Reduce site-visit frequency:** In the case of a single project that includes the aggregation of multiple distributed projects, a verification requires a site visit to each of the aggregated projects at each annual verification. It would be reasonable to assume that solar electricity generation projects, once initially verified, will remain in place for several years and so subsequent site visits are not required during each verification exercise. Offset aggregation schemes do exist for conservation cropping projects in Alberta and can serve to provide the legal framework necessary to develop and offer an aggregation program for residential, commercial and community solar electricity generation projects. Paper verification of generation volumes should be sufficient on an annual basis with a site visit required every five years instead of annually. The reduced site visits reduces the cost of offset verification.

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B. Quantification:

- **Remove requirement to quantify emissions associated with power generation facility operation:** Solar electricity generation projects should be exempted from quantifying the emissions associated with powering equipment, heating of buildings and use of fuels and refrigerants on site as they are immaterial.
- **Include provisions quantifying emission reductions that are generated from avoided line losses:** If a solar facility greater than 1 MW is connected to the distribution system (as is the case with the Distributed Renewable Energy Generation Protocol)[24] then that project should acknowledged for its displacement of emissions related to line losses as is the case for distribution-connected solar electricity generators.
- **Review the approach to grid emissions intensity factors:** Offsets generated from distributed generation are quantified by referencing the following formula: *Emissions Reductions = Electricity Generation x (Electricity Grid Displacement Factor + Avoided Line Loss Factor).* An electricity grid displacement factor reflects the emissions profile associated with the generation of one Megawatt-hour of electricity on the transmission grid. As such, it is used to quantify the emissions associated with the consumption of electricity, or, the emissions avoided by displacing grid electricity with an alternative source. In Alberta, the regulatory authority has opted to implement a Marginal Intensity-based approach to quantifying electricity grid emissions. Common to the marginal intensity-based approaches is the consideration of the emission intensity of the Build Margin (BM) and Operating Margin (OM). Currently, the electricity grid displacement factor for distributed generation projects is 0.64 tonnes of carbon dioxide equivalent emissions (CO_2e) per MWh generated and takes into account an equally weighted BM and OM and line losses. It also accounts for the regulated improvement in the emissions intensity of the OM as a result of the Specified Gas Emitters Regulation (12 per cent regulated improvement). As Alberta's Climate Leadership Plan is implemented, both the BM and OM will be impacted by the 30 percent renewable energy target and a phase-out of coal. This translates to a decrease in the emissions reduction potential of renewable energy projects. Also, as distributed generation projects proliferate, distribution line losses will theoretically decrease, further decreasing the emission reduction benefit of distributed generation projects.

C. Other:

[24] Under the Distributed Micro-Generation Protocol, projects are not required to quantify emissions associated with facility operations, due to their size, and the protocol provides specific guidance on how to quantify emission reductions from avoided line losses. The protocol assumes 0.083 MWh avoided line loss per MWh of power that is generated and consumed on site based on the results of a study performed by Jem Energy. This protocol allows for the environmental benefits from line losses associated with micro-generation to be quantified and monetized.

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- Provide clarity on offset ownership (i.e. legal language) for solar electricity generators that can have complex siting, offtake and ownership models: The requirement for proof of offset ownership for distributed solar projects presents a number of contractual and regulatory risks in quantifying and commercialising offsets from distributed solar projects. This becomes particularly relevant when multiple parties are involved in the implementation of a project. Differentiating land, rooftop, and facility ownership; power purchase agreements; and technology ownership can collectively introduce a barrier to defining the ownership of emissions reductions enabled through distributed generation. The chain of custody over an offset credit must be verifiable and clearly defined before a proposed emission reduction is considered a verified emission reduction in Alberta. Currently, ownership checklists or standardised terms and conditions of ownership in solar system purchase / lease agreements are not available for those will less experience with Alberta's carbon market. Guidance and tools that clearly document the ownership of offset credits generated could potentially remove some barriers to smaller generators.