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11th July, 2016

Dear the Electricity and Sustainable Energy Division at Alberta Energy,

Re: CanSIA Response to Distributed Alternative and Renewable Energy Generation Questionnaire

The Canadian Solar Industries Association (CanSIA) is the national trade association that represents the solar industry across Canada. This document presents the commentary and recommendations from CanSIA prepared in consultation with our Membership to Alberta Energy and Alberta Climate Change Office on the "Distributed Alternative and Renewable Energy Generation: Policy Discussion Document" circulated on June 30, 2016.

Commentary on Background, Policy Context and Desired Outcome

In order to reach the stated desired outcome of a "clear and comprehensive policy and regulatory framework for micro- and small-scale community generation", CanSIA provides the following four considerations related to the background, policy context and desired outcomes:

- *i) Communicate a clear new vision to consumers for electricity-use in 2030;*
- *ii) Renew the policy and regulatory approach for load displacement and stand-alone generation;*
- *iii) Facilitate community ownership but do not mandate it; and*
- *iv) Enable innovative business models to drive down costs.*

***Communicate a clear new vision to consumers for electricity-use in 2030**: The Climate Leadership Plan, phase-out of coal-fired generation and target for up to 30% of the province's electricity coming from renewable resources by 2030 will bring change to the ways in which electricity is generated, distributed and consumed in Alberta. New technologies (including solar and storage), products and services and the internet-of-things will also begin to provide consumers with a desire for more choice for their electricity-use than has previously been offered.*

CanSIA believes that the first step to achieving alignment amongst a variety of stakeholders toward in a common direction, is to create and ensure a common understanding of the vision being worked toward. A focus on project-level practices is a good first step, but has the potential to be a first step taken in multiple different directions.

Once a common vision is established with electricity sector stakeholders, the process led by the Energy Efficiency Advisory Panel then presents an excellent opportunity to communicate this clear new vision to electricity consumers across Alberta.

CanSIA recommends that Alberta Energy and Alberta Climate Change Office define and communicate a clear new vision for electricity-use in 2030 through this stakeholder engagement process with consideration for the four principals bulleted below:

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- *More energy efficiency, energy conservation and demand-side management;*
- *Delivered on a cleaner, smarter and more distributed grid;*
- *Greater choice for consumers; and*
- *More resilience to the impacts of climate change.*

Transitioning toward this vision for electricity-use represents a paradigm shift for all electricity sector stakeholders including: i) the Alberta Utilities Commission (AUC) (i.e. challenges posed for existing rate and tariff structures by new technologies, products and services and consumer behaviours and approaches to cost recovery for utilities when investments hold new risk and value profiles); and ii) Distribution Facility Operators (DFO) (i.e. the need to sustain revenue streams when consumers' usage and usage profiles are changing and for power system planning and grid operation changes to adapt as more consumers become "prosumers").

This paradigm shift will represent evolution and not revolution only if Alberta begins to move in a coordinated fashion starting today. In the long-run, proactivity will be the least costly and disruptive to DFO and consumers. A clear new vision should be the beginning of action to get there.

Renew the policy and regulatory approach for load displacement and stand-alone generation: *CanSIA believes that Alberta Energy and Alberta Climate Change Office's desired outcome for this stakeholder engagement should be to develop a clear and comprehensive policy and regulatory framework for two distinct end-users of solar technology in Alberta:*

i) Electricity customers who wish to offset their own electricity consumption; and
ii) Communities and businesses who wish to generate and export renewable electricity to the grid.

The key distinction between these two end-uses is that the former is intended to displace load while the latter is stand-alone generation. Both represent significant opportunities to support the policy objectives of Alberta's Climate Leadership.

The current "Micro-Generation" (MG) and "Distributed-Generation" (DG) policy and regulatory frameworks provide a good starting point for both end-users. Alberta Energy have expressed that MG will be revised and renewed. If it is the intent to encourage stand-alone generation solar projects, then significant changes to DG are required to see uptake. This is largely due to the challenges posed to investors by merchant risk for technologies with high up-front costs and minimal on-going costs. The unprecedented low power pool pricing currently being experienced compound this issue (however, a return to typical pool pricing would not overcome this issue due to the lack of revenue certainty).

DG projects provide many benefits relative to MG projects, including lower costs (i.e. $/MWh), more technical potential (i.e. MW), faster deployment (i.e. MW per year) and a wider variety of ownership models thus encouraging a broad variety of participants and investors.

Ensuring that stand-alone generation projects are captured by a renewed policy and regulatory framework will provide a basis by which DG projects can participate in Alberta's electricity sector. As such, a renewed policy and regulatory framework for stand-alone generation is an important desired outcome for this stakeholder engagement.

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Facilitate community ownership but do not mandate it: *The use of the term "community" in both discussion papers[1] makes it clear that these projects are understood to not be limited to load displacement (i.e. includes stand-alone generation) and are greater than 1 MW in size. As a result, a renewed policy and regulatory approach for load displacement and stand-alone generation is required (as per above) for "community" projects.*

In addition, it also remains ambiguous whether or if it is proposed that "community" relates to the size of a project or the ownership of the project (nor how ownership is defined i.e. full or partial, asset or offtake).

There are several project models for "community solar" as shown in the following table. The degree to which each of these models would proceed in Alberta will be highly dependent on the design of the policy and regulatory framework for stand-alone generation.

Table 1. Ownership Models for Community Distributed Generation

Model	*Description*	*Ownership or Offtake?*
Independent Power Producer (IPP) / Third Party Ownership (TPO) Model	*Voluntary participation in an IPP / TPO's project is open to members of the community.*	*IPP/TPO owns the asset in full. Community investment is to purchase electricity and/or environmental attributes.*
Special Purpose Entity (SPE) Model	*Individual investors join a business enterprise to develop a community solar project.*	*Renewable Co-Operative owns the asset in full. Community investment is to share in profits generated by the project.*
Non-Profit (NP) Model	*Donors contribute to community installation owned by charitable non-profit corporation.*	*Non-profit owns the asset in full. Community investment enables the charitable non-profit corporation to benefit from the electricity and/or environmental attributes and to receive profits generated by the project.*

CanSIA recommends that a guiding principle for the policy and regulatory framework development for stand-alone generation be a non-prescriptive approach to project ownership to ensure that community and business proponents can endeavour to advance all of the above models or combinations thereof or wholly commercial approaches should they wish

[1] *The "Energy Efficiency and Community Energy" discussion paper provides the following definition: "community energy systems technologies 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." The "Distributed Alternative and Renewable Energy Generation" policy discussion paper provides the following generation: "small-scale community generation" in Alberta. This type of generation tends to be connected to an electric distribution system and is generally called "distributed alternative and renewable generation."*

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– in all cases under the same policy and regulatory framework – to the benefit of more communities across Alberta at a lower cost.

Then, when and if necessary: encourage participation from specific groups within society (i.e. local communities, co-operatives or non-profit organizations including schools, post-secondary institutions and hospitals, etc.) with targeted program funding – but only if/where market-based solutions and solar industry products and services fall short. Following these guiding principles will: i) minimize program cost; ii) maximize program success; and iii) chart a long-term sustainable path for community participation in solar electricity generation projects in Alberta.

Enable innovative business models to drive down costs: *If full asset ownership was a requirement for those who wish to generate and export renewable electricity to the grid and if the governing policy and regulatory framework was only applicable to local communities, co-operatives or non-profit organizations including schools, post-secondary institutions and hospitals, etc. then support and incentivisation would be required to overcome the upfront capital cost of investment.*

Where there is an absence of capital there is a need to rely on third parties for finance or leasing arrangements for projects to proceed. 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 an entity'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.

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, benefits can be accrued as system owners, or system hosts and/or electricity and environmental attribute off-takers.

There are many benefits to allowing consumers the ability to choose the innovative business models that meet their needs best beyond the traditional approach:

- *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.*
- *Benefits to Government:*

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- *More Market Activity: A broader pool of capital enables more projects thus more community benefit.*
- *More Bang for Buck: This approach costs less to Government – more bang for the buck.*
- *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 this option sooner.*

1. Validate and refine Alberta Energy and Alberta Climate Change Office assumptions about the policy issue.

a) Electric distribution systems' readiness to accommodate growth in micro- and small-scale community generation.

Policy issues:

Alberta Energy and Alberta Climate Change Office require a clear understanding of Alberta's electric distribution systems' current ability to accommodate growth in micro- and small-scale community generation.

CanSIA agrees that revisions to the new policy and regulatory framework for solar electricity should be developed with a clear understanding of Alberta's electric distribution systems' current ability to accommodate growth in micro- and small-scale community generation.

Further to the "Commentary on Background, Policy Context and Desired Outcome" (re: paradigm shift for all electricity sector stakeholders including AUC and DFO), the "electricity sector readiness" is an important policy issue in addition to the "electric distribution systems' readiness" as it relates to not only load displacement and stand-alone generation but also to energy efficiency, energy conservation and demand-side management.

Accordingly, rate and tariff design also needs to be an integral part of the current assessment of Alberta's ability to accommodate growth in micro- and small-scale community generation.

Alberta Energy and Alberta Climate Change Office recognize that the service territories of Alberta's distribution companies, municipalities and Rural Electrification Associations differ significantly and require unique analysis and understanding.

While the service territories of Alberta's distribution companies, municipalities and Rural Electrification Associations differ significantly and require unique analysis and understanding, an emphasis on international best practices from similar jurisdictions, standardization and the sharing of expertise and best practices should be pursued to the extent possible to lessen the slope of the learning curve and to ensure that regulatory processes from service territory to service territory remain as consistent as is practical.

CanSIA is currently engaged in the Pan-Canadian Climate Change Framework consultation[2] and has strongly urged the Federal Government to reach out to transmission and distribution facility operators with an offer to create and contribute operating and research funding to a new forum that would enable system operators to come together on a regular basis to dialogue on issues of common concern with respect to increasing the deployment of renewable energy on their systems

[2] Canada's First Minsters agreed to the development of a pan-Canadian framework for clean growth and climate change in the "Vancouver Declaration" on March 3, 2016.

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and to identify and undertake joint research and analysis on agreed priorities to help inform potential solutions to such issues. We will continue to make this recommendation and will provide feedback to Alberta Energy and Alberta Climate Change Office as and when this issue advances.

Considerations:

Distribution lines, transformers, and substations' current capacity to handle larger number of micro-generation sites or small-scale community generation.

The hosting capacity (i.e. solar penetration level that can be integrated into a specific network without violating power quality or security issues), of Alberta's distribution system can accept significantly higher penetrations of distributed solar generation than the 0.06% (six ten thousandths) of total installed capacity currently on the system before any major changes to system operation need to take place as has been the case in many similar jurisdictions worldwide.

The International Energy Agency's (IEA) Photovoltaic Power Systems (PVPS) Task 14[3] have defined three phases of increasing solar penetration:

- *Phase 1 (Low Penetration):*
  - *Low solar penetration in a few distribution grids.*
  - *Solar electricity plays a passive role in the electricity system.*
  - *Local consumption exceeds local generation (uni-directional distribution grids).*
  - *TFO not monitoring variable generation (just load variability).*
  - *DFO may need to manage new over-voltage or over-loading issues (especially in rural grids).*
- *Phase 2 (Medium Penetration):*
  - *High solar penetration in a few distribution grids.*
  - *Local generation exceeds local consumption (bi-directional distribution grids).*
  - *Need for a focus on increasing the "hosting capacity".*
  - *Reverse power flows may begin to be experienced by TFO.*
  - *TFO may increasingly need to re-dispatch and manage congestion.*
  - *DFO may experience heightened over-voltage and over-loading issues and also changes in reactive power balance.*
- *Phase 3 (High Penetration):*
  - *High PV penetration in many distribution grids.*
  - *Solar as a major electricity source and integral part of system operation.*
  - *Low and medium penetration issues continue as before.*
  - *Increased need for TFO to re-coordinate protection settings and to manage potential reliability issues (e.g. constraint operations, voltage and frequency stability impacts, black start issues etc).*

[3] http://www.iea-pvps.org/index.php?id=58

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- *Full-load hours of base-load generation also reduced and increasing demand for peak-load generation (ramp rates).*
- *At the DFO-level, the local implications of high penetrations of solar electricity generation can be more profound and complex to manage.*

Alberta is currently firmly in the low penetration phase. By the time that Alberta begins to transition from low to medium penetration, new technologies such as "smart inverters" and approaches such as "smart integration" will be becoming an industry standard.

Smart Inverters provide advanced functional capabilities that can be categorized as:

- *Voltage Support: Provision of reactive power (in some cases independent of active power e.g. at night).*
- *Frequency Support: Reduce active power at over-frequency or inject active power at under-frequency.*
- *Grid Management: Adopt a DSO's set-point values to reduce active power or change power factor to guarantee grid stability in the case of emergency situations or congestion.*
- *Dynamic Grid Support: Remaining connected to the grid in the event of an under or over frequency event (includes Low Voltage Ride Through (LVRT), High Voltage Ride Through (HVRT), Contribution to short-circuit current).*

Smart integration is related to the ability to monitor and remotely control solar generation and its interactions with the grid at the local level and is another key solution to managing the technical implications of high penetrations of solar electricity generation. Managing the system in aggregate from the top-down will not be an appropriate strategy when consumers expect local control, data and technological choice.

Collaboration between the solar industry, utilities, regulators and other stakeholders is key to managing the growing role of solar, smart inverters, smart grid and storage.

Further to CanSIA's recommendation from our submission in December 2015, a multi-stakeholder working group on Distributed Energy Resources (DER) would be an effective way to collaborate on topics including:

- *Hosting Capacity: Calculation and Communicating Availability.*
- *Rate Design: Generator Compensation and Utility Cost Recovery.*
- *Ancillary Services: Maximizing Value of DERs (including solar and storage).*

Finally, on October 24 – 28 2016, the 7th International Conference on Integration of Renewable and Distributed Energy Resources will be taking place in Niagara Falls. This will be a valuable conference for stakeholders in Alberta's electricity sector.

Current meters and billing systems may require upgrades to track and bill micro-generation sites.

If electricity-use in Alberta is to achieve the vision for 2030 as presented in "Commentary on Background, Policy Context and Desired Outcomes" (re: communicate a clear new vision to consumers for electricity-use in 2030) then upgrades to

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current meters and billing systems will be required. Communicating this vision will signal to electricity sector stakeholders that the decisions they make need to be in alignment with realization of the province's vision for electricity-use in 2030.

Many electricity customers already have appropriate metering that could accommodate a number of different policy and regulatory framework outcomes due to the automated meter reading programme. Other near-term upgrades that would be required will depend on the nature of policy and regulatory framework design resulting from this consultation. CanSIA would welcome the opportunity to be further engaged on discussions of this topic.

There are costs associated with any upgrades required to the distribution system to accommodate growth in micro- and small-scale community generation.

There are costs and benefits associated with any upgrade to the distribution system for any type of generation. Increasingly, regulators are acknowledging the potential of Distributed Energy Resources (DER) in power system planning.

Investment decision-making to replace an asset at end-of-life or to provide a new or enhanced function that had not been provided before (i.e. new customers, new loads such as electric vehicles or new generation such as solar electricity) should be very different today than five or more years ago. This is due to: i) the technical potential rapidly declining costs of Distributed Energy Resources (DER); ii) the advancements in Advanced Metering Infrastructure (AMI) and Supervisory Control and Data Acquisition (SCADA); and iii) the increasing impacts of climate change and the new stresses that will be exerted on our electricity system as a result. As power system planning and investment decision-making changes, so too should the approaches to cost recovery for and cost allocation by utilities for said investments.

However, it should be noted that the costs associated with upgrades to accommodate low penetrations of micro- and small-scale community generation (that would be allocated to the rate-base and not paid for by the generator) are: i) necessary at some point in time if Alberta is to realize the vision stated in "Commentary on Background, Policy Context and Desired Outcome" above; ii) insignificant until higher penetrations are reached and when amortized over the full life of the upgrade, considered on a per-customer or per-kWh basis across the province and with the view that costs are incremental to standard asset replacement cycles; and iii) have the potential to defer greater costs in future to the benefit of the system and the rate-base.

Are there additional issues and considerations that Alberta Energy and Alberta Climate Change Office should take into account? Please explain.

In addition to potential costs for upgrades, there are also associated benefits. A recent report from the Brookings Institute demonstrated that by the end of 2015, 10 or more commission-sponsored analyses undertaken to value distributed generation and net metering in the United States demonstrated that net metering benefits all utility customers and that the economic benefits of net metering actually outweigh the costs and impose no significant cost increase for non-solar customers. Far from a net cost, net metering is in most cases a net benefit—for the utility and for non-solar rate-payers[4]. The Interstate Renewable Energy Council (IREC) produced a valuable report entitled: "Regulator's Guidebook: Calculating

[4] Brookings Institute (2016) "Rooftop solar: Net metering is a net benefit"

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the Benefits and Costs of Distributed Solar Generation" which details approaches to assessing the costs and benefits of distributed solar generation.

Another consideration would be the potential future need for ancillary services and the ability of inverter-based generation and distribution-connected storage to provide them.

b) Amending the Micro-generation Regulation sizing and siting requirements, and examining the feasibility of a regulation for small-scale community generation.

Policy issues:

Under the Micro-generation Regulation, a micro-generation generating unit cannot be larger than one megawatt (MW); must be located on the customer's site or a site owned by or leased to the customer that is adjacent to the customer's site; and must be sized to load.

These existing sizing and siting requirements limit the ways in, or extent to, project proponents can participate in MG 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 iii) absence of a summer large load but presence of a suitable roof/site.

There are several project models that are limited by the existing sizing and siting requirements in the Micro-Generation Regulation as presented in the table overleaf.

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, MG does not allow them for solar load displacement.

CanSIA recommends that for solar load displacement: i) the maximum MG system size limit is increased from 1 MW to 5 MW so that system size can instead be determined by site or system limitations; and ii) the "rating of customer's service" (in s.1(1)(h)(iii)) is interpreted to mean "rating of the service box on the customer's electrical panelboard"; and iii) the "Basic Meter Aggregation" and "Multi-Site Aggregation" project models (see table overleaf) are expressly permitted to provide consumers with more options for participation in MG..

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Table 1: Project Model Eligibility for Micro-Generation Regulation

	Term	*Electricity Customers (#)*	*Sites (#)*	*Meters (#)*	*Example*	*Eligible in Micro-Generation?*
1	*Net-Billing/ Net-Metering*	*1*	*1*	*1*	*House or Office*	*Yes*
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*	*No*
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*	*No*
4	*Virtual Net-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*	*No*

There is currently no regulatory framework in place for distributed alternative and renewable generation units sized between 1 and 5 MW.

CanSIA recommends that for stand-alone projects: i) virtual net-metering be permitted (see table 2 above) to enable both community and business ownership of stand-alone solar generation; and ii) a Small Power Producers program is also introduced to build upon the existing DG to enable solar generation to realize the true value for its electricity, system benefits and environmental attributes to provide revenue certainty through a Standing Offer Program (SOP).

These two approaches would enable each of the *ownership models for community Distributed Generation presented in Table 1 and projects that are led by other project proponents that are not community-owned to proceed. Virtual Net-*

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Metering has been demonstrated to provide a successful platform for community solar in several jurisdictions in the United States with a key benefit being broad participation from society including the ability for low and moderate income to participate. An SOP would be key for participation from renewable energy co-operatives.

Furthermore, please see further comments in section on "clustering/ effective aggregation of smaller generation".

Considerations:

Technical and/or market constraints regarding size ceiling for a small-scale community generation unit need to be determined.

CanSIA recommends that the size ceiling for stand-alone generation be defined by the available capacity at the point of interconnection which can range up to 20 MW.[5] *Enabling larger projects will allow for some economies of scale and the lowest costs possible. Furthermore, please see further comments in section on "clustering/ effective aggregation of smaller generation".*

Wire owners may need to implement system-wide capacity thresholds for distributed alternative and renewable generation in order to maintain system reliability.

Capacity thresholds are typically set to manage issues including:

- *Islanding concerns in events of grid failure;*
- *Voltage regulation;*
- *Frequency regulation;*
- *Reliability; and/or*
- *Power quality.*

To the extent possible, the method to calculate capacity thresholds should be standardized across the province and the calculation and communication of available capacity should be done in a transparent fashion.

Capacity and interconnection thresholds should be established in a way which enables hosting capacity to increase accordingly as advanced inverter functions and smart grids become more prominent.

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[5] *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 overvoltage scenarios occur.*

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Capacity and interconnection thresholds should be set relative to peak feeder load to reflect that solar will be generating during peak hours. Thresholds based on minimum feeder load have been used in many jurisdictions historically but do not represent a best practice nor an approach that will be common in future.

The Institute of Electric and Electronics Engineers (IEEE) has established a conservative interconnection threshold for Distributed Energy Resources (DER), including solar, through their 1547 Standard for Interconnecting Distributed Resources with Electric Power Systems[6]. The IEEE 1547 standard states that the maximum allowable amount of PV generation should not exceed one third of the feeder minimum load.

IEEE 1547 would serve as a good starting point for consideration in Alberta today.

The IEEE is currently reviewing and updating Standard 1547 and will complete the review by 2018. The review is examining:

- *Generation and storage, including storage as a load;*
- *Advanced functionalities of both DER and modern grid equipment;*
- *Distribution-transmission impacts and cross harmonization of requirements;*
- *Very high penetration of renewables and other DERs;*
- *Intermittency and uncertainty of renewable generation;*
- *Two-way communications, controls, and dispatchability;*
- *Interoperability and intelligent devices integration; and*
- *Potential requirements and specifications for considering evaluations of reliability and resiliency of DER-grid interconnections (among others)*

The review of Standard 1547 will provide electric utilities and system operators additional clarity on how the existing interconnection thresholds can be increased in future with the application of voltage and frequency support functionality of inverters, rapid shut-down, anti-islanding capabilities etc. However, it should be stressed that many of these issues and the solutions that can be deployed to mitigate them will not be required until penetrations move from low to high with appropriate capacity thresholds in place.

Upgrades may be required to the distribution system to accommodate additional distributed generation sites, as well as larger distributed generation sites.

The need for grid reinforcement to accommodate additional distributed generation sites, as well as larger distributed generation sites is limited at low solar penetrations and especially with smaller projects and load displacement applications. Smart inverters, storage and smart grid can limit the need for grid reinforcement. Active Power Curtailment (APC) is in place in some jurisdictions where extremely high solar penetrations are present but experience to date is that it is rarely needed due to other control strategies that are in place.

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[6] IEEE 1547 Standard for Interconnecting Distributed Resources with Electric Power Systems (http://grouper.ieee.org/groups/scc21/1547/1547_index.html)

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CanSIA's Interconnection Costs Forum is undertaking a jurisdictional scan on the current practices for the costs, allocation of costs and processes for the interconnection of solar at the distribution-level in several Canadian provinces. The report will be released in August and will contain conclusions and learnings of interest to Alberta on this topic.

Key questions:

Do you agree with the characterization of the policy issues as outlined in b? Are there additional issues and considerations that Alberta Energy and Alberta Climate Change Office should take into account? Please explain.

Please see comments as above.

c) Economic viability of micro- and small-scale generation

Policy issues

- **Micro- and small-scale community generation installations are currently cost prohibitive for many individuals, due to the high up-front capital costs and long payback periods.**
- **Project developers face challenges securing long-term financing for micro- and small-scale community generation projects due to insufficient (with respect to magnitude, duration, and certainty) project revenues.**

Project proponents typically face challenges securing long-term financing for projects of this scale for three key reasons: i) project proponent is not "credit-worthy" nor do they have the appropriate experience to develop a self-generation project ii) deal size is too small to secure commercial lenders; and iii) insufficient (with respect to magnitude, duration, and certainty) project revenues.

Project proponent is not "credit-worthy" nor do they have the appropriate experience to develop a self-generation project: *Please see "Enable innovative business models to drive down costs" (re: importance of innovative financial models to provide consumers with options for adoption) for examples that enable this issue to be overcome. These models and community solar enabled through Virtual Net-Metering have proven especially effective options for enabling participating from low and moderate income electricity customers in several United States jurisdictions.*

Deal size is too small to attract commercial lenders: *Unless aggregated into a portfolio, individual projects of this scale do not typically have access to competitive long-term financing. Innovative approaches such as Green Banks, Green Bonds and Crowd-Financing are options that are becoming proven to serve this market-segment but that are not yet prevalent. Please see "Enable innovative business models to drive down costs" (re: importance of innovative financial models to provide consumers with options for adoption) for examples of business models that enable project proponents to build portfolios to a scale at which commercial lending can be secured.*

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Insufficient (with respect to magnitude, duration, and certainty) project revenues: *Insufficient project revenues can be overcome in three ways: i) enabling the realization of the true value of solar's electricity and system benefits; ii) providing solar with a predictable revenue stream for its Environmental Attributes; and iii) incentives for specific segments of society.*

Enabling the realization of the true value of solar's electricity and system benefits: The cost of providing electricity to consumers varies hourly and seasonally. "Flat" rate design structures for consumption such as those in place in Alberta distort this reality for consumers. Price signals to customers do not incent efficient ("off-peak") behaviour and the most costly consumption patterns are subsidized by those with the least costly.

Alberta's current rate design structure does not reflect that efficiency, conservation and DSM in electricity system are most valuable during the day when demand is highest and thus so is the pool price and when system cost if highest due to its operation closest to maximum capacity.

There are challenges to the introduction of time-varying rate designs as a main driver of energy efficiency, energy conservation and DSM in support of Alberta's Climate Leadership in the near-term: i) current power pool prices are too low to deliver appropriate price signals; ii) Advanced Metering Infrastructure (AMI) and settlement infrastructure upgrades required; and iii) regulatory processes take time to address stakeholder input.

In lieu of new rate design and metering and settlement systems, the near-term solution that CanSIA recommends that the current approach to net-billing is augmented so that electricity exported from solar load-displacement generation is credited with a fixed value reflecting the time-of-generation and non-energy charges[7].

The medium-term solution that CanSIA recommends is that province-wide time-varying rate options and advanced metering and settlement and infrastructure are introduced[8].

Every kWh of solar electricity generated, whether displacing load or being exported to the grid, is offsetting emissions elsewhere on the system. (As solar is generated closer to load and in summer when transmission and distribution are at their least efficient so the emissions associated with line losses are also offset). CanSIA believes that there should be an appropriate mechanism for the Environmental Attributes of all solar electricity generated to monetized. A fixed-price Solar Renewable Energy Credit (SREC) or equivalent would provide a degree of revenue certainty for all solar adopters whether small or large. For smaller projects, a high degree of administrative rigour can outweigh the benefit of availing of the mechanism. For MG, an effective means to compensate generators would be with an SREC settled by retailers (as is the case with net-load and net-generation).

On-site solar generation reduces the WSP's service territory strain on the transmission network. This value is today realized via the Distribution Transmission Service (DTS) Credit: i) DG reduces the WSP's DTS credit paid to the AESO on a monthly

[7] Large Micro-Generators would retain the option for power pool participation as is currently the case.
[8] Existing on-site generation would have the option to be grand-fathered into the new approach or remain under the legacy system. Large Micro-Generators retain option for power pool participation as is currently the case.

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basis; ii) savings are flowed through to the generator; iii) paid monthly on substation basis (based on location of interconnection); and iv) how closely its profile matches the grid's coincident peak.

As Dx Solar penetration increases, the DTS credits received by individual generators will change based on who produced what power and when. Future DTS credit payments could be materially reduced if the AUC applies a different tariff structure in the future. For these reasons, the market value of DTS Credits: is meaningful in providing financial incentive for generators; however, variability significantly decreases the value of the revenue stream to project viability.

Demand charges are used to recover the costs of distribution to large commercial and industrial customers: historically applied to individual peak demand of each consumer, regardless of whether peak occurs during system peak periods; only very local components of the distribution system (service drop, line transformer) are sized to the individual customer load; and iii) generally agreed that demand or capacity-related costs are primarily associated with the system peak demand not individual customer peak.

Alberta utilities rely on time-related "ratchet" demand clauses to recover system access costs: daily or monthly peaks used in other North American jurisdictions; examples of 12 and 24 month periods used in Alberta; does not accurately reflect the cost-causation of serving load; and does not provide an incentive for load-shifting.

Rate and tariff design are essential for utilities to recover their costs but if inefficiently designed, they can act as a barrier to efficiency and innovation. There are several excellent resources on rate-making to encourage energy efficiency and distributed generation including: Regulatory Assistance Program (2015) "Smart Rate Design for a Smart Future"; and Rocky Mountain Institute (2015) "Rate Design for the Distribution Edge".

The medium-term solutions that CanSIA proposes are to: i) Revise the DTS Credit such that it provides on-site solar generation with a predictable revenue stream crediting the system benefit that it provides settled on-bill; and ii) review the use of Demand Charges with a view to introducing new rate design structures that enable distributors to recover their costs while valuing the system benefits that on-site solar electricity generation provides.

Alberta is currently experiencing low energy prices, resulting in longer payback periods.

The current low energy prices make investment in all forms of new electricity generation in Alberta challenging.

Analysis from the Market Surveillance Administrator (MSA) shows that between 2008 and 2015 solar's modelled average capture price in the power pool would have been an average of $99/MWh (45% above the average pool price). This represents the capture price from the power pool and does not include the payments that could be received for environmental attributes or system benefits.

Wire owners may not have direct incentive to facilitate the integration of micro- and small-scale community generation; and there is value in reviewing and considering the approaches adopted by other jurisdictions. However, these approaches may not always be appropriate for Alberta.

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CanSIA's Interconnection Costs Forum is undertaking a jurisdictional scan on the current practices for the costs, allocation of costs and processes in several Canadian provinces. The report will be released in August and will contain conclusions and learnings of interest to Alberta on this topic. There are several jurisdictional scans and best practices reports that will be reviewed in this report including: SEPA (2015) "Distributed Solar Interconnection Challenges and Best Practices"; and EQ Research (2015) "Comparing Utility Interconnection Timelines for Small--Scale Solar PV".

The economic incentives required for growth of micro- and small-scale generation may vary within Alberta depending on electric distribution service territory and rate class.

The economic incentives required for growth of micro- and small-scale generation would need to vary within Alberta depending on electric distribution service territory and rate class to achieve specific desired outcomes or policy objectives.

Limited public awareness, interest, and/or capacity.

CanSIA does not believe that limited public awareness, interest, and/or capacity will be a barrier to adoption.

Key questions:

Do you agree with the characterization of the policy issues as outlined in c? Are there additional issues and considerations that Alberta Energy and Alberta Climate Change Office should take into account? Please explain.

Please see comments above.

A key point to stress is that CanSIA believes the policy and regulatory framework should be designed to enable solar (load displacement and stand-alone generation) to realize the true value for its electricity, system benefits and environmental attributes. Then, when and if necessary: encourage participation from specific groups within society (i.e. local communities, co-operatives or non-profit organizations including schools, post-secondary institutions and hospitals, etc.) with targeted program funding – but only if/where market-based solutions and solar industry products and services fall short. Following these guiding principles will: i) minimize program cost; ii) maximize program success; and iii) chart a long-term sustainable path for community participation in solar electricity generation projects in Alberta.

CanSIA will bring forward further information related to the incentivization of solar generation as part of the Energy Efficiency Advisory Panel stakeholder engagement process.

d) Other amendments to the Micro-generation Regulation

Policy issues:

Amendments may be possible to simplify connecting rules and remove other regulatory barriers to connecting micro-generation.

Considerations:

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Inconsistent approvals and approaches to installation, connection, permitting, inspection, and billing across municipalities and utilities.

When designed and installed by qualified professionals, solar electricity systems are as structurally and electrically safe as any other electrical appliance or piece of plant commonly found in buildings. However, as solar systems are still viewed in many jurisdictions across Canada as an emerging technology, there exists processes, costs and barriers to control their deployment that could be viewed as not being fully fit for purpose (e.g. safety requirements that do not improve safety or delays due to unnecessary administration).

These processes, costs and barriers fall under the category of "Soft Costs". Soft Cost is a construction industry accounting term for an expense item that is not considered direct construction cost. Solar soft costs are typically considered to be "non-hardware" costs and include expenses that fall within five broad categories Customer Acquisition, Financing and Contracting, Permitting, Interconnection, and Inspection, Installation and Performance and Operations and Maintenance. The reduction of soft costs through streamlining and elimination of unnecessary processes, costs and barriers is an industry priority because following several years of significant declines in equipment costs, soft costs now represent the greatest opportunity for further cost reductions on the path to solar grid-parity.

There are "Alberta Energy-owned" regulatory barriers to micro-generation (e.g. *Electric Utilities Act* (EUA) s.95 applications for municipalities).

Please provide further details for commentary.

There may be other regulatory barriers to connecting micro- and small-scale community generation (e.g. safety codes, property assessment, taxation, appropriate exemptions to AUC Rules 007 and 024).

CanSIA recommends that MG are exempt from property assessment and linear property tax assessment. CanSIA would welcome the opportunity to be involved in further stakeholder engagement on other regulatory barriers.

The roles of the retailer and the Alberta Electric System Operator in compensating proponents for micro-generation. The Micro-generation Regulation currently requires the ISO to compensate retailers for energy supplied out of a micro-generation site through the applicable ISO tariff or fee or through the ISO's financial settlement system.

Please view comments under: "Economic viability of micro- and small-scale generation" (re: electricity and system benefts compensation) and under: "Amending the Micro-generation Regulation sizing and siting requirements, and examining the feasibility of a regulation for small-scale community generation" (re: "totalization" practices and Industrial Systems Designation Policy).

Key questions:

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Do you agree with the characterization of the policy issues as outlined in d? Are there additional issues and considerations that Alberta Energy and Alberta Climate Change Office should take into account? Please explain.

Please see comments above.

2. Identify and allocate costs and benefits

Alberta Energy and Alberta Climate Change Office understand certain system costs and benefits of micro- and small-scale community generation as outlined below. Alberta Energy and Alberta Climate Change Office would like stakeholder feedback on: What basis (e.g., cost causation, beneficiary pays, ability to pay) should be used for allocating costs and benefits between micro- and small-scale community generation proponents and others on the system?

Cost allocation is a very important topic to ensure that the interests and rights of DFO, electricity customers and solar adopters are balanced. There are many opinions on how best to allocate costs typically falling between: a "utility" perspective that solar load-displacement can shift costs to a subset of customers that cannot "afford" it; and the common solar advocate position the typical compensation structures do not enable solar to realize its true value.

CanSIA's Interconnection Costs Forum is undertaking a jurisdictional scan on the current practices for the costs, allocation of costs and processes in several Canadian provinces. The report will be released in August and will contain conclusions and learnings of interest to Alberta on this topic.

CanSIA recommends that for MG:

- *Direct cost associated with the project (i.e. such as project cost, operation and maintenance of the project equipment, administrative costs, interest on borrowed money, etc. should be strictly allocated to the generator);*
- *Indirect costs associated with the distribution systems ability to connect the project such as metering, system upgrades, interconnection, settlements, etc. should be shared amongst others on the system in the same way capital costs are recovered for system upgrades due to aging equipment up to a specified maximum threshold[9];*

[9] The government of Alberta should consider creating a specific category of grid enhancement costs for those costs that are related to the connection of renewable generating facilities. The province of Ontario has followed a similar approach in order to give clarity and certainty to electric utilities on which costs can be included in rate filings, and which costs are to be borne by the generator. These costs could include: modifications to, or the addition of, electrical protection equipment; modifications to, or the addition of, voltage regulating transformer controls or station controls; the provision of protection against islanding (transfer trip or equivalent); bidirectional reclosers; (e) tap-changer controls or relays; replacing breaker protection relays; Supervisory Control and Data Acquisition system design, construction and connection; any other modifications or additions to allow for and accommodate 2-way electrical flows or reverse flows; and communication systems to facilitate the connection of renewable energy generation facilities. Ontario has also instituted a regulated cap on the total costs that distributors are required to cover. This cap for upgrades for renewable facilities is $90,000/MW of installed capacity of the system. A similar cap could be considered for implementation in Alberta.

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- *Direct benefits associated with the production of energy from the generator such as electricity production, GHG reduction, net load reduction, etc. should be directly allocated to the proponent in a clear and transparent manner; and*
- *Intangible benefits such as reduction in pollution, regional economic growth, avoided long-term price risks, etc. will be inherently shared amongst others on the system.*
- *System benefits such as reduced system losses, enhanced distribution system reliability should we weighted against the indirect costs of the distribution systems ability to connect the project, if there is a net benefit to the system an additional incentive should be provided to proponents to connect these system (similar to a locational adder); and*
- *Capacity avoidance (i.e. avoided new generation and transmission cost) benefits and disaster recovery benefits should be directly allocated and incentivized to the generation proponents.*

3. Program development to promote micro- and small-scale community generation

Alberta Energy and Alberta Climate Change Office seek stakeholder input on how best to promote micro- and small-scale community generation and mitigate potential risks. Alberta Energy and Alberta Climate Change Office are seeking feedback on program development to promote micro- and small-scale community generation, taking into consideration the following principles:

Principles

1. Increase the total installed capacity and production of micro- and small-scale community generation in Alberta.

-Enable innovative business models for retailers, project developers, and project financiers

-Reduce remote, off-grid communities' reliance on diesel

-Enable Albertans to play an active role in distributed energy generation

2. Minimize cost impacts to wire owners, electricity ratepayers, and Alberta taxpayers.

-Programs should be designed to encourage efficiency and phase out as technology becomes cost-competitive on its own (e.g., incentives decrease as capacity increases)

-Allow for fair cost recovery of capital investments by wire owners

-Minimize potential cross-subsidization by distribution ratepayers

-Optimal siting of projects (i.e., close to load, require minimal distribution system upgrade)

3. Maintain or enhance the safety and reliability of Alberta's electric distribution systems.

4. Maintains or enhances Alberta's fair, efficient, and openly competitive electricity markets.

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5. Align with, or adapt to, potential distribution system enhancements of the future (e.g., smart grid, distribution-connected energy storage).

Do you agree with these principles? What other principles should Alberta Energy and Alberta Climate Change Office consider in designing a policy mechanism to promote micro- and small-scale community generation?

CanSIA agrees with these principles with the following nuances:

Minimizing costs to wire owners, electricity ratepayers and Alberta taxpayers should not be interpreted as "no cost". Maintaining, expanding and evolving the electricity system has a cost to the province in one way or another whether centralized or distributed, solar or otherwise.

Distributed solar generation brings significant value as noted elsewhere in this document. A statement to the effect "realizing the value of solar generation for the benefit of wire owners, electricity ratepayers and Alberta taxpayers" should be a theme included in principle "1" to balance the cost with the benefit.

"Transitioning solar electricity generation from a marginal to a mainstream option for consumers where it can thrive post-2020 with no direct subsidies" would be another theme that could be included in principle "1" that is aligned with CanSIA's Roadmap 2020 vision document.

"Resilience to climate change" may merit an explicit mention under "3".

b. With program funding what is an achievable target (e.g., X megawatts) for annual incremental increase in micro- and small-scale community generation?

Globally, developed jurisdictions with medium penetrations of solar electricity generation on their grids had deployment rates (i.e. cumulative installed capacity per capita) in excess of 50 watts per capita and less than 100 watts per capita at the end of 2015 (several have much higher). The average deployment rate for Canada was over 70 watts per capita and Alberta's was less than 5 watts per capita at the end of 2015.

If in 2021, Alberta had reached 70, 90 or 110 watts per capita, this would equate to a cumulative installed capacity in the range of 350, 450 or 550 MW (assuming a population of 4.8 million ala StatsCan).

What is the maximum project capacity which should be eligible for program funding? Should the clustering/ effective aggregation of smaller generation units be prevented? If so, how? If not, why not?

In the absence of further definition on the program objectives or mechanisms an exact answer is difficult to provide.

Some considerations include: i) solar electricity generation of all scales should be able to realize the true value of the environmental attributes that it provides in a predictable way; ii) technical and project-specific limits should be used to define project size so as not to limit economies of scale unnecessarily; and iii) targeted program support for specific groups within society should be layered on top of the policy and regulatory framework.

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The policy and regulatory framework should be designed to encourage aggregation of smaller generation units to enable economies of scale and innovative financial business models (aggregation of smaller generation units is a critical element of the future of the solar industry to enable businesses to achieve scale, overcome financial barriers and become "virtual power plants").

"Clustering" is typically used to define a gaming behaviour. Program design should be such that the benefits of "clustering" i.e. economies of scale can be achieved without exposing the program to the unintended consequences of gaming behaviour. CanSIA recommends that the size ceiling for stand-alone generation be defined by the available capacity at the point of interconnection which can range up to 20 MW. By enabling projects of this size, the required program funding ($/Tonne or $/MW) will be materially reduced. A maximum funding level per project could be implemented if limiting the payment per project is the issue that is being addressed.

Please assign percentage weights to the principles below (totaling 100%) according to how important you think each principle is when evaluating a policy to promote micro- and small-scale community generation.

Increases the total installed capacity and production of micro- and small-scale community generation in Alberta: 40%
Minimizes cost impacts to wire owners, electricity ratepayers, and Alberta taxpayers: 15%
Maintains or enhances the safety and reliability of Alberta's electric distribution systems: 15%
Maintains or enhances Alberta's fair, efficient, and openly competitive electricity markets: 15%
Aligns with, or can adapt to, potential distribution system enhancements of the future (e.g., smart grid, distribution-connected energy storage): 15%

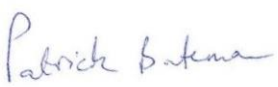
Other (please describe):

The answers above reflect short-term principles. As more installed capacity is achieved, the weighting would shift toward longer-term goals.

Thank you for your consideration and please do not hesitate to contact me with any further comments or queries.

Best regards,

Patrick Bateman



Director of Market Intelligence & Research

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