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

150 Isabella St., Suite 605, Ottawa, ON, CANADA K1S 1V7 | T 613-736-9077 • TF 1-866-522-6742 • F 613-736-8938 • E info@cansia.ca • www.cansia.ca

To whom it may concern,

RE: CanSIA Response to Renewable Electricity Program (REP) Stakeholder Engagement Questionnaire

This letter provides the responses of the Canadian Solar Industries Association (CanSIA) to the Alberta Electric System Operators stakeholder engagement questionnaire in support of the Renewable Electricity Program (REP) development. Questions that were not directly applicable to CanSIA are omitted. CanSIA Members will also be providing responses independently.

1. Name, Contact Information, Organization and Interest in Renewable Electricity Program (REP)

John Gorman, President & CEO
Canadian Solar Industries Association (CanSIA)

C/O Patrick Bateman, Director of Market Intelligence & Research
Direct Phone Number: (343) 700 – 3576
Email: pbateman@cansia.ca

The Canadian Solar Industries Association (CanSIA) is the national trade association for the solar energy industry in Canada. CanSIA Members represent the full value-chain of the solar energy industry including the leading companies who are focused on developing, constructing, owning and operating large solar facilities in Canada.

CanSIA has been an active participant in the Climate Leadership consultation process to date. CanSIA's interest in the Renewable Electricity Program consultation is to provide information and recommendations that would ensure that large solar facilities are part of the diverse renewable generation mix that would support the province's climate change and renewable energy policy objectives and that solar energy begins to play a meaningful role in the province's electricity-supply. CanSIA also has great interest in the policy and regulatory consultations for small-scale solar generation.

For further background, please find attached a submission made by CanSIA to the Government of Alberta on December 23, 2015 (*re: Solar Energy Policy and Procurement Implementation in Alberta*) outlining CanSIA's response to the recommendations of the Climate Leadership Report.

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2. View on Investing in solar electricity generation in Alberta

Barriers: The key barriers to investing in solar electricity generation in Alberta to date have been levelized cost of electricity (LCOE). Looking forward, the key barrier is revenue certainty and technology neutrality.

Levelized Cost of Electricity (LCOE): The LCOE from large solar facilities in Canada has decreased by more than 65% since 2009[1]. In 2016, Ontario's Large Renewable Procurement (LRP) (Canada's first competitive procurement that resulted in contracted large solar facilities) contracted seven projects with a total capacity of 139.89 MW at a weighted average price for awarded contracts of $156.7 /MWh.[2] CanSIA would expect competitively procured large solar facilities to achieve lower pricing in Alberta given the province's superior solar energy resource and the potential for a greater number of larger projects due to land availability and interconnection capacity. With the expectation of continued annual pricing declines due to economies of scale, deployment experience and technological advancements, the LCOE of solar will not likely remain a barrier for the majority of the annual REP procurements to 2030. However, the LCOE of solar would remain a barrier during the initial years of the REP most potentally as it relates to the the ability to achieve an appropriate level of Revenue Certainty.

Revenue Certainty: Analysis by the Market Surveillance Administrator (MSA) demonstrated that the average capture price of solar facilities in Alberta's wholesale electricity market would have ranged from $73 to 143/MWh in the years 2010 to 2013[3]. This represents a factor of 1.43 to 1.74 higher than the average pool prices during this period (average factor in those years of 1.54). As a solar facility's generation profile is such that it accesses a high average capture price in Alberta, it would not need to have the lowest LCOE of all renewable sources to be competitive. However, an appropriate level of revenue certainty is required for projects to secure investment. Too high a proportion of merchant revenue risk renders an investment unviable. The recommendations in the Climate Leadership Plan include making use of a centrally procured Renewable Energy Certificate (REC) to provide a level of revenue certainty to investors. CanSIA is supportive of this approach provided that the REC can be priced at a level which provides the appropriate level of revenue certainty for investment. (Market design mechanisms such as pool price floors above zero or mechanisms similar to contracts for differences that ensure average capture prices are not below or above a designated minimum and maximum amount could reduce the REC prices required for large solar facilities to proceed by mitigating exposure to merchant risk. This would be especially helpful during the initial years of the REP).

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[1] CanSIA Analysis.
[2] Independent Electricity System Operator, LRP Website: www.ieso.ca/Pages/Participate/Generation-Procurement/Large-Renewable-Procurement/default.aspx.
[3] "Alberta's Electricity Market: Design, Structure and Key Considerations" presented by Matt Ayres, Deputy Administrator and Chief Economist of the Market Surveillance Administrator at CanSIA's western regional conference Solar West 2014 on October 1, 2014.

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Technology Neutrality: The Climate Leadership Report recommends that the REP is conducted with the principal of technology neutrality. This principal would result in no large solar facilities being procured under the REP in the near-term. CanSIA recommends that the REP instead implement a Solar "Carve-Out", a mechanism which is common in the United States, to address this issue. The "Carve-Out" would for example set-aside a minimum of 15% of all RECs in all competitive procurement to 2021 for large solar facilities. The benefits of the "Carve-Out" would include technology diversity to build and maintain public confidence and support, regional diversity of economic development and heightened near-term job creation and the ability for the province to gain gradual and manageable operational experience with this technology that will play a major role in the province in future. Such a "Carve-Out" would be expected to increase average REC pricing by less than 15%[4]. For further background, please find attached a presentation made by CanSIA to the Government of Alberta on March 22, 2016 ("The "Why" for Large Solar Facilities Now in Alberta") outlining CanSIA's rationale for a Solar "Carve-Out".

Key Risks: Assuming that an appropriate level of revenue certainty can be captured from a REC, the key risk to investment in solar electricity generation in Alberta is that the revenues captured from the merchant market would not provide revenue adequacy. Current forward market pricing is such that the investment community's threshold for merchant risk is extremely low (thus no access to finance at a reasonable cost).

Information Required: In order to invest in solar electricity generation, developers and investors need more certainty on:

- *Forward Pool Pricing*: coal-retirement and renewable procurement schedules.
- *REC Revenues*: design such as term and potential for inflation protection; and
- *Potential Other Revenue Streams*: including greenhouse gas offsets and ancillary services.

4. Technological Advances on the Horizon

The technological advances on the horizon of interest to the solar energy industry are related to improvements in: i) solar modules; ii) power electronics; and iii) electrical storage.

Solar Modules: Solar modules represent the single largest component cost of a large solar facility. Solar modules continue to decrease in price ($) and increase in performance (W) with the net-effect that a module's cost per watt ($/W) continually decreases thus having a major impact on project economics.

Over the last six years the cost per watt of a crystalline solar module has decreased by a factor of roughly four[5] and the European Photovoltaic Technology Platform (EUPVTP) predicts that this will halve again by

[4] Assuming an SREC:REC pricing ratio of less than 2:1.
[5] See sources including PVX spot market price index solar PV modules.

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2030. Solar industry experts have differing views on the pace of cost reductions for solar PV into the future, but there is unanimous consensus that costs will continue to decline:

- National Renewable Energy Laboratory projects 0.4 - 4.7% annual system cost decline 2014-2025;
- International Energy Agency projects 4.2% annual system cost decline 2015-2020;
- Green Tech Media Research projects 5.6% annual module cost decline 2012-2017;
- Tracking the Sun VIII (Lawrence Berkley National Laboratory) (expects 9% 2015 reduction; and
- International Roadmap for Photovoltaic forecasts 3.5% annual system cost decline 2015-2025.

The record lab cell efficiency is 25.6 % for mono-crystalline and 20.8 % for multi-crystalline silicon wafer-based technology. The highest lab efficiency in thin film technology is 21.0 % for CdTe and 20.5 % for CIGS solar cells. In the last 10 years, the efficiency of average commercial wafer-based silicon modules increased from about 12 % to 16 %. At the same time, CdTe module efficiency increased from 9 % to 13 %. In the laboratory, best performing modules are based on monocrystalline silicon with about 23 % efficiency. Record efficiencies demonstrate the potential for further efficiency increases at the production level.

Power Electronics: There is potential for active power control in large solar facilities to provide ancillary services that range from spinning reserves, load following, ramping, frequency response, variability smoothing and frequency regulation to power quality. While these ancillary services are not commonly provided today by large solar facilities, appropriate ancillary service market design could incent asset owners to deliver them in future.

Electrical Storage: Over the last 34 years, each time cumulative global solar module production doubled, the price went down by 19.6%[6]. It is expected that the cost of electrical storage technologies will follow a similar path as the technology gains deployment experience. The ability to store electricity from a large solar facility (at the facility-level or moreso at the system-level) enables a greater level of flexibility in the solar fleet's generation profile and thus ability to participate in the market as both a provider of energy and capacity, but also in the provision of ancillary services. There does not appear to be significant economically viable potential for widespread deployment of electrical storage today. However, cost declines combined with market and regulatory reform will present opportunities in the medium-term.

[6] Fraunhoefer Institute

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5. General Comments and Feedback

There has been confusion surrounding the target for renewable electricity generation by 2030. In some cases the target is expressed as up to 30% of electricity in 2030 and in other cases it is expressed as replacing two thirds of the retiring coal-fired capacity. A firm definition and consistent approach to messaging this target would be beneficial to industry and stakeholders as the difference between the resultant supply-gap for renewables to deliver is substantial. Furthermore, the legislation of both the renewable procurement targets and of the coal retirement schedule for the period 2016 to 2030 would serve to provide the long-term market certainty that signals industry to invest, reduces the costs of the REP and maximizes the benefit to Alberta and Albertans.

CanSIA has been an active participant throughout the Climate Leadership process and looks forward to continuing to be an active participant in the Renewable Electricity Plan (REP) consultations and implementation.

Thank you for the opportunity to be engaged in this important process.

Best regards,

CC:

David Erickson, President and Chief Executive Officer, Alberta Electric System Operator

Mike Law, Vice-President, Renewables Development and Sustainability, Alberta Electric System Operator

Elizabeth Moore, Director Renewables Development, Alberta Electric System Operator