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Transmitted to: darlene.strong@gov.ab.ca

October 27th, 2016

Dear Ms Strong,

RE: Request for Information (#017614): Supply of New Alberta-Based Solar Power

The Canadian Solar Industries Association (CanSIA) is the national trade association that represents the solar energy industry throughout Canada. In response to the "*Request for Information (#017614): Supply of New Alberta-Based Solar Power*" issued on October 6th 2016, please find enclosed CanSIA's commentary and responses to the questions posed therein. The scope of our response is limited to the issues that will directly affect the successful contribution of this initiative to the long-term objectives of the province's Climate Leadership Plan. CanSIA's Members will respond independently on project- and procurement-related questions informed by the unique characteristics of their business structure and proposed projects.

CanSIA lauds the Government of Alberta leading by example by powering more than 1,500 government-owned buildings and sites with 100 per cent renewable electricity (250,000 MWh per year). Furthermore, CanSIA lauds the Government of Alberta's exploration of the potential to renew expiring renewable electricity contracts for 135,000 MWh per year (one contract expiring in December 2016, the second expiring in December 2017) with new contracts with solar electricity suppliers.

This initiative would make Alberta the first Canadian provincial or territorial government to be more than 50 per cent solar-powered. CanSIA understands that (in addition to meeting the Government's renewable electricity needs) an intent of contracting exclusively with solar electricity generators, is to give rise to Western Canada's first utility-scale solar electricity generation project, projects or portfolios, similar to how the province's first utility-scale wind farms came into commercial operation.

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This initiative has the potential to deliver the lowest contract pricing for solar electricity in Canada which will draw global attention to Alberta's Climate Leadership. In addition, this initiative will provide the practical deployment experience to ensure that new permitting and approvals processes for ground-mount utility-scale solar facilities are appropriate and robust in the province; and that the system integration experience informs the forecasting and system operation capability to manage future higher penetrations of utility-scale and locally-generated solar electricity on the grid.

CanSIA understands that solar electricity is new as a generation option for Alberta and that in order for targeted policies such as a "Solar Carve-Out" to be included in future rounds of the Renewable Electricity Program (REP) [1] or a major expansion of smaller-scales of solar electricity generation, the confidence of government, the electricity sector and the public needs to be earned primarily in the cost effectiveness of harnessing this renewable resource.

CanSIA views the approach of a near-term procurement for solar electricity generation in combination with a broader first round of technology-neutral competitive procurement for utility-scale renewable electricity as a pragmatic approach to ensuring that the province begins to move forward with solar electricity generation in preparation for a time when solar energy may become the lowest cost option resource for new electricity generation in the province.

In order to lay the groundwork for the province to begin to increasingly realise the benefits of utility-scale and smaller-scales of solar electricity generation from 2016 through to 2030, CanSIA believes that the focus for procurement design should be on contracting the lowest priced utility-scale solar electricity generation project, projects or portfolios possible today[2].

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[1] Please find enclosed *CanSIA (March, 2016) "The "Why" for Large Solar Facilities Now in Alberta: Renewable Electricity Program (REP) Design Considerations"* and *CanSIA (March, 2016) Response to AESO Questionnaire"* for further information on solar carve-outs and the role of utility-scale solar electricity generation in the province's upcoming competitive procurements. These documents also provide information on the concepts of "bundled off-take agreements" and "revenue certainty" which are mentioned later in this letter.

[2] A single solar electricity facility that generates 135,000 MWh per year could be expected to be in the range of 85 to 100 MW_{DC} (assuming capacity factors in the range of 15 to 18% respectively).

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CanSIA presents the following seven recommendations for the Alberta Infrastructure procurement design:

I. **Maximize Contract Size:** CanSIA recommends that any REC requirements that are not fulfilled during the period when existing contracts expire and when new contracts are entered-into, should be included in the new contracts offered to solar electricity generators[3]. Larger contracts will increase competition and enable larger project sizes with potential for the lowest possible contract pricing.

II. **Revenue Certainty:** CanSIA recommends that a "bundled" off-take agreement for all electricity and environmental or renewable attributes (i.e. Offsets, Renewable Energy Certificates etc) be offered to provide maximum revenue-certainty for the asset owner and thus, the lowest possible contract pricing.

III. **Contract Term:** CanSIA recommends that the contract term be set equal to the facility's expected lifetime (i.e. 25 years or more as in SaskPower's upcoming RFP for wind electricity generation). This will result in the lowest possible contract pricing.

IV. **Index for Inflation:** CanSIA recommends that the off-take agreement has the contract price indexed to inflation (as is the case in several jurisdictions i.e. Saskatchewan, Ontario, the UK, etc.) to result in lower contract pricing (and defer some spending to later years of the contract-term for the off-taker).[4]

V. **Enable Economies of Scale:** CanSIA recommends that the Government of Alberta permit generators who can find off-takers for the electricity or attributes from their project that are additional to those contracted by Alberta Infrastructure or who can supply their own load to enable them to structure larger and more cost-competitive projects to result in lower contract pricing.

VI. **Enable Innovative Approaches to Siting:** CanSIA recommends that portfolios of solar electricity generation facilities should be eligible to compete in the procurement regardless of whether they are sited on a rooftop or ground-mounted provided that the entire portfolio is greater

[3] For example, if the solar projects commence operation on July 1st 2018: the total procurement would be increased from 135,000 MWh to 143,100 MWh per year over a 25 year period to account for the 1.5 years during which RECs were not procured.
[4] For illustrative purposes only: a contract with priced at $78/MWh in year one indexed with an annual increase of 2 per cent has an average price of $100/MWh over a 25 year period.

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than 5 MW in size and that no single facility in the portfolio is less than 1 MW in size. These thresholds will ensure that the execution of the contracts remains simple while not exempting projects that are smaller in scale to compete on cost.

VII. **Encourage the Federal Government to follow Alberta's lead:** CanSIA recommends that the Government of Alberta encourage Public Services and Procurement Canada (who currently contract with renewable electricity providers to meet their needs for federal buildings in the province) to follow your lead and renew existing contracts in support of new solar electricity facilities.

Finally, the RFI asks for the shortcomings that a 135,000 MWh solar energy project, projects or portfolios would foster in terms of the environment and economy and for a description of how this would compare to other forms of renewable energy. Some of the major benefits that this initiative would contribute to are listed below.

Decarbonisation and Diversification: The decarbonisation and diversification of Alberta's electricity supply to 30% renewable by 2030 will have a significant impact on reducing the province's greenhouse gas emissions. A diversity of renewable resources will contribute to a more secure and resilient supply where pricing volatility and carbon risk of traditional fuels are hedged to a greater degree.

Declining Costs: The cost of utility-scale solar electricity generation has fallen by more than two thirds in the past five years. The cost is now at a point equal to or less than the market price that the technology's generation profile would have captured in Alberta's power pool in a number of recent years. Costs continue to decrease. The price discovery realised by this procurement will be essential information for those involved in the consideration of future policy and market design decisions and those considering making investments in traditional and renewable electricity generation (and in other electricity infrastructure assets).

Jobs & Economic Development: Solar electricity generation projects creates more jobs (per MW) than any other form of electricity generation and can create new economic development opportunities in locales that are otherwise unsuitable for investment in other types of resource development.

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Public Confidence & Support: Polls consistently show that solar is the favoured option for new electricity generation across Canada. Projects developed can achieve significant local public support when sited appropriately and with visual screening if required due to the minimal visual and noise impacts.

Relative to other traditional and renewable electricity generation options, these are some of solar electricity generation's competitive advantages. The competitive disadvantages of solar electricity generation are offset when integrated into a diverse supply-mix and when managed using the technologies and expertise that are available today and that have been demonstrated for many years in countries around the world.

The two most common shortcomings of solar electricity that we hear expressed in the public realm are cost and reliability. We believe that this Request for Information will demonstrate that there are multiple utility-scale projects and portfolios that can be contracted to provide electricity at a cost far lower than most Albertans would expect. We also know that the interconnection and market rules under development by the Alberta Electric System Operator (AESO) will ensure that the utility-scale project, projects or portfolios can be operated without any negative impact on system reliability. Higher penetrations of variable renewable generation on a grid require new approaches to system operation. Given that more than twenty countries meet more than 1 per cent of their annual electricity needs from solar electricity today, and that some meet between 7 to 9 per cent (Italy, Germany and Greece), Albertans can rest assured that as penetrations grow so too will AESO's capabilities to balance supply and demand and maintain grid stability without compromising reliability of supply.

Thank you for your consideration and please do not hesitate to contact CanSIA for further information.

Best regards,

John Gorman,
President & CEO, CanSIA

The "Why" for Large Solar Facilities Now in Alberta

Renewable Electricity Program (REP) Design Considerations

March 22nd, 2016

CanSIA
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PRESENTATION OUTLINE

- Meeting Context and Background.
- Ontario's LRP: Results and Implications for Alberta.
- Near-Term Benefits of Solar for Alberta's REP.
- Procurement Design Considerations:15% Solar Carve-Out.
- Conclusion & Summary.
- Contact Details.

ABOUT US

- Who we are:
  - National trade association representing the solar energy industry throughout Canada.
  - Since 1992, worked to develop markets and create opportunities for our Members.
- Where we will be in 2020:
  - Solar as mainstream energy source, integral part of Canada's diversified electricity-mix.
  - Ensure solar industry will be sustainable with no direct subsidies.

MEETING CONTEXT AND BACKGROUND (1/3)

- Alberta's Renewable Electricity Plan (REP) is currently being designed to procure new renewable electricity to replace Alberta's coal assets that will all be retired by 2030.

- 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.

- CanSIA's recommendations to the Government of Alberta for large solar facilities are supportive of much of the Climate Leadership Plan direction:
  - Increase in (and broader application of) Carbon Pricing.
  - A target of 30% renewable electricity by 2030.
  - Central competitive procurement of Renewable Energy Certificates.

MEETING CONTEXT AND BACKGROUND (2/3)

- However, “technology-neutrality” in the REP will miss-out on the opportunity that solar presents in the near-term:
  - CanSIA and CanWEA’s recommendations included Solar “Carve-Out”.
  - Without “Carve-Out”, no solar will be contracted for several years.

- Ensuring solar projects are a part of Alberta’s Climate Leadership in the near-term will be important to maximize the near-term benefits and to set-the-stage for the overall long-term success of the policy:
  - Regional diversity & economic benefits.
  - Technology diversity, visibility & public support.
  - System and market learning curve and experience.

MEETING CONTEXT AND BACKGROUND (3/3)

- The remainder of this slide-deck presents a:
  - Discussion of recent results of Ontario's Large Renewable Procurement and the implications for solar procurement in Alberta.
  - Rationale for ensuring that the REP in Alberta contracts a diverse array of renewable projects that include solar facilities in the near-term.
  - Example of an approach to structure a 15% Solar Carve-Out of RECs for the procurement of renewable electricity resulting from near-term coal retirements.

Ontario Large Renewable Procurement (LRP)

Results and Implications for Alberta

ONTARIO: LRP BACKGROUND

- Large solar facilities originally procured in Ontario via the Renewable Energy Supply (RES) competitive procurement:
  - No solar procured under RES as procurement was technology-neutral.
- With the introduction of the Green Energy Act (GEA) in 2009, large solar facilities were procured via the Feed-in Tariff (FIT) Program:
  - Contract pricing set by Ontario Power Authority (OPA).
  - Not a competitive process.
- In 2013, OPA was directed to commence development of competitive process for procurement of large renewables including 140MW solar and 300MW wind:
  - OPA conducted extensive public engagement on the development of the Large Renewable Procurement (LRP) throughout 2013 and 2014.

ONTARIO: LRP I RFP RESULTS (1/2)

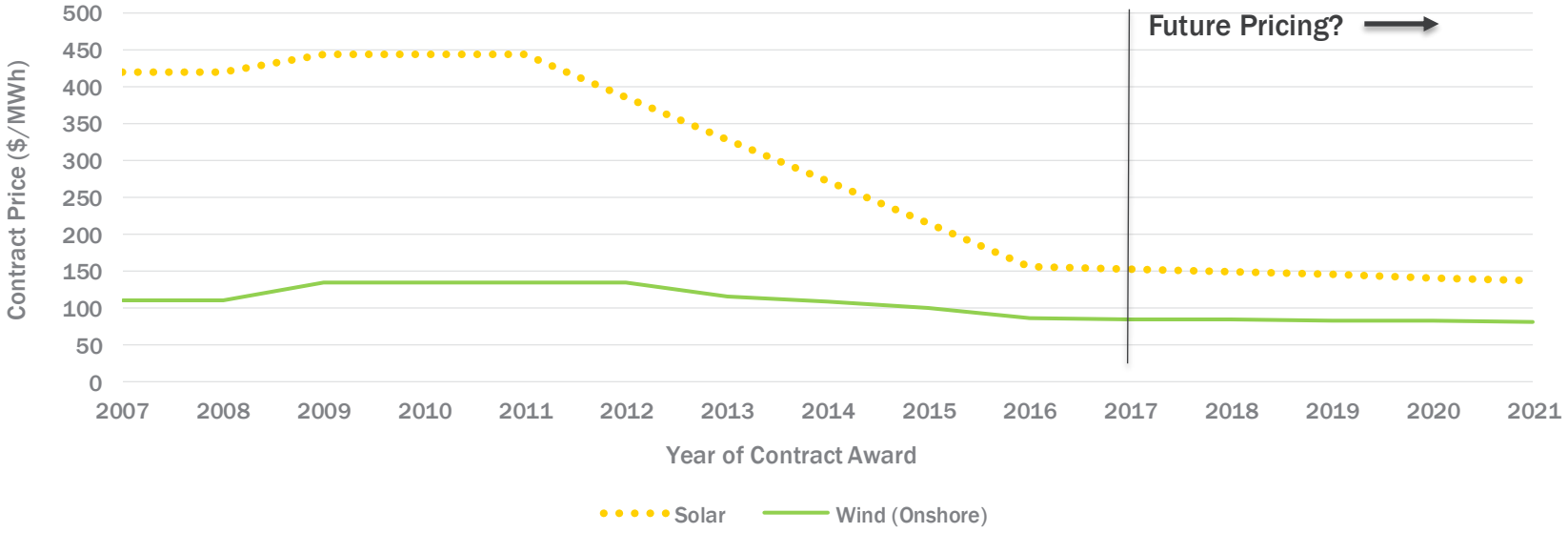
- 81 solar projects (~1,728 MW) registered to submit proposals.
- Seven solar projects (139.89 MW) were contracted:
  - Size: Two projects < 10 MW, Three = ~10 MW and Two = ~50 MW.
  - Weighted average price for awarded solar contracts = 156.7 $/MWh.
  - Range of bid prices for solar = 141.5 – 178.5 $/MWh.

Renewable Fuel	Procurement Target (MW)	Awarded Contracts (MW)	Weighted Average Contract Price ($/MWh)*	End of Term Contract Price ($/MWh)*
Wind	300	299.5	85.9	93.1
Solar	140	139.9	156.7	156.7
Hydro	75	15.5	175.9	205.6

* Rounded to one decimal place.

ONTARIO: LRP I RFP RESULTS (2/2)

- Solar contract pricing decreased by 65% since FIT (wind -36%)*.
- Assuming conservative annual price declines, could it be another decade before solar's levelized cost drops below that of wind?
  - Competitiveness reliant on capture price not levelized cost in Alberta.



* 20% of value of wind contracts escalate at consumer price index.

** Post 2016 solar pricing is assumed to decline at 2.6% per year and wind at 1.1% per year ref: Solar Energy Consulting (September, 2015) "THE ART OF THE POSSIBLE, RENEWABLE ENERGY IN ALBERTA" – Presentation to the Climate Change Panel".

LRP IMPLICATIONS FOR ALBERTA

- The results of the LRP (141.50 – 178.50 $/MWh) demonstrate that solar is now significantly less expensive than in years past:
  - Downward price declines will continue annually.

- There are several factors that would enable Alberta to achieve lower contract pricing than Ontario including:
  - Solar resource 20% higher in much of Alberta than that of Ontario's.
  - Land availability and interconnection may enable more larger projects.

- However, current policy and market uncertainty make it challenging to estimate non- REC revenues available in near-term in Alberta:
  - Without coal-retirement and renewables procurement schedules, forward pool prices may not provide level of investor confidence required.

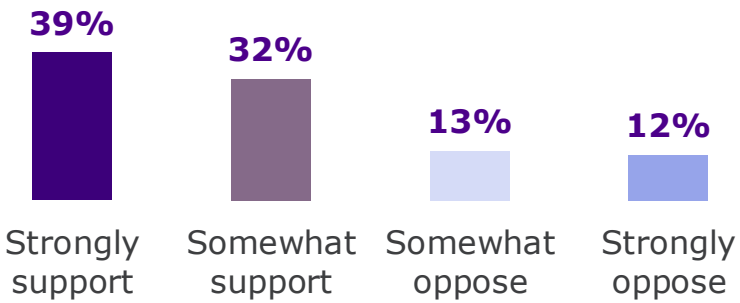
Rationale for Near-Term Solar Procurement

Public Confidence, Economic Development and the Learning Curve

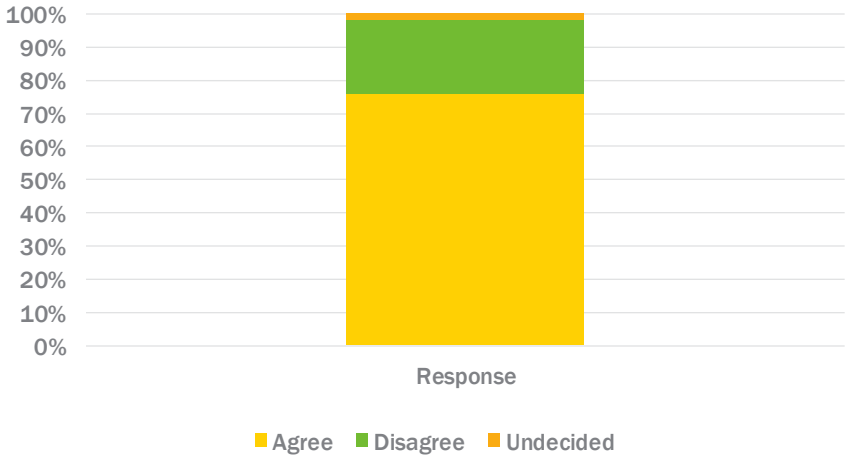
TECHNOLOGY DIVERSITY, VISIBILITY & PUBLIC SUPPORT

- Solar is the most favoured generation source of Canadians. Building public confidence and support from concept through implementation with a technologically diverse mix that includes large solar facilities will be critical for the sustained success of Alberta's Climate Leadership:

Support for Government of Alberta taking action to expand the production of renewable energy as part of a plan to address climate change (Environics, Sept. 2015)

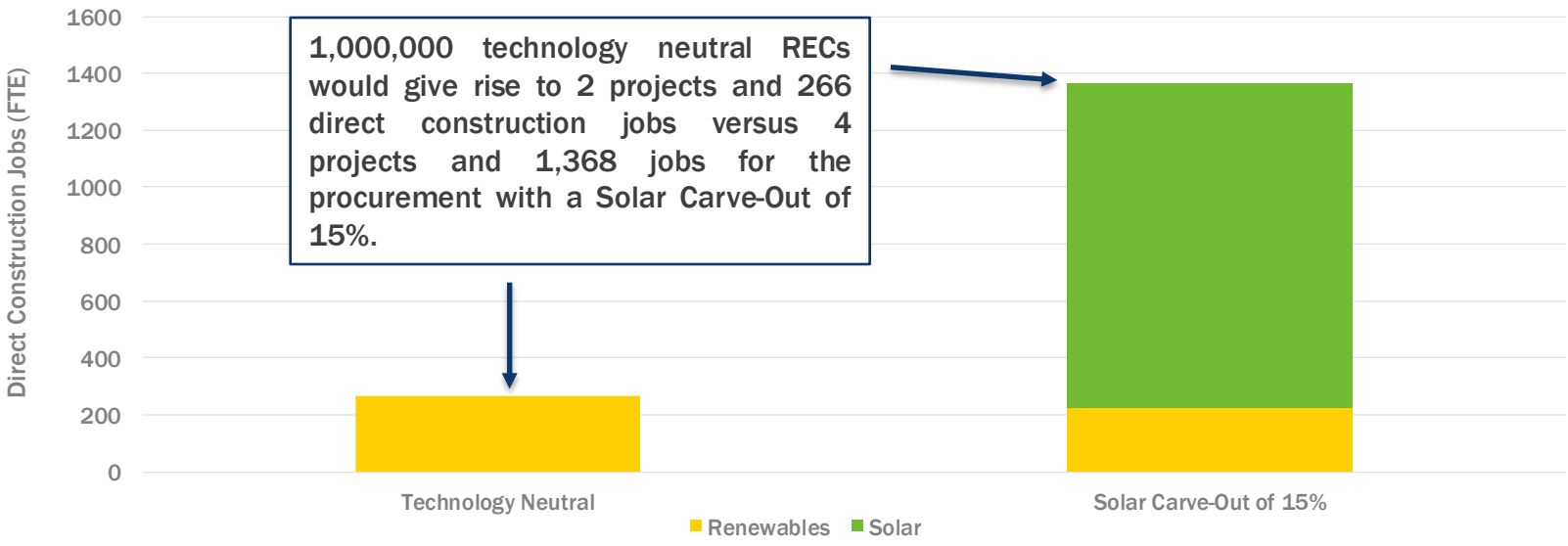


Support for development of clean energy and cleantech industry even if results in increased energy costs (EKOS, March 2016)



REGIONAL DIVERSITY & ECONOMIC BENEFIT

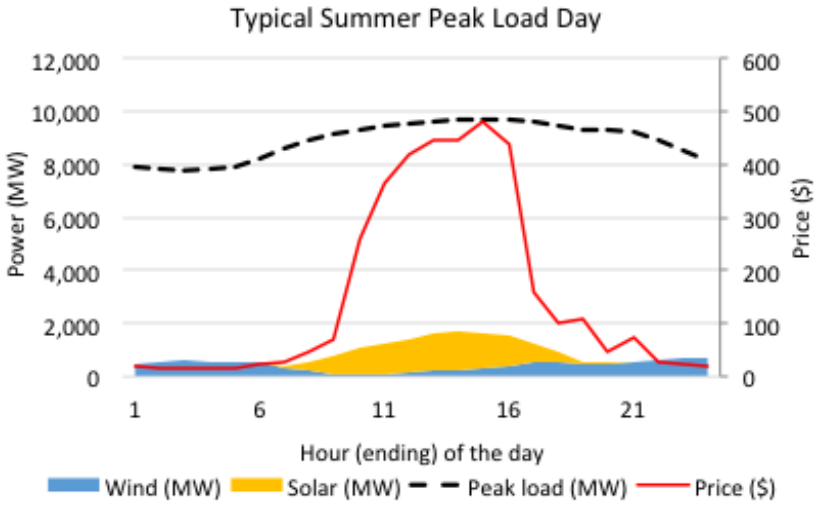
- Alberta's solar resource is ubiquitous. A regionally diverse renewables mix that includes large solar facilities can create more economic opportunities and jobs in more communities across Alberta than any other generation–type per $ invested:

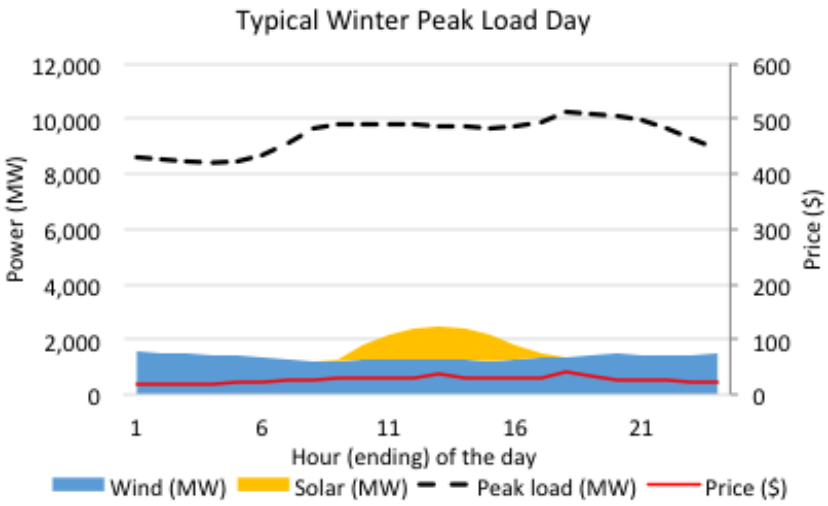


* Assumes 150 MW average project size and 0.93 direct construction jobs per MW of wind and 40 MW and 10 per MW for solar.

SYSTEM & MARKET LEARNING CURVE AND EXPERIENCE

- Solar's generation profile is complimentary to that of wind energy and has excellent coincidence with high day-time pricing. However, neither the AESO nor Market Participants are prepared for this new generation type:





REP Procurement Design Considerations

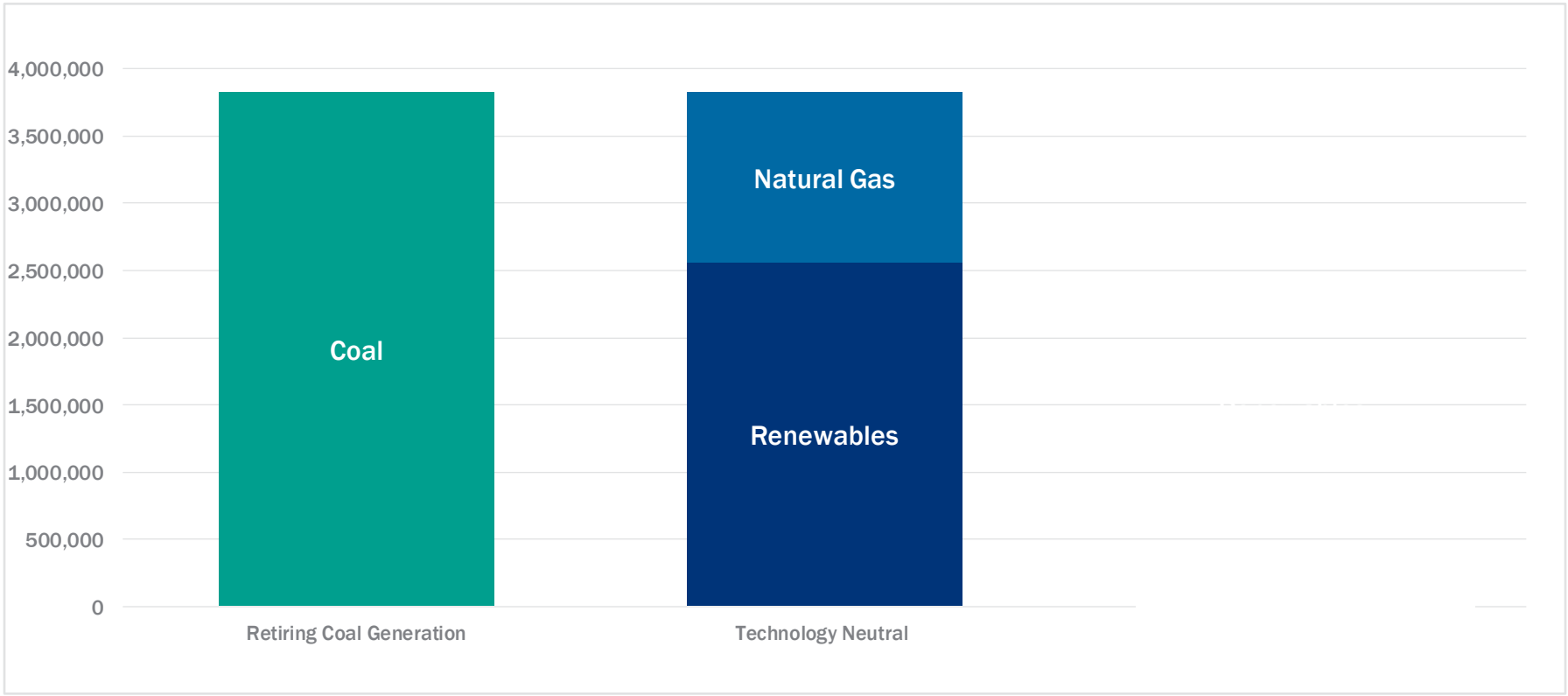
15% Solar Carve-Out

EXAMPLE: A 15% SOLAR CARVE-OUT (1/4)

- A target of up to 30% of electricity from renewables in 2030 creates a significant opportunity for renewable and solar electricity. In absence of accelerated coal retirement schedule, only 4 coal-fired facilities due to retire in 2019. They generated 3.8 TWh in 2015.

EXAMPLE: A 15% SOLAR CARVE-OUT (2/4)

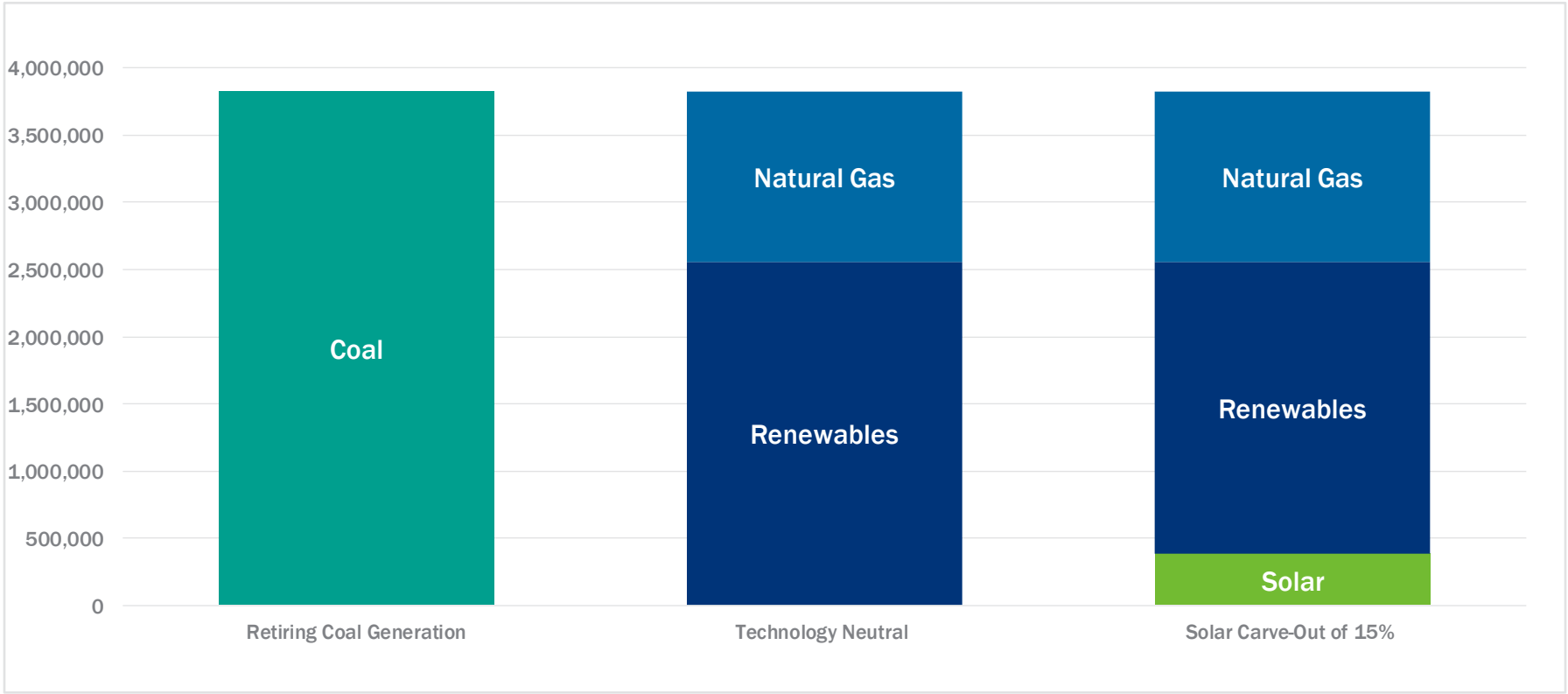
- Replacing 67% of this electricity with renewables would give rise to a need to procure 2.6 million RECs or 730 MW*:



*** Assumes a Capacity Factor of 40%.**

EXAMPLE: A 15% SOLAR CARVE-OUT (3/4)

- For example, a 15% Solar "Carve-Out" of these RECs would give rise to a need to procure ~384,000 RECs from solar or 292 MW*:



*** Assumes Solar Capacity Factor of 15%. Total procurement would be 913 MW. The generation from 292 MW of solar would represent <0.05% (five ten thousandths) of the Alberta Internal Load in 2015. AESO 2014 Long Term Outlook estimates 2015 IL at 82,214,000 MWh**

EXAMPLE: A 15% SOLAR CARVE-OUT (4/4)

- "Carve-Out" would increase average REC pricing by only <15%*.
  - Staging "Carve-Out" would improve competition, minimize costs and ensure procurements maximally benefit from lessons learned.
  - REC ceiling could be digressed annually to manage liability.

Year of Contract and Commercial Operation	%	MW
Stage 1: 2017 Contract, 2019 Operation	~25%	75
Stage 2: 2018 Contract, 2020 Operation	~35%	100
Stage 3: 2019 Contract, 2021 Operation	~40%	125

* Assumes a SREC:REC pricing ratio of less than 2:1. 15% could be expected to be within the variability of a competitive procurement with no carve-out.

CONCLUSION & SUMMARY

- The cost of solar electricity is now demonstrated to be within striking distance of competitively participating in future rounds of Alberta's Renewable Electricity Program (REP).

- However, without a Solar "Carve-Out" the REP will not give rise to solar in the near-term.

- A regionally and technologically diverse array of projects in the early years of the REP would deliver significant public support and confidence, economic development, job creation and system and market learning curve benefits.

- CanSIA recommends that a minimum Solar "Carve-Out" of 15% be applied to all Calls for Power to 2021. This "Carve-Out" would increase average REC pricing by less than 15%.

CONTACT DETAILS

Patrick Bateman,
Director of Market Intelligence & Research

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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:

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