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

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Barbara Ellard
Director, Markets and Procurement
Independent Electricity System Operator
1600-120 Adelaide Street West
Toronto, ON M5H 1T1

Dear Barbara,

On behalf of the Ontario solar industry, please accept this submission from the Canadian Solar Industries Association (CanSIA) regarding the Non-Emitting Resources Request for Information (NER RFI). CanSIA has complied a submission to compliment the information that you may receive from individual solar companies, with respect to specific solar PV facilities, projects or portfolios. Furthermore, CanSIA is a member of the consortium of renewable generators, energy storage providers, and industry associations (i.e., the "Consortium"). CanSIA's submission compliments the Consortium submission. As such, CanSIA's submission focuses on existing distribution-connected resources with IESO contracts, while recognizing that there are both transmission and distribution-connected projects within Ontario.

It goes without saying, that the solar industry in Ontario has seen significant growth over the past decade with the Renewable Energy Standard Offer Program (RESOP), the Feed-in Tariff (FIT) and microFIT programs, Green Energy Investment Agreement, and the Large Renewable Procurement (LRP). Ontario now has a very sizable fleet of solar resources that are constructed or under development, as further described in our Appendix A submission.

Solar will continue to be a valuable resource in Ontario's energy mix, with declining costs, ease of integration and the ability to provide a variety of services and products into the electricity market. Our Appendix B submission looks at the capabilities and barriers to participation of the existing IESO contracted solar fleet in the broader IESO-administered markets, as well as future markets that are being contemplated by the IESO.

While our NER RFI submission focuses on existing assets, it is important to acknowledge the transition of the solar industry from the FIT program to the net metering regime, including the potential for virtual net metering. Solar is very scalable; from residential scale to utility scale. New market mechanisms developed by the IESO should enable value-stacking of services provided to different entities on the grid (e.g., customer, LDC and IESO). CanSIA further notes that energy storage is a natural partner for solar generation, helping firm energy supply and enabling broader availability.

CanSIA recognizes the importance of the IESO's Market Renewal Program, which is being developed to provide long-term transparency and an enduring, stable market. The future of Ontario's market will be dependent on the overarching confidence for investment. As such regulatory and market stability are of utmost importance for CanSIA and the Ontario solar market.

Thank you for your consideration of the information provided herein, and we look forward to future engagement and discussions with the IESO.

Sincerely,

Wesley Johnston
Vice President, CanSIA

	Canadian Solar Industries Association			
			Solar FIT - microFIT and small FIT <= 500 kW	Solar RESOP and FIT - large FIT > 500 kW
Section	**Information Required**		**Response**	**Response**
Section 1: Respondent Details	Organization/Company Name		CanSIA - member total	CanSIA - member total
	Company Address		240 Bank Street, Suite 400, Ottawa, ON CANADA K2P 1X4	241 Bank Street, Suite 400, Ottawa, ON CANADA K2P 1X4
	Contact Person Name and Title		Wes Johnston	Wes Johnston
	Contact Person Phone Number		tel: 613-736-9077 ext.224	tel: 613-736-9077 ext.225
	Contact Person Email		wjohnston@cansia.ca	wjohnston@cansia.ca
Section 2: Facility Characteristics	Facility or Portfolio Name		Solar FIT - microFIT and small FIT <= 500 kW	Solar RESOP and FIT - large FIT > 500 kW
	Facility Address (or applicable description of location if a project portfolio)		across Ontario	across Ontario
	Facility GPS (if applicable)		n/a	n/a
	Number of facilities		28,630 Operating / 4,157 under development	220 operating / 7 LRP under development
	Transmission Connected or Distribution Connected		Distribution Connected	Distribution Connected
	Registered IESO Market Participant? (yes or no)		no	no
	Facility Type (Stand-Alone Generation or Behind-the-Meter)		stand alone	stand alone
	Fuel Type		solar PV	solar PV
	Nameplate Capacity (MW AC)		351 operating / 429 under development	1743 operating / 140 LRP under development
	IESO Contract Type (if applicable)		FIT and microFIT	RESOP and FIT v1.3
	Commercial Operation Date Year		2010	2007
	Contract Expiry Year (if applicable)		2038	2031
	Facility Description (or description of Portfolio)		Rooftop and ground mount	Rooftop and ground mount
Section 4: Technical Information	Estimated Seasonal Capacity (peak summer and peak winter)		peaks are similar but energy output is reduced in winter	peaks are similar but energy output is reduced in winter
	Flexibility in Size/Capacity? (yes or no)		restricted under IESO contracts	restricted under IESO contracts
	Expected Annual Energy Output (MWh)		approx 1100MWh/MW fixed axis	approx 1100MWh/MW fixed axis
	Estimated Ramp Rate Up (MW/min)		10 MW/min (with curtailment)	10 MW/min (with curtailment)
	Estimated Ramp Rate Down (MW/min)		-10 MW/min (with curtailment)	-10 MW/min (with curtailment)
	Dispatchable (yes or no, if no please identify as intermittent or self-scheduling)		intermittent	intermittent
	Restrictions on Availability of Facility Operations (hours/days/months)		daylight hours, seasonal, and weather dependent	daylight hours, seasonal, and weather dependent
	Connection Point (or description of connection if Portfolio)		distribution feeders	distribution feeders
	Connection Voltage		distribution voltages < 50 kV	distribution voltages < 50 kV
	Transformer/Distribution Station Closest to Connection Point		variety	variety
	Local Distribution Company		variety	variety

Appendix B: Questionnaire

The following questions aim to gather information from providers of non-emitting technologies, generation facilities and load resources, as well as other relevant stakeholders. This information will help the IESO understand the prevailing market conditions under which non-emitting resources are currently operating both in Ontario and elsewhere, the opportunities for increased participation in IESO markets and the role that the IESO can play in further enabling that participation.

Where a particular question does not specify the status of a facility, respondents may assume that the intention of the question is to capture both existing facilities, proposed facilities or potential facilities and resources. If a particular question appears to target a specific technology or resource type, it does not preclude other parties from answering. Please provide context around answers that will help the IESO more easily understand the responses and the information provided.

For respondents who feel that the questions posed in Appendix B do not offer ample opportunity to provide the information relevant to their particular context, they are encouraged to provide additional information using the space provided in the questionnaire or through additional documentation.

Current Market Opportunities and Challenges

The IESO administered market is currently comprised of 1) real-time markets, affecting actual delivery and use of electricity and comprised of markets for energy and operating reserve; 2) financial markets, not in scope for this RFI; and 3) the ancillary service market (also referred to as the procurement market in some IESO documentation), including black-start capability, regulation services, reactive support and voltage control (RSVC) and reliability must-run. In addition to the IESO administered market, the IESO also runs an annual Demand Response (DR) auction, as a means of selecting providers of DR in a transparent and cost-effective way. Collectively, these markets provide revenue opportunities for those participating in Ontario's electricity system, which are further discussed in the Revenue Opportunities in the IESO-Administered Markets document. Review the resources provided on the IESO website for an understanding of the products/services currently on offer in the IESO markets.

The IESO is soliciting insight into the specific characteristics and capabilities of various non-emitting resources, to better understand participation of non-emitting resources in the IESO administered markets.

For current and prospective market participants, the IESO seeks an understanding of current conditions under which non-emitting resources are operating in the market and any gaps that may exist. For information regarding market participant status review Chapter 2 of the Market Rules, Participation.

IESO Markets (General)

1. Supplement Appendix A with information describing what service/products your resources can currently provide.

The Canadian Solar Industries Association (CanSIA) is submitting a response on behalf of its members. As such, this submission will focus on the existing fleet of IESO-contracted solar generation resources that are distribution-connected. This includes resources with Renewable Energy Standard Offer Program (RESOP), Feed-in Tariff (FIT) and microFIT contracts, as well as the Large Renewable Procurement (LRP).

Most existing solar generation resources in Ontario are providing energy in accordance with their IESO contract. By way of their contracts, capacity is provided indirectly and environmental attributes (EAs) are transferred to the IESO.

Distribution-connected resources are not required to become registered market participants. That said, solar resources that are 5 MW AC or larger are variable generators in accordance with the IESO Market Rules and, therefore, must register with the IESO for the purpose of providing operational and meteorological data for the IESO's centralized forecasting of variable generation.

Solar has the capability of providing the following products and services:
1) energy, operating reserve (OR), regulation and reactive support and voltage control (RSVC) - these products and ancillary services (A/S) are currently defined with the IESO-administered market (IAM),

however solar resources are not (for reasons discribed below) providing all of these services in today's IAM;
2) capacity - this product is currently in development per Incremental Capacity Auction (ICA)
3) additional ancillary services (A/S) that are not presently defined in IAM, such as ramp, load following, inertial response; and
4) other products such as EAs.

While solar can provide valuable products and services to the IAM and broader Ontario market, consumers will leverage solar to help off-set their electricity consumption, thereby lowering their electricity bills, via net metering and load displacement generation. The IESO is also exploring additional models for net metering, including virtual net metering, through the Renewable Distributed Generation Integration (RDGI) Fund. CanSIA advocates for customer choice, and the abiltiy for customers to choose how they would want to participate or invest in solar. Likewise, customers should have options for participating in the IAM to ensure full value of their solar resource is recognized.

2. Identify any limitations to resource participation in the IESO administered markets, as outlined in the IESO Market Rules, Chapter 7.

The ability of distribution-connected facilities to supply multiple electricity products to IESO-administered markets is limited (ref. Chapter 7, Section 2.1.3). Facilities that are less than 1 MW are not eligible to receive dispatch instructions from the IESO unless they are part of an aggregated facility. The IESO further restricts the aggregation of facilties by requiring resources to be located at the same connection point (ref. Chapter 7, Section 2.3).

Several of the products and services that solar could provide are not defined in the IAM, for example ramp and load following (Chapter 7, Section 1.3.3.1). Furtherermore, the classification of market participants and registration of facilities needs to enable applicable resources to supply multiple electricity products. Once these resources are defined, the IESO will need to consider the implications with respect to integration with the dispatch algorithm (Chapter 7, Section 4), pre-dispatch schedule (Chapter 7 Section 5), real-time scheduling (Chapter 7, Section 6), and dispatch instruction (Chapter 7, Section 7).

Participation of behind-the-meter solar resources in the IAM can also be limited by the registration or classificattion of the host customer (e.g., non-market participants).

a. Specific requirements are listed within Chapter 7 of the Market Rules for generators considered self-scheduling facilities and intermittent generators. If your facility is considered either self-scheduling or intermittent, what additional limitations exist (if any), that may limit participation in IESO markets?

Distribution-connected solar resources that are less than 5 MW are considered intermittent generators per the IESO's Market Rules.

Outside of the Market Rules, distribution-connected solar resources are prevented from supplying non-energy products, such as A/S, to IESO-administered Market due to limitations of the IESO's software and IT platforms, specifically as it relates to aggregation of resources. Upgrades to the IESO's network model would be required in order to account for the resource's connection configuration and to ensure that the resources can be appropriately scheduled and dispatched in the IAM. This is an underlying technical and IT challenge for broad-scale adoption of many distributed energy resources (DERs), including solar and energy storage.

b. Are there any Market Rules outside of Chapter 7 that limit your resource from participating in the IESO markets?

The following limitations have been identified:
1) Need to review prudential requirements in light of new electricity products that may be provided (Chapter 2)
2) Need to define compliance, inspection, testing, and monitoring obligations/requirements for energy storage supplying a range of energy products (Chapter 4)
3) Amendments may be required to permit broader supply of regulation, OR and RSVC, and other A/S, as well as capability testing from a broader range of facilities providing A/S (Chapter 5)

3. Is the energy profile of your facility firm or variable? If variable (self-scheduling or intermittent generators for example), what measures could be considered to provide a more firm energy profile?

The energy profile for solar generation resources is variable.

It is possible to to 'firm' the energy profile through equipment upgrades, reducing the time to apply forecast data (i.e., reducing forecast error), and through the integration with other firm resources (i.e., energy storage).

4. For variable non-emitting resources, what type of resource forecasting do you perform? What is the level of accuracy day-ahead, 1-hr ahead, 5-min ahead? If you do not perform forecasting, why not?

The IESO is responsible for centralize forecasting of variable generation using inputs from variable generators and CanSIA supports centralized forecasting obligations.

Solar generation facility operators monitor the energy output of a facility to ensure that the actual energy output of a facility matches the expected energy output of a facility. If there is a discrepency, the operator would dispatch technicians or maintenance staff to identify and resolve any discrepency on site. Operators also monitor meteorological forecasts for operational purposes (e.g., to plan for extreme weather events).

There is typically no need to forecast the energy output at a granular level in Ontario based on the requirements set out by IESO contracts and the IAM.

5. For variable non-emitting resources, does or can your technology perform self-adjustments to smooth or normalize the energy profile or generation curve? Please describe or explain why not.

Currently there is no incentive for solar resources under IESO contract to try to smooth or normalize the energy profile. Solar facilities could increase capacity factor by increasing the DC capacity of the facility and generating Contract Capacity for more hours of the day, however the IESO contracts in general prohibit such increases. Similarly storage technology could smooth facility output, but in general IESO contracts prohibit such increases.

6. For existing facilities (currently operating in IESO markets): are there any modifications, expansions or reconstructions of a facility or facilities that may enable participation in additional IESO (or other) markets or revenue streams? If yes, provide details and explanations of how this would be enabled. Identify any relevant examples from other jurisdictions.

It is possible to smooth/normalize energy output through equipment upgrades and with the integration with other firm resources (i.e., energy storage).

7. For existing or proposed energy storage facilities, what is the maximum duration of service that your facility is capable of providing?

N/A

8. For new build facilities, what is the lead time required for your facility to reach commercial operation in Ontario and participate in the IESO markets?

While this submission focuses on existing assets, CanSIA notes that ground-mounted solar facilties are anticipated to take 3-years to reach commerical operation, which allows sufficient time for permitting and approval through the Renewable Energy Approval. Smaller scale projects may be eligible for a streamlined permit via the Environmental Activity and Sector Registry (EASR) and can be developed within one year. Rooftop solar projects can be developed within one year as such facilties do not require environmental permits.

Ancillary Services

The IESO contracts for four ancillary services to help ensure the reliable operation of the power system: certified black start facilities, regulation service, reactive support and voltage control service (RSVC), and reliability must-run.

Reliability must-run services are not in scope for this RFI. Certified black start facilities help system reliability by being able to restart their generation facility with no outside source of power. In the event of a system-wide blackout, black start facilities would be called on during restoration efforts to re-energize other portions of the power system.

Given subsequent discussions on the operating reserve (OR) market, it is important to distinguish that regulation services as a unique and separate ancillary service, which is called on to act on a shorter time horizon than OR. Regulation service acts to match total system generation to total system load (including transmission losses), and helps correct variations in power system frequency. This service corrects for short-term changes in electricity use that might affect the stability of the power system.

Reactive support and voltage control service is contracted from generators and allows the IESO to maintain acceptable reactive power and voltage levels on the grid. Both active and reactive are required to serve loads. Reactive power flow is needed in an alternating-current transmission system to support the transfer of active power over the network. All generating facilities that are injecting energy into the IESO-controlled grid are required to provide reactive support and voltage control service in accordance with the market rules. Moreover, the IESO contracts for RSVC service to ensure reliability on the grid at all times.

The IESO Market Rules, Chapter 7, section 9, speaks specifically to the ancillary services market (referred to as the procurement market).

9. Does your resource currently provide any of these ancillary services in Ontario?

No, exisitng distribution-connected solar projects are not providing these exising A/S.

a. If not, are there any limitations that currently prevent your resource or technology from providing any of the market's ancillary services?

In addition to the response provided in previous section, there is no abiltiy to provide such services without becoming a registered market participant. There are limitations for smaller distribution assets, due to the limitations for aggregated resources as set out in Chapter 7 of the Market Rules.

b. Specifically, identify any market rules or requirements that limit participation in a particular type of ancillary service (e.g., regulation service).

With respect to specific rules that limit the participation of solar generation providing A/S:

1) permiting broader standards and applications of A/S (Chapter 5, Sections 4.2 and 4.3)
2) permiting broader supply of regulation, OR, and RSVC (Chapter 5, Sections 4.4 to 4.6)
3) testing requirements for a broader range of facilities regarding their capabilities in providing A/S (Chapter 5, Sections 4.9 and 4.10)

c. If you do not believe there are limitations and your resource does not currently provide these services, why not?

N/A

10. Are there aspects of your resource that you believe could be of benefit to the ancillary service market? If so, please provide details and, if available, other jurisdictions where these are currently being leveraged.

Yes, as described above, solar generation can provide a variety of A/S.

Solar PV provides RSVC even while not generating by using power electronics. Solar can provide very fast and very accurate frequency regulation, however this can be uneconomic, particularly in the upwards direction, because of the requirement to "pre-curtail" the energy output. There is no incentive provided by the current IESO contracts to provide such services (e.g., lost revenue due to decreasing production).

However, we do note as an example for IESO to consider, in the Southwest Power Pool, dispatchable variable energy resources (including solar) may qualify to provide regulation-down ancillary service.

Operating Reserve Markets

Operating reserve (OR) is stand-by power or demand reduction that can be called on with short notice to deal with an unexpected mismatch between generation and load. Through the administration of OR markets, the IESO ensures that additional energy supply is available should an unanticipated event take place in the real-time energy market.

The three types of operating reserve classes that can be offered by dispatchable generators and dispatchable loads are:

10-minute synchronized (spinning) reserve
10-minute non-synchronized (non-spinning) reserve
30-minute reserve (non-synchronized)

11. Is your facility or technology currently operating, in the OR market?

No.

a. If not, what barriers (if any) prevent your technology/facility from operating in the OR market?

As indicated in the responses to previous sections, the challenges are market based. Furthermore, the existing generation is under IESO-contract, and distribution-connected solar generators have additional barriers as they are in most cases not already registered market participants.

i. If they exist, are they economic, technological or market based? Explain.

The barriers are market-based and economic, as described in earlier sections of this submission. Any technical challenges may be overcome with faciltiy upgrades or through pairing with other technologies (such as energy storage).

ii. If you do not believe there are limitations and your resource does not currently operate in this market, why not?

N/A

Market Renewal Program (MRP)

At its core, the MRP is about doing things better. The MRP is about improving the way electricity is priced, scheduled and procured in order to meet Ontario's current and future energy and capacity needs reliably, transparently, efficiently and at lowest cost.

The MRP includes a number of initiatives that will enable the province to more efficiently meet demand over the near and longer terms and include:

- Introducing a Day-Ahead Market to provide greater certainty to market participants and lower the cost of producing electricity.
- Reducing the cost of scheduling and dispatching resources to meet demand as it changes from hour-to-hour and minute-to-minute through a Single Schedule Market and Enhanced Real-Time Unit Commitment process.
- Improving the way Ontario acquires the resources to meet longer-term supply needs by implementing an Incremental Capacity Auction.

Capacity

Traditionally Ontario has secured new investments in generating resources either by procurements for long-term contracts or by rate regulation; however, MRP will see the introduction of a competitive auction mechanism to help meet the province's incremental capacity requirements. The Incremental Capacity Auction (ICA) initiative will develop an enduring market-based mechanism that will secure incremental capacity to help ensure Ontario's resource adequacy needs are met cost effectively.

The IESO is currently working with stakeholders to develop a number of design elements for the ICA. More information on ICA design elements can be found on the IESO's ICA stakeholder website.

12. Based on the proposed ICA design work to date, are you considering including your resource or technology in an incremental capacity auction? Please explain either why or why not.

This submission is focusing on existing, IESO-contracted facilities; therefore, they would not be eligible for the ICA as currently outlined by the IESO. That said, they could be eligible for the ICA at the end of the contract term, or for upgraded capacity (e.g., additional solar or firming through adding energy storage).

While there are still a number of design decisions to be made, materials presented to-date indicate a number of challenges for distribution-connected solar:

- defining qualified capacity
- short commitment periods
- concern about revenue adequacy
- deliverability / connection constraints at distribution system
- requirements with respect to resource aggregation

CanSIA notes that other jurisdictions provide options for solar participation in capacity marekt mechanisms. For example, in ISO-NE, solar participate in the Forward Capacity Market (FCM) as demand resources. The threshold for demand resource participation is 100 kW. A demand resources can either be:
a) Active demand resources (demand response) – activated when dispatched by the ISO; or
b) Passive demand resources – designed to save electricity across many hours but cannot change the amount saved in response to a dispatch instruction. Examples include: energy efficiency measures, advanced cooling and heating technologies, and passive behind-the-meter generation, such as solar power.

13. To the best of your ability, describe your resource's availability in detail?

Solar is available during daylight hours. As this is an aggregated submission, CanSIA is unable to provide information on a project specific basis. However, we note that historic information can be derived using the information received by the IESO through centralized forecasting of variable generation.

a. How many hours per day can your capacity be available?

Solar is available during daylight hours, with the output rising and falling at a peak in correlation with the solar intensity during mid-day. Important to note that some solar facilities in Ontario are fixed tilt (Rooftop and some ground mounted), while some ground mount facilities employ single-axis tracking and dual-axis tracking to increase availability.

b. During what months/seasons?

There is greater availablity during the summer compared to the winter due to increased daylight hours.

c. How many times can it be called on? (Identify the timeframe in your response)

Solar can be called upon as long as there is fuel availablity (i.e., sunlight).

d. Could your resource be reconfigured to provide capacity in more hours?

Yes, however, this is primarily achieved through addition of energy storage (per below).

e. Can your resource be paired with another technology or resource in order to change or increase availability?

Yes, in particular, solar facilties can be paired with energy storage to provide capacity for more hours. That said, much of the solar production occurs during on- and mid-peak periods, therefore shifting solar to more hours (e.g, to the off-peak) may not be as valuable to the system. The addition of energy storage however, can help manage ramps as solar output decreases at nightfall.

i. If so, does it need to be co-located in order to achieve this increase?

Not necessarily. The IESO would need to consider potential changes to rules with respect to resource aggregation per Chapter 7 of the IESO Market Rules.

f. On average, how many hours per year does your resource need to go on outage for regular maintenance?

Maintenance outages are very rare. Substaintive maintenance to the solar facility may be completed overnight when the resource is not delivery electrictity to the grid.

Energy Market

Within the context of the energy market, the IESO is currently working with stakeholders to improve the scheduling and dispatch of facilities. Market Renewal will see the introduction of a single schedule market (SSM), which better aligns the pricing of supply and load with the dispatch instructions, reducing the need for out of market payments, which are required under Ontario's current market design. The IESO is also developing a financially-binding Day-Ahead Market (DAM), which will provide market participants with price certainty ahead of real-time, increase operational certainty for market participants and the IESO, and also reduce out of market payments. In addition to the SSM and DAM, an Enhanced Real-Time Unit Commitment (ERUC) program is being developed that will improve efficiency of unit commitments in the intra-day timeframe by taking into account all resource costs in commitment decisions. An ERUC will also improve commitment decisions overall by optimizing over multiple hours rather than solving for each hour independently.

For the purposes of this RFI, information will be collected on participation in energy markets, which will include all three of the Market Renewal initiatives (SSM, DAM and ERUC) with responses treated generally, unless the specific initiative is identified.

14. Based on engagement with the IESO on the design of the Single Schedule Market (SSM), Day-Ahead Market (DAM) and Enhanced Real-Time Unit Commitment (ERUC), identify any design gaps for non-emitting resources.

There needs to be a better understanding about the impacts and implications for distribution-connected projects, in terms of the ability to participate in the IAM, data and technical requirements to integrate within the dispatch/scheduling models.

15. Based on experience in other electricity market jurisdictions with comparable market design to the MRP, identify best practices for non-emitting resources.

Energy revenues should reflect the value of non-emitting generation. Existing IESO contracts have incorporated the value of EAs (which are transferred to the IESO). The transition away from contracts to market based mechanisms for new generation (and generation coming off contract) must recognize this value. Other regions have used Renewable Portfolio Standards (RPS) to help ensure that the environmental value is recognized in the energy rate.

Best practices in other jurisdictions also indicate the use of centralized forecasting with respect to solar output (e.g., MISO). This helps mitigate against forecasting risk (as discribed below).

ISO-NE has a Distributed Generation Forecast Working Group (DGFWG) that provides input on long-term distributed generation (DG) forecast. Its role includes gathering information on planned DG projects and examining challenges and solutions associated with large-scale DG integration in New England.

Furthermore, other jurisdictions enable participation from smaller scale resources (100 kW minimum) and/or enable aggregation within zones (e.g., ISO-NE, NYISO, PJM, CAISO, MISO, SPP).

16. What risks would you face in committing your resource in the day-ahead market and thus receiving a financially binding schedule?

Distribution-connected generation is not expected to have a requirement to participate in the day-ahead market. That said, energy offers in the day-ahead market are based on forecasts of energy output based on meteorological information. Therefore, there is financial risk if this output is above or below the forecast if forecasting obligations were transferred to the asset owner. Given the number of variable generation facilities in Ontario, centralized forecasting is an efficient approach to managing this risk.

a. What risks would you face in committing your resource hours ahead in a real time market?

The primary risk is forecasting energy output based on expected meterological conditions.

Future Markets – Continued Evolution

The high penetration of renewables, the phase-out of coal and the increases in distributed energy resources that have been seen across the Ontario power sector are trends that are expected to continue and in some cases accelerate into in the future market. These changes, paired with a more efficient marketplace following implementation of the MRP, will present additional opportunities and challenges for non-emitting resources. The IESO wishes to understand these opportunities and challenges in greater detail, to enable participation by non-emitting resources in future markets, ensure cost effective economic markets and spur any additional market evolution.

17. Are there any services/products that your resource could provide that are not yet compensated for in the current market by the IESO? If so, list jurisdictions where this service is being, or will be, provided.

Outside of an IESO-contract, there is currently no mechanism to value the EAs produced from solar generation. Other jurisdictions have RPS as well as voluntary market for Renewable Energy Cerificates (RECs). This is particularly important for distributed solar, much of which is expected to be connected behind-the-meter as net metering or load displacement generation. The current regulatory construct within Ontario does not recognize environmental benefit of carbon-free electricity produced by solar systems.

a. If your resource is currently providing a service or product to an IESO administered market, what changes if any (i.e. to your facility) could increase the amount of this service or product currently provided?

N/A

18. Are there opportunities to pair technology types in order to facilitate participation in any future market? If yes, please explain and provide supporting examples.

Yes, in particular, energy storage is a natural partner for solar. We note that recently FERC Order 841 is intended to help eliminate the barriers of energy storage from participating in wholesale electricity markets. In particular, energy storage must be eligible to participate in all energy, capacity and ancilary services within its capability, and should be elibigle to set the market clearing price as either a buyer or a seller. Market rules must take into consideration the operating parameters of energy storage, as an energy limited resource and that the purchase/sale of electricity should be at wholesale locational marginal prices.

a. Identify any factors that may limit the pairing of technologies.

There are two key barriers for pairing solar and storage: 1) ability to make a contract facility amendment to incorporate energy storage (must be approved both by the IESO, as well as by aset owners investment committees) 2) Uncertainty and possible interconnection constraints

System Flexibility

In 2014, Ontario retired its last coal-fired generating plant as part of a concerted effort by the province to decarbonize the electricity sector. Non-emitting resources and additional natural gas generation have replaced most of the coal-fired generation and today approximately 90% of Ontario's electricity production is provided by non-emitting resources.

The IESO administered system is increasingly dependent on flexible resources to respond to intra-hour fluctuations in demand. The system is normally reliant on quick start resources to mitigate for instances where there is an over-forecast in wind output. An intra-hour over-forecast of wind output essentially equates to a proportion of the province's supply mix which is accounted for, but unavailable when needed.

The IESO and stakeholders are examining the emerging need to schedule resources capable of responding within a short timeframe in order to manage forecast uncertainty in the real-time energy market.

19. How quickly could your facility or technology provide flexibility either through ramping speed or start-up requirements (coming online if offline) to the Ontario market?

Solar is capable of providing flexibility to the Ontario market a the very fast timeframe (response time of seconds to a minute).

20. Is the ramping profile of your facility linear in nature, or does it have a different ramping profile?

Linear.

21. Where available, please provide details of ramp direction and speed. For example in 30 minutes, how quickly could your resources ramp up?

Estimated down and up ramp rate of 100% of nameplate capacity per minute for most solar resources. In order to provide ramp up, the resource must be operating in "curtailed" mode.

a. For existing or proposed facilities: how many MWs of flexibility can your facility provide?

As CanSIA's submission focuses on aggregated information, we are not able to comment on specific faciltiy capabilities.

b. For existing or proposed facilities: how long can your facility provide the flexibility services?

As CanSIA's submission focuses on aggreated information, we are not able to comment on specific faciltiy capabilities.

22. What restrictions, if any does your technology or facility have in providing these services?

It may not be economic to provide this service; particularly upward response, as the resource would need to be "pre-curtailed". Solar output is dependent on fuel availabity (i.e., sunlight) and the existing contracts compensate fully for all electricity output.