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Part 1: Request for Information

1.0 Introduction and Purpose

This Request for Information (“RFI”) is being issued by the IESO to gather information to better understand how non-emitting resources can participate in current and future IESO markets and contribute to a reliable and efficient electricity system in Ontario today and tomorrow. The purpose of the RFI is to solicit information on the technical characteristics of existing resources and potential projects, while gaining a better understanding of the barriers facing different resource types from participating in the IESO administered markets. Information from the technical component and barriers to participation will inform the Market Renewal Program (MRP) and the Non-Emitting Resource Subcommittee (NERSC).

In order to support the timelines for MRP and NERSC, this RFI is being issued in two phases:

Phase 1 (current) is soliciting information related to how non-emitting resources can participate in the IESO administered electricity markets of today and tomorrow.

Phase 2 (proposed for Q3 2018) will solicit information on how non-emitting resources are developed, project economics and additional considerations.

Market Renewal Program. Together with its stakeholders, the IESO has begun a major initiative to renew its electricity market design. The objective of the MRP is to address existing market inefficiencies and lay a foundation for a more efficient market place in the future.

Independent Electricity System Operator. The Independent Electricity System Operator (the “IESO”) works at the heart of Ontario's power system – ensuring there is enough power to meet the province's energy needs in real time while also planning and securing energy for the future. It does this by:

- balancing the supply of and demand for electricity in Ontario and directing its flow across the province's transmission lines;
- planning for the province's short term, medium term and long-term energy needs and securing clean sources of supply to meet those needs;
- overseeing the electricity wholesale market where the market price of electricity is set; and
- engaging in activities that promote electricity conservation and the efficient use of electricity.

Market Evolution. Since the market opened in 2002, the province's power sector has experienced significant change, including coal phase-out, thousands of megawatts (MWs) of new or refurbished generation and conservation, a growing demand response program and increased amounts of distributed energy resources. Looking into the future, change is expected to accelerate with a greater penetration of renewables, smart grid technology implementation and the government's policy of further reducing its carbon footprint. Major trends in the electricity industry include falling costs for non-emitting resources like solar PV and storage resources, a drive towards decarbonization, and new technologies and business

models that are enabling the growth of distributed resources. With all of this change there is potential for the electricity sector of 2030 to look substantially different than it does today.

1.1 Integration with Current IESO Initiatives

This RFI is intended to solicit information that may inform IESO-led initiatives, including the work streams of the MRP.

The [MRP](#) will enhance the Ontario electricity market design by putting in place a foundation to manage a range of potential energy futures driven by decentralization, digitization and decarbonization. By doing so it will address known issues within the existing market design and deliver ratepayer value by meeting system needs more cost-effectively. Responses to this RFI that identify barriers to participation for non-emitting resources will support the MRP design work, as it enhances an unbundled market structure with significant enhancements to the energy market and introduction of an incremental capacity auction.

The long-term goal of the IESO is to develop new and transparent revenue streams. Establishing energy and capacity prices that more accurately reflect locational needs, will mean investments can be made in the regions where they provide greatest value. For example, as resources at the distribution level grow and distribution services become better defined, the revenue streams available at the transmission level can help to incent effective investments in distributed energy resources. The IESO is also examining options to meet operability requirements, which may offer additional revenue streams that will help to drive new investment decisions or the more efficient use of existing resources.

Responses to this RFI will also support the work of the NERSC, which is a subcommittee of the Market Renewable Working Group (MRWG). The NERSC's mandate is to ensure the unique characteristics of non-emitting resources are appropriately reflected in the MRP design and to begin to identify how Ontario can build upon the foundation established by the MRP to prepare for the system of the future. Responses are intended to inform the NERSC technical report, to be presented to the MRWG in Q3/4 2018. Information on the technical capabilities and the economics of various non-emitting resource types will contribute to the subcommittee's modelling exercise, which will take into account a range of potential futures.

2.0 Information Requested

Each respondent should ~~complete~~[provide](#) the information ~~requests~~[requested](#) in Appendix A and Appendix B to this RFI.

Appendix A: Respondent and Technical Information Spreadsheet, requests respondent contact information and information about the facility or non-emitting resource. Appendix B: Questionnaire, supplements information related to the respondent's facility or resource, in addition to how it currently or could prospectively provide a series of products or services. The focus of the questions ranges from the current IESO market to future market evolution. Respondents are encouraged to review the questionnaire carefully and answer each question [in as detailed](#)~~much detail~~ as possible. Supporting information and examples/comparisons from other jurisdictions are welcome.

The RFI aims to collect information from a broad range of resources, technologies, facilities and project types. As such, questions are intended to be phrased in a way that allows respondents to reply in the context that best fits their technology, project or facility, and stage of development, as applicable. Where a respondent wishes to provide information that appears to not be captured by the questions provided in Appendix A or B, they are encouraged do so, either in response to the most relevant question or through supplemental documentation in the format of their choosing.

2.1 **Facility/Project Characteristics**

This RFI does not define qualifying non-emitting resources, as it is intended to be broad and inclusive. Below are examples of technologies and resources considered in scope.

1. Facility/Project:
 - New build
 - Upgrade
2. Development status:
 - Planning and design
 - Development and permitting
 - Commissioned and operating
3. Facility/Project type:
 - Variable generation
 - Energy not continuously deliverable due to limited resource availability
 - Dispatchable generation
 - Can be dispatched on and off at the request of the system operator
 - Self-scheduling generation
 - Non-dispatchable generator that may not be able to increase or decrease energy output at the request of the system operator
 - Multi-technology projects
 - Demand response resources
 - A load resource with the ability to reduce its energy demand at specific times of power system need, as dispatched by the system operator
 - Energy efficiency program
 - Energy storage
4. Electrically connected to:
 - the IESO-Controlled Grid
 - a Local Distribution Company's (LDC's) distribution grid
 - an end-user connected to either of the above
 - a power system outside of Ontario

The IESO recognizes that information ~~requests~~requested in Appendix A and B may not be applicable to ~~resource or facility~~all resources, facilities or projects, depending on ~~the project~~their status. Respondents are encouraged to provide as much detailed information as possible.

2.2 Multiple Configurations and Facilities

If a respondent wishes to provide technical information about a number of different configurations or technologies, the respondent should do so within a single submission, as opposed to multiple submissions. Within the submission, provide separate Respondent and Technical Information Spreadsheets and Questionnaires, for each of those different configurations/technologies, as applicable.

Part 2: Terms & Conditions

3.0 RFI Timetable

The following is the schedule for this RFI (all times noted in Toronto time):

Post draft Phase 1 RFI for comment	February 16, 2018
Comments due on draft Phase 1 RFI	March 2, 2018
Issue Date of RFI	March 19, <u>21</u> , 2018
Submission deadline	May 2, <u>4</u> , 2018 (<u>11:59 pm</u>)
Evaluate responses and design draft Phase 2 RFI	May - August, 2018

This RFI timetable is tentative only and may be changed by the IESO. Any change to the RFI timetable will be shared via communication on the [RFI website](#).

4.0 Submission Instructions

Respondents should submit all requested documents electronically to the IESO at engagement@ieso.ca, by the proposal submission deadline, identified above. The IESO will only be accepting electronic submissions and in the interest of limiting administrative effort, electronic submissions should reference the respondent's name and the Non-Emitting Resources RFI at engagement@ieso.ca.

Email: [insert email address]

Subject: "Name of Respondent" _RFI – Non-Emitting Resources

The Respondent and Technical Information Spreadsheet should contain the respondent's full name and address and should include the main contact information of the respondent. The IESO may request additional information in relation to a response after the submission deadline. Additionally, the IESO may request to meet with select respondents to further discuss their response.

5.0 Inquiries and Clarifications

This RFI and any related documentation will be posted publicly and will be accessible via the RFI website

~~(<http://www.ieso.ca/en/sector-participants/engagement-initiatives/engagements/non-emitting-resource-request-for-information>)~~. The IESO invites questions and comments from all interested parties regarding

the information provided in this RFI to engagement@ieso.ca. The IESO will endeavor to respond to questions as they are received, depending on quantity. Any response to a question or comment that may be relevant to all potential respondents will be posted publicly. If a question or comment is posted publicly the IESO will redact any respondent or project/facility specific information.

6.0 Confidentiality and Disclosure of Information

The respondent consents to the IESO's collection of information as contemplated under this RFI for the uses contemplated hereunder. The respondent further consents to the disclosure of its RFI submission to the Ministry of Energy, including any confidential information, which will be shared with the Ministry of Energy under confidentiality agreement with the IESO. Respondents are advised that any non-confidential information or redacted versions of a respondent's RFI submission may be posted publicly, in the interest of transparency and information sharing with stakeholders. Respondents are advised that information provided may be shared with the NERSC, MRWG and to other IESO initiatives, as appropriate, in an aggregated and non-identifiable manner.

The Freedom of Information and Protection of Privacy Act, R.S.O. 1990, c.F.31, as amended, applies to information provided to the IESO by a respondent. A respondent should clearly identify any information in its response or any accompanying or supplemental documentation which is supplied in confidence and for which confidentiality is to be maintained by the IESO. Where the respondent is providing information in confidence, the word "Confidential" should precede the specific response. The confidentiality of such information will be maintained by the IESO, except as otherwise required by law or by order of a court or other administrative body.

Appendix A: Respondent and Technical Information Spreadsheet

See the [Microsoft Excel version of the Respondent and Technical Information Spreadsheet on the RFI website](#).

[The intention of Appendix A is to capture existing facilities, proposed facilities, potential facilities, projects and resources.](#) For respondents submitting information ~~regarding~~[pertaining to](#) an existing or planned facility/[project](#), provide the relevant information about that facility/[project](#). For responses related to non-emitting resources only, where the respondent does not have an existing or planned facility, it is not necessary to create a theoretical facility.

[In addition to existing or planned facilities, Appendix A may be completed for a portfolio of existing or planned facilities, either by aggregating information onto one submission \(i.e., one single Appendix A showing the aggregate data for a portfolio\) or by providing multiple different versions of Appendix A, each representing a separate existing or planned facility.](#)

[Respondents may choose to complete Appendix A in a manner that allows them to best provide relevant information, even if this information is not specifically requested in Appendix A. Respondents are asked to provide context where applicable, in order to aid the IESO in interpreting the information provided. Context may be provided through the comment fields in Appendix A or through additional documentation.](#)

Appendix B: Questionnaire

[See a fillable Microsoft Word version of the Questionnaire on the RFI website.](#)

The ~~following questions aim~~[intention of Appendix B](#) is 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 existing facilities, proposed facilities, potential facilities, projects 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.
2. Identify any limitations to resource participation in the IESO administered markets, as outlined in the IESO Market Rules, Chapter 7.
 - a. Specific requirements are listed within ~~chapter~~[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?
 - b. [Are there any Market Rules outside of Chapter 7 that limit your resource from participating in the IESO markets?](#)
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?

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

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. ~~7.~~ Does your resource currently provide any of these ancillary services in Ontario?
- If not, are there any limitations that currently prevent your resource or technology from providing any of the market's ancillary services?
 - Specifically, identify any market rules or requirements that limit participation in a particular type of ancillary ~~services~~service (e.g., regulation service).
 - If you do not believe there are limitations and your resource does not currently provide these services, why not?

10. ~~8.~~ 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.

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. ~~9.~~ Is your facility or technology currently operating, in the OR market?

- If not, what barriers (if any) prevent your technology/facility from operating in the OR market?
 - ~~b.~~ If they exist, are they economic, technological or market based?

Explain.

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

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. 10-~~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.

- ~~13. 11-~~To the best of your ability, describe your resource's availability in detail?

- a. How many hours per day can your capacity be available?
- b. During what months/seasons?

- c. How many times can it be called on? [\(Identify the timeframe in your response\)](#)
- d. Could your resource be reconfigured to provide capacity in more hours?
- e. Can your resource be paired with another technology or resource in order to change or increase availability?
 - i. If so, does it need to be co-located in order to achieve this increase?
- f. On average, how many hours per year does your resource need to go on outage for regular maintenance?

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.](#) ~~12.~~ 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.
- [15.](#) ~~13.~~ Based on experience in other electricity market jurisdictions with comparable market design to the MRP, identify best practices for non-emitting resources.
- [16.](#) ~~14.~~ What risks would you face in committing your resource in the day-ahead market and thus receiving a financially binding schedule?
 - a. What risks would you face in committing your resource hours ahead in a real time market?

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. ~~15.~~ 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.
- 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?
18. ~~16.~~ Are there opportunities to pair technology types in order to facilitate participation in any future market? If yes, please explain and provide supporting examples.
- a. Identify any factors that may limit the pairing of technologies.

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. ~~17.~~ 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?
20. ~~18.~~ Is the ramping profile of your facility linear in nature, or does it have a different ramping profile?

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

- a. For existing or proposed facilities: how many MWs of flexibility can your facility provide?
- b. For existing or proposed facilities: how long can your facility provide the flexibility services?

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