ISO New England Interconnection Process

Recommendations and Observations

Prepared by RENEW Northeast
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Summary of Ideas

1. Improving the Material Modification review process;

2. Perform preliminary operating studies during the SIS;

3. Develop a mechanism to allow an interconnection customer the option of not being dispatched against certain local generation in their interconnection studies;

4. Hold wind OEM workshop to discuss model options and features and discuss generator model feature desirability as part of the standard wind generator scoping meeting agenda;

5. Develop an optional pre-application screening report;

6. Improve data availability, presentation, and access on the ISO's website to make it easier for developers to do their own pre-screening using that information;

7. Reduce the lag time for performing PSCAD studies;

8. Use of the new wind data collection template;

9. Consider opportunities for using batch/cluster interconnection studies;

10. Explore creation of a mechanism for interconnection customers to be reimbursed for upgrades that create headroom utilized by future interconnection customers or that are used to serve load at a later date; and

11. Consider developing standard minimum requirements for wind interconnections.

Detailed Descriptions of Ideas

1. Improving the Material Modification review process.

RENEW appreciates the Material Modification guidelines the ISO recently presented at the RENEW meeting and before the PAC. However, even with these guidelines, from the developer's view, many questions remain and additional clarification and/or changes are needed. For instance, some developers report that, when proposing changes to their projects, the ISO has categorized the change as a material modification due to an existing study backlog before any analysis has even been done. This response seems inconsistent with RENEW's understanding that a material modification review in and of itself does not constitute a material modification nor would the outcome of such a review be predetermined without any analysis even where a backlog exists.

- Even if the project is in an area where there is a queue backlog and performing a material modification review would itself delay later-queued projects, the ability

to make certain changes to a project is critical to the development process. This is particularly true where the current backlog in the queue may contribute to the need for changes;

- If the results of the material modification review indicate that later queued projects would require restudy, then it is our understanding that the change would be material. However, where a change might not result in restudy requirements but the material modification review itself would delay the later queued projects, the material modification review should be allowed;

- If the ISO believes the results of the review will cause the change to be material, the ISO should share that expectation with the customer. However, the customer should be able to have a formal review and determination made;

- It would be reasonable for the ISO to limit the number of turbine-change material modification review requests a customer can make following the SIS to a small number, perhaps two. Customers do not need unlimited opportunities;

- It would be reasonable for the ISO to require a deposit with each such material modification review request to prevent excessive or unnecessary turbine shopping. The deposit should be applied towards actual study costs and reconciled at the end of the study process; and

- Does ISO have a target timeframe for completion of material modification determination reviews? Or, can ISO share the range of durations experienced for material modification reviews?

2. Perform preliminary operating studies during the SIS

The ability to complete a preliminary operating study during the SIS process for both generator and ETU interconnections would provide extremely valuable information to interconnection customers It will allow them to confirm the viability of their projects before construction and to pursue elective upgrades if needed prior to operation.

- Such a study would ideally determine the conditions under which full output would not be possible. To the extent possible, pursuant to the Info Policy, these conditions would be identified for the Interconnection Customer;

- The study would be based on current system configuration (although if major maintenance like MPRP were in process, it would be desirable for the study to look at the post-maintenance system). As the system is constantly in flux, results would be preliminary and non-binding. It is possible that by the time the generator begins operating, the system would have changed in a way that the results of this study are no longer valid. Even so, the preliminary study would at least provide an indication of the current risks;

- This study would likely be an optional election at the customer's expense, similar to the preliminary overlapping impact test[1];

- Should the preliminary operations study identify conditions of concern to the interconnection, what would the appropriate steps be to identify upgrades required to resolve those concerns? Could this be done through a Facilities Study or would an ETU study be the only avenue for identifying solutions?

RENEW understands Tariff revisions as well as ISO staffing would both be involved as this may require the operations staff to conduct additional study work with which they are not currently tasked.

3. Develop a mechanism to allow an interconnection customer the option of not being dispatched against certain local generation in their interconnection studies

RENEW recommends development of a mechanism, such as a higher deliverability standard beyond the minimum interconnection standard, that would allow the interconnection customer to elect to have upgrades identified as part of the interconnection study that would be required to allow the interconnecting generator and customer-selected local generation to run at the same time.

- In the past, the ISO allowed this type of election in the interconnection study process. RENEW understands t difficulty with interconnection customers changing their elections, and triggering re-studies when they did not like the identified upgrades. This can exacerbate queue backlogs;

- The ISO staff have indicated in previous conversations that a deliverability standard might work using a binding election so that it does not contribute to the queue backlog;

- If a customer wanted to identify the minimum upgrades as well as the higher deliverability upgrades so they could decide which to pursue, this change might also work using two separate interconnection requests. This is currently how a customer would evaluate multiple options for other project characteristics such as alternative points of interconnection, project sizes, or turbine types. Because the two interconnection requests would be mutually exclusive they could be studied in parallel. They could even be in a single study that explores the alternatives so as not to cause queue delays equivalent to studying the two requests in series.; and

- When a customer submits multiple interconnection requests for the same project under the existing Tariff, is it required to submit multiple Interconnection Request

[1] Described in Schedule 22 Section 6.2 and 7.3

deposits and multiple study deposits? Can the study of both alternatives be done together and a single report be issued as is done today for incremental increase requests submitted following the initial interconnection request? If a second interconnection request deposit is required and the additional cost of evaluating the alternate configuration is less than the second deposit, is the remainder of the deposit forfeited or can it be refunded/applied to the primary queue position?

4. Hold wind OEM workshop to discuss model options and features and discuss generator model feature desirability as part of the standard wind generator scoping meeting agenda

RENEW recommends OEMs be invited wind turbine to host a series of workshops for developers and the ISO on their technology and what features/options are available, what benefits the features have for resolving various challenges, and how their turbines behave under various conditions. Educating developers and the ISO of the available options outside of the interconnection study process may make the scoping study discussion more productive and improve everyone's ability to identify the most beneficial features to study initially as well as troubleshoot concerns that arise during studies. While a single workshop could be held with multiple OEMs, the OEMs can be more detailed and open if the other OEMs are not in the room. As a result, RENEW recommends a series of workshops, potentially back to back on a single day, in which each OEM can discuss its model features separately.

RENEW recommends including a discussion of the desirability of the various wind generator model features to the wind farm scoping meeting agenda. Because the ISO studies the features indicated by the Interconnection Customer in its data submittal, some guidance about the most promising initial submittal may be helpful for everyone involved. For example:

- The ISO noted at the interconnection workshop it considers response features like "extended dip" to be undesirable in many parts of the system; and

- The ISO recommends turbine voltage control in some projects and power factor control in others.

5. Develop an optional pre-application screening report

RENEW recommends the ISO develop an optional pre-application screening report that may be requested prior to entering the interconnection queue, similar to what is available in the Small Generator Interconnection Procedures and at ERCOT. This report would allow interconnection customers to "right size" their projects, select the most beneficial points of interconnection, or propose features/controls that are likely to be desirable for the given project prior to entering the queue and tying up valuable queue positions and resources. While some potential suggestions are below, the specific

screening analysis and information to be provided would need to be discussed in detail to make sure it is a reasonable scope for this type of effort and provides the most useful information.

- Under Section II Schedule 23 Section 1.2.2.2 of the ISO-NE Tariff (Small Generator Interconnection Procedures), an Interconnection Customer may submit a formal written request form to the ISO with a non-refundable $500 fee for a pre-application report on a proposed project at a specific site. The ISO and the Transmission Owner (TO) then work together to provide a pre-application report within 20 days.
    - The pre-application report confers no rights, is non-binding, and does not enter a generator into the queue.;
    - Multiple pre-application reports can be requested to explore multiple Points of Interconnection (POI); and
    - The pre-application report provides only available information and no analysis or study work is completed as part of this process. In the case of a Large Generator pre-application screening report, a basic level of screening analysis would be appropriate. A higher fee and longer timeline would thus be appropriate as well.

- ERCOT, for example, starts the interconnection process with a screening study.
    - Its Tariff requires the screening study to be completed within 90 days though ERCOT's internal target is to provide the report within 45 days. There is a $5,000 - $7,000 non-refundable fee for this study depending upon the generator size. This timeline and fee level seem reasonable for a New England process.;
    - ERCOT interconnection customers have 6 months following receipt of the screening study to decide whether to move forward with a full interconnection study. In New England, this screening study would likely be more appropriate if performed prior to receiving a queue position, so there would be no timeline requirement for moving ahead with a full Interconnection Request; and
    - The ERCOT screening study identifies only steady state transmission constraints at the proposed POI, which is likely not sufficient for a pre-screening study in New England.

- A valuable pre-application screening report may include things like:
    - Available information regarding the ability to interconnect in the proposed location, similar to the information specified in the SGIP pre-application report;
    - A basic steady state load flow study, similar to what is performed in the ERCOT study;
    - Additional screening as discussed at the September 30th meeting consists of:

- The N-1 Surge Impedance Loading (SIL) and the ratio of wind farm real power output and any other local generation to the SIL (see ISO presentation to the RENEW interconnection workshop[2], slide 16);
- Power vs. Voltage (PV) Analysis: All-lines-in and N-1 Wind Farm PV curves with no reactive support from wind farm (see ISO presentation slide 19);
- Reactive Power vs. Voltage (QV) Analysis to determine reactive power margin (see ISO presentation slide 22); and
- Short Circuit Ratio (SCR) at the Point of Interconnection for all-lines-in conditions as well as credible combinations of local line-out and autotransformer-out conditions (see ISO presentation slides 23-24).[3]

6. Improve data availability, presentation, and access on the ISO's website to make it easier for developers to do their own pre-screening using that information

RENEW recommends creating a new "suggested screening resources" section on the "New or Modified Interconnections" webpage[4] or a link to a new screening suggestions page. The following initial list of resources and any others ISO may deem appropriate could be linked from that location:

- A historically high loss component of LMPs at the Point of Interconnection is indicative of voltage problems and voltage-based interface limits at that location. High congestion components are also indicative of curtailment risk. LMP data at individual nodes may be accessed on ISO's website[5];

- Geographic transmission maps are available on the Planning Advisory Committee webpage under Document Type: System Maps;[6]

- System Diagrams are available on the smd homepage from the Transmission System Information link for those with access granted in CAMS;[7]
- All of the voltage and stability interface limits are defined in the periodically updated "generic interface constraints" document;[8] And

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[2] http://renew-ne.org/wp-content/uploads/2014/10/ISO-NE-Presentation-9-30-14_rev6.pdf

[3] If the customer moves ahead with an Interconnection Request, it would presumably be at the generator's discretion whether to correct the SCR in order to run under multiple-element-out conditions rather than a mandate by the ISO to correct for every conceivable multiple-element-out condition. Any mandates to correct SCR must be clear about what system conditions this must be done for.

[4] http://iso-ne.com/participate/applications-status-changes/new-modified-interconnections

[5] http://iso-ne.com/isoexpress/web/reports/pricing/-/tree/lmp-by-node (note, this feature does not appear to work in Chrome)

[6] http://iso-ne.com/committees/planning/planning-advisory

[7] https://smd.iso-ne.com/transmission_system_information/System%20Diagrams/

[8] http://iso-ne.com/static-assets/documents/markets/hrly_data/support_docs/generic_interface_constraints.xlsx

- Historical binding constraints are all available on the ISO website[9] but the data is difficult to work with right now because reports must be downloaded one day at a time.
    - This could be improved by making it possible to search the data by specific interfaces over a period of time rather than by date.[10]
    - Adding data on the historical interface limits and flows for the minor interfaces most relevant to wind to the ISO's annual LMP and Interface Flow report to the PAC (that currently only provides information on the major interfaces) would be useful for generators to screen interconnection locations.[11]
- Section 2 of the ISO presentation at the RENEW Interconnection Workshop in September 2014 on "ISO-NE Overview of New England Power System as it Relates to Wind Interconnection" would be useful to have posted publicly in this location as well;

- Updated PSS/E system base case models are available[12] each year for use in the FCM qualification process, and can be used as a screening tool for interconnections as well. Are there better base case models to point people to or are these the best models to use if a developer wants to do their own analysis prior to submitting an Interconnection Request? Alternatively, should developers submit an individual CEII request for a particular model?; and

- Make NX-9A transmission line thermal rating data available to those people with the appropriate CEII access and digital certificates. These ratings for relevant elements are often provided upon the interconnection customer's request following a scoping meeting, but having access to the data prior to an Interconnection Request would be helpful in the screening process.

7. Reduce the lag time for performing PSCAD studies

RENEW recommends PSCAD study delays due to sole-sourcing be reduced by bringing these studies in-house or exploring ways to reduce those delays with the study vendor.

- The ISO has needed to do PSCAD studies for an increasing number of wind farms, but only one vendor has been approved by all of the turbine OEMs to

[9] www.iso-ne.com/isoexpress/web/reports/grid
[10] Abby Krich spoke with Michael Beganny on January 26, 2015 and he is looking into making this type of report available.
[11] A presentation is made to the PAC each January with summary charts, and the source data is posted annually at http://www.iso-ne.com/isoexpress/web/reports/load-and-demand/-/tree/historical-hourly-flows-and-limits for the major interfaces. Abby Krich made an information request in May 2014 and again in January 2015 for this information to be provided for particular minor interfaces relevant to wind development that have sufficient generation that they would not pose a confidentiality concern.
[12] http://iso-ne.com/markets-operations/markets/forward-capacity-market (Filter for document type: FCM Base Cases)

complete the studies due to model confidentiality (e.g., Siemens would not want GE to have access to the Siemens PSCAD models in order to do this study, and vice versa);

- This sole-sourced vendor generally has a 3-month time lag before it is able to begin a PSCAD study for the ISO. This situation lengthens the interconnection study timeline;

- One solution may be to bring these studies in-house at the ISO. Some RENEW members with experience in other regions have shared that this single vendor is able to produce results more quickly in those other regions and that it is only here in New England that we see such delay. At least initially, it may be more appropriate to explore what is driving the delay in their New England studies rather than bringing the studies in house.

8. Use of the new wind data collection template

RENEW has encouraged its members to provide Al McBride with feedback on the revised wind Interconnection Request (IR) data forms[13].

- It would be helpful for ISO to divide the data sheet into:
    - What is needed from the developer for the Feasibility Study
    - What is needed from the developer for the System Impact Study; and
    - The data that results from the SIS.

- Once it is ready, the template should be posted in the New and Modified Interconnections section of the ISO website so developers can review the form and begin compiling the data prior to submitting an Interconnection Request; and

- Conforming the data required in the Interconnection Agreement appendices with this template would also be desirable so the data can be easily copied from this form into the IA at the end of the study process.

9. Consider opportunities for using batch/cluster interconnection studies

RENEW recommends exploration of opportunities for using MISO-style cluster/batch studies for interconnection requests in a similar area. This process seems to provide more predictability in the schedule for going through the interconnection process. In addition, it allows for allocation of upgrade costs among the participants in the batch study so there is less of a concern with the first generator footing a major bill for upgrades and later generators free-riding on those upgrades.

[13] These were passed out as a handout at the Interconnection Workshop

- NYISO, PJM, SPP, and CAISO also do batch studies;
- The MISO batch study process uses a first ready first studied process;
- MISO announces the deadline for the new batch study and anyone in the area and ready to move forward gets studied as a group. This could be particularly useful in New England if the timeline is coordinated with state renewable energy RFPs which tend to spark an influx of new interconnection requests;
- Northern Maine is the obvious area where this type of study could be most useful;
- In MISO, during the transition to batch studies, generators that had not yet started their SIS were put into the new batch study process and those that had already started or completed their SIS were allowed to continue with the pre-existing process; and
- If generators could choose whether to enter a batch study or proceed with an individual study, this might alleviate some concerns regarding such a change. For example, such a process could be used in conjunction with projects that are selected in state procurements, or projects that are associated with public policy transmission upgrades being developed in the transmission planning process.

10. Explore creation of a mechanism for interconnection customers to be reimbursed for upgrades that create headroom utilized by future interconnection customers or that are used to serve load at a later date

Where an interconnection customer is required to make upgrades in order to interconnect, the customer pays for the full cost of the upgrades. There can be a concern when funding such upgrades that those upgrades will benefit later interconnection customers or will be used to serve load without any provisions for the interconnection customer who originally paid for the upgrades to be reimbursed for these later uses. This free rider concern can result in delays in the interconnection process, queue position jockeying, push back against identified upgrades, or design of the upgrades in a way that makes it difficult for them to be used by others in the future. All of these prolong the interconnection process, exacerbate the queue backlog, and can lead to system inefficiencies.

If there were a mechanism that required later users/beneficiaries of the facilities paid for by an interconnection customer to reimburse the interconnection customer, a number of these issues could be resolved or at least alleviated.

At the May 2015 Reliability Committee meeting, the representative of Central Maine Power described a mechanism used by CMP that is similar to this in many ways. He explained that when CMP builds an express feeder in order to connect a new generator to the transmission system the interconnecting generator pays the upfront costs. If at a later date CMP chooses to serve load from that feeder, CMP provides some amount of reimbursement to the interconnecting generator for use of the feeder.

11. Consider developing standard minimum requirements for wind interconnections

The ISO posed the concept of developing minimum requirements for wind interconnections to RENEW at the interconnection workshop and requested feedback.[14] ISO postulated that this could result in higher interconnection upgrade costs but could also potentially help speed the interconnection study process and improve system function and deliverability.

- Examples:
  - Short Circuit Ratios below a threshold would have to be corrected back to the threshold. The ISO initially proposed a threshold of 5.0, which RENEW members indicated was highly conservative. Should it be a standard value for all projects or should it be based upon the turbine manufacturer's certification of the SCR at which their models are valid? Would a standard value avoid PSCAD study requirements?
  - Voltage studies would consider the upgrades needed to be able to operate under the "most severe maintenance condition";

- RENEW members are open to discussing this with the ISO but have expressed concerns that standard requirements like these would add costs without necessarily speeding the interconnection study process or ensuring deliverability; and

- If there were a guarantee of an expedited interconnection process or other tangible benefits for any wind generator meeting certain standard requirements, then this could be appealing.

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[14] See ISO presentation slide 33