Dispatch Priority

DRAFT

The criteria used to determine the operability of the Ontario Power Authority's (OPA) Integrated Power System Plan (IPSP)[1] includes assessment criteria for the ability of the future supply mix to:

- Provide sufficient load following capability;
- Manage surplus baseload generation conditions;
- Serve Ontario demand during high demand conditions; and
- Meet operating reserve requirements.

For the purpose of this paper, the focus will be on the second bullet point, managing surplus baseload generation (SBG) conditions (both global and local SBG). Global SBG is an over generation condition that occurs when Ontario's electricity production from baseload facilities such as nuclear and must run hydroelectric units is greater than market demand. Local SBG is an over generation from baseload units that is greater than the local demand and the transmission system's ability to move the excess generation out of the area (the energy is locked-in to the area). For example, Ontario's northwest can, at times, have baseload generation larger than its demand in the area. This excess generation is unable to leave the northwest area due to transmission limitations or constraints.

The OPA IPSP and the IESO operability reports point to several supply mix changes that will add to Ontario's baseload generation and impact the IESO's ability to manoeuvre units to manage local or global SBG conditions:

- Phase out of all coal-fired generation by the end of 2014;
- Growth of wind generation in Ontario's generation portfolio;
- Increase in biomass and gas-fuelled generation;
- Refurbishment of 16 nuclear units as well as addition of two new units; and
- General reduction in the proportion of manoeuvrable generation in Ontario's generating fleet.

The phasing out of coal and the general reduction in the proportion of manoeuvrable generation in Ontario's generating fleet will result in a change in the flexibility and manoeuvrability of Ontario's generation fleet in times of SBG. Ontario's coal generators, specifically, have significant ramp depth typically achieving low minimum loading levels and can move relatively quickly in order to mitigate SBG conditions. With the phase out of coal, the mind set and management strategies for supply and demand balancing, including SBG, will have to change and evolve.

[1] The OPA's IPSP can be found at http://www.powerauthority.on.ca/Storage/82/7763_B-1-1_updated_2008-09-04.pdf

With a supply mix consisting of natural gas, increasing amounts of renewable resources, conservation and the increase in nuclear fleet, a larger baseload generation mix will exist in Ontario than what is seen today. As baseload generation will be a large percentage of the total generation mix in Ontario, during hours of low demand and transmission constraints, the IESO will have to look to manoeuvring this baseload generation in order to manage SBG.

With renewable generation coming online in the next few years and nuclear generation currently online experiencing dispatch issues due to SBG, this paper will be split into two sections: nuclear policy with respect to surplus generation and renewable policy with respect to surplus generation. It should be noted that the dispatch methodology for renewable generation will be similar to that of nuclear generation, however at times the dispatch of nuclear will need to be prioritized against dispatch of renewable resources.

NUCLEAR

On several occasions, the IESO has manoeuvred nuclear units to manage local or global SBG. Although consistent with the Market Rules and governing procedures and policy, the actions taken have put into question the reasonableness of those ideals. To reduce the impact on the nuclear fleet's operating performance and to help mitigate the impacts of potential nuclear unit outages, the IESO has modified its procedures to the extent permitted by the Market Rules. The current processes include the following actions which will be taken whenever nuclear units were set to be dispatched down in pre-dispatch or real-time:

- Two-hours prior to the dispatch hour, expand the Net Interchange Scheduling Limit (NISL) to 1000MW (from 700MW);
- One-hour prior to the dispatch hour, cut import transactions if nuclear are being dispatched down;
- During check-out, if export transactions are curtailed causing nuclear to be dispatched down, cut import transactions of equal MW value to the exports that are curtailed; and
- If a nuclear unit receives a dispatch down instruction midway through an hour and no other internal resources can be reliably reduced, imports will be cut mid-hour for a value equal to the nuclear dispatch down amount;
- If there are still reliability concerns, the IESO will dispatch off self-scheduling generators and/or intermittent embedded and non-embedded generators.

BACKGROUND

Although nuclear generation is considered baseload generation in Ontario, these generators are dispatchable and, as such, must offer into the market along with all other dispatchable generation, imports or exports. Any time a nuclear unit is requested to change its output there are operational implications relating to the ability of the unit to reliably provide power to the grid.

The design basis for nuclear units presumes the unit will generally remain at a constant output. Manoeuvring a nuclear unit for the purpose of economic dispatch causes an imbalance within the reactor which can lead to equipment damage as well as a potential for adverse environmental impacts[2]. As a result, these units are preferred to be running at a constant energy output (or be dispatched off) versus manoeuvring up and down to follow dispatch. Given the scheduling processes and the interactions between hourly intertie scheduling and real-time offer evaluation for internal generation, there is a chance that the most economic solution to satisfy the short term needs of the market will be to dispatch down nuclear generation while at the same time Ontario could be importing, commissioning a new unit and/or have substantial amounts of non-dispatchable renewable or self-scheduling resources.

If a nuclear unit is dispatched off, and there is no equipment damage as a result of ramping down, the unit typically cannot come back online for 48 - 72 hours, depending on the unit. With nuclear generation representing a majority of Ontario's generation and baseload generation, this minimum down time can create reliability issues for the IESO as well as costs to the consumers of Ontario.

RECOMMENDATIONS AND MOVING FORWARD

Nuclear generation is limited in its manoeuvrability. Often times when asked to move, the nuclear generator will agree for technical reasons, to a specific MW amount which may be much greater than what they were asked to move. For example, the IESO may request a nuclear unit to move 80MW down. Due to equipment limitations, the nuclear unit may agree to move down but will have to move by 300MW. Even though these units are limited, they can still manoeuvre. For this reason, it is recommended that nuclear generators remain classified as dispatchable, but have more specific guidelines on when to dispatch them down. These guidelines would be stakeholdered.

RENEWABLE GENERATION

With large amounts of new renewable generation on the horizon, both embedded and non-embedded, the IESO must develop policy for efficient integration of these intermittent generators. As these generators will be considered baseload generation, they will need to be looked at as options for reducing output during times of low consumption or transmission constraints. For these reasons, the IESO will be developing a dispatch policy considering the following elements:

- Nuclear units vs. intermittent renewable resources;
- Self-scheduling commissioning units vs. intermittent renewable resources; and
- Embedded non-MP intermittent renewable generator vs. a IESO MP intermittent renewable resource. (This variant will also be considered in the context of the previous considerations.)
- Renewable vs. renewable resources (wind spill vs. water spill).

[2] For more details see the Bruce Power presentation to the MPWG at http://www.ieso.ca/imoweb/pubs/consult/mep2/MP_WG-20081202-Presentation-SBG-Bruce_Power.pdf

BACKGROUND

The IPSP includes increases in conservation, which will have a lowering effect on demand – thus potentially exacerbating the issue of excess generation in low-consumption periods and local SBG transmission. This coupled with increasing amounts of renewable generation will create situations which may require manoeuvring of nuclear and/or renewable resources.

Using wind generation as an example, the difficulties and complications associated with renewable manoeuvring can be illustrated. Although wind generation is forecasted, it is not dispatchable. Wind generators run when there is wind and there is power generated. The IESO considers their dispatch to be the equivalent of their output 10 minutes (or two intervals) earlier. This is how wind generation is integrated into the dispatch. The IESO has no control over the dispatch of wind generation except to call the generator to go offline for reliability purposes. When the reliability concern no longer exists, these wind generators can come back online as long as the wind is blowing.

Unlike nuclear units, there are no known equipment limitations that we are aware of, at this time, with taking a renewable resource offline. As mentioned above, as long as there is wind, wind generators can come on and go offline quickly to meet reliability needs. In order to maximize the amount of renewable resources on the system, managing these low load or limited transmission periods with intermittent resources is paramount. Having the capability to dispatch off or down these resources during the necessary periods will facilitate significant increases in the amount the system can accommodate when demands are higher and transmission is not limiting.

Curtailing renewable energy may be an efficient way to reduce energy availability in Ontario without causing longer term issues to other baseload generation. Renewable wind energy has quick response time, which is an ideal characteristic for addressing SBG conditions. The downside is that the energy is intermittent and not stored. For example, the wind generator may be able to provide energy during low consumption hours overnight but not during the day. If curtailed, the energy is lost and the unit will not be able to generate until there is wind again.