PRODUCTION FORECAST AND METHODOLOGY – REGULATED HYDROELECTRIC

1.0 PURPOSE

This evidence provides the production forecast for the regulated hydroelectric facilities and a description of the methodology used to derive the forecast.

2.0 OVERVIEW

The regulated hydroelectric production for the years 2010 to 2015 is presented in Ex. E1-1-1 Table 1. OPG is seeking approval of a test period production forecast of 64.1 TWh (31.4 TWh in 2014, and 32.7 TWh in 2015) for the regulated hydroelectric facilities. Of this total, 39.3 TWh (19.1 TWh in 2014, and 20.2 TWh in 2015) is related to the Niagara Plant Group and R.H. Saunders, and 24.8 TWh (12.4 TWh in 2014, and 12.5 TWh in 2015) is related to the newly regulated hydroelectric facilities. Annual changes in production are mostly due to actual or forecast changes in water availability, though an increase in production starting in mid-2013 is related to the Niagara Tunnel Project. Forecast monthly production data for the test period are presented in Ex. E1-1-1 Table 2.

Differences between forecast and actual production that are due to changes in water conditions are captured in the Hydroelectric Water Conditions Variance Account. (See Ex. H1-1-1).

The methodology used to determine the Niagara Plant Group and R. H. Saunders production forecasts is the same as that approved by the OEB in EB-2010-0008. Brief descriptions are presented in Sections 3.2 to 3.4. The forecast methodology for the newly regulated stations are presented in Section 3.5. A brief description of outage planning for the regulated hydroelectric facilities is presented in Section 4.0.

3.0 REGULATED HYDROELECTRIC PRODUCTION FORECAST

3.1 Forecast Methodology

Hydroelectric production is impacted by water availability. OPG seeks to optimize the use of available water while meeting safety, legal, environmental, and operational requirements. The availability of water is affected by meteorological conditions, particularly precipitation and evaporation. The forecast methodology accounts for operational strategies that attempt to maximize use of available water and minimize spill (i.e. ,unutilized water).

Computer models are used to derive production forecasts for the six previously regulated hydroelectric facilities and twenty-one of the forty-eight newly regulated hydroelectric plants. Forecast monthly water flows, generating unit efficiency ratings, and planned outage information are used to convert forecast water availability into forecast energy production. The remaining twenty-seven newly regulated hydroelectric plants (25 Central Hydro Plant Group stations, plus Indian Chute GS and Matabitchuan GS in the Northeast Plant Group) are small stations (capacity up to 10 MW), for which computerized modeling is not available. Average historical production is used as the production forecast for these stations.

There are no deductions made for Surplus Baseload Generation (SBG) in this application, as per the OEB's Decision with Reasons in EB-2010-0008. Instead, as per the Decision, a variance account has been established to deal with SBG. Please see Exhibits E1-2-1 and H1-3-1 for additional information.

3.2 Niagara River Flow and Production Forecast

The Hydrological Response Model for the Great Lakes (developed by the Great Lakes Environmental Research Laboratory – GLERL) and the Advanced Hydrological Prediction System (adapted by GLERL for the Great Lakes system) are used by OPG to derive a forecast of monthly average water levels and outflows for Lake Erie for the next 24 months. Minor adjustments are applied to the forecast of monthly Lake Erie outflows to determine the Grass Island Pool inflow forecast (i.e. the section of the Niagara River immediately above Niagara Falls where water is diverted to the hydropower plants). These minor adjustments account for seasonal variations in local inflows and flow reductions due to ice or weed retardation effects. Beyond 24 months, the flow forecasts trend back towards historical monthly median flows.

The forecast Grass Island Pool inflows are input to the Niagara Utilization Model which uses generating unit efficiency ratings and planned unit outage information to calculate the monthly energy production for the Sir Adam Beck plants. These values are adjusted for losses primarily associated with electrical system operational requirements (e.g., automatic generation control, operating reserve, condense-mode operations, and system constraints), based on an assessment of historical model performance.

OPG has estimated the long-term incremental energy production from the Niagara Tunnel Project (NTP). This "average case" estimate has recently been revised from the 1.6 TWh indicated in the NTP Business Case to 1.5 TWh[1]. The revision is due to some minor refinements in the modeling.

The 2013-2015 Business Plan energy production forecasts included in this application were prepared assuming the new Niagara tunnel in-service in August 2013.

3.3 DeCew Falls Diversion Flow and Production Forecast

Water is diverted from the Welland Seaway Canal and routed to the DeCew Falls plants to generate electricity. Forecasts of monthly DeCew diversion flows are prepared based on historical diversion flows, and consideration of planned Seaway Canal maintenance, planned unit outages at the DeCew plants, and flow constraints during major scheduled rowing regatta events held downstream of the plants.

The forecast DeCew diversion flows are used with DeCew Falls unit availability information and generating unit efficiency ratings to calculate the monthly energy production forecast for the DeCew Falls stations.

[1] The long-term average production number is an estimate of the incremental energy from the Niagara Tunnel based on historical information about water availability, and the operation of water control facilities on the Niagara River and OPG's Sir Adam Beck complex. The 2005 figure was 1.555 TWh and the current figure is 1.472 TWh, a difference of 0.083 TWh or about 5%.

3.4 St. Lawrence River Flow and Saunders Production Forecast

Lake Ontario and the St. Lawrence River outflows and levels are regulated by the International St. Lawrence River Board of Control ("ISLRBC"). "Regulation Plan 1958-D" has been used by the ISLRBC to provide artificial control of the outflows and levels of Lake Ontario since 1963. The ISLRBC has the authority to deviate from the approved plan under specific conditions. An alternative regulation plan is currently under review by the International Joint Commission and is expected to be implemented in 2014, if approved. Electricity production is not expected to be significantly affected under the proposed alternative plan.

Forecast monthly Lake Ontario outflows and levels are derived from applications based on the Regulation Plan 1958-D model and, if necessary, adjustments applied to reflect ISLRBC authorized deviations from plan. These forecast flows and levels are utilized for up to six months in the forecast period; thereafter, monthly flows are projected consistent with trends predicted by the Niagara River flow forecast.

The forecast St. Lawrence River flow is used with R. H. Saunders unit availability information and generating unit efficiency ratings to calculate the monthly energy production forecast for the R. H. Saunders station.

3.5 Production Forecast for the Newly Regulated Hydro Plants

Water availability on the watersheds of the newly regulated plants can change quickly in response to significant precipitation events. Consequently, long-term flow forecasting is not undertaken for these rivers. Instead, historical median monthly flows are used as the basis for determining the monthly energy production forecasts.

Energy production forecasts for twenty-one of the newly regulated hydroelectric plants, located on nine river systems (Ottawa, Madawaska, Montreal, Abitibi, Aguasabon, Nipigon, Kamanistikwia, English and Winnipeg Rivers) (See Appendix 1), are produced using computer models that convert water availability to forecast energy production using generating unit efficiency ratings and planned outage information.

Energy production forecasts for the other twenty-seven small newly regulated hydroelectric stations (25 Central Hydro Plant Group stations located on ten river systems: Beaver, Mississippi, Muskoka, Otonabee, Rideau, Severn, South, Sturgeon, Trent, and Wanapitei Rivers, plus Indian Chute GS on the Montreal River and Matabitchuan GS on the Matabitchuan River in the Northeast Plant Group) (See Appendix 2), are based on historical mean monthly production values, adjusted to account for planned outages. These small stations account for only 5 percent of the total production from the newly regulated hydroelectric facilities and less than 2 percent of total production from all regulated hydroelectric facilities. Development of computer models to forecast production for these twenty-seven small stations is unwarranted. OPG proposes to exclude these 27 small stations from the Hydroelectric Water Conditions Variance Account. (See Ex. H1-1-1).

Ottawa River flow may be augmented at times with water diverted from Quebec to the Ottawa River basin upstream of Lake Temiskaming (referred to as the “Cabonga diversion”). The production forecasts for the four Ottawa River plants are based on historical median flow data that includes the Cabonga diversion flow. OPG benefits from additional energy produced at the four plants due to the Cabonga water. By agreement, a portion of the additional energy generated is returned to Hydro Quebec (“Cabonga payback”). Cabonga payback typically amounts to less than one percent of total production from the Ottawa River plants. In addition, OPG shares in operation, maintenance and project refurbishment costs associated with Hydro Quebec’s facilities that enable the Cabonga diversion. (See Ex. F1-4-1, Section 4, Hydro Quebec – Dozois Agreement.)

4.0 OUTAGE PLANNING

Outage planning for OPG’s hydroelectric generating stations is unchanged from EB-2010-0008 and continues to be based on the streamlined reliability-centered maintenance philosophy as described in Ex. F1-1-1.

Outages are generally planned to conduct:

- Major overhaul, rehabilitation or upgrade work
- Preventative maintenance

- Condition based maintenance
- Inspection and testing

The normal cyclical patterns of river flow within a year are considered when scheduling outages in order to minimize the spilling of water. Generating unit availability is determined from the planned outage schedule and included in the energy production forecast.

Major overhaul and rehabilitation work is planned, in addition to regularly scheduled maintenance outages, at Niagara Plant Group facilities and a number of the newly regulated plants during 2014 and 2015. (See Ex. D1-1-2 and F1-3-1).

APPENDIX 1

NEWLY REGULATED STATIONS WITH MODELED PRODUCTION FORECASTS

River System	Station
Madawaska	Mountain Chute Barrett Chute Calabogie Stewartville Arnprior
Ottawa	Otto Holden Des Joachims Chenaux Chats Falls
Abitibi	Abitibi Canyon Otter Rapids
Montreal	Lower Notch
Nipigon	Pine Portage Cameron Falls Alexander
Aguasabon	Aguasabon
Kamanistikwia	Silver Falls Kakabeka Falls
English	Manitou Falls Caribou Falls
Winnipeg	Whitedog Falls

APPENDIX 2

NEWLY REGULATED STATIONS WITHOUT MODELED PRODUCTION FORECASTS

River System	Station
Montreal	Indian Chute
Matabitchuan	Matabitchuan
Mississippi	High Falls
Rideau	Merrickville
Otonabee	Lakefield Auburn
Trent	Seymour Ranney Falls Hagues Reach Meyersburg Sills Island Frankford Sidney
Beaver	Eugenia Falls
Muskoka	Trethewey Hanna Chute South Falls Ragged Rapids Big Eddy
Severn	Big Chute
South	Elliot Chute Bingham Chute Nipissing
Sturgeon	Crystal Falls
Wanapitei	Stinson Conistion McVittie