

CAPITAL BUDGET – REGULATED HYDROELECTRIC

1.0 PURPOSE AND OVERVIEW

This evidence provides an overview of the capital budget for OPG's regulated hydroelectric facilities for the historical years, bridge years, and the test period, as well as period-over-period explanations, and an overview of the hydroelectric project management processes.

2.0 CAPITAL EXPENDITURES SUMMARY

Capital expenditures for the regulated hydroelectric stations are dominated by the cost of the Niagara Tunnel project. The total estimated cost of this project is \$985M, of which \$517M is to be spent in 2008 and 2009. The project was approved by the Board of Directors on July 28, 2005, with an expected in-service date of 2010. In comparison, the balance of the regulated hydroelectric capital budget planned for 2008 and 2009 is \$87M. The non-tunnel expenditures are primarily focused on the rehabilitation of generators G7, G9, G10 and G3 at the Sir Adam Beck I Generating Station, with planned in-service dates of 2008, 2009, 2010 and 2011 respectively. These four projects are estimated to cost a combined \$127.7M, of which \$63.3M is to be spent in 2008 and 2009. Estimates for G9, G10 and G3 are based on the estimates presented in the G7 business case approved by OPG's Board of Directors in August 2007.

The capital expenditures associated with these projects are consistent with OPG's mandate as set out in the Memorandum of Agreement with its shareholder, which provides as follows:

"With respect to investment in new generation capacity, OPG's priority will be hydro-electric generation capacity. OPG will seek to expand, develop and/or improve its hydro-electric generation capacity. This will include expansion and redevelopment on its existing sites as well as the pursuit of new projects where feasible"

Three other significant projects are the replacement of the heating, ventilation, and air conditioning system ("HVAC") at the R.H. Saunders Generating Station, the rehabilitation of the Sir Adam Beck I power canal, and grouting of the Sir Adam Beck Pump Generating

Station dyke foundation. The R.H. Saunders HVAC project, estimated at \$11.5M, is expected to come into service at the end of March 2008. The rehabilitation of the Sir Adam Beck I power canal project is currently estimated at \$51M and is expected to come into service at the end of 2011. Expenditures on the power canal project involve the inspection and repairs to the canal walls and civil structures. The canal walls below the waterline cannot be accessed while the canal is in operation. Repairs will be made where required to areas of the canal, and debris that is constricting flow will be removed. Costs are expected to be limited to about \$500k for investigation and pre-engineering work during the test period. Finally, detailed inspections and testing of the Pump Generating Station dyke will commence during the test period in advance of the major grouting project in 2010. The total cost of the grouting project is \$20M, of which \$1M is to be spent during the test period.

Capital projects are listed in Ex. D1-T1-S2. These capital projects are required to sustain the availability and reliability of hydroelectric generation due to aging generators, associated mechanical and electrical equipment, and associated civil structures.

3.0 PERIOD-OVER-PERIOD EXPLANATIONS

2009 Plan versus 2008 Plan

Capital expenditures associated with the regulated hydroelectric facilities are expected to increase from \$208.8M in 2008 to \$395.6M in 2009, mostly due to incremental work associated with the Niagara Tunnel project. The lining of the tunnel with concrete is planned to be underway and will run concurrently with the excavation by the TBM. In addition, there will be work at the tunnel intake and outlet structures. In 2009, work will also be continuing on the rehabilitation of Generator G9 at Sir Adam Beck I, while the rehabilitation of Generator G10 and G3 will begin at Sir Adam Beck I.

2008 Plan versus 2007 Actual

Capital expenditures associated with the regulated hydroelectric facilities are expected to increase to \$208.8M in 2008 from the \$84.3M actual expenditure in 2007 due to the planned increase in the rate of excavation by the TBM (Niagara Tunnel project), the continuing work

1 on the frequency conversion of Generator G7 at Sir Adam Beck I, and the beginning of
2 rehabilitation work for Generator G9 at Sir Adam Beck I. Some of the increase is offset by
3 the reduction in capital requirements for the HVAC replacement project at R.H. Saunders as
4 the project reaches completion in the first quarter of 2008.

5
6 2007 Actual versus 2007 Budget

7 The 2007 actual capital expenditure was \$84.3M versus the 2007 budget of \$229.4M.

8
9 As previously discussed, the Niagara Tunnel project was \$144.6M under budget in 2007 due
10 to slower than expected progress. Considerable uncertainty remains with respect to the
11 schedule until the tunnel boring machine advances sufficiently beyond the St. David's Gorge
12 (at approximately the 2.3 kilometre mark), and establishes consistent tunnelling performance.
13 The contract structure places the onus on the contractor to mitigate schedule delays, and
14 includes liquidated damages provisions for failure to meet the contractual in-service date.
15 Based on the information provided by the contractor, the in-service date of the tunnel will be
16 delayed from the original project completion schedule of June 2010. To mitigate the impact
17 of the potential schedule delay, the contractor is investigating alternatives, including the
18 realignment of the tunnel. The estimated in-service date will be dependent on the alternative
19 selected by the contractor to mitigate the schedule delay. There is a potential that the
20 schedule delay could significantly impact the project cost. The project cost estimate of \$985
21 million will be reviewed in conjunction with the changes to the project completion schedule.

22
23 Capital spending at Niagara was \$0.2M below plan resulting from the deferral or cancellation
24 of a number of smaller projects, offset by the advancement of spending of approximately
25 \$0.9M on the G7 rehabilitation project.

26
27 R.H. Saunders Generating Station capital spending in 2007 was approximately \$0.2M under
28 plan (\$10.53M versus \$10.76M). The majority of the variance is attributed to:

- 29 • The HVAC replacement project spending was \$1.1M below plan primarily as a result of
30 very little discovery work requiring less of the contingency funds, and the late delivery of the
31 heat exchangers which pushed some of the expenditures into 2008.

1 • The Domestic Water System replacement project was reclassified to capital from OM&A
2 after the final assessment concluded that it was more cost effective to replace the system
3 than to upgrade or refurbish it. This resulted in \$0.7M of unplanned capital spending in 2007.
4

5 2007 Actual versus 2006 Actual

6 Regulated hydroelectric capital expenditures decreased to \$84.3M in 2007 from \$179.7M in
7 2006.
8

9 The main reason for the lower expenditures in 2007 is delays in the Niagara Tunnel project
10 as a result of slower than planned progress of the tunnel boring machine (TBM) through the
11 fractured rock formation along the tunnel. The fractured rock has required the installation of
12 horizontal supports so the TBM can advance. To the end of 2007, the tunnel boring machine
13 advanced 1.609 kilometers compared to a plan of 2.29 kilometers. OPG pays the contractor
14 based on progress of the machine. As well, most of the cost for the TBM was incurred in
15 2006.
16

17 Some of the decrease in capital associated with slower TBM progress, was offset by the start
18 of work on the frequency conversion of Sir Adam Beck I Generator G7, and the HVAC
19 replacement at R.H. Saunders.
20

21 2006 Actual versus 2006 Budget

22 The 2006 actual capital expenditure was \$179.7M versus a 2006 budget of \$203.8M.
23

24 Capital spending on the Niagara Tunnel project was \$25M lower than plan in 2006 due to the
25 contractor's slower than planned progress by the tunnel boring machine, lower interest costs,
26 and unspent contingency. The tunnel boring machine progress was slower than planned due
27 to start-up technical problems, including groundwater inflow and faster than expected wear of
28 the cutterheads. The contractor had to develop and implement a plan to address these

1 issues. The original plan for 2006 was for the tunnel boring machine to complete over 1 km
2 of excavation, but the actual excavation distance was 0.2 km.

3
4 Capital spending for the Niagara Plant Group in 2006 was \$7.3M, or \$1.1M under a budget
5 of \$8.4M. The lower costs are attributed to lower than expected final closeout costs for the
6 Sir Adam Beck II rehabilitation project. Based on the experience gained from the first units
7 completed on the project, the manufacturer's original recommendations for follow-up work
8 were modified resulting in significant cost savings.

9
10 Capital spending at R.H. Saunders Generating Station in 2006 was \$3.1M which was \$1.9M
11 higher than planned. This difference was due to the need for two unplanned projects and
12 higher costs of an already planned project, as follows:

- 13 • \$0.7M to install a new fence for the purposes of public safety. The canal between the
14 dam and the guardhouse was already fenced. However, security reports indicated that
15 there was public trespass on the section of the canal just downstream of the guardhouse
16 near a public bike path. A new fence was installed to reduce the risk to public safety.
- 17 • \$0.6M for new sectional service gates to dewater units. The sectional service gates were
18 an existing project which was delayed from a previous year due to technical and supplier
19 issues.
- 20 • The remaining \$0.6M was the result of higher than anticipated costs to complete the
21 Iroquois Control Dam crane rehabilitation project. The increase in this project was due to
22 an increased scope and higher than expected contractor bids.

23
24 2006 Actual versus 2005 Actual

25 The 2006 actual capital expenditure was \$179.7M versus the 2005 actual expenditure of
26 \$84.6M.

27
28 The Niagara Tunnel project spending in 2006 was \$103.1M more than 2005 (\$169.3M
29 versus \$66.2M) because the project started in the third quarter of 2005 and ramped up
30 during 2006. As well, the extra cash flow in 2006 was due to the following additional items
31 (as compared to 2005) which were either completed or initiated in 2006:

- Most of the work associated with the tunnel boring machine fabrication and assembly occurred in 2006 with fabrication being completed in August 2006.
- The tunnel boring machine commenced excavation of the tunnel in September 2006 and continued into 2007.
- Work at the intake area (approach wall, accelerating wall and cofferdam) commenced in April 2006, with the accelerating wall being completed in 2006 and work on the approach wall and cofferdam continuing into 2007.
- Decommissioning of Ontario Power Generating Station and Toronto Power Generating Station commenced in 2006, with the decommissioning of Ontario Power Generating Station being completed and the Toronto Power Generating Station work, including the removal of all equipment, progressing on schedule.

Capital spending within the Niagara Plant Group was \$7.3M in 2006 versus \$16.6M in 2005. The reduction in capital was due to the completion of the majority of the Sir Adam Beck II rehabilitation project in 2005.

Capital spending at R.H. Saunders Generating Station was \$3.1M in 2006 versus \$1.8M in 2005 due to higher than planned spending in 2006 as described below, and the deferral of planned work associated with the HVAC project, as described in the previous section.

2005 Actual versus 2005 Budget

The 2005 actual capital expenditure was \$84.6M versus the 2005 budget of \$87.8M. The components of the variance are discussed below.

With respect to the Niagara Tunnel project, activities included: project design, tunnel boring machine fabrication, site clearing, and the start of the excavation at the outlet area. The Niagara Tunnel project costs were \$3M under the 2005 budget amount of \$69.2M. The variance was due to delays in awarding some contracts and lower interest and insurance premium costs.

1 The Niagara Plant Group's capital spending in 2005 was \$0.5M over plan. The capital
2 variance was mainly due to the reclassification of the DeCew Falls II Generating Station
3 headgate project from OM&A to capital. OPG had originally planned to refurbish the
4 headgate system, but further investigation revealed that a complete replacement was
5 required. The decision to replace the headgate changed the classification of this project from
6 an OM&A project to a \$1.4M capital project. The additional capital requirement was partially
7 offset by the deferral of the Sir Adam Beck I turbine modelling project (\$300k), the controls
8 upgrade project (\$200k) at the Sir Adam Beck Pump Generating Station, and reduced work
9 requirements on the replacement of fire protection systems at both DeCew Falls I and II
10 (\$300k). It was found that these projects could be deferred at an acceptable risk to the
11 stations or the related Sir Adam Beck I turbine upgrade projects.

12
13 R.H. Saunders Generating Station capital spending in 2005 was \$700k under plan (\$1.8M
14 versus a plan of \$2.5M). The reduced spending was due to a deferral of the start of the
15 HVAC replacement project until 2007. The original plan was to do the work in consecutive
16 years with three distinct work packages in the spring and/or fall when the HVAC system
17 could be removed from service. However, to improve efficiency and minimize employee
18 disruption, the project is proceeding as one continuous work package without interruption.
19 The project is expected to be completed in March 2008.

20 21 **4.0 PROJECT MANAGEMENT – OVERVIEW**

22 The stages of a hydroelectric project are:

- 23 • Identification phase
- 24 • Initiation phase
- 25 • Definition phase
- 26 • Execution phase
- 27 • Final closing phase

28
29 Each step in the project life cycle may require a significant amount of time and resources (as
30 in the case of a major rehabilitation or new station construction), or represent steps that are

1 passed through relatively quickly in the case of the replacement of a minor plant component
2 due to breakdown.

3
4 Between each phase, a distinct "decision gate" is reached, where a decision is taken on
5 whether to allow the project to proceed to the next step, revert back to a previous step, or
6 cease the project entirely.

7
8 In general, problems or opportunities are identified by plant group staff as part of: annual
9 engineering reviews, periodic plant condition assessments, or ongoing maintenance activities
10 (e.g., recurring equipment failures, technological obsolescence, or health and safety or
11 environmental issues). If the identified problem or opportunity is likely to lead to a project,
12 then the project is proposed as part of the business plan with a budgetary estimate and
13 planned duration.

14
15 If, through the business planning process, the funding is approved for the identified project,
16 the project enters the initiation phase. During this phase a project charter is normally created.
17 The charter sets out the project objectives, defines the responsibilities of the project team,
18 identifies stakeholders, and specifies the initial project scope and schedule. Project charters
19 are normally prepared by a plant group's Asset Management Department.

20
21 Where a definition phase is deemed necessary, the Asset Manager is accountable for
22 carrying out the definition work according to the approved scope, cost, and schedule. This
23 activity may be supported by the Project Manager. Where the definition work required is
24 significant, the authorization to proceed is obtained through the approval of a developmental
25 business case summary. Definition work consists mostly of investigations required to
26 determine project scope, verify site conditions, perform preliminary engineering, and produce
27 a release quality estimate and a detailed schedule.

28
29 Once the project has been evaluated and a decision has been made to seek approval for the
30 execution phase of the project, a business case summary must be prepared. Business case
31 summary preparation and approval is normally coordinated by the Asset Management

1 Department. Projects are reviewed and approved in accordance with OPG's organizational
2 authority register, which sets out the approval authority for different levels of OPG
3 management. For example, projects with an approved budget up to a total cost of \$4M can
4 be approved by the Plant Group Manager. Projects above \$4M are reviewed and approved
5 at higher levels in the organization. In addition as outlined in the OPG organizational
6 authority register, a financial review is undertaken on all projects locally by the site controller
7 and, depending on the project's total cost, again at a higher level in the Finance organization.
8

9 The plant group Project Management Department carries out the execution phase of a
10 project. Activities associated with the execution phase typically include:

- 11 • Managing the people and resources required to complete the project deliverables.
- 12 • Managing the scope, quality, cost, and schedule.
- 13 • Managing project risks, health and safety, quality, and environmental requirements.
- 14 • Monitoring progress and forecasting time, effort, and cost to complete.
- 15 • Analyzing variances from the plan and re-planning the project as required.
- 16 • Managing project changes.
- 17 • Identifying and recording lessons learned as they occur.
- 18 • Commissioning, startup, and performance testing (in coordination with operations and
19 maintenance staff).

20
21 Ongoing oversight is also performed by the Asset Management and Finance Departments
22 through monthly cost review meetings.
23

24 For capital projects only, when equipment is placed into service, key accounting information
25 is provided so the asset can be properly recorded on the OPG balance sheet.
26

27 On completion of the execution phase, a project closure report describing the final project
28 costs is prepared within six months of the project's in-service date. In addition, if required a
29 post-implementation review is prepared for the project. Post implementation reviews are
30 required for all OM&A or capital projects over \$200k in value. The purpose of the post-
31 implementation review is to confirm whether the benefits and/or business objectives stated in

- 1 the business case summary have been achieved, and to communicate any lessons learned
- 2 back to management to aid in future decisions. The post-implementation review will normally
- 3 be completed within one year of the in-service date or as specified in the business case
- 4 summary.