NEWFOUNDLAND AND LABRADOR HYDRO

ASSET MANAGEMENT STRATEGY & PRACTICES

Revision 0 March 20, 2014

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newfoundland labrador hydro
a nalcor energy company

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EXECUTIVE SUMMARY

Newfoundland and Labrador Hydro (Hydro) is undertaking an internal review of the various aspects of the events and potential contributors to the supply disruptions on the Island Interconnected System during January 2014. The internal review will consider eight sub-sections:

1. Load Forecasting
2. Generation/Reserve Planning
3. Generation Availability
4. Transmission Availability
5. Asset Management Strategy and Practices
6. Coordination and Communication With Customers
7. Emergency Response and Restoration
8. Technology and Communications Infrastructure

The result will be an overall "Summary Report on Supply Disruptions – January 2-8, 2014" which is intended to summarize the results of Hydro's internal review of supply disruptions on the Island Interconnected System during January 2014. Each sub-section will have a supporting report such as this one. The summary document and supporting sub-section reports will be incorporated into the data available to inform those involved in the reviews completed by the Board of Commissioners of Public Utilities (PUB) and the Government of Newfoundland and Labrador.

This sub-section report, "Asset Management Strategies and Practices", outlines the results of the investigation/assessment of Newfoundland & Labrador Hydro's asset management strategy and practices. It is intended to summarize the results of a review of Hydro's Asset Management program, including specifically addressing several aspects:

1) Asset Management Strategy and Practices
2) Long Term Asset Management Plans (1,5, and 20 Year Plans)
3) Asset Criticality and Critical Spares Strategy
4) Maintenance Execution
5) Councils of Experts

Several positive key messages can be taken from the analysis of the information:

Hydro strives to follow a structured approach to Asset Management with Condition Assessment as the foundation for the development, ongoing care, and renewal of its installed asset base.

"Hydro's definition of asset management is the comprehensive management of asset requirements, planning, procurement, operations, maintenance and evaluation in terms of life extension or rehabilitation, replacement or retirement to achieve maximum value for the stakeholders based on the required standard of service to current and future generations. It is a holistic, cradle-to-grave lifecycle view on how they manage their assets."

Hydro's asset management approach is essentially consistent with best electric industry practices such as the Electric Power Research Institute's (EPRI) condition assessment process for large generation facilities.

Hydro's asset management program is a deliberate, rigorous process. It has an emphasis on self-assessment and measurement to ensure continuous progress and improvement. In essence it provides the basis for ensuring "the management of the right work on the right assets at the right time".

Hydro's asset management program continues, as it has since 2006, to make steady progress in its scope and its application to all aspects of its business.

A key Hydro's asset management program result is the well thought- out, prioritized and integrated portfolio of 20 Year, 5 Years, and 1 Year expenditure plans that can be and are adapted as circumstances change with time. The Execution Work Plan program piloted at Churchill Falls and being extended to other parts of the business in 2014 is very extensive and is considered consistent with best industry practices.

Other key findings/recommendations and their status where applicable include:

1) Hydro's asset replacement/refurbishment activities for older breakers, disconnects, and transformers have been ongoing for several years and extend for many more. Given there were some issues with older breakers during the January 2014 outage incident, the scope and timing of the program should be reviewed in early 2014.
2) Hydro's new Execution Work Plan program has been well demonstrated in 2013 in other business lines. To improve resource utilization and effectiveness and outage management, its planned extension to replace existing Execution Work Plan processes at other Hydro facilities in 2014 is recommended.

3) Hydro critical spares tracking/management until 2011 has been done primarily on a local facility basis reflecting experience, condition assessments, and vendor recommendations, constantly evolving over past years and decades, and continues to do so. After an initial three year development and assessment period beginning in 2011, a comprehensive pilot to the equipment level at Holyrood in 2013 of Hydro's asset criticality and critical spares tracking / management plans provided valuable feedback at an initial "Lessons Learned" assessment that was undertaken January 30, 2014. This should be followed up on, as is Hydro's plan, in early 2014 following the work on the January 2014 incident. This will move the process towards a more comprehensive and cost effective approach consistent with industry practice and addressing critical issues before winter 2014-15 as a part of the overall asset management program for the winter of 2014/15.
4) Hydro has significant technical capability and staff, and has introduced a "Council of Experts" concept to enhance its best technology/technical practices adoption capabilities. It should, as is planned, continue to cost effectively utilize and enhance those groups and look for additional opportunities to enhance its best technology/technical practices capabilities.
5) A more rigorous winter readiness program should be introduced, largely driven by internal self-assessment with appropriate external support/review. An internal winter readiness self-assessment guide has been drafted and 2014 plans include a more rigorous winter readiness program, building on the self-assessment results and 2013 process/facilities review work.
6) Hydro's O&M at Holyrood has not been impacted since the sanction of Muskrat Falls. Condition assessments on critical systems (i.e. re: safety, reliability) have continued. Capital and major operations projects in Holyrood's long term asset management plan are consistent with the station's end of life plans and required to ensure safe, reliable and environmentally sustainable operation have not been impacted. Those not critical for the period to end of generation service in about 2020 have not been approved, and should not impact availability to then.

1 INTRODUCTION

Newfoundland and Labrador Hydro are undertaking an internal review of the various aspects of the events and potential contributors to the supply disruptions on the Island Interconnected System during January 2014. The internal review will consider eight focus area/elements sub-sections:

1. Load Forecasting
2. Generation/Reserve Planning
3. Generation Availability
4. Transmission Availability
5. Asset Management (AM) Strategy and Practices
6. Coordination and Communication With Customers
7. Emergency Response and Restoration
8. Technology and Communications Infrastructure

The result will be an overall "Summary Report on Supply Disruptions – January 2-8, 2014" which is intended to summarize the results of Hydro's internal review of supply disruptions on the Island Interconnected System during January 2014. Each sub-section will have a supporting report such as this one. The summary document and supporting sub-section reports will be incorporated into the data available to inform those involved in the reviews completed by the Board of Commissioners of Public Utilities (PUB) and the Government of Newfoundland and Labrador.

This sub-section report, "Asset Management Strategies and Practices", outlines the results of the investigation/assessment of Newfoundland & Labrador Hydro's asset management strategy and practices. It is intended to summarize the results of a review of Hydro's Asset Management program.

The scope of this focus area/element involves a review of Hydro's:

1) Asset Management Strategy and Practices
2) Long Term Asset Management Plans (1,5, and 20 Year Plans)
3) Asset Criticality and Critical Spares Strategy
4) Maintenance Execution
5) Councils of Experts

It should be noted that some charts and tables presented in this report are from Hydro's asset management process documentation. They are included for the information of the reader to reflect the robustness of analysis, planning and progress undertaken by Hydro on asset

management.

The report includes assessment of how the Asset Management program is related to the sequence of events associated with the January 2014 electrical supply disruptions. Finally it identifies key findings and recommendations and comments on their current status.
The report format is broken down into the following Sections:

2 REVIEW PROCESS

The review process involved three basic elements:

i. Review of existing Hydro data relevant to asset management strategy and practices in Hydro AM data room
ii. Discussions/interviews with Hydro AM staff
iii. Experience with Hydro facility practices in previous work (2011-2013 Holyrood Condition Assessments, 2013 Interconnected Island System winter readiness, 2013 Churchill Falls winter readiness, 2012 Capital Program review support, 2012 Holyrood staffing benchmark review)

For the purposes of the assessment, the AMEC staff member's significant experiences with utility practices while with AMEC (6+ years) and Ontario Hydro (OH) /Ontario Power Generation (OPG) (32+ years) were utilized including:

- 32+ years working with OH/OPG fossil and hydroelectric stations, including divisional capital expenditure plan reviews for senior management
- OPG/OH CEA/CEATI fossil generation technical representative
- OPG/OH Electric Power Research Institute (EPRI) fossil and hydro research representative and Generation Council representative
- OH/OPG fossil generation R&D program manager
- OPG/OH/Canada representative to International Energy Agency Greenhouse Gas and Fossil Generation committees

- OH/OPG representative on various joint projects with US and Canadian utilities on advanced generation and environmental controls including Southern Company, AEP, Duke, First Energy, Transalta, EPCOR, NSPower, NB Power, SaskPower, BC Hydro
- AMEC capital/OMA plan and staffing plans for BC Hydro Burrard (6 x 150 MW) natural gas fuelled steam generating station in 2008 through 2013
- AMEC thermal and hydroelectric due diligence expert for three generation and system facilities review in 2011 to 2013

Based on the information, an assessment was made as to the overall Hydro asset management strategy and practices.

3 BACKGROUND

Information relevant to Hydro's Asset Management strategy and practices includes the role it plays, the processes utilized in its execution, and the structure within Hydro by which it is accomplished.

1.1 Asset Management Strategy and Practices

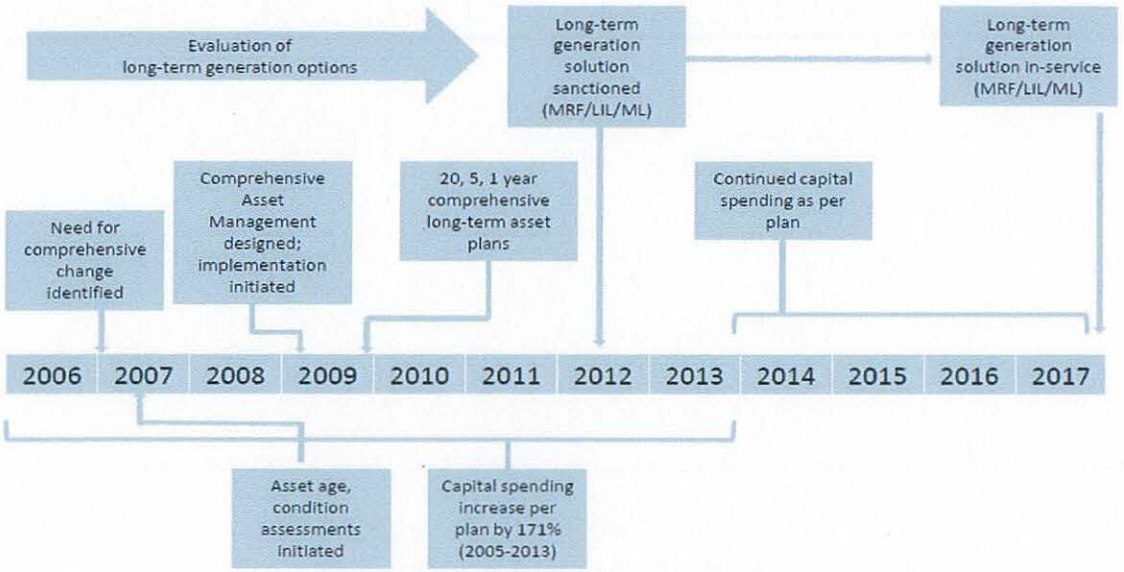
Asset Management Vision within Hydro

Within Hydro, asset management has been defined as follows:

> Asset management is the comprehensive management of asset requirements, planning, procurement, operations, maintenance, and evaluation in terms of life extension or rehabilitation, replacement or retirement to achieve maximum value for the stakeholders based on the required standard of service to current and future generations. It is a holistic, cradle-to-grave lifecycle view on how we manage our assets.

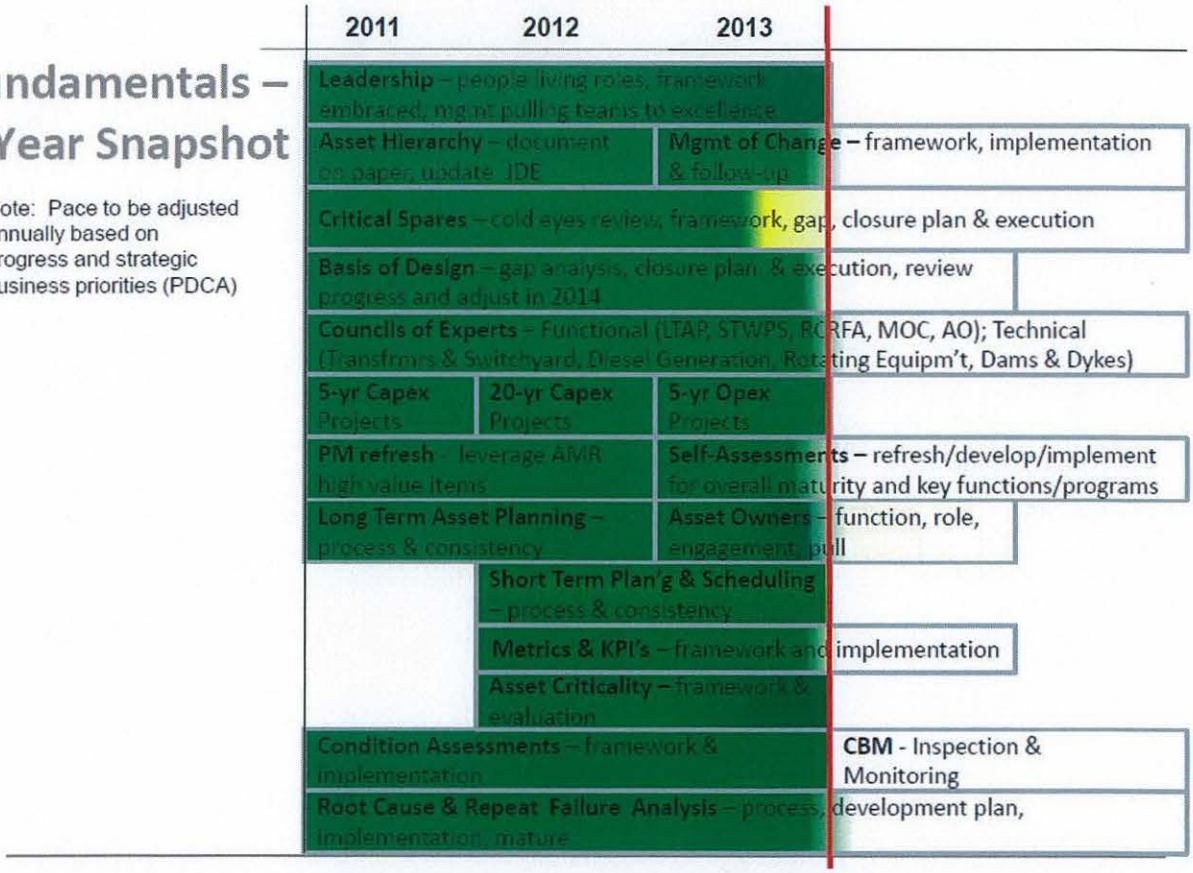
It is clear that while asset management is a backbone to any enterprise, it appears to have been identified as one of Hydro's key issues in 2006. There have been major steps forward, as illustrated in the following Hydro Asset Management charts and confirmed in interviews with Hydro staff. Clear, measurable progress has been made and more is planned by Hydro to be achieved going forward.

Asset Management Progression 2006-



Fundamentals – 3 Year Snapshot

Note: Pace to be adjusted annually based on progress and strategic business priorities (PDCA)



Hydro's broad and aging asset infrastructure requires robust asset management processes. This has been recognized by Hydro and their processes have been founded on best practice. Key changes instituted by Hydro to support this approach have included:

- A comprehensive organizational restructuring to focus on asset management and to support its key functions and outcomes.
- Specifically identified staff, in consistent organizational positions throughout the organization, with assigned accountability for the various aspects of asset management.
- Strengthening of planning and execution processes to align with overall asset management needs.

A key aspect is that Hydro through its strategy and practices and downstream execution has committed itself to having:

> **"The right work being done by the right people on the right assets at right time."**
> **"Knowing the condition of its assets, identifying the right maintenance work, operating the assets properly, managing risk and cost, and robust asset renewal plans."**

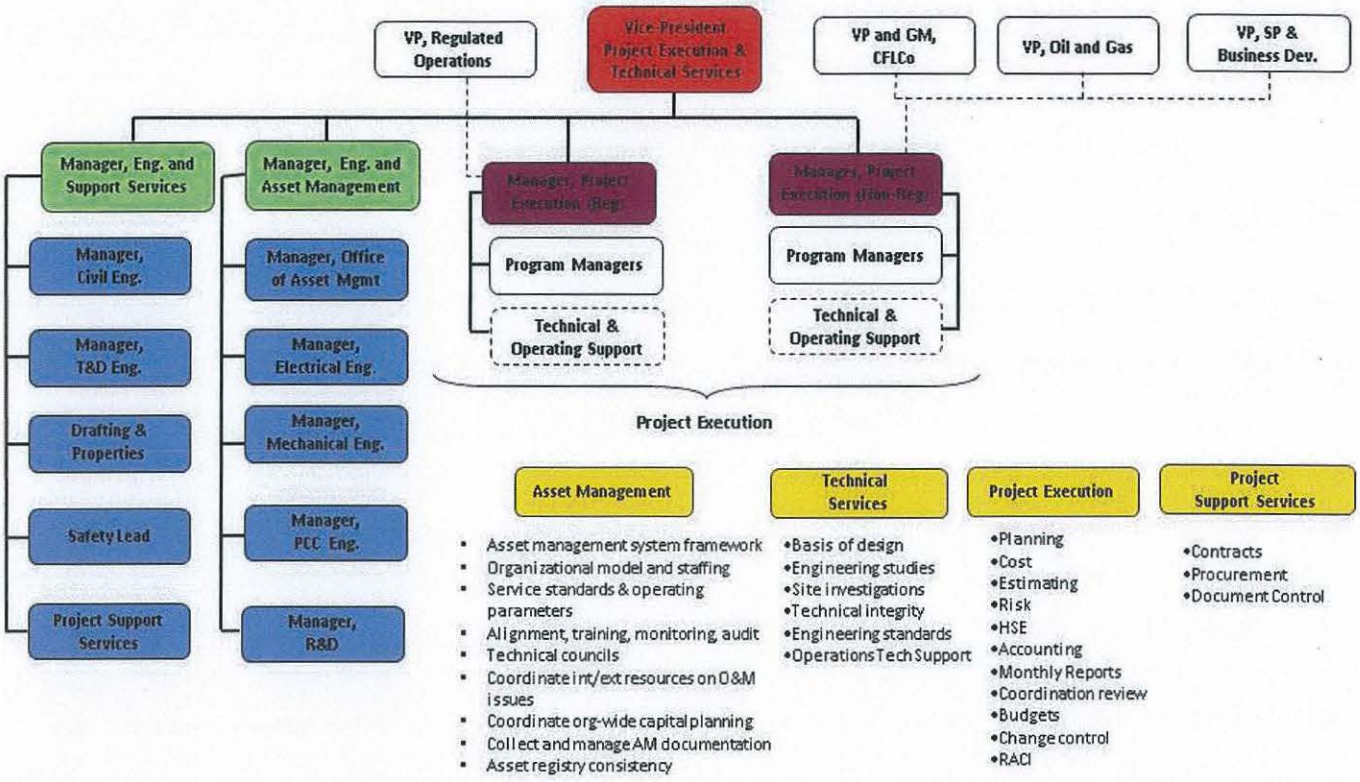
Hydro Structure

Hydro reorganized extensively to bring more accountability and consistency to asset management at all levels of the organization, notable changes include positions supporting the following:

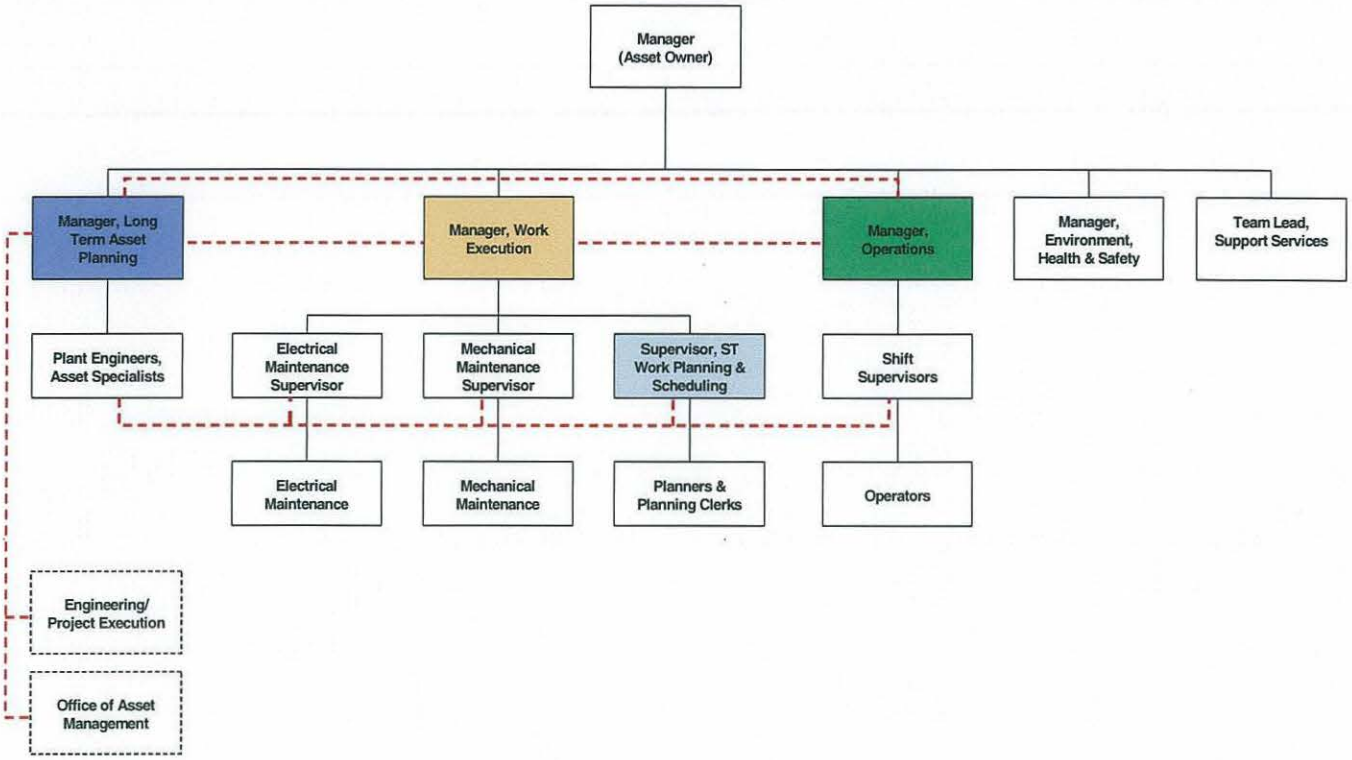
- Office of Asset Management
- Asset Owners
- Long Term Asset Planning
- Work Execution
- Short Term Work Planning and Scheduling
- Project Execution
- Operations
- Support Services

The following Hydro PETS Structure chart illustrates where the Office of Asset Management has been positioned at the corporate level, and the relationship with project execution and technical support for field operations.

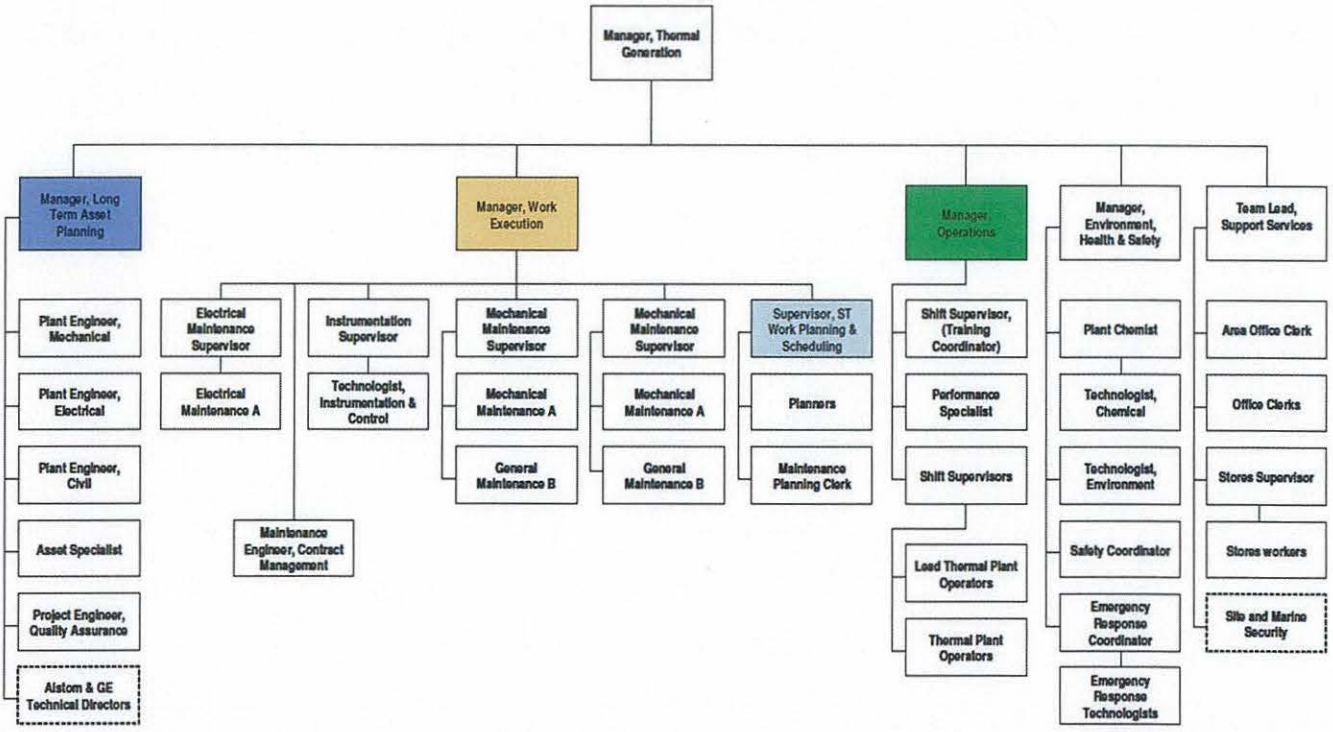
PETS Structure



At the facilities and regional level, the following Hydro organization chart is a representative structure with the asset management roles and relationships shown:



The actual structure for Holyrood GS is shown as an example:



The management and "ownership" of assets and their care at all levels is consistent throughout the organizational structure. This is also consistent with the direction at many utilities where

the importance of ownership/accountability for key assets has been recognized.

Asset Management Processes

Hydro strives to follow a structured approach to Asset Management with Condition Assessment as the foundation for the development, ongoing care, and renewal of its installed asset base.

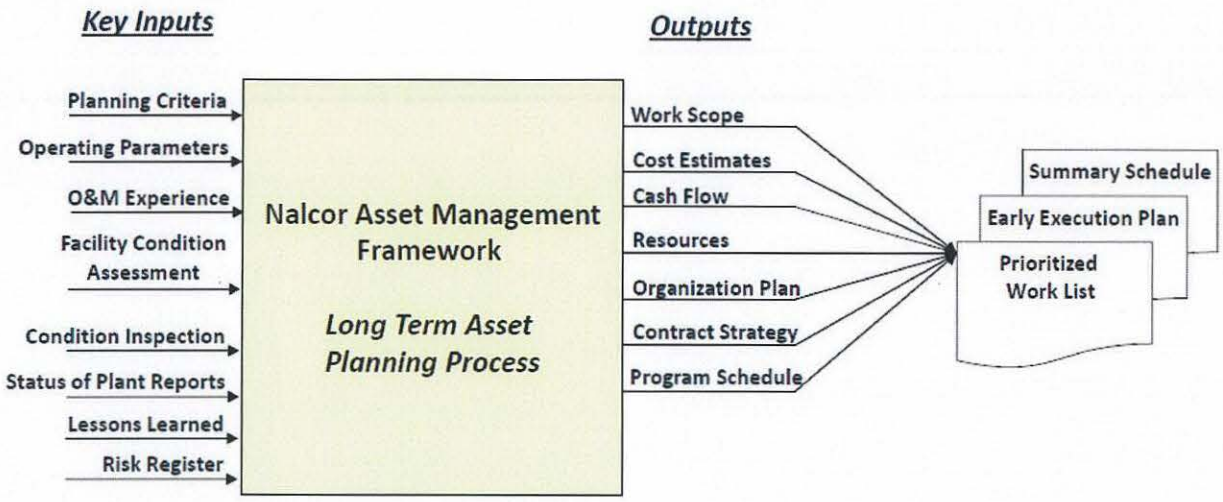
Hydro's asset management program continues, as it has since 2006, to make steady progress in its scope and its application to all aspects of its business. The program is a deliberate, rigorous process. It has an emphasis on self-assessment and measurement to ensure continuous progress and improvement. In essence it provides the basis for ensuring "the management of the right work on the right assets at the right time".

The asset management process involves several different aspects, including:

a) An Asset Management Framework
b) A Staged-Gate Process for Planning and Executing Individual Projects within the Long Term Asset Management Plan
c) A Process for Annual Project Plan Development
d) Condition Assessment and Monitoring
e) Benchmarking/Expert Reviews, including Project Execution/Management

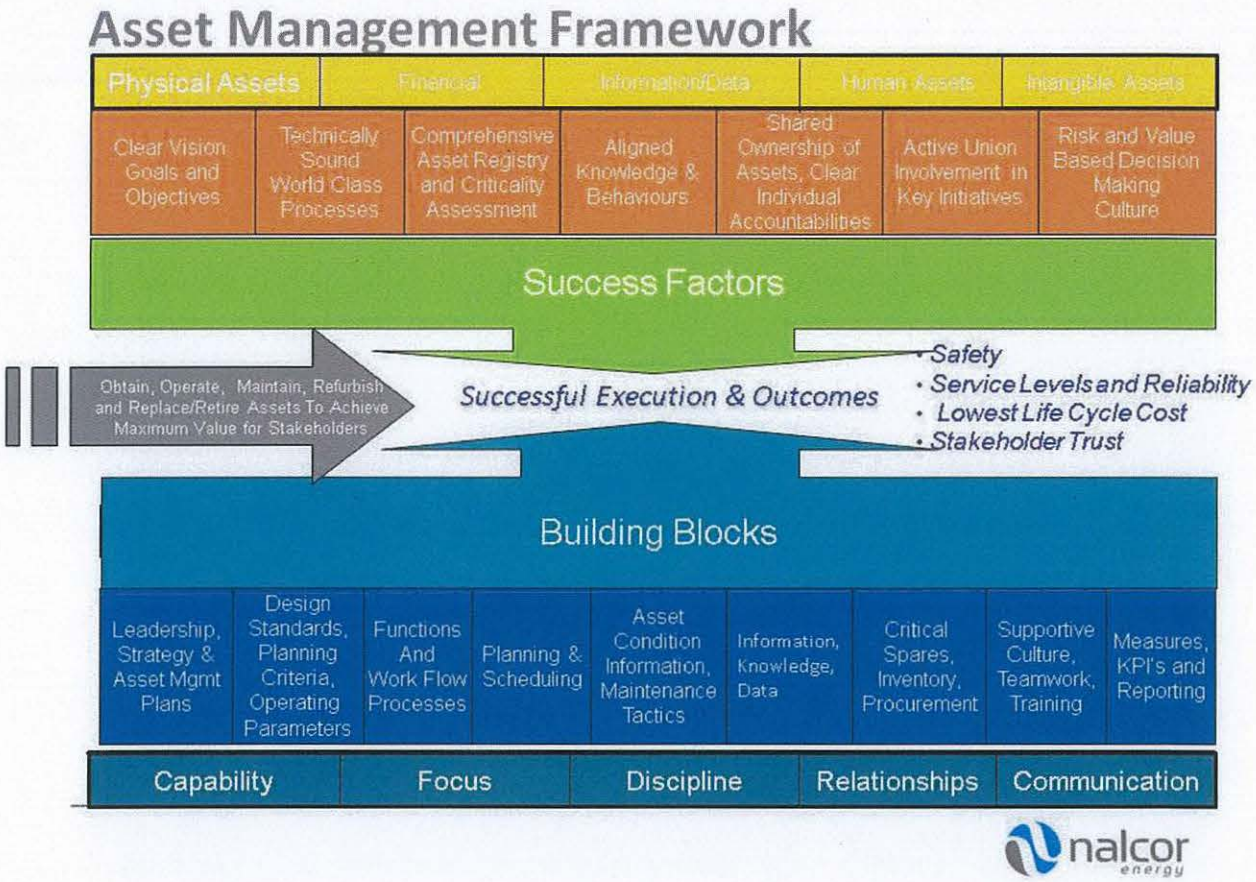
Condition Assessment is a key tool in the development of Hydro's Asset Management plans. Its condition assessment program includes detailed assessments using the principles and stages of power generation facility condition assessment developed by EPRI.

Other key inputs and outputs that form part of Hydro's asset management planning process are illustrated below. These are evident in information from various Hydro facilities and all of these elements work together to make Hydro's asset management approach consistent with good electric industry practices.



Hydro's Asset Management Framework

The Asset Management Framework used by Hydro is illustrated below. It identifies the steps/stages that Hydro's projects go through in order to become part of the overall Asset Management plan through to execution of both projects and maintenance programs. It is well structured and consistent in principle with practices employed by many utilities in North America.


Asset Management Framework
Physical Assets
Financial
Information/Data
Human Assets
Intangible Assets
Clear Vision Goals and Objectives
Technically Sound World Class Processes
Comprehensive Asset Registry and Criticality Assessment
Aligned Knowledge & Behaviours
Shared Ownership of Assets, Clear Individual Accountabilities
Active Union Involvement in Key Initiatives
Risk and Value Based Decision Making Culture
Success Factors
Obtain, Operate, Maintain, Refurbish and Replace/Retire Assets To Achieve Maximum Value for Stakeholders
Successful Execution & Outcomes
• Safety
• Service Levels and Reliability
• Lowest Life Cycle Cost
• Stakeholder Trust
Building Blocks
Leadership, Strategy & Asset Mgmt Plans
Design Standards, Planning Criteria, Operating Parameters
Functions And Work Flow Processes
Planning & Scheduling
Asset Condition Information, Maintenance Tactics
Information, Knowledge, Data
Critical Spares, Inventory, Procurement
Supportive Culture, Teamwork, Training
Measures, KPI's and Reporting
Capability
Focus
Discipline
Relationships
Communication
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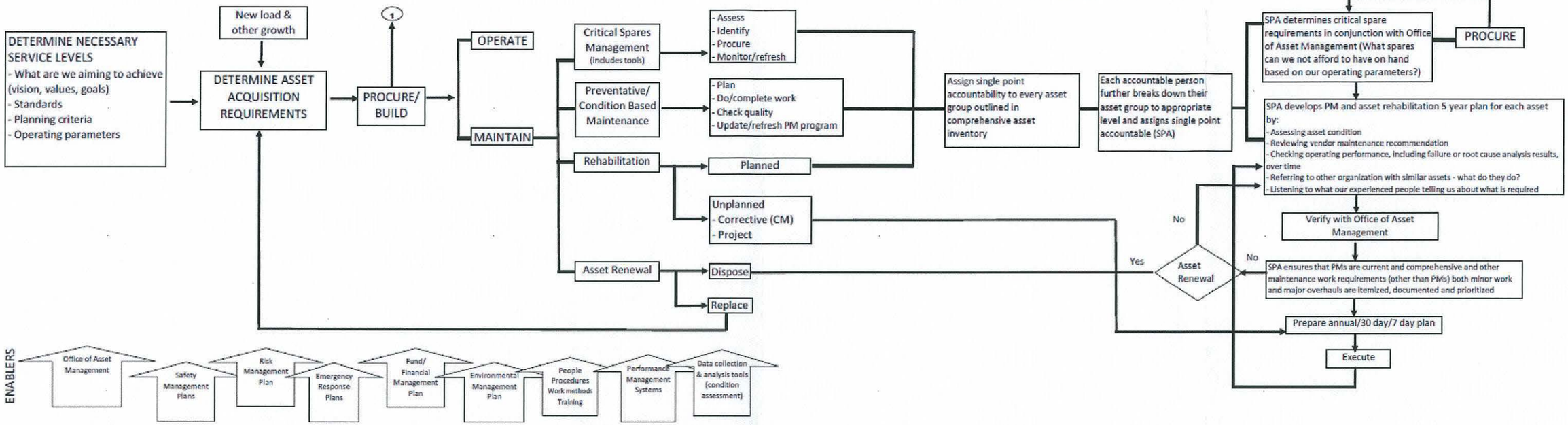
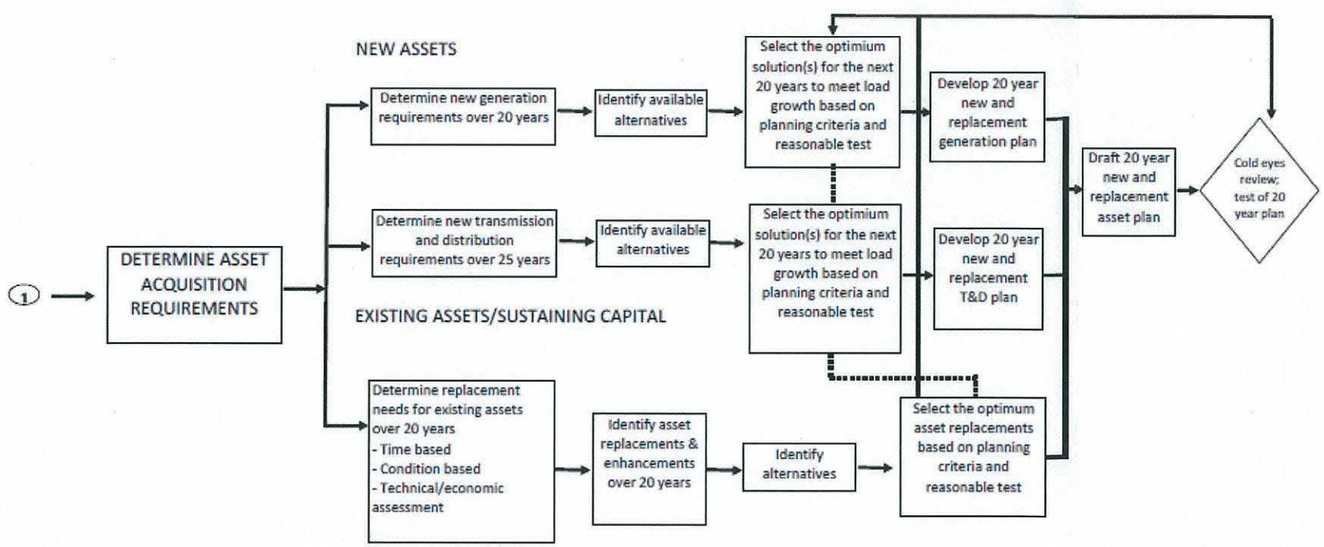
Asset Management Activities: Plant/region





1.2 Long Term Asset Plans (1, 5, and 20 Year Plans)

A key Hydro asset management program result is the well thought out, prioritized and integrated portfolio of 20 Year, 5 Years, and 1 Year expenditure plans that can be and are adapted as priorities change with time.

The 20 year overview with preliminary costs and timelines provides the context/overall picture of how the future may unfold and keeps longer term requirements front and center in planners' minds.

The five year overview provides the context for the nearer term work, particularly highlighting those activities with multi-year activities such as large scale breaker or transformer replacement programs. It focuses some of the prioritization work at a higher level.

The one year view is the budget year, work required and approved, with consideration of the short 3 year term, particularly with respect to multi-year projects. It is developed to a higher level of detail, a higher degree of cost accuracy, and a more detailed implementation schedule. It can often include work that extends over more than one year. It is the culmination of the prioritization process that goes on within the overall corporate program with inputs from all of the businesses and facilities.

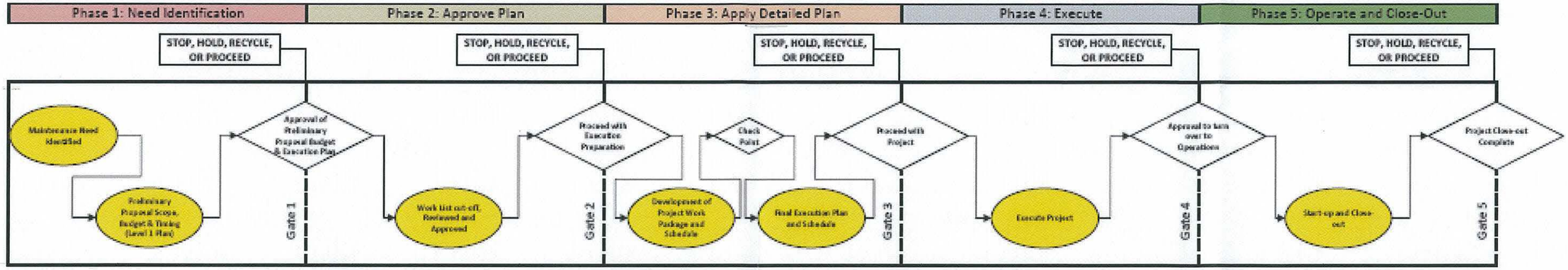
The budget forms the basis for the Execution Annual Work Program for each of the facilities. It includes a range of capital and operating projects, and maintenance programs – predictive, preventive, and corrective.

Staged-Gate Process for Planning and Executing Projects within the Long Term Asset Management Plan

The stage–gate process for planning and executing projects within a Long Term Management Plan is key to ensuring that the right work is done on the right assets at the right time. The Hydro figure below illustrates how Hydro actually uses a stage gate process.

This approach is typical of industry best practice, not only within the electricity industry but in most large process industry (oil, gas, and manufacturing).

Application of Staged-Gate Process for Planning and Executing Individual Projects within the Long Term Asset Management Plan



Phase - Actions	20+ Year Plan	5-Yr Plan	1-2 Yr Plan	Execution Year(s) Plan	
	Anybody **Phase 1:** - Identify need - Create proposal - Forward proposal to Mgr LTAP - Identify multiple alternatives - Categorize project based on Asset Category (BU) - Create Level 1 Plan, including: prelim scope, budget estimate, timing (year) LT Planning	**Phase 2:** - Review wrt Business Objectives - Review work list with Work Execution, Op's Mgr - Assign Project Estimator - field / site inspection req'd - Preliminary BOM[4] Class 3[5] estimates - Review project economics - Narrow alternatives - Initiate Project Plan[6] - Review project estimates with Project Execution - Schedule by duration - Budget for Front End Engineering and Design (FEED) - Revise budget estimate - Training identification - Retirements & disposals identification	**Phase 3:** - Assign project execution team - Execute FEED - Prepare red-line drawings - Conduct risk assessments - Identify contracting strategy - Class 3 estimates / reforecast - Scope Statement (Design Transmittal) prepared - schedule refined, by date for next year - Review outage schedules with Short Term Planning - Mesh with outage schedules - Work Package created - Apply management of change PETS - Tech. Services	**Phase 4:** - Order long lead items - Detailed engineering - Prepare tender documents - Eng'g bi-weekly progress meeting - Engage contractors - Begin construction - Report against schedule, cost - Construction weekly progress meeting - On-site construction management - Initiate completion plan including: - commissioning - performance testing - pre-start review - startup - demobilization - Complete / update drawings / As-builts - Train employees - Identify PM requirements - Identify and order spare parts, add to inventory - Review need for critical spares - Apply management of change - Identify operating parameters	**Phase 5:** - Startup by Operations - Update PM Program - Identify / address deficiencies LOB Operations PETS - Proj. Execution
Gate - point at which	**Gate 1:** - Project begins - More detailed scope & operating history applied - Project added to LTAMP, in future yr. - Decision to hold, abandon, recycle	**Gate 2:** - Single alternative selected - project just'n and scope updated and finalized - Reference point for future MOC - Decision to hold, abandon, recycle	**Gate 3:** - Board of Directors (BOD) / PUB approved - Project starts in next year's Annual Work Plan - Decision to hold, abandon, recycle	**Gate 4:** - Construction & commissioning complete - Prepared for turn over to Operations - Drawings completed / updated - Employees trained	**Gate 5:** - Deficiencies addressed - Project accounts closed-out

Execution Work Plan

The budget that comes out of the staged gate process for the upcoming fiscal/operating year forms the basis for the Execution Work Plan for each of the facilities. It includes a range of capital and operating projects, and maintenance programs – predictive, preventive, and corrective.

The planning process to arrive at the Execution Work Program is extensive. It is also a work in steady progress. Other Nalcor lines of business were first to fully implement/pilot the current planning process program in 2013 to produce a complete deliverable with a further refinement planned for 2014. The following Hydro figure illustrates the path that the process is on and where some elements contributing to the program are currently considered to be at and planned to be. It is considered that Hydro can reasonably be considered to be in level 3 in 2013.

		2012	2013	2014	2015
	Level 1 Initial	Level 2 Structured	Level 3 Organized	Level 4 Managed	Level 5 Optimized
Integration management	No established activity integration practices or standards. All activities are ad hoc.	Activities are documented only in basic format with limited planning and reporting.	Procedures and standards exist to integrate independent projects. Some cross-project integration may exist.	Processes and standards for all projects – integrated with each other and with processes and/or systems.	Project integration efforts are documented and utilized to ensure improvement.
Scope management	Business requirements are stated in very general terms. Scope poorly documented if at all.	Business requirements more formally reported. Items in scope are likely mentioned, items out of scope not mentioned.	Project management processes are established and used. Stakeholders take active role in scoping decisions.	Management processes and methodology used on all projects.	Project scope management is primarily driven by effectiveness and efficiency metrics.
Time management	No scheduling or resource planning performed.	An informal task or activity list is used. No formal scheduling standards or processed exist.	Time management processes documented and used by most projects. Tracking processes begin to emerge.	Time management uses historical data to forecast future performance.	Improvement procedures are utilized for time management processes.
Cost management	No established practices or standards. Costing is performed ad-hoc, if at all.	Basic processes exist for cost estimating, planning and scheduling.	Cost estimating, planning and scheduling are prepared and compared against baselines.	Cost planning and tracking is integrated into the project office, financial and human resource systems.	Lessons learned improve documented cost management processes.

The program includes as inputs:

- Preventive Maintenance Programs and Inspections
- Overhauls
- Capital Projects

- Operating Projects
- Non-Maintenance Activities (e.g. training)
- Corrective Maintenance Packages
- Outage management and constraints (i.e. Winter Availability)

It is agreed that the result for the pilot project going into 2014 is a "Fully Integrated, Resource Levelled, and Ready-for-Use Annual Execution Work Plan". The plan has been vetted by Long Term Asset Planning, Work Execution, Project Execution, Operations, Asset Owners and Finance, having been through iterations to ensure that the activities, resources, outage window availabilities converge to a viable program. The plan has been signed off and the execution team is currently working the plan.

The plan addresses many elements critical to successful execution, including:

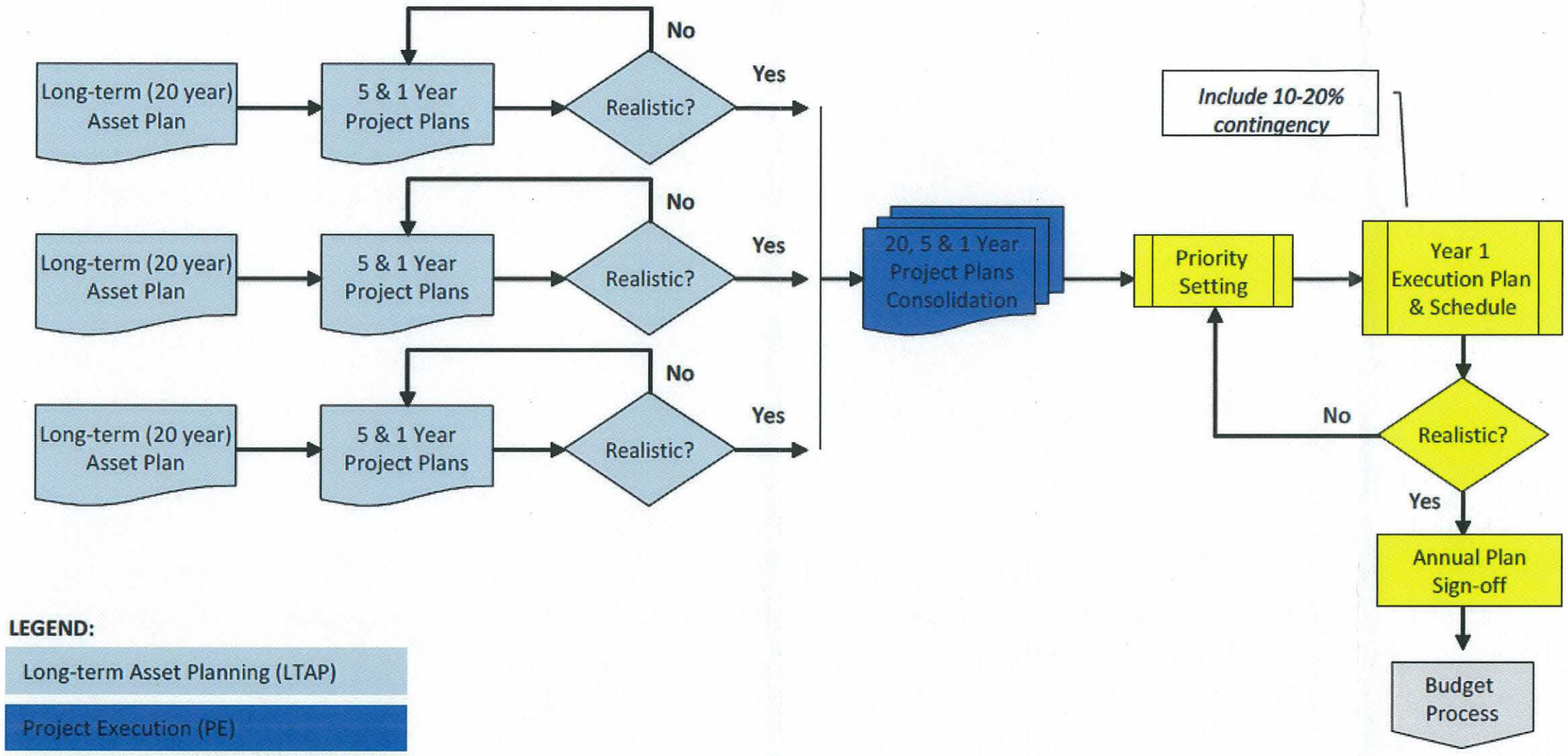
- Work project schedule by week (or more detail if required)
- Overall project resource scheduling
- Overall work plan resource scheduling by skill type
- Equipment outage scheduling
- Overall facility outage schedules/plans
- Overall program requirements and plans
- Monthly red line reviews and active management of change

The annual Execution Work Plan package is very consistent with good utility practice.

This same work is ongoing in the various parts of Hydro to develop their own aligned "Fully Integrated, Resource Levelled, Ready-for-Execution Annual Work Plan" in 2014 and thereafter to work the plans. This represents a continuous improvement/evolution upon current, often local, practices rather than a radical change.

Once fully implemented the process would optimize resource allocation and maximize successful project execution, which in turn will improve overall system reliability. Once fully implemented this would minimize unplanned resource shortages and provide the ability to better adjust to real changes. It would be consistent with very good industry practice.

Process for Annual Project Plan



LEGEND:

- Long-term Asset Planning (LTAP)
- Project Execution (PE)
- Engineering Discipline (Eng. Dis.)
- Joint LTAP/PE/Eng. Dis.

Fully integrated planning is a key requirement given the many demands on existing resources and funds. In the current process, some delays in the timing of scheduled PM work occur in deference to major capital projects and some resource inefficiencies occur due to shifting outage windows.

Condition Assessment and Monitoring

Condition Assessment is a key tool in the development of Hydro's Asset Management plans and can take many forms, including:

- Formal facility condition assessment processes, either directly using or aligned with the principles and stages of assessment developed by EPRI, such as were done for Holyrood Generating Station, for Holyrood's black start gas turbine, and for the Hardwoods and Stephenville gas turbines.
- Condition monitoring/testing of key equipment (i.e. transformers, breakers, generators, large motors) through various preventative maintenance measures (continuous, annual, 3 years, 6 years, 9 years PM's) and tracking (JDEdwards - JDE)
- Major equipment overhauls/refurbishments

Given the age of a significant number of major/critical equipment, the importance of condition assessment and monitoring has increased. Hydro's increased focus in this area is reflected in the increased associated activities and allocation of resources.

Benchmarking/Expert Reviews

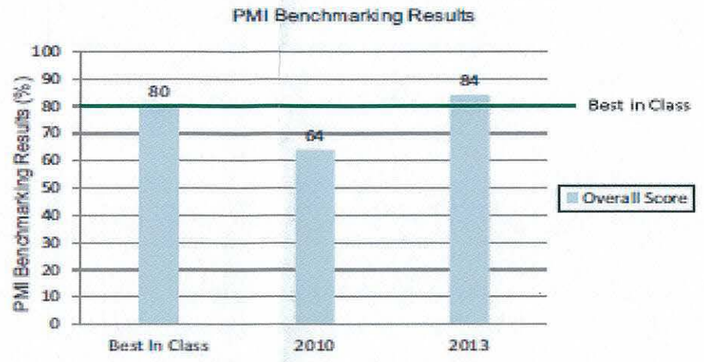
Hydro has undertaken a number of steps since 2006 to assess its performance in asset management and its ability to execute through project management, as well as bring expertise (internal and external) to improve its performance and understanding.

- Participation in CEA and CEATI groups and surveys on various issues, including reliability/availability
- Establishment of Council of Experts to leverage experience, knowledge and best practices, and provide input on plans and project needs
- Integrated use of specific external expertise (i.e. P&C systems analysis; generation condition assessment)
- Integrated use of vendor/OEM support for major equipment (boilers, steam turbines, gas turbines)
- Stantech managed PMI (Project Management Institute) project management benchmarking review in 2011 and 2013 (illustrated below, showing significant improvement between 2011 and 2013)
- Internal self-assessments of Asset Management Maturity by region

Hydro's summary results of the PMI project management benchmarking survey is shown below:

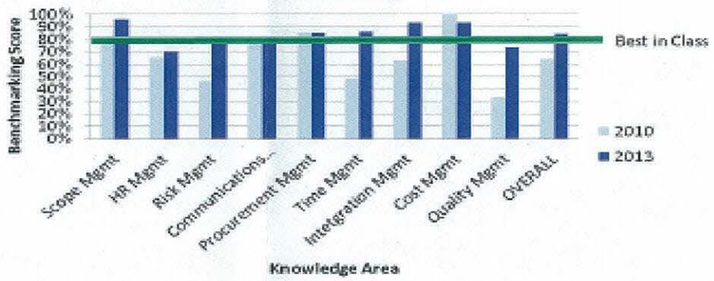
Nalcor Energy _ P.E.T.S. PMI Benchmarking Survey Comparison 20131125

KNOWLEDGE AREA	SURVEY DATE	SURVEY RESULTS	
Project Scope Management	8/16/2011	80%	*More about Knowledge Area* The processes required to ensure that the project includes all the work required, and only the work required, to complete the project successfully. See Ch. 5 of The PMBOK® Guide
	11/25/2013	96%	
Project Human Resource Management	8/16/2011	65%	*More about Knowledge Area* The processes that organize, manage, and lead the project teams comprised of the people with assigned roles and responsibilities for completing the project. See Ch. 9 of The PMBOK® Guide.
	11/25/2013	70%	
Project Risk Management	8/16/2011	46%	*More about Knowledge Area* The processes of conducting risk management planning, identification, analysis, response planning, and monitoring and control on a project. See Ch. 11 of The PMBOK® Guide
	11/25/2013	80%	
Project Communications Management	8/16/2011	80%	*More about Knowledge Area* Processes required to ensure timely and appropriate generation, collection, distribution, storage, retrieval, and ultimate disposition of project information. See Ch. 10 of The PMBOK® Guide
	11/25/2013	88%	
Project Procurement Management	8/16/2011	85%	*More about Knowledge Area* The processes necessary to purchase or acquire products, services, or results needed from outside the project team. See Ch. 12 of The PMBOK® Guide.
	11/25/2013	85%	
Project Time Management	8/16/2011	46%	*More about Knowledge Area* Includes the processes required to manage timely completion of the project. See Ch. 6 of The PMBOK® Guide
	11/25/2013	86%	
Project Integration Management	8/16/2011	63%	*More about Knowledge Area* The processes and activities needed to identify, define, combine, unify, and coordinate the various processes and project management activities. See Ch. 4 of The PMBOK® Guide
	11/25/2013	93%	
Project Cost Management	8/16/2011	100%	*More about Knowledge Area* The processes involved in estimating, budgeting, and controlling costs so that the project can be completed within the approved budget. See Ch. 7 of The PMBOK® Guide
	11/25/2013	93%	
Project Quality Management	8/16/2011	33%	*More about Knowledge Area* The processes and activities that determine quality policies, objectives, and responsibilities so that the project will satisfy the needs for which it was undertaken. See Ch.8 of The PMBOK® Guide
	11/25/2013	73%	

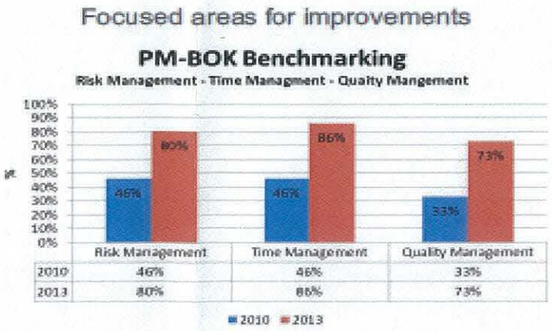


All Areas

External Benchmarking Results



Focused areas for improvements



1.3 Asset Criticality and Critical Spares Strategy

Hydro recognizes the importance of asset criticality and of managing critical spares, as part of the overall asset management plan and to ensure readiness. It has developed a strategy, framework, and process that are consistent with good practice.

Prior to 2011, Hydro generally managed and maintained critical spares based on vendor and OEM recommendations and operational experience, failure history, and equipment condition assessments. Critical spares have been continuously developed over the years. Recent examples of successful sparing strategy are evidenced by the Transmission and Rural Operations group's ability to quickly replace bushings/breakers/disconnect switches which failed and by the ability of generation facilities to respond to incidents like a generator winding failure and a transformer failure with parts from their critical spares.

In 2011 Hydro undertook a three year, three phase asset criticality and critical spares program in recognition that assets were later in their life cycle and that the critical spares program should be refreshed for improved response to equipment failures.

The first phase in 2011 involved a cold eyes review by internal maintenance experts involving both frontline maintainers and technical leads. The process consisted of internal round table reviews of available spares against an area's asset hierarchy and the health of those assets. Perceived gaps were identified, discussed in the context of failure probability and impact, and addressed as appropriate to support least cost reliable service to customers. The process identified some initial augmentations in spares, some potential spares inventory reductions, and some gaps and risks requiring broader discussion. The purpose was to identify obvious risks and address them quickly before the upcoming peak winter season.

The second phase in 2012 involved adding a more structured and detailed approach. External expertise was introduced in the form of an Asset Criticality Workshop facilitated by supply chain experts BDI. The process referenced was a disciplined approach to identifying asset criticality and then strategically stocking critical spares so that negative impacts to corporate goals and objectives are minimized and positive impacts are maximized. An initial framework was identified and sample assets were analyzed.

The third phase in 2013 involved the various divisions undertaking asset criticality reviews. Holyrood piloted a detailed review down to the individual equipment/component level. Other groups undertook an initial review at a higher level in the asset hierarchy.

In 2014 the aim is to refresh the plan for the next 3 years, broadly leveraging the rigor and disciplined process piloted at Holyrood and incorporating knowledge and experience gained to date. An initial "Lessons Learned" workshop was organized and executed with relevant participants through the Long Term Asset Planning Council on January 30, 2014. While higher level assessments have provided some value, the findings had usually been addressed through the qualitative reviews of the past. Detailed equipment/component level assessments were identified by Holyrood as critical to further identify and reduce operational risks relating to spares. This process requires significant work to effectively analyze data and make informed decisions, making prioritization and focus through asset criticality assessments essential.

The Asset Criticality (AC) & Critical Spare (CS) process includes review by qualified personnel and stake holders. It utilizes a two stage approach using an Asset Criticality Risk Matrix and a Critical Spare Decision Diagram to assess asset criticality and identify critical spares. Key elements include the following:

- Identification of critical assets (Consequences and Probability of Failure);
- Spare part lead time;
- Number of potential suppliers;
- Availability of technical specifications and knowledge;
- Type of maintenance whether corrective or preventive;
- Decision diagram for spare part criticality classification.

Hydro's self-assessment "dashboard" chart below illustrates where Hydro believes the status of the work is in 2013. Green is program completed as planned for 2013; yellow is partially completed; red is deferred to 2014). These types of dashboards are used in several Hydro systems to quickly present current status vs plan. Based on available information, Hydro's assessment seems reasonable.

Target	Churchill Falls	Hydro Generation	Thermal/ Holyrood	TRO G&TS	TRO T&D
Asset Criticality assessments				50% Gas Turbines done, Diesel Plants 36% complete, Term Stns 15% done	50% Transmission done, Distribution into 2014
Critical spares rationalizat'n 2013 phase				25% Advanced transformer bushings, priority item	Rescheduled into 2014

The work is continuing in 2014 and is planned to continue beyond that.

1.4 Maintenance Execution

Excellence in maintenance execution is the end result of the successful execution of the "Fully Integrated, Resource Levelled, Ready-for-Use annual Execution Work Plan" – "Plan the Work and Work the Plan". The plan is intended to ensure that the activities, resources, outage window availabilities and other considerations all converge to a viable program, successfully executed. The execution of the plan takes those elements and ensures that they are undertaken so as to achieve the cost, schedule, performance, environmental and regulatory requirements associated with the work.

Hydro has highly competent and well trained staff, including those in maintenance, project management, planning, engineering, operations, and skilled trades. Overall, staff interviews and interactions make it clear that staff commitment to Hydro's success and to performing their work well is very high.

Typically maintenance work priorities start with PM work undertaken on a scheduled basis (typically annual, three year, six year, nine year, or as required by equipment condition/tests), then critical corrective and scheduled outage/overhaul/project work. The scope and schedule for PM work has been updated through a structured Asset Maintenance Review Project completed in 2011. It looked externally at leading practices in the utility industry across North America and compared those to Hydro's own practices, adopting or adjusting as appropriate for Hydro's unique operational and environmental context with evaluation performed by

roundtable panels of internal experts and frontline maintainers and operators. Work execution status is tracked through the JD Edwards maintenance module and reviewed by facility management on a regular basis to ensure critical work is being done.

Testing, inspection and routine ongoing equipment condition assessment is a key element of identifying potential or developing difficulties. Generally Hydro utilizes industry standard testing protocols and frequencies. Decisions are sometimes taken, weighing the benefits and risks, to postpone some more time consuming/complex tests to optimize resource/outage requirements and constraints between tasks.

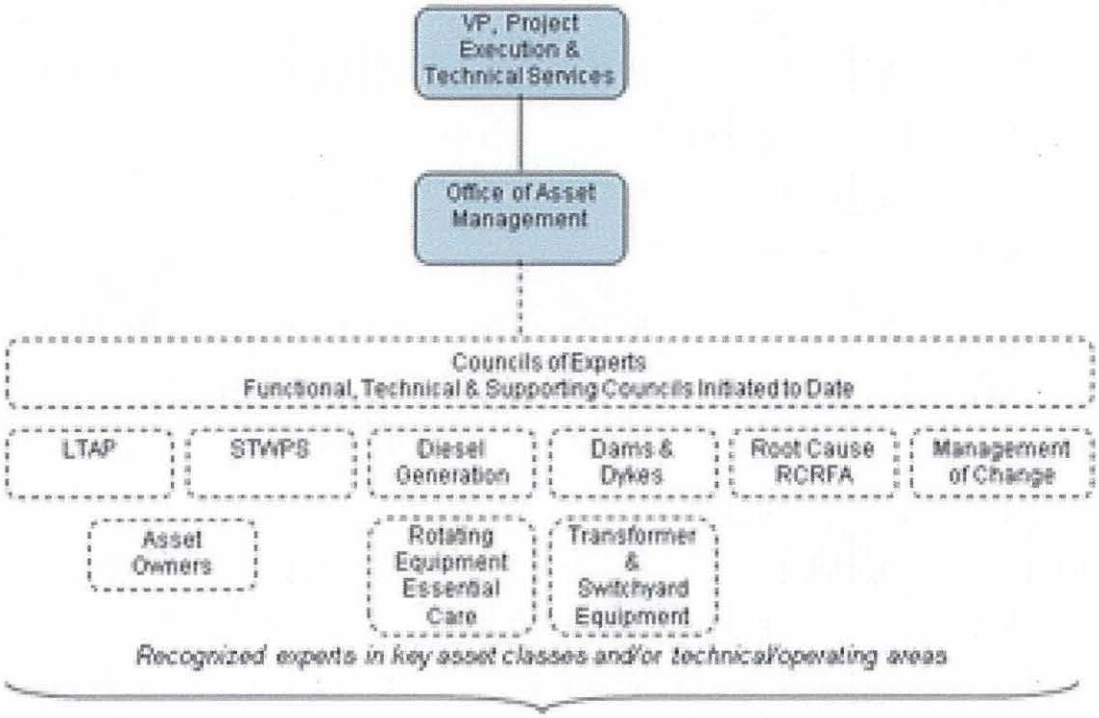
Historically some PM work has been deferred due to shifts in outages for system/economic reasons, or due to trade-offs between work programs. These kinds of decisions on trade-offs are normal practice in any utility, but given the age of much of the Hydro equipment the risks can be higher.

As is evident from the previous PMI benchmarking survey, Hydro is continuing to improve its execution of project work. Similar improvements are expected in preventative maintenance execution and in corrective maintenance as the new annual Execution Work Plan process is fully implemented.

1.5 Council of Experts

Hydro has established Technical Councils / Councils of Experts to assist the Office of Asset Management, through providing input on plans and project needs (for organization see Hydro figure below). These can be either internal Hydro experts or external experts from vendors, consultants or other utilities. These are intended to ensure that the latest and best information is available as input into the asset and project plans for Hydro facilities to enhance its best technology/technical practices capabilities.

In 2011 these "Council of Experts" included Root Cause and Repeat Failure Analysis; Long Term Asset Planning, Short Term Work Planning & Scheduling; and Management of Change. In 2012 the councils added were Transformers & Switchyard Equipment, Diesel Generation, and Rotating Equipment Essential Care. In 2013 councils were added for Asset Owners and Dams & Dykes. In 2014, the plan is to stabilize and mature the councils established to date and examine future needs.



4 SEQUENCE OF EVENTS: RELEVANT TIME FRAME

Asset Management is related to the Sequence of Events associated with the January 2014 System Outage Incident in that it helped Hydro be better prepared to deal effectively and efficiently with unforeseen failures, and it supports continuous improvement and learning from those events. In essence the work of Asset Management has helped to reduce the impacts of unforeseen failures (e.g. through availability of required spares) and reduce the risk to reliable service from aging assets (e.g. through continuously improving asset condition data and asset renewal plans). This works is continuing in 2014 and beyond.

Incident Review Process – Jan 2014

The actual "Sequence of Events Incident Review" process was carried out in a manner consistent with good industry practice in terms of working towards determining a root cause and actionable steps for the future. The methodology used was a robust process, including: a formal "Tap Root" root cause analysis tool and facilitator, OEM/Hydro investigations of failed/suspect equipment, internal and independent external experts reviews and interviews,

field inspections, and system data mining and reviews.

Winter Readiness

In general terms, Asset Management helped ensure that the system was prepared for responding to issues during a high load winter period. Several aspects were evident that much of the work associated with asset management had been done or were underway and that in fact extra effort had been undertaken to ensure winter readiness:

- FM Global Insurance inspections, at Bay d'Espoir and Holyrood in particular, had been undertaken earlier in 2014 and much of the work that could be addressed in 2014 and was relevant to winter readiness had been completed
- 2013 PM's in the Execution Work Plan at generating and TS facilities (including Bay d'Espoir GS and TS, Holyrood GS and TS, Oxen Pond TS, Sunnyside TS, Come-By-Chance TS, Western Avalon TS, Hardwoods TS) had been completed. A trade-off decision had been taken on some TS's to defer some six year PM's due in 2013 and not include them in the 2013 Execution Work Plan due to higher priority capital work programs and other longer backlogged PM's at the various sites.
- Many of the critical PM's at Holyrood GS Unit 2 which were important to winter readiness and had previously been postponed were completed during a shortened 4 day outage and weekend maintenance outages in late November and on weekends into Dec. The Unit 2 outage had been postponed due to even higher priority work on Holyrood Unit 1 steam turbine generator in order to get Holyrood Unit 1 back into service.
- Holyrood Level 2 boiler and high pressure steam/water condition assessment work was undertaken to better assess any operational and safety risk associated with those systems.
- A selective third party winter readiness review was undertaken between November 12 and 26 2014 (weather delays extended the overall duration) which included Holyrood Unit 2 and the fuel system, Bay d'Espoir Unit 7 and auxiliaries, and the major facilities at Bay d'Espoir TS, Holyrood TS, Oxen Pond TS, Sunnyside TS, Come-By-Chance TS, Western Avalon TS, and Hardwoods TS. The review process was based on a visual walkdowns, interviews with management and maintenance/operations staff, reviews of available 2013 Execution Work Plan PM and work records, transformer inspection/oil analysis data, and thermography where practical of major GS switchgear and TS connections.
- A selective third party winter readiness review was undertaken Dec 3 to 6 2014 which included the Churchill Falls GS, the Churchill Falls TS, and the Wabush TS. The review process was based on a visual walkdowns, interviews with management and maintenance/operations staff, reviews of available 2013 Execution Work Plan PM and

work records, transformer inspection/oil analysis data, and thermography where practical of major GS switchgear and TS connections.

- A multi-year program for replacement/refurbishment of older critical equipment (i.e. breakers – OCB, SFA, ACB; disconnect switches, transformers, switchgear, air compressors and piping) that has been ongoing for the last several years and is planned for several years to come. This is evidenced as part of the significant growth in capital program in last five years

Overall the Hydro corporate management and field operations management and staff at the generation, transmission and terminal station facilities are well aware of the importance of Winter Readiness and had undertaken significant efforts to implement projects needed to be ready for the 2014 winter season.

Asset Management Aspects of the Results of the January 2014 Incident Review (Preliminary)

The incident investigation and Tap Root review process related to the January 2014 process has been underway essentially since the system was restored. Several pieces of equipment appear to have failed to operate properly and/or were damaged in the January 2014 outage incident. Details of the causal factors and root cause analysis and recommended actions are part of the formal Tap Root Analysis report.

5 KEY FINDINGS AND RECOMMENDATIONS

Several positive key messages can be taken from the analysis of the information:

Hydro strives to follow a structured approach to Asset Management with Condition Assessment as the foundation for the development ongoing care and renewal of its installed asset base.

"Hydro's definition of Asset Management is the comprehensive management of asset requirements, planning, procurement, operations, maintenance and evaluation in terms of life extension or rehabilitation, replacement or retirement to achieve maximum value for the stakeholders based on the required standard of service to current and future generations. It is a holistic, cradle-to-grave lifecycle view on how they manage their assets."

Hydro's asset management approach is consistent with best electric industry practices such as the Electric Power Research Institute's (EPRI) condition assessment process for large generation facilities.

Hydro's asset management program is a deliberate, rigorous process. It has an emphasis on self-assessment and measurement to ensure continuous progress and improvement. In essence it provides the basis for ensuring "the management of the right work on the right assets at the right time".

Hydro's asset management program continues, as it has since 2006, to make steady progress in its scope and its application to all aspects of its business.

A key Hydro's asset management program result is the well thought- out, prioritized and integrated portfolio of 20 Year, 5 Years, and 1 Year expenditure plans that can be and are adapted as priorities change with time and data. The Execution Work Plan program piloted within another Nalcor line of business is being leveraged to the various parts of Hydro in 2014. It is very extensive and is considered consistent with best industry practices

Other key findings and their recommended actions where applicable include:

1) Hydro's asset replacement/refurbishment activities for older breakers, disconnects, transformers have been ongoing for several years and extend for many more. Given some issues with older breakers during the January 2014 outage incident, the scope and timing of the program should be reviewed in early 2014.
2) Hydro's new Execution Work Plan program has been well demonstrated in 2013 in other business lines. To improve resource utilization and effectiveness and outage management, its planned extension to replace existing Execution Work Plan processes at other Hydro facilities in 2014 is recommended.
3) Hydro critical spares tracking/management until 2011 has been done primarily on a local facility basis reflecting experience, condition assessments, and vendor recommendations, constantly evolving over past years and decades, and continues to do so. After an initial three year development and assessment period beginning in 2011, a comprehensive pilot to the equipment level at Holyrood in 2013 of Hydro's asset criticality and critical spares tracking / management plans provided valuable feedback at an initial "Lessons Learned" assessment that was undertaken January 30, 2014. This should be followed up on, as is Hydro's plan, in early 2014 following the work on the

January 2014 incident. This will move the process towards a more comprehensive and cost effective approach consistent with industry practice and addressing critical issues before winter 2014-15 as a part of the overall asset management program for the winter of 2014/15.

4) Hydro has significant technical capability and staff, and has introduced a "Council of Experts" concept to enhance its best technology/technical practices adoption capabilities.
5) A more rigorous winter readiness program should be introduced, largely driven by internal self-assessment with appropriate external support/review.
6) Hydro's O&M at Holyrood has not been impacted since the sanction of Muskrat Falls. Condition assessments on critical systems (i.e. re: safety, reliability) have continued. Capital and major operations projects in Holyrood's long term asset management plan consistent with the station's end of life plans and required to ensure safe, reliable and environmentally sustainable operation have not been impacted. Those not critical for the period to end of generation service in about 2020 have not been approved, and won't impact availability to then.

6 RECOMMENDATIONS STATUS

- Recommendation 1): Hydro's asset replacement/refurbishment activities for older equipment (i.e. breakers, disconnects, transformers) have been ongoing for several years and extend for many more. A decision is required in early 2014 in order to begin an assessment in early 2014 of the need for its acceleration.
- Recommendation 2): Hydro's new Execution Work Plan program has been well demonstrated in other business lines. To improve resource utilization and effectiveness and outage management, it is currently planned to extend this to other Hydro facilities in 2014.
- Recommendation 3): Hydro's asset criticality and critical spares tracking/management plans were intended to be broadly expanded beginning in February 2014, but have been deferred modestly due to the January 2014 Outage Incident impacts. An initial "Lessons Learned" assessment was undertaken January 30, 2014. Further detailed work is planned to be initiated in 2014 with critical issues addressed before winter 2014-15.
- Recommendation 4): Hydro has introduced several "Council of Experts" to enhance its best technology/technical practices capabilities. It plans to continue these in 2014 to cost effectively enhance its technical capabilities and to look for additional opportunities to enhance its best technology/technical practices capabilities.

- Recommendation 5): Hydro has drafted an internal winter readiness self-assessment guide and will undertake a more rigorous winter readiness program in 2014, building on the self-assessment and 2013 work.

Acronyms

AC	Asset Criticality
ABC	Air Circuit Breaker
AEP	American Electric Power
AM	Asset Management
BDE	Bay d'Espoir
BOD	Board of Directors
CBC	Come-By-Chance
CEA	Canadian Electricity Association
CEATI	Canadian Electricity Association Technologies Incorporated
CEO	Chief Executive Officer
CM	Corrective Maintenance
CS	Critical Spares
EPRI	Electric Power Research Institute
FD	Forced Draft
FEED	Front End Engineering and Design
GS	Generating Station
GT	Gas Turbine
HRD/HTGS	Holyrood GS/Holyrood Thermal Generating Station
JDE	JD Edwards
kV	kilovolt
LTAM (LTAMP)	Long Term Asset Management (LTAM Plan)
LTAP	Long Term Asset Plan
MOC	Management of Change
MRF/LIL/ML	Muskrat Falls/Labrador Island Link/Maritime Link
OAM	Office of Asset Management
OCB	Oil Circuit Breaker
OEM	Original Equipment Manufacturer
O&M	Operations and Maintenance
O/S	Out of Service
OPG/OH	Ontario Power Generation/Ontario Hydro
NLH	Newfoundland and Labrador Hydro
PETS	Project Execution and Technical Services
PM	Preventive Maintenance
PMI	Project Management Institute
P&C	Protection and Control
PUB	Board of Commissioners of Public Utilities
R&D	Research and Development
SC	Synchronous Condenser
SFA	SF6 Circuit Breaker
SOE	Sequence of Events

SPA	Single Point Accountable
SSD	Sunnyside TS
T&D	Transmission and Distribution
T1	Transformer #1
TRO	Transmission and Rural Operations
TRO G&TS	TRO Generation and Terminal Stations
TS	Terminal Station
WAV	Western Avalon TS

Appendix 1

Asset Management Information Related to Responses to "Other Questions"

Question a) The decision to temporarily remove the jacking oil pump from the Stephenville GT on December 11 and install it at Hardwoods. How and why the decision was made and its implications?

Asset Management Program Response: This would have been an operations decision based on the best information available as to which facility would have benefitted most in terms of in-service and contributed most to supply security. It was not strictly speaking an Asset Management process issue. Had other factors been evident, a different decision might have been made. As far as the January 2014 system incident is concerned, this had no impact.

Question b) The need to replace insulating blankets on end B of the Stephenville GT appears to have been known since the summer of 2013, Why the delay in this issue being addressed? Could it have been addressed sooner, if so would that have entailed additional cost?

Asset Management Program Response: From an asset management process perspective, this is a project management/design issue that likely should have been picked up in a timely fashion. As far as the January 2014 system incident is concerned, this had no impact.

Question c) Was there an alternative that would have allowed the Hardwoods GT alternator repair/replacement to be carried out before the end of the planned outages at Holyrood? Could reasonable efforts have been made to advance the planned Hardwoods GT outage to an end-date before December 19?

Asset Management Program Response: The plan was to have Hardwoods available well before the winter. Delays and the failure of the fuel control valve were not expected. As far as the January 2014 system incident is concerned, the plan had no impact on the January 2014 system incident.

Question d) The new fuel control valve failed at Hardwoods GT on Dec 21 but the required external specialist was not available until Jan 6. Considering the importance of Hardwoods as a "critical generating asset", could extra efforts been made to expedite the availability of the require expertise? How can such matters be planned for more expeditious action going forward?

Asset Management Program Response: Efforts were made to obtain the required expertise more quickly, but were unsuccessful. The failure of the control valve was not expected - a reasonable assumption. The situation will likely be reviewed to see what could be done –

project timing, commissioning spares, etc... As far as the January 2014 system incident is concerned, the failure didn't have a significant impact on the larger system incident, but would have impacted the extent and duration of the rotating power outages. Detailed study would have to be undertaken to make a definitive statement.

Question e) Were any of the required actions to bring the various impacted units, breakers, transformers, etc. which failed during mid-Dec to mid-Jan back into action delayed due to timely access to critical spares or personnel (NLH or external specialists). If so, how is this being addressed?

Asset Management Program Response: Given the analysis to date regarding the January 2014 incident is concerned, it is not believed that any of the required actions to bring the various impacted units, breakers, transformers, etc. which failed during mid-Dec to mid-Jan back into action was delayed due to timely access to critical spares or personnel (NLH or external specialists).

Question f) Were there any prior indications of the issue which caused the Sunnyside transformer fire?

Asset Management Program Response: The transformer PM testing had been completed earlier in the year and did not indicate any significant issue. Thermal imaging of the various Sunnyside switchyard connections and equipment had been completed and showed no issues requiring immediate response. The equipment is being inspected to better define what happened and how it happened, and what could be done to avoid similar occurrences.

Question g) Were there any prior indications of the issue with the Holyrood Unit 3 forced draft fan that could have signalled a concern?

Asset Management Program Response: No PM testing had indicated any concerns earlier in the year. The equipment has been repaired and Hydro have some results on the root cause of the failure. As far as the January 2014 incident is concerned, it is unlikely that the de-rating of Unit 3 due to the FD fan would have had a significant impact on the on the larger system incident, but would have impacted the extent and duration of the rotating power outages. Detailed study would have to be undertaken to make a definitive statement.

Question h) Has the anticipated removal of HTGS from service in any way impacted the capital works considerations which might otherwise have been carried out? Have any of these decisions potentially impacted the availability of the Holyrood generating units?

Asset Management Program Response: Holyrood is planned to remain in generation service until 2020 (as a standby between 2017 and 2020) and Unit 3 will continue as a synchronous

condenser (SC) for the foreseeable future to provide system voltage support. The primary capital impact had to do with converting Units 1 and 2 to synchronous condenser capability which would have required significant expenditures for generator life extension as well as costs for modifying the facility to accommodate the SC service. An alternative approach at Soldier's Pond was selected. No capital was removed that would have significantly affected the availability of Holyrood. As far as the January 2014 incident or similar incident is concerned, there would be no impact on the outcome.

Appendix 2

Documents/References Reviewed List

Asset Management Strategies & Updates

Asset Management and Project Execution at Nalcor Energy
Asset Management Status Update Q1 2013

Asset Management Excellence – December 2013 Progress Report

Project Execution

Project Execution & Technical Services PMI Benchmarking Survey Comparison 2013-11-25

Application of Staged-Gate Process for Planning and Executing Individual Projects within the Long Term Asset Management Plan 2013-05-21

Project Execution Multi-year Plan November 23, 2011 (R3)

Driving Project Execution and Technical Services Excellence December 15, 2013

2011 Project Execution & Technical Services PM Benchmarking Report

2013 Project Execution & Technical Services PM Benchmarking Report

Churchill Falls 2014 Annual Work Plan Integrated Resource Planning

Long Term Asset Management

Holyrood

Hydro Generation

Transmission Rural Operations

- Gas Turbines & Terminal Stations
- Transmission Distribution

Condition Assessments

Holyrood Thermal Generating Station Condition Assessment and Life Extension Study - Phase 2

2012/2013 Level II Condition Assessment Civil Structures and Unit 3 Generator AM141/RP/002 R00 AMEC December 20, 2013

Holyrood Thermal Generating Station Condition Assessment and Life Extension Study - Phase 2 2012/2013 Level II Condition Assessment Boiler and High-Energy Piping AM132/RP/005 R03 AMEC November 13, 2013

Power System Performance Review Report January 11, 2013 - Winter Storm Events Prepared by: Power System Review and Analysis Committee June, 2013

Condition Assessment & Life Extension Study Holyrood Thermal Generating Station Prepared by: AMEC January 28, 2011

Holyrood Gas Turbine Condition Assessment & Options Study Holyrood Thermal Generating Station Prepared by: AMEC December 19, 2011

Diesel Plant Remediation Phase II - Final Report H342925-0000-00-124-0002 Prepared by: Hatch April 12, 2013

Hydraulic Structure Life Expectancy Study Prepared by: Hatch May 22, 2009

Condition Assessment and Life Cycle Cost Analysis Hardwoods and Stephenville Gas Turbine Facilities Prepared by: Stantec December 18, 2007

Circuits TL202, TL203, TL206, TL207 and TL237 Transmission Line Protection Performance and Settings Review Prepared by: Henville Consulting Inc December 31, 2010

Circuits TL201, TL217, TL218, TL236 and TL242 East Coast Transmission Line Protection Performance and Settings Review Prepared by: Henville Consulting Inc December, 2011

Gas Turbines

Maintenance Strategy Manual Hardwoods and Stephenville Gas Turbines April 21, 2008

Final Report - Condition Assessment and Life Cycle Cost Analysis Hardwoods and Stephenville Gas Turbine Facilities December 18, 2007 Stantec Consulting

Hardwoods Gas Turbine Plant Life Extension Upgrades, Year 1 (2009)

Plant Life Extension Upgrades, Hardwoods Gas Turbine, Years 2-4 (2010-2012)

Hardwoods Gas Turbine Alternator Replacement (2013)

Replace Automatic Voltage Regulator on Gas Turbine, Stephenville (2009)

Critical Spares – Plan & Progress

Transmission Rural Operations (Gas Turbine & Terminal Stations)

Transmission Rural Operations (Transmission & Distribution)

Holyrood

Hydro Generation

Capital Plans

Approved 2014 Capital
20 Year Consolidated Plan

Holyrood Binder

Maintenance Strategy Manual Holyrood Thermal Generating Station June 28, 2010

Condition Assessment and Life Extension Study, Holyrood Thermal Generating Station January 28, 2011 AMEC

Holyrood Gas Turbine Condition Assessment and Options Study December 19, 2011 AMEC

Holyrood Thermal Generating Station Condition Assessment and Life Extension Study – Phase 2: Boiler and High Energy Piping November 13, 2013 AMEC

Holyrood Thermal Generating Station Condition Assessment and Life Extension Study – Phase 2: Civil Structures and Unit 3 Generator December 20, 2013 AMEC

Capital Projects 2009, 2010, 2011, 2012, 2013, 2014 - Summary sheets for projects approved by the Public Utilities Board for commencement in 2009

Sample Project Schedule

Sample Project Risk Workshop

Project Management Manual

Project Management Manual
Project Management Manual Updates
Quality Management
Change Management
Time Management
Risk Management
Safety & Health Management

Self-Assessment

Asset Management Maturity - Self-Assessment Surveys 2011 Results, 2012 Results, 2013 Results
Asset Management System Implementation
Planning & Scheduling Function
Lubrication Program - Self-Assessment Template, TRO, BDE, CF(I) Co, Exploits, Menihek, Results Summary
Root Cause Failure Analysis – Self Assessment
LTAP Function
KPI's and Metrics - 2013 Results – Holyrood, Labrador, TRO Northern, TRO Central, Hydro Generation
System Performance - Power System Reliability and Equipment Performance Report – 2011, 2012, 2013

TRO Terminal Stations

Maintenance Strategy Manual, TRO Terminal Stations, April 6, 2011
Capital Projects 2009, 2010, 2011, 2012, 2013 - Summary sheets for projects approved by the Public Utilities Board for commencement

Critical Spares – Plan & Progress

Holyrood
Hydro Generation
Transmission Rural Operations

Asset Criticality & Critical Spares

Asset Criticality and Critical Spares Framework
Asset Criticality Workshop BDI December 05, 2012
Equipment Criticality Assessment Guide

Holyrood Asset Criticality - Lessons Learned January 30, 2014
Holyrood Critical Spares
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Transmission

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Wood Pole Line Management Annual Reports 2014-2004
Wood Pole Line Management Using RCM Principles April 7, 2004
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Distribution Internal Standards
Canadian Standards Associations C22.3 No. 1-10
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Enterprise Risk
Internal Audits
Operations Readiness Check 2013
Business Continuity
Asset Management Councils Status