Review of Asset Management Practices in the Ontario Electricity Distribution Sector

March 10th, 2009

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Executive Summary

The office of the Chief Regulatory Auditor ("CRA") has completed a review of a selection of Ontario's Electricity Local Distribution Companies ("distributors") to gather information and advise the Board on the status of processes for managing capital assets.

In this review we examined the following core asset management processes:

- Inspection and maintenance processes;
- Capital expenditure planning processes;
- Capital financing processes; and
- Information management processes.

There is at present no codified standard setting out asset management practices that has general acceptance. There is a British standard, commonly referred to as PAS-55, that provides a good framework[1]. However, it has not yet gained broad acceptance and is geared toward the very large enterprises with sophisticated management systems. Accordingly, based on our own experience in asset management, we developed a maturity model as a framework for evaluating and describing the state of asset management practices at Ontario distributors. This model reflects the essential elements of PAS 55. The model is used to position utilities as "lagging", as at an "expected" level, or as "leading" with respect to their asset management processes. We then developed a composite assessment of the state of asset management practices at distribution utilities from three principal sources:

- We visited four utilities to understand their current processes for inspection, maintenance, capital planning, and financing.
- We reviewed material on asset management plans in some recent rate applications from a number of other Ontario distributors.
- We incorporated the results of a survey questionnaire on asset management practices that was issued by Board staff. This survey was completed by 17 distributors.

The 21 utilities contacted directly in the course of this work collectively represent the majority of the customers and net assets in the electricity distribution sector. Hence, our review provides a reasonable basis for assessing overall asset management practices. We did not sample the smallest electricity distributors in Ontario.

We were generally satisfied that the asset management practices by distributors are at the "expected" level of maturity In general, while there is variability in practices, distributors are applying appropriate care and diligence in their asset management practices. While we noted areas for improvement, management at each of the four

[1] *The Institute of Asset Management. Publicly Available Specification 55-2: Asset Management (PAS 55)*

utilities visited, for the most part, focused on the right issues with respect to their assets and had identified and were working towards enhancements in key areas. We do not have any concern that the utilities visited are failing to address important safety or reliability issues. The results of the survey that was conducted as part of this review also provide comfort with respect to the state of asset management practices at Ontario distributors.

The review is based on visits to 4 distributors, and questionnaire responses from another 17. The review did not include a sample of distributors with less than 5,500 customers. The results of this review therefore, cannot be extrapolated to apply to the smallest utilities. This review concentrated on asset management processes. As such, it was not itself an asset condition assessment or assessment of the adequacy of individual utility asset management plans. Its focus was on the practices in place to develop such plans.

The results of the assessment are also shown in the maturity model on pages 18-21.

Report

Introduction

The Ontario Energy Board ("OEB" or the Board), in carrying out its responsibilities under the *Ontario Energy Board Act, 1998* is guided by an objective of protecting the interests of consumers with respect to prices and the adequacy, reliability, and quality of service by the regulated entities. To support this objective, the office of the Chief Regulatory Auditor ("CRA") has completed a review of a selection of Ontario's Electricity Local Distribution Companies ("distributors") to gather information and advise the Board on the status of processes for managing capital assets. Consistent with good asset management practices, we identified the key processes as follows:

- Inspections and maintenance processes;
- Capital expenditure planning:
- Capital financing processes: and
- Information management processes.

During this review, we examined distributors' activities with respect to the execution and monitoring of plans associated with the processes noted above.

The information gathered is expected to help the Board understand if this topic is being addressed adequately by distributors and to help inform potential future policy development work. In addition, it is expected that the findings may assist individual utilities in evaluating their current practices.

The above processes represent the core functions of asset management within a utility. According to one definition, asset management is a process to optimize performance, costs and risks relevant to service delivery. These elements should be reflected in any discussion of Asset Management.

Thus:

> "A key characteristic of successful asset management is consistently making sound decisions and good compromises, and carrying out the appropriate tasks at the right time and at the optimum level of expenditure.."[1]

We expect that the manner in which utilities apply asset management practices will vary by utility size:

- Larger utilities will generally require more formalized processes for the ranking and evaluation of capital projects. Knowledge with respect to individual projects is dispersed across more personnel, and there needs to be processes to ensure that projects are assessed consistently across the organization.

[1] *The Institute of Asset Management. Publicly Available Specification 55-2: Asset Management. Part 2, Section 0.1*

- The size of the capital budget means that it may be more cost-effective for a large utility to undertake detailed analysis with respect to the optimal timing of a particular replacement activity than it would be for a smaller utility.
- Larger utilities will have more options for raising external capital.

Any process for ranking asset management practices at utilities needs to take into account these types of differences. Nevertheless, differences between large and small utilities should not be overstated:

- Smaller utilities should not have any more difficulty in using many new and innovative technologies. Many such technologies can be readily obtained from outside service contractors.
- Smaller utilities should work toward the same objectives (e.g. optimized life-cycle costing, high reliability, and high standards of safety). They may simply require less formalized processes to do so.

Smaller utilities can also be expected to work together within their peer group and with industry associations to gain economies of scale in carrying out certain functions. We found substantial evidence that such collaboration is common in the Ontario electricity distribution sector.

Approach to this Review

A first step in a review of this nature is to establish a reference against which practices can be assessed – some sort of standard, list of best practices, etc. There is at present no codified standard setting out asset management practices that has general acceptance. There is a British standard, commonly referred to as PAS-55, that provides a good framework[1]. However, it has not yet gained broad acceptance and is geared toward the very large enterprises with sophisticated management systems. Accordingly, based on our own experience in asset management, in the course of this review, we developed a maturity model as a framework for evaluating and describing the state of asset management practices at Ontario distributors. This model reflects the essential elements of PAS-55. The model is used to position utilities as "lagging", as at an "expected" level, or as "leading" with respect to their asset management processes. We then developed a composite assessment of the state of asset management practices at distribution utilities from three principal sources:

- We visited four utilities to understand their current processes for inspection, maintenance, capital planning, and financing.
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distributors. The survey results are provided in Appendix A and the questions in Appendix B.

See pages 18-21 for the results of this assessment.

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The 21 utilities contacted directly in the course of this work (4 utilities visited and 17 survey respondents) collectively represent over 74% of the retail customers in the electricity distribution sector and more than 81% of the total net assets as reported by all distributors as of December 31, 2007. Hence, our review process covers the majority of the Ontario distribution sector and provides a reasonable basis for assessing overall asset management practices.

Inspection

In our view, good utility practice requires that utilities make conscious and informed decisions about the level and frequency of inspection.

Among the utilities we visited, results of the inspection process are generally used to support maintenance and capital planning. Similarly, all utilities in the OEB staff survey reported that they use inspection results to inform decisions on maintenance levels and on the selection of projects (Question 2.4).

While additional inspection will almost always lead to improved information, the benefits of such information may not offset its additional costs. As such, making appropriate trade-offs between cost and performance is an important objective of the decision-making process. One utility in the survey process noted that it continually reviews its inspection performance with respect to the OEB's Distribution System Code ("DSC") while at the same time collecting data, reviewing best practices and reviewing related industry developments to make process adjustments where necessary.

Key Practices

Key practices we expected to find in our review are as follows:

- Inspection records should be available electronically and, ideally, integrated with the utility's Geographic Information System ("GIS"). This allows control room and other personnel to readily bring up the inspection records for any given asset, and to see spatial relationships with respect to outages, past inspection activities, and asset age and condition.
- Inspection results should be a major input to inform decisions on maintenance levels and requirements, and decisions on the selection of capital projects.

- There should be an audit or review to ensure that inspection processes are actually completed.

Utility Evaluation

All of the utilities examined in our interview process incorporated, for at least some assets, some of the practices of "leading" utilities in their inspection processes. Processes are also consistent with the requirements of the DSC. Taking into account their overall performance in this area, however, we believe that Ontario electricity distributors fall into the "expected" category. Among survey utilities, all report that inspections provide adequate warning of asset deterioration and that inspections assist in identifying major problems. Overall, respondents to the survey questionnaire incorporate many of the practices of leading utilities and, in general, appear to conduct inspection activities with appropriate diligence and care.

Maintenance

In our view, good utility practice requires that utilities make conscious and informed decisions about the level and frequency of maintenance. More maintenance is not necessarily better. It is entirely appropriate if a utility decides that a certain level of maintenance does not yield benefits that offset its costs, and chooses to scale back or reduce a particular maintenance activity. Examples where a utility has consciously decided to change its level of maintenance activity are as follows:

- A particular utility decided to eliminate insulator washing because it undertook an analysis that showed it had no reliability benefit under its particular circumstances. (This does not mean that insulator washing is not appropriate in other circumstances.)
- One utility discontinued its use of dry-ice cleaning for switching (or sectionalizing) enclosures. Its analysis showed that this cleaning did not yield reliability benefits. The utility did, however, increase its use of corona testing on the same equipment, since this testing was found to be a good predictor of future equipment failure

The key element of the situations above is that the management based its decisions on objective analysis of actual reliability results. Many distribution assets do not require regular maintenance and can simply be "run to failure".

Maintenance activities should ideally be linked to inspection results.

- Two utilities noted that the firms undertaking infra-red inspections provided them with a list of "hot-spots" for further investigation and review. This list was used to generate maintenance work orders.
- Visual line inspections undertaken to meet inspection guidelines in the DSC often lead directly to requests for additional vegetation control or for replacement of damaged or deteriorated line assets.

In some cases, inspection and maintenance activities are undertaken together. Interesting examples include the following:

- One utility has combined its processes for infra-red testing and dry-ice cleaning of substation switchgear. Infra-red testing is thus done immediately after dry-ice cleaning to identify the improvement obtained. When hot spots remain, the dry-ice cleaning can be immediately repeated until any problems are resolved. If repeated cleaning does not obtain an improvement in test results, then the asset can be tagged for further work or analysis.
- Contractors that are assigned to do insulator washing can carry out inspection of the overhead lines at the same time.

Among utilities in the OEB staff survey, all 17 reported that immediate dangers were addressed immediately (Question 3.15). Fifteen reported that maintenance activities are linked to inspection results and to plans for asset replacement, i.e. capital planning (Question 3.25).

As a matter of good practice, utilities should have some process, either formal or informal, for reviewing the causes of recent outages and for identifying corrective actions to reduce outage frequency in the future. The adequacy of such processes is a clear indicator of the quality of a utility's asset management processes. As many utility assets can provide service well beyond their expected service life, actual reliability data, rather than simply asset age is an important driver of actual maintenance and replacement expenditures.

Managers at each of the four utilities that we visited indicated that actual reliability experience was a major driver of their asset replacement decisions and that such data were used in preference to replacement cycles driven simply by asset age.

Sixteen of the 17 utilities in the OEB staff survey report that they keep track of historical outages sorted by codes by outage source (Question 3.27). Fourteen of these utilities report that they analyze detailed outage information (Question 3.19).

The Board has prescribed a series of codes for categorizing outages as to their sources. Distributors are required to keep historical records of outages sorted by these codes. We understand the OEB is also now gathering reliability statistics from distributors annually that exclude upstream loss of supply. Some years of data will be required to derive full value from this information.

We also expect that a well-managed utility will seek continuous improvement in its maintenance processes.

In the OEB staff survey, 16 of the 17 respondents report that they consider the applicability of new maintenance practices (Question 3.26). Fourteen of 17 utilities review the quality of maintenance activities (Question 1.18).

One utility in the OEB staff survey noted that the ease of evaluating maintenance effectiveness varies by activity: it is hard to evaluate the effectiveness of dry-ice cleaning, for example, but relatively easy to identify when additional tree-trimming is required (based on tree-related outages).

Key Practices

In the maintenance area, key practices are as follows:

- Utilities should have a process for reviewing the causes of outages, identifying corrective actions and using the results as input to the planning of maintenance activities.
- Utilities should have written standards to define in detail what specific procedures each maintenance activity entails. This helps ensure that maintenance is done consistently.
- Maintenance records should be available electronically and, ideally, integrated with the utility's GIS system.
- There should be some periodic check or review of the quality of maintenance that has been completed. This will ensure that utility standards are maintained.

Each of these practices was found among some or all of the utilities visited.

Utility Evaluation

Among utilities that we visited, maintenance actions are often driven by inspection reports. In some cases, inspection and maintenance activities are undertaken together.

Among the utilities visited, we were generally very impressed with the quality of maintenance processes. One utility clearly ranked as a "leading" utility in this area. While the remaining utilities also incorporated elements of leading practices, we ranked their overall performance at the high end of "expected" based on somewhat less consistency in the implementation of leading practices.

Based on the results of the survey questionnaire, there is good evidence that respondents in this broader group also incorporate many of the maintenance practices of leading utilities. More generally, it appears that survey participants conduct maintenance activities with appropriate diligence and care.

Capital Planning

Capital planning processes are those required to integrate the needs for renewal or development of the utility asset base with financial resource planning and acquisition. The work involves selecting appropriate projects, choosing the means for their execution (e.g., self-construct, contractor construction, etc), determining appropriate overall funding levels for all the utility projects and arranging the necessary financing (e.g., internally generated funds, borrowing, developer contributions, equity capital infusion).

For our discussion of the capital planning process, we have grouped our comments into the following subsections:

- Project Selection
- Project Delivery and Outcomes
- Overall Funding Levels

Project Selection

All utilities group their projects in some manner. This is required in order to organize and prioritize the work. Projects can also be grouped into "buckets" to reflect their different nature and priority. Buckets may include items such as:

- Those driven by safety or health concerns.
- Those driven by customer growth.
- Those driven by requirements imposed by other parties (e.g. legal / statutory).
- Those related to renewal or replacement that is needed to address concerns over asset deterioration (which, in turn, could lead to decreases in service quality or reliability).

In determining funding priorities, it must be recognized that only a portion of utilities' capital spending is discretionary. Non-discretionary items include the following:

- Utilities must immediately address any issues that pose an imminent safety concern.
- Utilities must meet all environmental, health, and safety regulations.
- Utilities must replace infrastructure when requested to do so by municipalities, for example because of road widening or road realignment.
- Utilities must immediately replace any assets that fail. While the overall level of such reactive expenditure can generally be predicted, events such as ice-storms or major equipment outages can significantly increase the amounts of funding required in a particular period.
- Utilities must meet their projected demand growth and they must provide connections to all new customers that request service. Thus, they must add new transformer station capacity in time to meet system load growth and provide the entire infrastructure associated with new individual connections. The timing of new customer growth cannot be predicted precisely, and is influenced by real estate and general market cycles.

Any capital budgeting process will require a mechanism for ranking all projects and thus to determine those that need to be scheduled immediately versus those that can be postponed or, perhaps, indefinitely deferred.

Our interview process suggests that major decisions on the ranking of capital projects largely occur through discussion amongst management personnel. In the group of utilities that we visited, utility managers generally believe that informed discussion by management personnel will yield better decisions than a mechanistic process with predetermined decision criteria and weights. A decision making process that provides for some management discretion can better account for differences among different types of projects and evolving priorities and objectives.

Given that many projects are non-discretionary, they are generally prioritized first with the remaining funds allocated among discretionary projects.

To facilitate the ranking processes discussed above and, more generally, as good management practice, any significant project should be supported by appropriate

documentation. Typically, this means that each project should have a business case that identifies the cost of the project and its expected benefits.

Eight of 17 utilities in the OEB staff survey report that each project in the capital plan includes business case documentation including problem statement, scope and cost of project, and justification and evaluation of project (Question 3.23). Twelve of 17 utilities reported that all potential future projects are listed in a central repository (Question 3.21).

Several utilities noted that spending on general plant (i.e. assets not directly associated with the distribution network) accounts for an increasing proportion of utility capital spending. In the early part of this decade, for example, utilities invested heavily in customer information and billing systems to facilitate retail market opening. Spending has now ramped up again to accommodate smart meters and associated IT infrastructure. This type of IT spending is not driven by the need for asset replacement and renewal but, rather, by external regulatory requirements and opportunities for innovation.

In addition, IT spending is driven by the need to replace and upgrade existing in-house systems on an ongoing basis, and the desire to integrate and automate more administrative processes, such as work-order management, inventory control and inspection and maintenance activities.

Because of the increased pressure for IT spending, there is a potential risk that this spending could "crowd out" spending on infrastructure repair and replacement. Generally, however, the utilities that we visited see many benefits from increased IT spending:

- GIS systems will facilitate spatial analysis of outage data and maintenance histories. This should allow utilities to improve the effectiveness of their inspection and maintenance processes
- Automated work order systems and project tracking software will allow better monitoring of actual capital costs. This will improve feedback in the capital delivery process.

In addition to IT systems and metering, general plant includes utilities' vehicle fleets and building assets, including offices and work centres.

For large utilities, we would expect that high-level demand forecasts and capital plans be prepared with a time horizon of 15 or more years. This includes, in particular, planning and designing new transmission substations, which are typically costly and difficult to site. The large utilities that we examined each put significant effort in planning for these major upgrades, and taking a long-term perspective on demand planning.

Two smaller utilities in the group of utilities that we visited suggested that a long-term planning horizon of more than 5 years is not useful in their circumstances. One noted that it is difficult to predict future growth in load in its service area (no long-term growth trend is evident). The other utility, which has had a stable and predictable growth rate, noted, however, that it is difficult to predict where new

growth will occur. This influences where new feeders and substations need to be installed.

Because of the variation in utility circumstances, it may be inappropriate to impose a defined frequency or horizon for capital planning. However, utility management should be required and able to defend the planning horizon that they adopt.

Ideally, assets should be replaced based on decline in their condition (and risk of failure) and their reliability performance. This will ensure that service quality issues are addressed but that replacement does not occur sooner than would be warranted. It thus ensures that the capital budget is efficient and effective. Paradoxically, however, replacement based on asset condition makes longer-term capital planning more difficult. When replacement is done on predetermined cycles, in contrast, future spending requirements can be more easily predicted.

This suggests that it is prudent to use a mixture of approaches that includes replacement of very old assets as a backstop or default approach to help stabilize long term maintenance cost planning.

The utilities in the group of utilities we visited clearly relied more on assessments of asset condition than on pre-set cycles in decisions on asset replacement. As noted above, the larger utilities had long-term plans with respect to the infrastructure upgrades needed to meet demand growth. However, they had not prepared long-term projections of potential replacement costs for all assets based on assumed replacement cycles, as was done by some utilities in support of their recent rate filings.

Project Delivery and Outcomes

While it is important for a utility to select the right projects in their capital budgeting process, utilities must also ensure that selected projects are completed on time and on budget. If actual project costs vary significantly from expected, the following problems result:

- The business case for the project may no longer be valid, since costs may exceed benefits.
- The utility's financing plan may need to be modified, or other projects scaled back, to deal with the cost variances.

Accordingly, we reviewed the processes at each utility for tracking cost and schedule variances. Each of the utilities that we visited undertakes some analysis of project cost variances. They also notify their Boards of Directors of significant variances that require a re-ordering of capital project schedules.

A key objective of asset management processes is to ensure that the utility maintains good service quality. Reliability is a key service quality metric.

In theory, utilities can assign a specific dollar value to customer outage minutes, and then use this value to take outage costs explicitly into account in their analyses of the benefit-cost of specific capital projects. Thus, for example, we have seen utilities assign a cost, from the customer's perspective, of $1 or $2 per lost kWh. This value

can be used to at least quantify the relative value of improvements in reliability and/or decreases in planned outage duration.

Based on our review, however, such explicit values play only a limited role in distributor capital planning. A more common approach is to rank projects in terms of the reliability improvement expected, often by creating a ratio that expresses the cost of the project per unit increase in expected reliability performance. (Thus, this ratio could be calculated by dividing the cost of the project by the expected impact of the project on, for example, the total number of customer outage minutes.) This provides a convenient means of identifying projects that have the greatest net benefit in terms of reliability.

Utilities do look at their overall level of reliability to assess whether overall system performance is adequate. Among the 17 utilities participating in the OEB staff survey, 14 report that they regularly hold staff meetings to discuss distribution network performance issues (Question 1.4).

Some utilities undertake periodic surveys of customer satisfaction. They use these surveys to assess whether their recent reliability performance, and their associated targets, are appropriate.

Outage statistics reflect both planned and unplanned outages. One utility noted that one limitation on its capital program was its ability to shut-down parts of the system to do repair and replacement activities. A big increase in repair and maintenance activities would cause its outage statistics to increase in the short-term and could cause customer dissatisfaction.

Commonly-used reliability statistics such as SAIDI, CAIDI, and SAIFI weight each customer equally in deriving overall performance indicators. Thus, one minute of outage to a residential customer is equal to a minute of outage at a large industrial plant. Two utilities in the group of utilities we visited noted this as a problem.

Load-weighted reliability measures are available and one utility in our group had investigated implementing some such measures on a go-forward basis. This utility noted, however, that such measures suffer from the following disadvantages:

- Because they have not been commonly used, there is limited benchmark data available for comparison.
- They are more difficult to calculate, since they require data on individual customer loads. These data are often not available.

Nevertheless, a number of utility engineers noted that it is conceptually attractive to take the size of load into account. This is particularly true since it is likely that large customers, such as industrial plants and data centres, will be more sensitive to supply outages. Large customers also account for more of the utility's load and revenue base.

Although outages to large customers may arguably be under-weighted in current reliability statistics, utility managers nevertheless do pay significant attention to large customers' needs in their capital planning processes.

The OEB staff survey asked a number of questions related to risk assessment.

Four of 17 utilities reported that they have a formalized process for risk assessment related to asset management (Question 3.11). Three of these utilities fall into the top quartile in terms of size.

Responses to other questions related to risk assessment are as follows:

- Eight companies report that they consider all aspects of risks related to AM, including assets, skills, resources and logistics (Question 3.12)
- At 14 companies, risk assessment is performed jointly with Engineering and Lines and Operations staff (Question 3.13)
- Ten companies perform risk assessment at least annually (Question 3.14).

Overall Funding Level

Among utilities visited, the initial target budget as determined by "top-down" analysis is compared to the total cost of projects that are put forward for consideration by company management and engineering personnel ("bottom-up" analysis). The list of projects is then adjusted, often downward, to fit within the target spending envelope.

We found that utilities generally group projects appropriately by cost driver and in consideration of whether or not the work is discretionary.

Utility managers are increasingly relying on Asset Condition Assessments (or ACAs) in order to gauge the appropriate level of spending on pro-active replacement and repair. The three larger utilities visited noted either that ACA's had been an important input to their spending decisions in the past and/or that they were looking to commission ACA's in the near future. ACA's were also submitted by a number of utilities in the OEB's recent process for setting 2008 rates.

Because age (and book value) is not necessarily a good predictor of required replacement, an asset condition assessment helps to refine replacement spending based on actual asset condition. It thus avoids premature or unwarranted replacement or, conversely, the neglect of emerging problems.

Among participants in the OEB staff survey, 12 report that they have performed asset condition assessment on their assets (Question 3.4). Among these 12, one noted that it has performed asset condition assessments on equipment where it has determined that there is a practical use for the information.

Key Practices

In the capital planning area overall key practices are:

- A structured approach for identifying, costing and determining the relative importance of potential capital works projects. The structured approach takes into account reliability information (e.g., outage information, worst performing circuits, etc), as well as age of equipment, inspection and maintenance results;
- A process of Asset Condition Assessment ("ACA") the results of which are integrated into the capital expenditure planning process. An ACA provides a

more defensible basis for estimating future replacement expenditures than a planned replacement program based only on asset age. Age by itself is not a sufficient predictor of the need for replacement;

- A financial planning process that identifies the available sources of funds that can be devoted to capital work in accordance with a target capital structure and long-term strategies of the utility. This includes a rational approach for determining developer contributions that can be consistently applied;
- A process for integrating the needs for capital work with the available funds. This commonly involves a trade-off between the "bottom-up" approach of identifying and accumulating the desired projects and a "top-down" approach of reconciling the needed projects with the available capital funds in a manner that makes appropriate risk trade-offs; and
- A reasonable level of documentation of the options considered, including appropriate individual business cases, and decisions made during the trade-off process that inevitably occurs.
- Utility has adequate project tracking process in place to ensure that selected projects are completed on time and on budget.

Utility Evaluation

Among the utilities visited, we found that one clearly fulfills the requirements of a leading utility will respect to project selection within the capital planning process. We were also favourably impressed with project selection processes at the other three utilities, although we ranked them overall in the expected category.

We ranked all of the utilities in the expected category with respect to project delivery. All of the utilities used outside contractors and had good rationale to support their choices. They did not rank as leading utilities only because it was not clear that they had optimized these choices after taking into account the financial contributions by developers.

Each of the four utilities visited met the requirements to be classified in the expected category with respect to processes for developing their funding levels.

It was also evident from the questionnaire that many respondents report incorporating elements of leading practice, reinforcing our observations from the site visits and corroborating an assessment of these attributes at the expected level of maturity. It is of note that, notwithstanding being at the expected level, there is a range of practices among respondents with respect to the development of asset management strategies, policies and plans.

Capital Financing

To support their capital plans, organizations require access to sufficient capital at a reasonable cost. There is often a trade-off between the availability of capital and the level of capital spending. Organizations must balance their total capital spend with their availability of funds.

The process of maintaining a target debt to equity ratio determines the amount of capital spending in excess of funds generated from operations (including depreciation) that need to be funded by net new debt or new equity.

Key Practices

In the capital financing area, key practices are as follows:

- It is generally good practice for companies to adopt a formal dividend policy. Such a policy identifies expected dividend levels, generally in reference to book net income or past dividend payments. Formal policies can help ensure that municipal owners have income expectations that are consistent with utility financial capability and plans.
- Utilities should prepare long-range forecasts of cash flow, taking into account their spending plans and the OEB's expected rate setting process.
- Utilities should ensure that they properly evaluate the costs and risks of alternative funding sources.
- Utilities should consider and model the potential impact of changes in the economic environment on their financing plans and costs.

Utility Evaluation

In making financing choices, utilities generally try to maintain a debt/equity ratio that is consistent with the OEB's deemed capital structure.

Utilities realize to varying degrees that, while cash generated from the depreciation amounts that are included in rates can be readily justified for use in funding replacement plant, depreciation expense bears no real relationship to capital spending requirements. For instance, most seem to realize depreciation does not reflect the needs for system growth or replacement cost.

Utilities in the group visited typically adjust their equity balances by adjusting their dividend payout ratios. Equity balances will grow over time by retained earnings. None of the utilities we observed had received new equity injections in the recent past.

Management at several utilities emphasized that the success of their capital planning process is dependent on the support and approval of their Boards of Directors and of the municipal shareholder. This support has helped these utilities retain sufficient income for re-investment in their physical plant.

Each of the utilities visited met all of the requirements of an expected utility with respect to financing plans. Three of the four utilities clearly incorporate some elements of leading practice.

Information Management Processes

Our review suggests the GIS is a key enabler of asset management processes and when implemented, is generally at the centre of utility asset data. Such systems typically hold most of a utility's data on its assets, and help to control the processes that affect those assets. Information systems support each of the processes of inspection, maintenance, capital planning and financing. Further, they can help to integrate these processes by providing a common base of asset data and a conduit for the exchange of information across functional departments.

The state of a utility's GIS is thus an indicator of the ability of a utility's information systems to support good asset management practices. Several utilities that we visited were in the process of implementing new GIS systems, and this was a significant focus of their IT effort in the operations area.

Among utilities in the OEB staff survey, 5 (29%) report that there is a linkage between the company's asset records and GIS, including mapping for locations, fault monitoring etc. (Question 3.10).

Only 1 utility in the OEB staff survey reported that maintenance records are integrated with the company's GIS system (Question 3.29). Among utilities reporting that maintenance records are *not* integrated, we note the following:

- For one utility, the GIS system has recently been activated and ongoing integration of functions is ongoing. The long term plan is to have maintenance and inspection records integrated with GIS.
- Another large utility noted that it has chosen to document all of its maintenance activities outside its existing GIS and leverage the better capabilities of its existing ERP system.

System Control and Data Acquisition ("SCADA") systems are used by utilities to operate their systems in real time. These are remote terminal units used to monitor and control equipment from a central location. SCADA systems provide instantaneous information on the power flows within the distribution network and on the status of associated equipment, including switches and transformers. Utility operators use SCADA systems to control and monitor the flow of power, to operate automated switches, and to direct utility field personnel.

Like GIS, SCADA systems are an important means to enhance reliability. If operators monitor the system around-the-clock, they can respond quickly to emerging problems. Further, automation (e.g. remotely controlled switches) allows utilities to restore power more quickly and minimize outage duration. Outage and usage data collected by SCADA systems can feed into, or be otherwise integrated with, the GIS system. Utility managers noted that this will facilitate analysis of reliability issues.

Three of the utilities in the group we visited had made, or were in the process of making, upgrades to their SCADA systems and control rooms. Utility managers noted that these upgrades were a major component of their reliability initiatives. The smallest utility visited does not have a SCADA system: management believes that the cost of such a system cannot be justified given its size. The utility has only four switches and does not believe that automating them is appropriate. The utility does

monitor feeder currents instantaneously and can view prior day demand peaks via access to wholesale metering data.

Fifteen (88%) of the 17 companies in the OEB staff survey report that they have a SCADA system. Of the remaining two, one with a largely rural service territory notes that its distribution system is mainly radial in design. There is little redundancy in supply to customers and thus limited opportunity to switch to alternative supply paths. Hence, most failures require immediate repair to restore service. This utility also noted that smart meters currently being installed may be able to provide some of the functionality of a SCADA system (such as outage reporting) at lower cost. The other utility responding negatively noted that it does monitor its Hydro One wholesale supply points, even though it does not have a full SCADA system.

Key Practices

Key practices in the area of information systems are as follows:

- Asset data should be readily accessible by all engineering and operating personnel, so that these data can inform their decisions on operating and design matters and their efforts to improve network performance.
- Utilities should implement a GIS system to identify the geographic location of all of their assets and to integrate all of their data on network assets. This system should thus incorporate or provide access to information on physical and technical specifications, inspection and maintenance history, outage data and asset condition.
- Paper-based processes are eliminated to the extent possible and all information systems are integrated, facilitating the sharing of information through electronic data-bases and avoiding duplication of data-entry and of data-sets.
- Management and Executive have regular access to integrated information and reports regarding asset management activities and outcomes.

Utility Evaluation

All of the utilities that we visited incorporated some elements of leading practice and they had clear plans for improving their information systems moving forward. We would rank them in the expected category. Responses to the OEB staff survey suggest that survey respondents are working towards many of the practices outlined in our matrix for leading utilities. Overall, there appears to be good consensus on appropriate practices in the IT area.

Overall Summary Assessment

Except for the smallest electricity distributors in Ontario, which we did not consider in the scope of our review, we were generally satisfied that the asset management practices by distributors are at the "expected" level of maturity. In general, while there is variability in practices, distributors are applying appropriate care and diligence in their asset management practices. While we noted areas for improvement, management at each of the four utilities visited, for the most part, focused on the right issues with respect to their assets and had identified and were

working towards enhancements in key areas. We do not have any concern that the utilities visited are failing to address important safety or reliability issues. The results of the survey also provide comfort with respect to the state of asset management practices at Ontario distributors.

Maturity Model

The maturity model explained in this report, which covers each of the processes of inspection, maintenance, capital planning, capital financing, and information management systems, summarizes our overall assessment and is provided in the table below. The shaded cells correspond to where we think the utilities lie based on our visits, our review of utility filings on asset management, and the results of the survey questionnaire.

Inspection	
Lagging	- Inspection processes are unclear. - Poor documentation of inspection results. - Process has failed to identify major system problems.
Expected	- Follows OEB guidelines as identified in the DSC and other related documents. - Has written standards for inspection processes. - Inspection results are documented in a timely manner. - Inspection results are a major input to inform decisions on maintenance levels and decisions on the selection of capital projects. - Some inspection findings are audited to ensure consistency of results. - Inspection process provides adequate warning of asset deterioration.
Leading	- Considers OEB guidelines as identified in the DSC and other related documents and adjusts based on past experience, industry data and cost/benefit. - Utility has reliable and readily accessible information on the condition of all of its assets. - Utility has evaluated leading edge inspection processes (infra-red, corona testing) and applies them if appropriate.

Maintenance	
Maintenance	
Lagging	- No formal maintenance plans or standards. - Poor documentation of actual maintenance activities. - It is not clear that maintenance processes are applied consistently.
Expected	- Utility has written standards outlining the timing and content of the maintenance to be undertaken for each type of asset. - Actual maintenance activities are documented in a timely fashion. - Maintenance history for major assets is readily available. - At a minimum, utility follows manufacturers' recommendations. - Utility has a formal process for following up and investigating the causes of major outages, and for finding ways to reduce outages in the future.
Leading	- Maintenance activities are linked to inspection results and to plans for asset replacement (i.e. capital planning). - Utility adjusts maintenance levels and timing based on past experience and/or formal analyses of cost/benefit. - Utility may adjust maintenance levels and timing for certain sub-sets of assets based on their condition, location, and/or equipment loading. - Utility considers applicability of new maintenance practices (e.g. dry-ice cleaning)

Capital Planning – Project Selection	
Lagging	- Utility has little documented support for its selection of projects for funding. - There is evidence that the utility has failed to address or anticipate key safety or reliability issues.
Expected	- Utility prepares a capital plan over at least a medium-term horizon (5-10 years). - Utility has documentation to support the projects that it selects for funding. - Utility has a rational basis for grouping and prioritizing capital projects. - Utility ensures that risks to the health and safety of the public and its employees are adequately addressed. - A process of Asset Condition Assessment is followed, the results of which are integrated into the capital expenditure planning process.
Leading	- Utility has a long-term planning horizon (>10 years for major assets). - Utility has a defensible and rigorous process for selecting the projects to be undertaken. - If appropriate for the size of the utility, individual projects are supported by formal criteria ranking or a business case. - Each project has a clearly defined rationale or deliverable with respect to performance improvement. - Utility explicitly considers customer outage costs and reliability targets in its project evaluation framework. - Planning process is linked to the utility's Strategic Plan.

Capital Planning – Delivery Mechanism	
Lagging	- Utility has not examined alternative methods of project delivery (e.g. external contracting versus internal resources).
Expected	- Utility has considered alternative delivery mechanisms (contracting-out, Design-Build, lease arrangements) to meet fluctuations in work-load or to improve performance or reduce cost. - Utility has adequate project tracking process in place to ensure that selected projects are completed on time and on budget.
Leading	- Utility has a good idea of the relative costs of alternative delivery methods and optimizes the use of various methods.

Capital Planning – Overall Funding Level	
Lagging	- Capital budget is set based primarily on past spending levels or cash available.
Expected	- Utility considers, at least informally, a variety of perspectives (past spending, internal delivery capability, external benchmarks, and project listing) in setting its overall capital budget. - Budgets are formally reviewed by the Board. - Variances from budget are reviewed and analyzed.
Leading	- Utility formally considers and documents a variety of perspectives (past spending, internal delivery capability, external benchmarks, and project listing) in setting its overall capital budget. - Utility can justify that its level of spending is optimum over the long-term based on all relevant considerations (customer growth, asset age and condition, safety, reliability, and minimization of life-cycle costs). - Utility has "buy-in" from important stakeholders in its spending levels.

Capital Financing	
Lagging	- Utility funding requirements are not predicted in advance. - Past capital spending plans have been constrained by lack of funding availability or poor planning.
Expected	- Utility anticipates future funding requirements, and makes sure cash is available when required. - When new debt is required, utility ensures that this is obtained at low cost.
Leading	- Utility has a clear plan for financing, which considers its target capital structure, shareholder expectations for dividends, and the costs of borrowing (including issuing costs). - Financing plan provides some diversification with respect to debt term and structure of interest (fixed versus variable). Risks are managed appropriately through swaps or other methods. - Utility has evaluated non-traditional sources of financing, such as leases, receivables financing, etc. - Any deviations from the utility's deemed capital structure are explicitly modeled and justified.

Information Management Processes	
Lagging	- Most asset data are still in hard-copy form. - IT systems are dated and are no longer supported by their vendors. - The utility does not have a plan for maintaining and upgrading its IT systems. - There is limited integration of data across functional areas. - GIS and SCADA systems have not been implemented. - Financial systems cannot readily provide variance information with respect to individual projects or utility financial results.
Expected	- The utility has, or is in the process of implementing, a GIS to facilitate analysis of network performance and to help in project planning. - If appropriate to its size, the utility has implemented a SCADA system to facilitate network operations. - Variance analysis is available on a timely basis for projects and for utility financial results. - New information with respect to assets is captured electronically, even though historical data may still be in hard copy form. - The utility has a documented plan for its IT systems and how they will evolve over the next 5+ years to keep abreast of industry developments.
Leading	- The utility has a GIS that shows the complete network and that incorporates all relevant asset information, facilitating the analysis of outage data on a geographic basis. - Inspection, maintenance and asset records are stored electronically and readily available to operating and engineering personnel. - Field personnel have remote access to utility information systems. - Asset information is updated close to real time, and manual data input is avoided.

Appendix A

Survey Results

Appendix A – Survey Results

In this Appendix, we provide detailed results from the OEB survey on asset management practices.

1. Implementation and Operations

	QUESTIONS	All 17		Large** 9		Medium** 7		Small** 1	
		YES	NO	YES	NO	YES	NO	YES	NO
1.1	Has the company established performance targets (e.g. reliability factors, operational efficiency, health and safety, customer service) for the distribution network to measure the progress and effectiveness of its AM system?	11 (65%)	6 (35%)	8 (89%)	1 (11%)	3 (43%)	4 (57%)	0 (0%)	1 (100%)
1.2	Is responsibility assigned to each level for management for achieving the performance targets?	13 (76%)	4 (24%)	9 (100%)	0 (0%)	4 (57%)	3 (43%)	0 (0%)	1 (100%)
1.3	Are AM related accountabilities integrated with the performance measurement system at all levels?	10 (59%)	7 (41%)	8 (89%)	1 (11%)	2 (29%)	5 (71%)	0 (0%)	1 (100%)
1.4	Are meetings held regularly to discuss distribution network performance issues?	14 (82%)	3 (18%)	9 (100%)	0 (0%)	5 (71%)	2 (29%)	0 (0%)	1 (100%)
1.5	Are historical outage records and outage source considered in AM decisions (e.g. records of outages categorized by Board prescribed codes as to their sources)?	16 (94%)	1 (6%)	9 (100%)	0 (0%)	6 (86%)	1 (14%)	1 (100%)	0 (0%)
1.6	Does the company have documented AM procedures in place, and have they been communicated to the responsible staff.	6 (35%)	11 (65%)	4 (44%)	5 (56%)	2 (29%)	5 (71%)	0 (0%)	1 (100%)
1.7	Does the company ensure that asset condition information is accurately recorded and available to the responsible staff.	12 (71%)	5 (29%)	8 (89%)	1 (11%)	4 (57%)	3 (43%)	0 (0%)	1 (100%)
1.8	Are capital and maintenance plans updated on an ongoing basis as new developments occur?	17 (100%)	0 (0%)	9 (100%)	0 (0%)	7 (100%)	0 (0%)	1 (100%)	0 (0%)
1.9	Does the company conduct performance reviews of staff responsible for AM?	15 (88%)	2 (12%)	9 (100%)	0 (0%)	6 (86%)	1 (14%)	0 (0%)	1 (100%)

* Questions 3.6, 3.10, 3.16a, 3.16b, 3.24f, 5.1, and 5.2 only receive answers from 16 of the 17 respondents.
* Questions 6.1 only receive answers from 14 of the 17 respondents.
** Large = 1st Quartile; Medium = 2nd Quartile; Small = 3rd Quartile

	QUESTIONS	All 17		Large** 9		Medium** 7		Small** 1	
		YES	NO	YES	NO	YES	NO	YES	NO
1.10	Does the company use external links for leading practices to new technologies, practices and network performance?	14 (82%)	3 (18%)	8 (89%)	1 (11%)	6 (86%)	1 (14%)	0 (0%)	1 (100%)
1.11	Does the company regularly evaluate leading edge inspection processes (e.g. infrared testing) and apply them if appropriate?	17 (100%)	0 (0%)	9 (100%)	0 (0%)	7 (100%)	0 (0%)	1 (100%)	0 (0%)
1.12	Does the company have a methodology for forecasting future capacity requirements, and is the effectiveness of forecasting reviewed on a regular basis?	13 (76%)	4 (24%)	7 (78%)	2 (22%)	6 (86%)	1 (14%)	0 (0%)	1 (100%)
1.13	Does the company have a Geographic Information System (GIS) to facilitate analysis of network performance and help in project planning?	16 (94%)	1 (6%)	8 (89%)	1 (11%)	7 (100%)	0 (0%)	1 (100%)	0 (0%)
1.14	Are the company's inspection and maintenance records integrated with its GIS system?	4 (24%)	13 (76%)	2 (22%)	7 (78%)	2 (29%)	5 (71%)	0 (0%)	1 (100%)
1.15	Does the company have a SCADA system to facilitate its network operations?	15 (88%)	2 (12%)	9 (100%)	0 (0%)	6 (86%)	1 (14%)	0 (0%)	1 (100%)
1.16	Are routine inspection and maintenance activities performed documented in a timely manner?	17 (100%)	0 (0%)	9 (100%)	0 (0%)	7 (100%)	0 (0%)	1 (100%)	0 (0%)
1.17	Are maintenance and inspection records available to staff electronically?	10 (59%)	7 (41%)	8 (89%)	1 (11%)	2 (29%)	5 (71%)	0 (0%)	1 (100%)
1.18	Does the company review the quality of maintenance activities?	14 (82%)	3 (18%)	8 (89%)	1 (11%)	5 (71%)	2 (29%)	1 (100%)	0 (0%)
1.19	Does the company link the maintenance activities to inspection results and plans for asset replacement?	16 (94%)	1 (6%)	8 (89%)	1 (11%)	7 (100%)	0 (0%)	1 (100%)	0 (0%)

* Questions 3.6, 3.10, 3.16a, 3.16b, 3.24f, 5.1, and 5.2 only receive answers from 16 of the 17 respondents.
* Questions 6.1 only receive answers from 14 of the 17 respondents.
** Large = 1st Quartile; Medium = 2nd Quartile; Small = 3rd Quartile

2. Checking and Corrective Action

	QUESTIONS	All 17		Large 9		Medium 7		Small 1	
		YES	NO	YES	NO	YES	NO	YES	NO
2.1	Is the adequacy of inspection process reviewed periodically?	12 (71%)	5 (29%)	7 (78%)	2 (22%)	4 (57%)	3 (43%)	1 (100%)	0 (0%)
2.2	Do inspections provide adequate warning of asset deterioration?	17 (100%)	0 (0%)	9 (100%)	0 (0%)	7 (100%)	0 (0%)	1 (100%)	0 (0%)
2.3	Do inspections assist in identifying major problems?	17 (100%)	0 (0%)	9 (100%)	0 (0%)	7 (100%)	0 (0%)	1 (100%)	0 (0%)
2.4	Does the company use inspection results to inform decisions on maintenance levels and requirements and on the selection of projects?	17 (100%)	0 (0%)	9 (100%)	0 (0%)	7 (100%)	0 (0%)	1 (100%)	0 (0%)
2.5	Are OEB inspection guidelines adjusted based on past experience, industry data, and cost/benefit analysis?	11 (65%)	6 (35%)	6 (67%)	3 (33%)	5 (71%)	2 (29%)	0 (0%)	1 (100%)
2.6	Are key performance indicators for critical assets in place (e.g. service/supply standards, reliability, availability, maintainability, customer satisfaction, safety, legislative compliance etc.)?	9 (53%)	8 (47%)	6 (67%)	3 (33%)	3 (43%)	4 (57%)	0 (0%)	1 (100%)
2.7	Are service quality indicators reviewed regularly to ensure that service level is acceptable, and appropriate action is taken?	14 (82%)	3 (18%)	9 (100%)	0 (0%)	5 (71%)	2 (29%)	0 (0%)	1 (100%)
2.8	Are AM process audits conduced to ensure that the process in consistent with the strategy and policy?	2 (12%)	15 (88%)	2 (22%)	7 (78%)	0 (0%)	7 (100%)	0 (0%)	1 (100%)
2.9	Does the company use a specific industry standard for its AM process (e.g. PAS 55, ISO)?	3 (18%)	14 (82%)	0 (0%)	9 (100%)	3 (43%)	4 (57%)	0 (0%)	1 (100%)

* Questions 3.6, 3.10, 3.16a, 3.16b, 3.24f, 5.1, and 5.2 only receive answers from 16 of the 17 respondents.
* Questions 6.1 only receive answers from 14 of the 17 respondents.
** Large = 1st Quartile; Medium = 2nd Quartile; Small = 3rd Quartile

3. Asset Management Information, Risk Assessment and Planning

	QUESTIONS	All 17		Large 9		Medium 7		Small 1	
		YES	NO	YES	NO	YES	NO	YES	NO
3.1	Does the company have a complete inventory of its assets?	16 (94%)	1 (6%)	9 (100%)	0 (0%)	6 (86%)	1 (14%)	1 (100%)	0 (0%)
3.2	Has the company identified all asset categories?	15 (88%)	2 (12%)	8 (89%)	1 (11%)	6 (86%)	1 (14%)	1 (100%)	0 (0%)
3.3	Have assets been identified as critical or non-critical?	7 (41%)	10 (59%)	5 (56%)	4 (44%)	1 (14%)	6 (86%)	1 (100%)	0 (0%)
3.4	Has the company performed asset condition assessment on its assets?	12 (71%)	5 (29%)	8 (89%)	1 (11%)	4 (57%)	3 (43%)	0 (0%)	1 (100%)
3.5	Is the life expectancy of assets known?	15 (88%)	2 (12%)	8 (89%)	1 (11%)	6 (86%)	1 (14%)	1 (100%)	0 (0%)
3.6*	Is the asset performance information available?	11 (69%)	5 (31%)	9 (100%)	0 (0%)	2 (33%)	4 (67%)	0 (0%)	1 (100%)
3.7	Is location of each asset known?	17 (100%)	0 (0%)	9 (100%)	0 (0%)	7 (100%)	0 (0%)	1 (100%)	0 (0%)
3.8	Do the company asset records maintained include incident and event information?	9 (53%)	8 (47%)	6 (67%)	3 (33%)	3 (43%)	4 (57%)	0 (0%)	1 (100%)
3.9	Are inspection results entered into the asset records on a timely basis?	12 (71%)	5 (29%)	8 (89%)	1 (11%)	4 (57%)	3 (43%)	0 (0%)	1 (100%)
3.10*	Is there a linkage between the company's asset records and Geographical Information System including mapping for locations, fault monitoring etc.?	5 (31%)	11 (69%)	3 (33%)	6 (67%)	2 (33%)	4 67%)	0 (0%)	1 (100%)
3.11	Does the company have a formalized process for risk assessment related to asset management?	4 (24%)	13 (76%)	3 (33%)	6 (67%)	1 (14%)	6 (86%)	0 (0%)	1 (100%)
3.12	Does the company consider all aspects of risks related to AM, including assets, skills, resources, and logistics?	8 (47%)	9 (53%)	6 (67%)	3 (33%)	1 (14%)	6 (86%)	1 (100%)	0 (0%)
3.13	Is risk assessment performed jointly with Engineering and Lines and Operations staff?	14 (82%)	3 (18%)	9 (100%)	0 (0%)	5 (71%)	2 (29%)	0 (0%)	1 (100%)
3.14	Is risk assessment performed at least annually?	10 (59%)	7 (41%)	8 (89%)	1 (11%)	2 (29%)	5 (71%)	0 (0%)	1 (100%)

* Questions 3.6, 3.10, 3.16a, 3.16b, 3.24f, 5.1, and 5.2 only receive answers from 16 of the 17 respondents.
* Questions 6.1 only receive answers from 14 of the 17 respondents.
** Large = 1st Quartile; Medium = 2nd Quartile; Small = 3rd Quartile

	QUESTIONS	All 17		Large 9		Medium 7		Small 1	
		YES	NO	YES	NO	YES	NO	YES	NO
3.15	Are immediate dangers addressed immediately?	17 (100%)	0 (0%)	9 (100%)	0 (0%)	7 (100%)	0 (0%)	1 (100%)	0 (0%)
3.16*	Do the risk assessment results feed the company's:								
o	Capital plan?	14 (88%)	2 (13%)	9 (100%)	0 (0%)	4 (67%)	2 (33%)	1 (100%)	0 (0%)
o	Maintenance plan?	14 (88%)	2 (13%)	9 (100%)	0 (0%)	4 (67%)	2 (33%)	1 (100%)	0 (0%)
3.17	Does the company have a "run-to-failure" policy that differentiates critical assets from non-critical assets?	4 (24%)	13 (76%)	3 (33%)	6 (67%)	1 (14%)	6 (86%)	0 (0%)	1 (100%)
3.18	Has the company performed a system wide risk assessment related to its:								
o	Overhead lines assets?	7 (41%)	10 (59%)	5 (56%)	4 (44%)	2 (29%)	5 (71%)	0 (0%)	1 (100%)
o	Underground cables?	6 (35%)	11 (65%)	4 (44%)	5 (56%)	2 (29%)	5 (71%)	0 (0%)	1 (100%)
o	Substations?	9 (53%)	8 (47%)	6 (67%)	3 (33%)	2 (29%)	5 (71%)	1 (100%)	0 (0%)
3.19	Is detailed outage information analyzed?	14 (82%)	3 (18%)	8 (89%)	1 (11%)	5 (71%)	2 (29%)	1 (100%)	0 (0%)
3.20	Does the company's capital plan include all identified future projects?	12 (71%)	5 (29%)	6 (67%)	3 (33%)	5 (71%)	2 (29%)	1 (100%)	0 (0%)
3.21	Are all potential future projects listed in a central repository?	12 (71%)	5 (29%)	7 (78%)	2 (22%)	4 (57%)	3 (43%)	1 (100%)	0 (0%)
3.22	Does the capital plan reflect the overall strategy for replacing aging assets?	14 (82%)	3 (18%)	7 (78%)	2 (22%)	6 (86%)	1 (14%)	1 (100%)	0 (0%)
3.23	Does each project on the capital plan include business case documentation including problem statement, scope and cost of project, and justification and evaluation of project?	8 (47%)	9 (53%)	7 (78%)	2 (22%)	1 (14%)	6 (86%)	0 (0%)	1 (100%)

* Questions 3.6, 3.10, 3.16a, 3.16b, 3.24f, 5.1, and 5.2 only receive answers from 16 of the 17 respondents.
* Questions 6.1 only receive answers from 14 of the 17 respondents.
** Large = 1st Quartile; Medium = 2nd Quartile; Small = 3rd Quartile

	QUESTIONS	All 17		Large 9		Medium 7		Small 1	
		YES	NO	YES	NO	YES	NO	YES	NO
3.24*	Do any of the following factors influence your company's capital budget decisions?								
	• Past spending on capital projects	15 (88%)	2 (12%)	8 (89%)	1 (11%)	6 (86%)	1 (14%)	1 (100%)	0 (0%)
	• Level of depreciation expense	9 (53%)	8 (47%)	4 (44%)	5 (56%)	5 (71%)	2 (29%)	0 (0%)	1 (100%)
	• Target capital structure	8 (47%)	9 (53%)	4 (44%)	5 (56%)	4 (57%)	3 (43%)	0 (0%)	1 (100%)
	• External benchmarks	7 (41%)	10 (59%)	4 (44%)	5 (56%)	3 (43%)	4 (57%)	0 (0%)	1 (100%)
	• Ability to complete or deliver capital projects	14 (82%)	3 (18%)	7 (78%)	2 (22%)	7 (100%)	0 (0%)	0 (0%)	1 (100%)
	• Other (please list below under Utility's Comments section).	8 (50%)	8 (50%)	6 (67%)	3 (33%)	2 (33%)	4 (67%)	0 (0%)	1 (100%)
3.25	Are maintenance activities linked to inspection results and to plans for asset replacement (i.e. capital planning)?	15 (88%)	2 (12%)	8 (89%)	1 (11%)	6 (86%)	1 (14%)	1 (100%)	0 (0%)
3.26	Does the company consider applicability of new maintenance practices (e.g. dry-ice cleaning)?	16 (94%)	1 (6%)	8 (89%)	1 (11%)	7 (100%)	0 (0%)	1 (100%)	0 (0%)
3.27	Does the company keep track of historical outages sorted by codes by outage source?	16 (94%)	1 (6%)	9 (100%)	0 (0%)	6 (86%)	1 (14%)	1 (100%)	0 (0%)
3.28	Are actual maintenance activities documented in a timely manner into the asset records?	12 (71%)	5 (29%)	8 (89%)	1 (11%)	4 (57%)	3 (43%)	0 (0%)	1 (100%)
3.29	Are maintenance records integrated with the company's GIS system?	1 (6%)	16 (94%)	1 (11%)	8 (89%)	0 (0%)	7 (100%)	0 (0%)	1 (100%)

* Questions 3.6, 3.10, 3.16a, 3.16b, 3.24f, 5.1, and 5.2 only receive answers from 16 of the 17 respondents.
* Questions 6.1 only receive answers from 14 of the 17 respondents.
** Large = 1st Quartile; Medium = 2nd Quartile; Small = 3rd Quartile

4. Asset Management Policy and Strategy

	QUESTIONS	All		Large		Medium		Small	
		17		9		7		1	
		YES	NO	YES	NO	YES	NO	YES	NO
4.1	Does the company have a documented AM strategy?	7 (41%)	10 (59%)	5 (56%)	4 (44%)	2 (29%)	5 (71%)	0 (0%)	1 (100%)
4.2	Does the company have clearly stated and documented AM objectives in place?	6 (35%)	11 (65%)	5 (56%)	4 (44%)	1 (14%)	6 (86%)	0 (0%)	1 (100%)
4.3	Does the company ensure that its AM strategy is consistent with its:								
	• Strategic plan?	10 (59%)	7 (41%)	7 (78%)	2 (22%)	3 (43%)	4 (57%)	0 (0%)	1 (100%)
	• Priorities?	11 (65%)	6 (35%)	7 (78%)	2 (22%)	4 (57%)	3 (43%)	0 (0%)	1 (100%)
	• Asset condition requirements?	11 (65%)	6 (35%)	7 (78%)	2 (22%)	4 (57%)	3 (43%)	0 (0%)	1 (100%)
	• Health and Safety values?	11 (65%)	6 (35%)	7 (78%)	2 (22%)	4 (57%)	3 (43%)	0 (0%)	1 (100%)
	• Environmental position?	11 (65%)	6 (35%)	7 (78%)	2 (22%)	4 (57%)	3 (43%)	0 (0%)	1 (100%)
	• Continual improvement needs?	10 (59%)	7 (41%)	7 (78%)	2 (22%)	3 (43%)	4 (57%)	0 (0%)	1 (100%)
4.4	Is the company's capital planning process linked to its strategic plan?	14 (82%)	3 (18%)	9 (100%)	0 (0%)	5 (71%)	2 (29%)	0 (0%)	1 (100%)
4.5	Does the company's capital plan consider all assets?	17 (100%)	0 (0%)	9 (100%)	0 (0%)	7 (100%)	0 (0%)	1 (100%)	0 (0%)
4.6	Is the company's capital plan for less than 10 years?	12 (71%)	5 (29%)	6 (67%)	3 (33%)	5 (71%)	2 (29%)	1 (100%)	0 (0%)
4.7	Does the company have a documented AM policy in place?	4 (24%)	13 (76%)	3 (33%)	6 (67%)	1 (14%)	6 (86%)	0 (0%)	1 (100%)
4.8	Has the policy been communicated to Managers, employees, stakeholders and understood and accepted by them?	4 (24%)	13 (76%)	3 (33%)	6 (67%)	1 (14%)	6 (86%)	0 (0%)	1 (100%)

* Questions 3.6, 3.10, 3.16a, 3.16b, 3.24f, 5.1, and 5.2 only receive answers from 16 of the 17 respondents.
* Questions 6.1 only receive answers from 14 of the 17 respondents.
** Large = 1st Quartile; Medium = 2nd Quartile; Small = 3rd Quartile

5. Management Review and Continual Improvement

	QUESTIONS	All 16		Large 9		Medium 7		Small 0	
		YES	NO	YES	NO	YES	NO	YES	NO
5.1*	Does the company perform a regular review of its AM policy and objectives?	4 (25%)	12 (75%)	4 (44%)	5 (56%)	0 (0%)	7 (100%)	0 -	0 -
5.2*	Does the company have a procedure to identify new assets/technology that may be beneficial?	9 (56%)	7 (44%)	5 (56%)	4 (44%)	4 (57%)	3 (43%)	0 -	0 -

6. General

	QUESTIONS	All 14		Large 8		Medium 5		Small 1	
		YES	NO	YES	NO	YES	NO	YES	NO
6.1*	Is the company's assessment of the current overall condition of its assets								
	Poor	2 (14%)	12 (86%)	1 (13%)	7 (88%)	1 (20%)	4 (80%)	0 (0%)	1 (100%)
	Fair	3 (21%)	11 (79%)	1 (13%)	7 (88%)	2 (40%)	3 (60%)	0 (0%)	1 (100%)
	Good	14 (100%)	0 (0%)	8 (100%)	0 (0%)	5 (100%)	0 (0%)	1 (100%)	0 (0%)

* Questions 3.6, 3.10, 3.16a, 3.16b, 3.24f, 5.1, and 5.2 only receive answers from 16 of the 17 respondents.
* Questions 6.1 only receive answers from 14 of the 17 respondents.
** Large = 1st Quartile; Medium = 2nd Quartile; Small = 3rd Quartile

Appendix B

Survey Questionnaire

Ontario

Review of Asset Management Practices of Ontario Electricity Distributors

Questionnaire
June 2008

Utility Name:

As set out in the Board's Chief Regulatory Auditor's letter of July 23, 2008, the Board is conducting a review of Asset Management (AM) practices in the Electricity Distribution Sector. Please refer to that letter for further information regarding the purpose of the review and regarding reporting on the questionnaire responses and the results of the review.

Respondent Instructions:

This questionnaire is based on PAS 55[1] Asset Management standards. However, for practical reasons, we have changed the ordering of the sections. We have divided the questionnaire into 6 sections:

- Implementation and Operation;
- Checking and Corrective Action;
- Asset Management Information, Risk Assessment and Planning;
- Asset Management Policy and Strategy;
- Management Review and Continual Improvement; and,
- General.

Please review each question and provide your answers by clicking on ☐ under the appropriate column.

You may also provide your comments about your practices related to each section.

Please email the completed questionnaires by August 15, 2008 to rajvinder.sabharwal@oeb.gov.on.ca.

[1] The PAS is prepared and published by British Standards Institution (BSI). The standards are available on a fee basis from the BSI website at http://www.bsi-global.com

Ontario

Review of Asset Management Practices of Ontario Electricity Distributors

Questionnaire

June 2008

1. Implementation and Operation

	Questions	Yes	No
1.1	Has the company established performance targets (e.g. reliability factors, operational efficiency, health and safety, customer service) for the distribution network to measure the progress and effectiveness of its AM system?	☐	☐
1.2	Is responsibility assigned to each level for management for achieving the performance targets?	☐	☐
1.3	Are AM related accountabilities integrated with the performance measurement system at all levels?	☐	☐
1.4	Are meetings held regularly to discuss distribution network performance issues?	☐	☐
1.5	Are historical outage records and outage source considered in AM decisions (e.g. records of outages categorized by Board prescribed codes as to their sources)?	☐	☐
1.6	Does the company have documented AM procedures in place, and have they been communicated to the responsible staff.	☐	☐
1.7	Does the company ensure that asset condition information is accurately recorded and available to the responsible staff.	☐	☐
1.8	Are capital and maintenance plans updated on an ongoing basis as new developments occur?	☐	☐
1.9	Does the company conduct performance reviews of staff responsible for AM?	☐	☐
1.10	Does the company use external links for leading practices to new technologies, practices and network performance?	☐	☐
1.11	Does the company regularly evaluate leading edge inspection processes (e.g. infrared testing) and apply them if appropriate?	☐	☐
1.12	Does the company have a methodology for forecasting future capacity requirements, and is the effectiveness of forecasting reviewed on a regular basis?	☐	☐
1.13	Does the company have a Geographic Information System (GIS) to facilitate analysis of network performance and help in project planning?	☐	☐
1.14	Are the company's inspection and maintenance records integrated with its GIS system?	☐	☐
1.15	Does the company have a SCADA system to facilitate its network operations?	☐	☐
1.16	Are routine inspection and maintenance activities performed documented in a timely manner?	☐	☐
1.17	Are maintenance and inspection records available to staff electronically?	☐	☐
1.18	Does the company review the quality of maintenance activities?	☐	☐
1.19	Does the company link the maintenance activities to inspection results and plans for asset replacement?	☐	☐

Utility's comments on its AM implementation and operation process:

Ontario

Review of Asset Management Practices of Ontario Electricity Distributors

Questionnaire

June 2008

2. Checking and Corrective Action

	Questions	Yes	No
2.1	Is the adequacy of inspection process reviewed periodically?	☐	☐
2.2	Do inspections provide adequate warning of asset deterioration?	☐	☐
2.3	Do inspections assist in identifying major problems?	☐	☐
2.4	Does the company use inspection results to inform decisions on maintenance levels and requirements and on the selection of projects?	☐	☐
2.5	Are OEB inspection guidelines adjusted based on past experience, industry data, and cost/benefit analysis?	☐	☐
2.6	Are key performance indicators for critical assets in place (e.g. service/supply standards, reliability, availability, maintainability, customer satisfaction, safety, legislative compliance etc.)?	☐	☐
2.7	Are service quality indicators reviewed regularly to ensure that service level is acceptable, and appropriate action is taken?	☐	☐
2.8	Are AM process audits conduced to ensure that the process in consistent with the strategy and policy?	☐	☐
2.9	Does the company use a specific industry standard for its AM process (e.g. PAS 55, ISO)?	☐	☐

Utility's comments on its AM checking and corrective action process:

Ontario

Review of Asset Management Practices of Ontario Electricity Distributors

Questionnaire
June 2008

3. Asset Management Information, Risk Assessment and Planning

	Questions	Yes	No
3.1	Does the company have a complete inventory of its assets?	☐	☐
3.2	Has the company identified all asset categories?	☐	☐
3.3	Have assets been identified as critical or non-critical?	☐	☐
3.4	Has the company performed asset condition assessment on its assets?	☐	☐
3.5	Is the life expectancy of assets known?	☐	☐
3.6	Is the asset performance information available?	☐	☐
3.7	Is location of each asset known?	☐	☐
3.8	Do the company asset records maintained include incident and event information?	☐	☐
3.9	Are inspection results entered into the asset records on a timely basis?	☐	☐
3.10	Is there a linkage between the company's asset records and Geographical Information System including mapping for locations, fault monitoring etc.?	☐	☐
3.11	Does the company have a formalized process for risk assessment related to asset management?	☐	☐
3.12	Does the company consider all aspects of risks related to AM, including assets, skills, resources, and logistics?	☐	☐
3.13	Is risk assessment performed jointly with Engineering and Lines and Operations staff?	☐	☐
3.14	Is risk assessment performed at least annually?	☐	☐
3.15	Are immediate dangers addressed immediately?	☐	☐
3.16	Do the risk assessment results feed the company's: o Capital plan?	☐	☐
	o Maintenance plan?	☐	☐
3.17	Does the company have a "run-to-failure" policy that differentiates critical assets from non-critical assets?	☐	☐
3.18	Has the company performed a system wide risk assessment related to its: o Overhead lines assets?	☐	☐
	o Underground cables?	☐	☐
	o Substations?	☐	☐
3.19	Is detailed outage information analyzed?	☐	☐
3.20	Does the company's capital plan include all identified future projects?	☐	☐
3.21	Are all potential future projects listed in a central repository?	☐	☐
3.22	Does the capital plan reflect the overall strategy for replacing aging assets?	☐	☐
3.23	Does each project on the capital plan include business case documentation including problem statement, scope and cost of project, and justification and evaluation of project?	☐	☐
3.24	Do any of the following factors influence your company's capital budget decisions? o Past spending on capital projects	☐	☐

	Questions	Yes	No
	○ Level of depreciation expense	☐	☐
	○ Target capital structure	☐	☐
	○ External benchmarks	☐	☐
	○ Ability to complete or deliver capital projects	☐	☐
	○ Other (please list below under Utility's Comments section).	☐	☐
3.25	Are maintenance activities linked to inspection results and to plans for asset replacement (i.e. capital planning)?	☐	☐
3.26	Does the company consider applicability of new maintenance practices (e.g. dry-ice cleaning)?	☐	☐
3.27	Does the company keep track of historical outages sorted by codes by outage source?	☐	☐
3.28	Are actual maintenance activities documented in a timely manner into the asset records?	☐	☐
3.29	Are maintenance records integrated with the company's GIS system?	☐	☐

Utility's comments on its AM information, risk management, and planning process:

Review of Asset Management Practices of Ontario Electricity Distributors

Questionnaire
June 2008

4. Asset Management Policy and Strategy

	Questions	Yes	No
4.1	Does the company have a documented AM strategy?	☐	☐
4.2	Does the company have clearly stated and documented AM objectives in place?	☐	☐
4.3	Does the company ensure that its AM strategy is consistent with its: o Strategic plan?	☐	☐
	o Priorities?	☐	☐
	o Asset condition requirements?	☐	☐
	o Health and Safety values?	☐	☐
	o Environmental position?	☐	☐
	o Continual improvement needs?	☐	☐
4.4	Is the company's capital planning process linked to its strategic plan?	☐	☐
4.5	Does the company's capital plan consider all assets?	☐	☐
4.6	Is the company's capital plan for less than 10 years?	☐	☐
4.7	Does the company have a documented AM policy in place?	☐	☐
4.8	Has the policy been communicated to managers, employees, stakeholders and understood and accepted by them?	☐	☐

Utility's comments on its AM policy and strategy:

Ontario

Review of Asset Management Practices of Ontario Electricity Distributors

Questionnaire

June 2008

5. Management Review and Continual Improvement

	Questions	Yes	No
5.1	Does the company perform a regular review of its AM policy and objectives?	☐	☐
5.2	Does the company have a procedure to identify new assets/technology that may be beneficial?	☐	☐

Utility's comments on its management review and continual improvement processes:

6. General

	Questions	Yes	No
6.1	Is the company's assessment of the current overall condition of its assets: o Poor	☐	☐
	o Fair	☐	☐
	o Good (Note: Poor condition assets will need remedial action within 5 years to correct significant deterioration; fair condition assets have noticeable deterioration but should survive another 5 years with regular maintenance; good condition assets are within the range expected for distribution assets that have been well maintained.)	☐	☐

Utility's comments on its current condition of assets: