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Enterprise Risk Management at Hydro One (B): How Risky are Smart Meters?

On June 23, 2004 the Minister of Energy in the Government of Ontario issued a directive requiring utilities to install 800,000 smart meters by December 31, 2007 and for all Ontario customers by 2010. The government's Smart Metering Initiative wanted to create a conservation culture among commercial and residential users while also providing utilities with time-of-use (TOU) pricing, a new demand management tool. Hydro One, under this directive, had to install 240,000 meters by 2007 and about 1.2 million meters to complete the coverage required by 2010, even for customers in the most remote areas of the province.

Usage data from the smart meters would be collected and transferred "raw" to a centralized Repository, managed by Ontario's Independent Electricity System Operator (IESO). The Repository would process, store, and manage the data feeds, making them accessible to utilities such as Hydro One for use in billing and reporting to customers. In the past, Hydro One typically recorded four manual readings a year from customers. Now it would have to process millions of data points a day to provide residential and small commercial customers with an hourly reading. Hydro One also planned extensive adjustments to its legacy Customer Information and Billing System to integrate and report the new smart meter data coming from the IESO Repository.

Hydro One established a C$670 million budget for the Smart Metering project. It selected a mesh technology[1] system from Trilliant, a third party vendor. This choice, however, affected only the communications board inside the meters. Hydro One understood that smart-metering was new technology and rapid change could occur; consequently, it specified that Trilliant use international standards in its design so that the meters would not be dependent on a singular supplier's technology. Hydro One retained the option to order meters from other suppliers, including Landis+Gyr, Itron, and General Electric and instructed Trilliant to cooperate with all these alternative vendors.

[1] A mesh system is a system in which a meter "talks" to neighboring meters. Consequently, a meter does not only capture and disseminate its own data, but also serves as a relay for other meters. The data therefore travels through a chain, until reaching a collector that transmits the accumulated data to a central point, usually via a wireless cellular network.

Professor Anette Mikes and Research Associate Dominique Hamel prepared this case. Monetary amounts and timelines are for case study purposes only and may not be the actual estimates of the company. HBS cases are developed solely as the basis for class discussion. Cases are not intended to serve as endorsements, sources of primary data, or illustrations of effective or ineffective management.

The smart-metering technology required a new set of skills from Hydro One's employees. The old analog meters could withstand rough handling but the delicate electronics in the new smart meters required careful handling. The company planned to use its 115 meter-reading staff and 40 additional temporary staff for the on-site replacements of new for old meters. Once installed, however, the automated smart meters made the meter-reading staff redundant. Those opting to retire (the company expected about 20 percent to take this option) would not be replaced and Hydro One planned to retrain and reassign the remaining staff.

After installation, Hydro One planned to switch customers to TOU billing, as was required by the Ontario Energy Board. It estimated that completing this switch would take about a year. The new pricing scheme required several new administrative processes: to ensure that meter readings were accurate; to educate customers about the changes under TOU pricing, and to operate a helpline for customer questions and complaints. A recent pilot study conducted with five hundred Ontario homeowners showed that real-time electricity monitors helped reduce consumption of electricity by up to 8%. However, the effects of TOU billing were uncertain. Under the old "Tiered Prices" plan, customers paid a higher price per kWh if their consumption exceeded a monthly "threshold" amount. Under the new TOU scheme, they would pay a different price ranging from 5.1c to 9.9c per kWh, depending on what time of day the power was consumed (**Exhibit 1**). Hydro One planned to reach out to customers with high peak-hour use of power to communicate the likely effects of TOU billing. Over time, Hydro One expected that the smart meter readings would significantly enrich its knowledge about customers' electricity use, allowing it to manage customer expectations even more proactively. While Hydro One prided itself on its high customer satisfaction among residential and corporate customers, it knew that if customers failed to understand TOU billing, and were surprised by sharp increases in their electricity bills, calls and complaints to Hydro One could easily swamp the help lines, leading to long queues and further customer dissatisfaction.

Hydro One was aware of the recent experience of Californian utility, Pacific Gas and Electric Company (PG&E), after its deployment of smart meters and TOU billing. PG&E customers began complaining about unusually high power bills, and others, concerned about theft of data and privacy issues, quickly raised their voices as well. Some attributed alleged health problems to the radio transmissions from wireless meters. An independent inquiry confirmed the accuracy of the meters and that the devices emitted less radio frequency energy than cell phones or microwave ovens. But PG&E's reputation was still severely damaged, and it was still litigating billing disputes[2].

Risk manager Rob Quail and project manager Rick Stevens convened a workshop to assess the enterprise risks of the Smart Metering project. They invited a diverse group of managers from all areas impacted by the project. They confirmed in advance the three primary objectives of the project:

1. Install smart meters on schedule
2. Deploy TOU billing on schedule
3. Avoid budget overruns

[2] Rebecca Smith, High-Tech Utility Meters Spark a Fight; PG&E Cites Need to Control Energy Use, but Some Residents Fear Higher Prices, Reduced Privacy From Digital Readings," *The Wall Street Journal Online*, 9 September 2010.

The risk-management team, after consultation with Stevens, updated the objective-impact matrix (**Exhibit 2**) to facilitate the impact assessments that would occur during the risk workshop (**Exhibit 3**). Stevens also informed workshop participants about several actions his team had already taken to reduce the project's risk profile.

Hydro One would stipulate terms in vendor contracts to hold them accountable for delivering the smart meters and the accompanying information technology. The terms included detailed functional specifications followed by a clause that enabled Hydro One to charge vendors with the quantifiable costs of technical revisions, modifications and delays. However, delays could still cause secondary costs to Hydro One through linkages to other vendors and Hydro One's potential failure to deliver the project on schedule and on budget. The Ontario Energy Board allowed Hydro One some increases in rates to recover the forecasted project costs. A contingency fund of 20% had been built into the project budget of C$670 million, but cost over-runs beyond this would be absorbed by Hydro One. A six-month delay could cost Hydro One C$20-30 million in non-recoverable extra costs.

The planned smart network linking each meter to the data center with cellular technology would dramatically lower the operating costs for meter-readings. But Hydro One would have high front-end capital costs to connect up to 150,000 "last mile" customers who lived at remote, hard-to-reach locations. In their cases, satellite transmissions were called for. Setting these up would be an expensive and time-consuming operation, perhaps adding a previously undetermined capital cost of C$30-40 million and a possible completion delay of seven months.

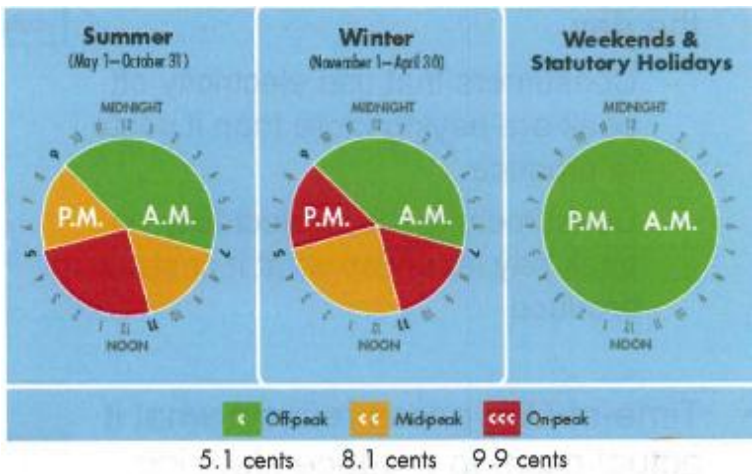
Exhibit 1 Tiered Price Plan versus Time of Use (TOU) price plan

Under the "Regulated Price Plan", customers pay a lower rate for the amount of electricity they use each month below a threshold (set at 600 kWh in the summer and 1,000 kWh in the winter, and a higher price for electricity used in excess of the threshold (the "Higher-tier" price).

Under the new TOU pricing scheme, the pricing is adjusted by time of day when the electricity is used.

Regulated Price Plan (RPP) - Tiered Prices	
Lower-tier Price:	6.4 ¢/kWh
Higher-tier Price:	7.4 ¢/kWh
Current Tier Threshold:	Residential winter threshold: 1,000 kWh per month

Regulated Price Plan (RPP) - Time-of-Use (TOU) Prices	
Off-peak Price:	5.1 ¢/kWh
Mid-peak Price:	8.1 ¢/kWh
On-peak Price:	9.9 ¢/kWh



Source: Company document.

Exhibit 2 Objectives-Impact Matrix

Objective	Attribute	Event	5 Worst Case	4 Severe	3 Major	2 Moderate	1 Minor
FINANCIAL	Net Income	Net Income Shortfall (after tax, in one year)	>$150M	$75M–$150M	$25M–$75M	$5M–$25M	<$5M
	Credit Worthiness	Change in financial ratios or risk	Event of default; Unable to raise any capital due to credit rating.	Credit rating downgrade to below investment grade; Unable to raise full amount required capital.	Credit rating downgrade.	Hydro One Inc. put on credit "watch".	Credit rating agencies and bondholders express concern.
	Value of the Enterprise	Loss in Value of Hydro One	Loss of >25% Value	Loss of 10–25% Value	Loss of 5-10% Value	Loss of 1-5% Value	Loss of <1% Value
REPUTATION	Public Profile	Negative media attention; Opinion leader and public Criticism	National media attention; Opinion leaders/customers nearly unanimous in public criticism.	Provincial media attention; Most opinion leaders/ customers publicly critical.	Significant local attention; Several opinion leaders/ customers publicly critical.	Letter(s) to Minister of Energy.	Letter(s) to Senior Management.
	Shareholder confidence	Owner/ shareholder involvement in Hydro One operations	Complete loss of confidence; CEO and Board replaced by the owner.	Extensive loss of confidence; CEO or several Sr. Managers replaced.	Credit Rating agencies and bondholders express concern.	Confidence in question; owner requests significant changes to business plan.	Some concern with management decisions; occasional requests from owner for details.
	Employee confidence	Employee Dissatisfaction	Widespread departures of key staff with scarce skills or knowledge.	Sharp, sustained drop in employee survey results; departures of key staff with scarce skills or knowledge.	Sharp decline in employee survey results; sharp increase in grievances.	Modest decline in employee survey results; modest increase in grievances.	Less than planned improvements in employee survey results.
REGULATORY RELATIONSHIP	Meet License Conditions	Loss of Credibility with Regulators	General loss of Credibility; Intrusive Involvement.	Some loss of Credibility; Excessive Involvement.	Some Concerns re: Competence; Difficult Demands.	Increase in Reporting Detail and Frequency.	Balanced; some challenges.
CUSTOMER/ RELIABILITY	Reliable Delivery of Electricity	Outages on the Hydro One system	Outage affects: >100,000 Customers Distribution or >1000MW Transmission for more than seven days.	Outage affects: 40k-100k Customers Distribution or 400–1000 MW Transmission for 4–7 days.	Outage affects: 10k–40k Customers Distribution or 100–400MW Transmission for 2–4 days.	Outage affects: 1k–10k Customers Distribution or 10–100MW Transmission for 4–24 hrs.	Outage affects: <1000 Customers Distribution or <10MW Transmission for <4 Hrs.
	OEB Service Quality Indices	Failure to Meet Service Quality Indices	Achieve 25% of Overall Expected Performance.	Achieve 67% of Overall Expected Performance.	Achieve 80% of Overall Expected Performance.	Achieve 90% of Overall Expected Performance.	Achieve 95% of Overall Expected Performance.
	Direct Customers, Local Distribution Companies, Generators	Increase in customer dissatisfaction with Hydro One	Numerous Direct Customers initiate action such as bypass or relocation; Numerous LDC's default on bill payments; Generator reluctance to locate in Ontario leads to shortages.	Exponential increase in customer lawsuits for direct and/or collateral damage believed to be caused by Hydro One; Complaints to provincial government increase dramatically.	Customer associations step up lobbying efforts for stricter penalties against Hydro One.	One "large" customer experiences significant production losses due to Hydro One actions/inaction; high level (CEO, COO, etc.) calls to Hydro One CEO's office.	Increase in number of customer complaints.
	Residential and Small Business Customers	Increase in customer dissatisfaction with Hydro One service quality	Significant numbers of customers begin to default on bill payments.	Exponential (>50%) increase in call centre volumes and complaints received by field staff.	Call centre volumes increase noticeably (25%); noticeable increase in complaints received by field staff.	Sharp deterioration in customer satisfaction as per survey responses.	Moderate deterioration in customer satisfaction as per survey responses.
COMPETITIVENESS	Unit Cost Reduction	Failure to Reduce Unit Costs (incl. overhead & non-billable time)	Unit Costs increase by >25%	Unit Costs increase by 15%–25%	Unit Costs increase by 10% - 15%	Unit Costs increase by 5% 10%	Unit costs not reduced
	Work Program Accomplishment	Work Program Shortfall	>10 Critical Projects late or; <50% of noncritical work completed.	5-10 Critical Projects late or 50%–70% of noncritical work completed.	3–5 Critical Projects late or 70%–85% of non critical work completed.	1-3 Critical Projects late or >85% of non critical work completed.	No Critical Projects late >85% of non critical work completed.
SAFETY AND ENVIRONMENT	Employee: Workforce Availability/ Safety	Change in availability (%) in one year; Accident Severity Rate.	Key functions/locations unavailable > 1 week; Employee fatality or major permanent disability.	Key functions/locations unavailable > 1day; Employee critical injury.	Accident Severity Rate > 50% above target.	Accident Severity Rate > 25% above target.	Accident Severity Rate above target.
	Environmental Performance	Adverse Environmental Impact	Widespread offsite impacts e.g., regional or municipal water supply.	Multiple local offsite impacts e.g., multiple residential properties or private water supplies.	Significant local offsite impact e.g., a public thoroughfare; Significant spill/release with impact on Hydro One Inc. property only	Minor local offsite impact e.g., a single residential property or private water supply).	Minor impact on Hydro One Inc. property only.
	Public Safety	Public Injuries with Hydro One at fault.	Fatality or major permanent disability.	Significant increase in number of injuries.	Moderate increase in number of injuries.	Small increase in number of injuries.	No change.

Source: Company document.

Minor = noticeable disruption to results; manageable. **Moderate** = material deterioration in results; a concern; may not be acceptable; management response would be considered. **Major** = significant deterioration in results; not acceptable; management response. **Severe**= fundamental threat to operating results; immediate senior management attention. **Worst Case** = results threaten survival of company in current form; potentially full time senior management response until resolved.

Exhibit 3 Additions to the Objectives-impact matrix for Smart Metering project risk workshop

Objective	Attribute	Event	5 Worst Case	4 Severe	3 Major	2 Moderate	1 Minor
Project objectives	Schedule	Project delivery is behind schedule	TOU Billing not in service by 2010 > 20% off-target on number of meters installed by 2010	"TOU Billing in-service by Q3/2008"-target missed by > 6 months 10%-20% off-target on number of meters installed by 2010	"TOU Billing in-service by Q3/2008" target missed by 3-6 months Q4/07 Target for number of meters installed (240,000) not met	"TOU Billing in-service by Q3/2008" target missed by < 3 months Q4/07 Target for number of meters installed (240,000) not met	Milestones substantially met
	Budget	Cost Overrun	> $40M Cost Overrun	$30M-$40M Cost Overrun	$15M-$30M Cost Overrun	$5M-$15M Cost Overrun	< $5MCost Overrun
	Scope	Undelivered Scope/Value	Hydro One and Ministry of Energy's TOU billing requirements not met Most or all additional business benefits unavailable	Substantial gaps in compliance with Hydro One TOU billing requirements Substantial deficiencies in ability to realize additional business benefits	Moderate gaps in compliance with Hydro One TOU billing requirements	Minor gaps in compliance with Hydro One TOU billing requirements	Hydro One and Ministry of Energy's TOU billing requirements substantially met

Source: Company document.