



CHATHAM-KENT HYDRO

Review of Smart Meter Pilot Project

October 2005

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Chatham-Kent Hydro – Review of Smart Meter Pilot Project

Background:

In an effort to conserve energy, the Ontario government has mandated that all electrical meters in Ontario be upgraded to “smart” meters by the end of 2010. This presents an enormous financial and scheduling challenge to all electrical distributors in the province. The Ministry of Energy as well as the Ontario Energy Board (OEB) have issued several papers and reports detailing the plan and the general specifications of the smart meter system. However, at the time of this writing (October 2005), the complete requirements have not been finalized.

Early in 2004, Chatham-Kent Hydro (CKH) concluded a lengthy technical review of available smart metering technologies. Possible solutions were compared, not only in terms of cost and technological innovation, but also against stated government and OEB goals and expectations at that time. In the end, CKH chose a retrofit option that would convert existing watt-hour meters to smart interval meters. The wireless technology and smart meter modules are designed and provided by Tantalus Systems Corporation, a Vancouver-based company that designs and manufactures wireless, two-way and real-time communication networks for distributors.

In November 2004, CKH launched a pilot project to test 1,000 community households with the smart meter technology. Existing non-smart meters were retrofitted and upgraded to add all the functionality expected from smart meters. For CKH, the pilot project was considered a success by all accounts. With the pilot project essentially complete since May 2005, CKH sought out the services of an independent and industry recognized consulting firm to review the costs and conclusions derived from the pilot project. In August 2005, Deloitte was engaged to review the findings of the pilot project.

Objectives:

The main objectives of the pilot project review were to:

1. Assess cost estimates and develop a cost model for full implementation.
2. Validate assumptions and conclusions (as they relate to the cost model).
3. Provide CKH the ability to demonstrate to other distributors and government agencies the independence and correctness of the results and estimates for full implementation.

CKH also requested general recommendations on how to leverage the learnings and potentially offer smart meter related services to other Local Distribution Companies (LDCs).

The scope of the assignment did not include validating the following:

1. Vendor selection(s)
2. Technical feasibility of the solution
3. Implementation strategy

Approach:

Prior to the commencement of this review, CKH prepared a draft cost model that extrapolated the pilot project costs to a full smart meter implementation (see Appendix A). Using this cost model as the starting point, the approach included:

1. Understanding the original cost model by interviewing key CKH participants
2. Performing additional research by studying industry reports and OEB documentation
3. Updating the cost model to reflect new information
4. Validating assumptions with other Deloitte utility consultants and industry contacts
5. Refining the cost model based on further discussions with CKH participants

It should be noted that the business case for smart metering initiatives is not an exact science and is subject to differences in opinion. In an independent study called “The AMR Business Case” by Donald L. Schlenger, Ph.D., the following challenges were discussed:

- The process of building the business case is a project by itself.
- The investigation can fall into “analysis paralysis” trying to pin down all the details and uncertainties.
- Both the “target” and the “shooter” are moving: the utility’s operating and regulatory environment, the technologies and the AMR marketplace are constantly changing, even over the course of the business case study.
- The more complex the benefits, the harder they are to quantify and the more resources required to evaluate them and convince others of their validity.
- The number of dimensions (customer segments, technologies, benefit areas, etc.) and variables in the business case can easily generate an extraordinary number of permutations. Considering them all can be overwhelming.
- The same methodology can easily lead to different conclusions. If the investigation is initiated at an operational level in meter reading for example, the business case is likely to look different than if it started in customer service or at the executive level.
- There is no way to arrive at the “correct” or “perfect” answer. Every time the study team looks at a situation, they will see it a different way. This could lead to a situation where the business case is never quite completed.

Many of these challenges were relevant during the course of this review. To avoid “analysis paralysis”, more attention was paid to the items which had the biggest impacts. For these items, costs were validated from actual invoices and confirmed with vendors; numbers used to derive savings were compared against other LDCs to ensure they were realistic. For items with little impact, estimates may have been accepted but were confirmed to be reasonable. Where uncertainty existed, assumptions were documented. To avoid the problem of different people

leading to different conclusions, the rationale and calculations were discussed with representatives from each key functional area present at the same time. Cost and benefit items were compared against OEB and industry reports to ensure everything was accounted for.

The main challenge involved the uncertainty of the regulatory environment. For example, currently the exact procedures for cost recovery are unknown. This could have a significant impact on the final numbers. Thus, it is important to understand the limitations and to review the cost model as new information becomes available.

Cost Model – Summary of Findings:

As mentioned earlier, the new cost model is a refinement of the original model upon further examination and investigation. Some of the changes made to the new cost model include:

- Basing certain cost items on actual figures as opposed to estimates (e.g. smart meters).
- Adjusting amortization periods to better reflect correct depreciation schedules.
- Removing items that were not eligible for cost recovery (e.g. communication tower).
- Revising calculations and estimates to better reflect reality (e.g. meter reading savings).
- Introducing new cost and benefit items (e.g. training and marketing costs, outage restoration savings). Although some of the new items may be difficult to quantify currently, they are now accounted for and can be updated as new information becomes available.
- Including a rate of return for capital costs.

The resulting model is broken out into four main sections: capital costs, costs related to stranded assets, annual costs and annual savings. The summary information is listed in the following tables (for complete details of the cost model, please refer to Appendix B).

Table 1: Capital Costs

No.	Description	Initial Cost	\$/Month /Customer
1	Smart meters	\$3,171,913.60	\$0.587
2	Temporary labour to support implementation	\$1,180,000.00	\$0.219
3	Meter socket retrofits	\$150,000.00	\$0.017
4	IT supplies for new personnel	\$25,000.00	\$0.014
5	Tantalus hardware & software	\$66,820.00	\$0.037
6	CIS - incremental hardware & software	\$17,500.00	\$0.010
7	Modifications to existing CIS system	\$0.00	\$0.000
8	Tower	\$0.00	\$0.000
9	Data storage	\$10,000.00	\$0.006
10	Training	\$7,191.78	\$0.001
11	Marketing and communications	\$10,000.00	\$0.002
Total:		\$4,638,425.38	\$0.892
Average return on capital:		\$3,316,211.47	\$0.613

Table 2: Costs Related to Stranded Assets

No.	Description	Initial Cost	\$/Month /Customer
1	Obsolete meters	\$350,000.00	\$0.039
2	Existing interval meters	n/a	n/a
3	Meter reading equipment	n/a	n/a
4	Meter reading contract	n/a	n/a
5	CIS system	n/a	n/a
6	Settlement systems	n/a	n/a
7	EBT hubs	n/a	n/a
8	Human resources	n/a	n/a
Total:		\$350,000.00	\$0.039
Average return on capital:		\$404,950.00	\$0.045

Table 3: Annual Costs

No.	Description	Cost/Year	\$/Month /Customer
1	Tantalus	\$12,000.00	\$0.033
2	CIS (Harris)	\$4,500.00	\$0.013
3	Radio licensing	\$10,000.00	\$0.028
4	Incremental reverification effort	\$5,250.00	\$0.015
5	Additional personnel	\$135,800.00	\$0.377
6	EBT - additional data management	\$7,200.00	\$0.020
7	Additional meter maintenance	\$2,284.70	\$0.006
8	Meter replacement	\$0.00	\$0.000
9	Additional IT support	\$0.00	\$0.000
10	Vendor support for new servers	\$1,200.00	\$0.003
Total:		\$178,234.70	\$0.495

Table 4: Annual Savings

No.	Description	Savings/Year	\$/Month /Customer
1	Reduction in hydro meter reads	\$69,000.00	\$0.192
2	Reduction in re-reads	\$53,016.00	\$0.147
3	Reduction in final reads	\$155,382.00	\$0.432
4	Increased meter accuracy	n/a	n/a
5	Theft & tamper detection	n/a	n/a
6	Improved billing/cash flow	n/a	n/a
7	Improved outage management	\$10,000.00	\$0.028
8	Fewer estimated bills	n/a	n/a
9	Distribution system optimization and system planning	n/a	n/a
10	Reduction in site visits (e.g. disconnects/reconnects)	n/a	n/a
11	Detection of equipment overload	n/a	n/a
12	Avoided costs	n/a	n/a
13	Innovation in services	n/a	n/a
Total:		\$287,398.00	\$0.798

The final summary is as follows:

Description	\$/Month/Customer
Capital Costs	\$.892
Costs Related to Stranded Assets	\$.039
Return on capital	\$.658
Annual Costs	\$.495
<i>Annual Savings</i>	<i>(\$.798)</i>
Total:	\$1.29

Assumptions:

Listed below are the general assumptions for the cost model. For details on the calculations and assumptions for individual line items, please refer to Appendix B.

1. The cost model may not reflect OEB requirements for cost recovery and rate application.
2. The cost model does not take into consideration financing, actual cash flow, taxes etc.
3. Some cost items are based on estimates and/or vendor quotes and may not include applicable taxes.
4. The cost model is based on information available at the time of writing and is subject to change.
5. The cost model assumes an 8.9% rate of return (provided by CKH) and is only applicable for capital costs; annual costs are flow-through to customer.
6. The return on capital amount is based on an average throughout the amortization period and does not consider the time value of money.
7. The cost model is for residential customers. The number of customers used for the model is 30,000.
8. Depreciation uses the straight line method. Salvage value is zero at the end of the amortization period.
9. For values that were in US\$, an exchange rate of 1.20 was used to convert to CDN\$.
10. For some items, it was necessary to rely solely on the guidance from CKH (e.g. worker salaries, effort required to perform certain tasks, estimates such as the number of meters that will need to be replaced).
11. Timing is not factored in for costs and benefits (e.g. annual cost and benefit figures are for steady state after full deployment, materials are assumed to be purchased all at once etc.).
12. For equipment purchases, potential costs for insurance and inventory storage are not included.
13. The cost model does not take into account potential effects from inflation (e.g. price increases).
14. The cost model assumes items have a useful life at least equal to the depreciation period and does not take into consideration potential replacement costs during or beyond this period.
15. The cost model does not take into account the effects different amortization periods would have on the final numbers. For example, items with shorter amortization periods may need to be removed from the rates once they have been fully depreciated.

Conclusions:

The results of this review indicate that CKH's smart metering initiative would most likely result in an incremental monthly customer charge of between \$1.20 - \$1.40. This cost assessment is accurate within the bounds of existing information and assumptions. It is also important to note that every LDC will have its own unique characteristics which could have significant impacts on the final numbers. For example:

1. CKH has access to an existing communication tower; for other LDCs, the tower and related expenses could easily add up to over \$100,000 in upfront costs and there may be on-going costs as well (for example, if land had to be leased). Assuming the customer base is comparable to CKH (i.e. 30,000), this could add another \$.05 to the monthly customer cost.
2. The incremental costs for CKH to upgrade, modify and maintain its CIS system to meet the smart meter requirements are relatively low (~\$.02). Other LDCs could have significantly higher costs in this area, especially if external resources are required. The range for this item would be very wide but could add as much as \$.25 - \$.75 to the monthly customer cost (again assuming the customer base is similar to CKH).
3. CKH chose the retrofit option. Other LDCs who take the replacement route with a non Tantalus/Harris based solution may incur higher costs that could add as much as \$.75 - \$1.00 to the monthly customer cost (again assuming the customer base is similar to CKH).
4. Conversely, LDCs who conduct their own meter reading may have an opportunity to reduce costs through smart metering to a greater extent than CKH, which outsources its meter reading.

In closing, it is also important to mention that certain requirements of the Provincial government, particularly with respect to customer presentment, interfaces with external parties and in relation to a central data management system, could result in higher costs.

Disclaimer:

This review of the Smart Meter Pilot Project (the "Review") conducted by Deloitte Inc. ("Deloitte") is subject to the assumptions and qualifications contained in the Review. The Review is current as of the date indicated on the cover page and Deloitte is not responsible for updating or amending this Review to take into account circumstances and information subsequent to the date of the Review which may have a material effect on the contents of the Review.

The Review was based on information provided by Chatham-Kent Hydro and while Deloitte performed a review of certain of the information, the Review does not constitute an audit of the financial and other information contained in the Review. The Review was not conducted for the implied or express benefit of any third party and not with respect to any specific transaction. The content of this Review is for general information purposes only.

Except with the express written consent of Deloitte, this Review should not be circulated or copied, in whole or in part, without including this disclaimer and the assumptions and qualifications contained in the Review.

Appendix A – Original Draft of CKH Cost Model:

Customer Count 32,000

Capital Depreciation	Initial Cost	Years	Depreciation	/Month /Customer	Comments
Smart Meters	\$129.00	25	\$5.16	\$0.43	Labour: 10.00 Module: 110.00 WAN:9.00
Installation Cost	\$1,000,000.00	25	\$40,000.00	\$0.10	2 additional meter Techs for 5 years @\$100,000 each/year
Meter Socket Retrofits	\$160,000.00	10	\$16,000.00	\$0.04	For meter socket extensions = 1% of meters @\$50/meter socket
Additional IT Cost	\$20,000.00	5	\$4,000.00	\$0.01	Extra PC's and software to support installation effort
SM H/W	\$20,000.00	5	\$4,000.00	\$0.01	
SM Software	\$10,000.00	5	\$2,000.00	\$0.01	
CIS H/W	\$10,000.00	5	\$2,000.00	\$0.01	
CIS Software	\$15,000.00	5	\$3,000.00	\$0.01	
Tower	\$100,000.00	25	\$4,000.00	\$0.01	
Base Station	\$40,000.00	5	\$8,000.00	\$0.02	
Stranded Cost	\$350,000.00	25	\$14,000.00	\$0.04	Cost to replace 1/3 of existing meter population @\$35/meter

			/Year	/Month /Customer	Comments
Software Licensing					
Smart Metering			\$20,000.00	\$0.05	
CIS			\$4,500.00	\$0.01	
Radio Licensing			\$10,000.00	\$0.03	500 WAN Portals (needed for data collection)
Data Storage			\$19,200.00	\$0.05	per discussions with SyBase - includes power, maintenance cost to keep data
Cycle Meter Reading			(\$96,000.00)	(\$0.25)	Based on 32000 and 6 reads per year @.5/read
Re-reads			(\$57,216.00)	(\$0.15)	1% of reads 1/2 hr for one person and vehicle @\$16 + \$15 for vehicle and 40% burden
Final Reads			(\$7,176.00)	(\$0.02)	Final reads : 20/month @ same labour and vehicle costs as for Re-reads
Reverification Cost			\$30,000.00	\$0.08	
Additional Admin Cost			\$160,000.00	\$0.42	1 FTE in Hydro to manage day-to-day TUNET system 1 FTE in UTS to manage CIS data
Additional EBT Cost				\$0.02	Per OEB projection

Total/Customer/Month

\$0.92

Appendix B – Cost Model Details:

No.	Capital Costs	Initial Cost	Amort. (yrs)	\$/Month /Customer	Comments	Assumptions
1	Smart meters	\$3,171,913.60	15	\$0.587	<p>TPM Controller: Pilot: 1000 customers x \$129.70 CDN = \$129,700 CDN Full Deployment: 29000 customers x \$78.00 US = \$2,714,400 CDN WAN (220 MHz transceiver) Pilot: 40 x \$452.55 CDN = \$18,102 CDN Full Deployment: 642 x \$297.75 US = \$229,386.60 CDN Tantalus Licensing: 30000 customers x \$.40 US = \$14,400 CDN Incremental Reverification: (30000 x 2/3) - (5 yrs x 3000 meters/yr) x \$8.75 = \$43,750 Damages: Est. 5 per 1000 (90% are glass replacements @ \$10, 10% are full replacement @ \$35) = \$1,875 CDN Other: 1 meter shop program tool @ \$1,300 CDN Est. shipping charges of \$19,000 CDN Grand Total: \$3,171,913.60</p>	<ol style="list-style-type: none"> The affects of timing and cashflow are not being considered. It is assumed everything is purchased at once. Depreciation schedule for new smart meters (and related equipment) will be 15 yrs as opposed to 25 yrs (this may need board approval). WAN is based on a 1/44 Ratio (note: by 2006, a newer version is scheduled to support up to 250 end points). Roll-out is over 5 years. Normally 3000 units are reverified each year (smart metering will add an additional 1000 per year during the roll-out period). One third of the meters will be new and will not incur reverification costs. London Hydro will continue to reverify the meters (new cost will be \$8.75). CKH will realize the volume discount from Tantalus for full deployment. Damages are expected to be minimal (5 per 1000) with 10% of the damages being full meter replacement and 90% being broken glass. Labour for these damages is negligible. Other damages such as panel replacement or to the meter base are the responsibility of the customer.

2	Temporary labour to support implementation	\$1,180,000.00	15	\$0.219	2 additional Meter Techs for 5 years, each @\$100,000/year (represents \$42/hr after burden + estimated cost of using CKH vehicles) 1 additional Customer Service Rep for 5 years @\$30,000/year + 20% burden	<ol style="list-style-type: none"> 1. Costs can be included as part of capital and be amortized over 15 yrs. 2. Two meter techs are sufficient for all meter and module related work required for the smart meter roll-out. 3. One additional customer service representative is sufficient for the extra call volume. 4. Call volume will return to normal levels upon completion of the smart meter implementation. 5. Overtime and/or premiums for after hrs work are not applicable. 6. CKH will not need to purchase additional vehicles.
3	Meter socket retrofits	\$150,000.00	25	\$0.017	10% of meters @\$50/meter socket	<ol style="list-style-type: none"> 1. Approximately 10% of all meters will require a retrofit in order to work correctly. 2. Additional labor to add the socket is negligible. 3. Sockets follow the same amortization period as the current meters (i.e. 25 yrs).
4	IT supplies for new personnel	\$25,000.00	5	\$0.014	PC's and software for 3 temps and 2 new hires. Estimated @ \$5,000 per person.	<ol style="list-style-type: none"> 1. The existing facilities can accommodate the additional staff.
5	Tantalus hardware & software	\$66,820.00	5	\$0.037	1 Network Server (incl. software) @ \$27,625 CDN 1 Network Controller (incl. software) @ \$39,195 CDN	<ol style="list-style-type: none"> 1. Only 1 network server and 1 network controller is required for full deployment.
6	CIS - incremental hardware & software	\$17,500.00	5	\$0.010	CKH has upgraded their Harris CIS system so that it can accommodate a number of future enhancements (five in total). This particular cost item is for the portion related to the Smart metering initiative (i.e. billing, customer presentment) and represents 20% of the total cost. The breakdown (at 20%) is: new server (\$2,000), CIS upgrade (\$14,000) and estimated Harris set-up costs (\$1,500).	<ol style="list-style-type: none"> 1. CKH's upgraded CIS system along with any modifications (item 7 below) will support all the requirements for the smart meter initiative. No other systems are affected. 2. CKH effort to support installation is negligible. 3. Related support costs are listed in the Annual Cost section.
7	Modifications to existing CIS system	\$0.00	5	\$0.000	Initial discussions with Harris suggests that costs, if any, are included in item 6 above.	Same as above.

8	Tower	\$0.00	25	\$0.000		<ol style="list-style-type: none"> 1. Tower already existed and is a sunk cost (cost cannot be recovered). 2. One tower is sufficient for CKH (including forecasted growth). 3. On-going tower maintenance including related land costs are negligible.
9	Data storage	\$10,000.00	5	\$0.006	Cost for new data server (Raid 5 configuration).	<ol style="list-style-type: none"> 1. The raw smart metering data will reside on the Tantalus side; CIS will only need the summary data required for billing. 2. Per the point above, only one data server is required. CIS server has sufficient space for growth. 3. Due to the importance of the data, a Raid 5 configuration (supports high availability, fault tolerance, redundancy) is recommended. 4. Installation will be handled by UTS and there will be no additional costs for this. 5. Related support costs are listed in the Annual Cost section.
10	Training	\$7,191.78	15	\$0.001	30 people for a day (@ an average wage of \$70K per person) plus 25% additional effort for documentation, preparation and delivery.	<ol style="list-style-type: none"> 1. Costs can be included as part of capital and amortized over 15 yrs.
11	Marketing and communications	\$10,000.00	15	\$0.002	\$2000 per year for flyers (dropped off at customer site following the meter retrofit)	<ol style="list-style-type: none"> 1. Costs can be included as part of capital and amortized over 15 yrs. 2. Flyers are sufficient to provide all the information the consumer needs to know about the smart meter implementation. 3. Other related communication costs (e.g. updating company homepage) are considered negligible.
	Total	\$4,638,425.38		\$0.892		

No.	Stranded Costs	Initial Cost	Amort. (yrs)	\$/Month /Customer	Comments	Assumptions
1	Obsolete meters	\$350,000.00	25	\$0.039	Cost to replace 1/3 of the existing meter population (which is not compatible with the Tantalus module) @\$35/meter.	Note: this is not a stranded cost per se but is a capital cost related to stranded assets 1. Approximately 1/3 of the existing meters are not compatible with the Tantalus module and will need to be replaced. 2. Additional labor costs for meter replacement is negligible since these will be done during the meter retrofit. 3. New meters do not require reverification. 4. The meters being replaced are assumed to have zero salvage value. 5. Depreciation period for the replacement meters is 25 yrs (since they are the older electromechanical meters). 6. There is no additional cost recovery for the stranded assets (i.e. over and above the cost of the replacement meters).
2	Existing interval meters					1. No interval meters will be stranded due to the smart meter implementation.
3	Meter reading equipment					1. No meter reading equipment will be stranded due to the smart meter implementation.
4	Meter reading contract					1. CKH can stop hydro meter reading services without incurring any charges.
5	CIS system					1. The existing Harris CIS system will not be rendered obsolete due to the smart meter implementation.
6	Settlement systems					1. There are no settlement systems (or related services) that will be stranded due to the smart meter implementation.
7	EBT hubs					1. There are no existing EBT hubs (e.g. interfaces) that may be rendered obsolete due to the smart meter implementation.

8	Human resources					1. CKH will not incur stranded costs related to potential staff reduction (e.g. some collective agreements involve redeployment, training and termination costs).
	Total	\$350,000.00		\$0.039		

No.	Annual Costs	Costs/Year	\$/Month /Customer	Comments	Assumptions
1	Tantalus	\$12,000.00	\$0.033	\$5,000 US annually for network server license plus \$5,000 US annually for network controller license	1. CKH requires only one network server and one network controller.
2	CIS (Harris)	\$4,500.00	\$0.013	This cost represents the portion of the incremental Harris support fees that can be apportioned to smart metering (i.e. 20% of total).	
3	Radio licensing	\$10,000.00	\$0.028	Required for the 500 WAN Portals (needed for data collection), exact costs are unknown at this time. Spectrum option would be less than \$1000/yr, o/w a fully licensed system is estimated to be around \$10K/yr.	1. Due to unknown information at this time, the costs for a fully licensed system will be used.
4	Incremental reverification effort	\$5,250.00	\$0.015	It is estimated that there is 25% more labor to reverify the new meters. London Hydro currently does this at a cost of \$7/meter. Thus, the incremental cost is 3000 meters @ \$1.75/meter.	1. Smart meters will require 25% more effort to reverify. 2. London Hydro will continue to provide this service and will charge 25% more for labour. 3. After the 5 year roll-out schedule, CKH will go back to reverifying 3000 meters per year. 4. Reconfiguring TOU buckets will not result in the need for reverification.
5	Additional personnel	\$135,800.00	\$0.377	1 FTE in Hydro to manage day-to-day TUNET system [52K + 40% burden] 1 FTE in UTS (Utility Services) to manage CIS data [45K + 40% burden]	1. One additional person in TUNET and UTS is sufficient to handle the additional workload from smart metering in the respective areas.
6	EBT - additional data mgmt	\$7,200.00	\$0.020	Per OEB projection.	1. Due to lack of information, the OEB estimate will be used.
7	Additional meter maintenance	\$2,284.70	\$0.006	WAN (sharkfin) batteries need to be replaced every 10 yrs @ \$10 per battery. Labour costs are estimated as 1/2 hr for 1 person @\$32 (includes 40% burden) and vehicle @\$15 = \$23.50/visit	1. The only additional maintenance costs with the Tantalus solution is battery replacement for the WAN units.

8	Meter replacement	\$0.00	\$0.000	Already accounted for in the depreciation schedule (i.e. useful life of 15 years)	1. Product replacement follows the same schedule as depreciation.
9	Additional IT support	\$0.00	\$0.000	Additional IT costs to support new hardware and software such as the CIS and data server (e.g. monitoring, back-ups, archiving etc.)	1. Existing IT department can accommodate support of new hardware and software at no additional costs.
10	Vendor support for new servers	\$1,200.00	\$0.003	Estimated support costs from vendors: Data Server (\$1,000/yr); CIS server (\$200) - represents 20% that can be apportioned to smart metering.	
	Total	\$178,234.70	\$0.495		

No.	Annual Savings	Savings /Year	\$/Month /Customer	Comments	Assumptions
1	Reduction in hydro meter reads	\$69,000.00	\$0.192	<p>"Potential AMR savings in this area include reduction of labor, supervision, and overhead by eliminating manual meter reading activity. Other related reductions include fleet/vehicle expenses, handheld system capital and expense, accidents, property claims, workers' compensation, and the cost to estimate unread accounts. Typical AMR-related savings for these areas is \$6 to \$15 per meter per year, depending upon utility size, geography, labor rates, and meter accessibility". Source: Today's AMR: Looking at Advantage by A.H. Alpert"</p> <p>OEB: estimated savings are \$.30/meter/month Because CKH outsources their meter reads to URB, savings are based on estimated fees from URB after the smart meter implementation (i.e. future URB fees will only be for water reads).</p>	<ol style="list-style-type: none"> 1. CKH outsources meter reads to URB. 2. After the smart meter implementation, CKH will no longer need to pay URB for hydro meter reads. 3. Savings are estimated based on current URB fees. 4. The cost of water reads may increase but is not considered in this cost model.
2	Reduction in re-reads	\$53,016.00	\$0.147	<p>Based on an average of 376 re-reads per month (only 50% could be eliminated). Average was taken from January 1, 2005 - August 31, 2005. Savings = 1/2 hr for 1 person @\$32 (includes 40% burden) and vehicle @\$15 = \$23.50/visit</p> <p>OEB: estimated savings are \$25/visit or a range of \$.06 - \$.13 /meter/month [range includes both final and re-reads]</p>	<ol style="list-style-type: none"> 1. Total re-reads can be reduced to half of current levels. 2. Because re-reads are done in-house, actual savings may not be realized unless current staff levels are reduced.

3	Reduction in final reads	\$155,382.00	\$0.432	<p>Based on an average of 551 final reads per month (all can be eliminated). Average was taken from January 1, 2005 - August 31, 2005. This represents about 15% mobility. Same savings as re-reads (i.e. \$23.50 per visit).</p> <p>OEB: estimated savings are \$25/visit or a range of \$.06 - \$.13 /meter/month [range includes both final and re-reads]</p>	<p>1. All final reads can be eliminated. 2. Because re-reads are done in-house, actual savings may not be realized unless current staff levels are reduced.</p>
4	Increased meter accuracy	n/a	n/a	Electromechanical meters subject to accuracy drift as they age. However, the OEB view is that there are no actual savings since this is compensated for in the loss uplift.	
5	Theft & tamper detection	n/a	n/a	Theft of power by tampering with the meter is detectable by most electronic meters and reportable over an AMR system. In Ontario, the more common mode of theft is by meter bypass. Although the CKH solution can also detect meter bypasses, it is difficult to quantify the savings. In addition, theft losses are partially recovered in the loss uplift.	
6	Improved billing/cash flow	n/a	n/a	AMR would support more frequent billing (savings arise from the fact that customers who are only billed bimonthly are carried by the LDC since billing are in arrears not in advance). However, the OEB view is that the benefits are questionable since the cost of preparing and sending more frequent bills may actually exceed cashflow benefits.	

7	Improved outage management	\$10,000.00	\$0.028	<p>Smart meter data and communication capability are the basis for improved outage management claims. Outages can be broken down into different stages:</p> <p>a) Notification of an outage - this is a small part of the overall outage time (no benefits from AMR system)</p> <p>b) Dispatch and repair - this part consumes the most time (for most outages, meter data information is not expected to add any appreciable efficiency to the repair effort)</p> <p>c) Restoration - involves reenergizing the system and checking to see if all customers have been restored. Meter polling could be more efficient and may save a return visit to restore a customer that was overlooked (est. \$200/crew revisit). Quantifying the numbers are very difficult and will depend on the LDC's service territory characteristics. The OEB set an estimated savings of \$.05/meter/month.</p> <p>For CKH, estimated savings is 1.7 hrs/week @ \$114/hr or \$10,000/yr</p>
8	Fewer estimated bills	n/a	n/a	<p>PROS: improved cash flow from actual reads; fewer customer disputes</p> <p>CONS: more complex rate plans may increase customer inquiries</p> <p>BENEFITS: estimated to be \$.03/meter/month (1% of customers x 10 minutes x \$20/hr). However, these are offset by the CONS.</p> <p>OEB view: PROS and CONS cancel each other out and there is no net benefit.</p>
9	Distribution system optimization and system planning	n/a	n/a	<p>Benefits are related to the ability of LDCs to design and operate their systems more efficiently (enhanced by finer demand data at the customer level). Savings could be reduced system losses and better timing of capital investments. The OEB view is that smart metering will result in minimal value since LDCs already have tools to optimize.</p> <p>Agreed to put n/a due to challenge in quantifying this.</p>

10	Reduction in site visits (e.g. disconnects/reconnects)	n/a	n/a	<p>"AMR has also yielded substantial savings for utilities in field service and work order management labor required to activate and de-activate customers (e.g. turn on/turn offs, move ins/move outs). On average, between 15 and 25% of a utility's customer base will move each year, at an average field service cost of \$5 to \$25 per activity. This process is traditionally very labor intensive" Source: Today's AMR: looking at advantage by A.H. Alpert</p> <p>The OEB estimate is \$25/visit. CKH is only enabling the disconnect feature for repeat offenders (~100 homes). The cost is \$250. Savings is roughly \$25/visit with 3 visits per year. It is not being considered since it is felt that this is outside the scope of the smart metering initiative.</p>	
11	Detection of equipment overload	n/a	n/a	Reduced equipment damage. Value is unknown.	
12	Avoided costs	n/a	n/a	<p>NOTE: to accurately reflect the AMR business case, it is important to treat avoided investments and expenses as incremental cash flows to the business case, just as budgeted cost reductions are included.</p> <p>Example: efficiencies gained in customer service may eliminate the need to hire additional staff (and additional expenses such as equipment) to handle future growth.</p>	
13	Innovation in services	n/a	n/a	TOU data may permit creation of new retailer services and assist LDCs in optimizing their services. This is not being considered due to lack of information.	
	Total	\$287,398.00	\$0.798		

Return On Capital (items with 15 years)		
Capital Amt	Rate of Return (%)	
\$4,369,105.38	8.9	
Year	Book Value	Return Amt
1	\$4,369,105.38	\$388,850.38
2	\$4,077,831.69	\$362,927.02
3	\$3,786,558.00	\$337,003.66
4	\$3,495,284.30	\$311,080.30
5	\$3,204,010.61	\$285,156.94
6	\$2,912,736.92	\$259,233.59
7	\$2,621,463.23	\$233,310.23
8	\$2,330,189.54	\$207,386.87
9	\$2,038,915.84	\$181,463.51
10	\$1,747,642.15	\$155,540.15
11	\$1,456,368.46	\$129,616.79
12	\$1,165,094.77	\$103,693.43
13	\$873,821.08	\$77,770.08
14	\$582,547.38	\$51,846.72
15	\$291,273.69	\$25,923.36
	\$0.00	\$3,110,803.03
	Avg per year	\$207,386.87
	Avg cust \$/month	\$0.576

Return On Capital (items with 25 years)		
Capital Amt	Rate of Return (%)	
\$150,000.00	8.9	
Year	Book Value	Return Amt
1	\$150,000.00	\$13,350.00
2	\$144,000.00	\$12,816.00
3	\$138,000.00	\$12,282.00
4	\$132,000.00	\$11,748.00
5	\$126,000.00	\$11,214.00
6	\$120,000.00	\$10,680.00
7	\$114,000.00	\$10,146.00
8	\$108,000.00	\$9,612.00
9	\$102,000.00	\$9,078.00
10	\$96,000.00	\$8,544.00
11	\$90,000.00	\$8,010.00
12	\$84,000.00	\$7,476.00
13	\$78,000.00	\$6,942.00
14	\$72,000.00	\$6,408.00
15	\$66,000.00	\$5,874.00
16	\$60,000.00	\$5,340.00
17	\$54,000.00	\$4,806.00
18	\$48,000.00	\$4,272.00
19	\$42,000.00	\$3,738.00
20	\$36,000.00	\$3,204.00
21	\$30,000.00	\$2,670.00
22	\$24,000.00	\$2,136.00
23	\$18,000.00	\$1,602.00
24	\$12,000.00	\$1,068.00
25	\$6,000.00	\$534.00
	\$0.00	\$173,550.00
	Avg per year	\$6,942.00
	Avg cust \$/month	\$0.019

Return On Capital (items with 5 years)		
Capital Amt	Rate of Return (%)	
\$119,320.00	8.9	
Year	Book Value	Return Amt
1	\$119,320.00	\$10,619.48
2	\$95,456.00	\$8,495.58
3	\$71,592.00	\$6,371.69
4	\$47,728.00	\$4,247.79
5	\$23,864.00	\$2,123.90
	\$0.00	\$31,858.44
	Avg per year	\$6,371.69
	Avg cust \$/month	\$0.018

Return On Capital (related to Stranded Assets)

Capital Amt **Rate of Return (%)**
\$350,000.00 8.9

Year	Book Value	Return Amt
1	\$350,000.00	\$31,150.00
2	\$336,000.00	\$29,904.00
3	\$322,000.00	\$28,658.00
4	\$308,000.00	\$27,412.00
5	\$294,000.00	\$26,166.00
6	\$280,000.00	\$24,920.00
7	\$266,000.00	\$23,674.00
8	\$252,000.00	\$22,428.00
9	\$238,000.00	\$21,182.00
10	\$224,000.00	\$19,936.00
11	\$210,000.00	\$18,690.00
12	\$196,000.00	\$17,444.00
13	\$182,000.00	\$16,198.00
14	\$168,000.00	\$14,952.00
15	\$154,000.00	\$13,706.00
16	\$140,000.00	\$12,460.00
17	\$126,000.00	\$11,214.00
18	\$112,000.00	\$9,968.00
19	\$98,000.00	\$8,722.00
20	\$84,000.00	\$7,476.00
21	\$70,000.00	\$6,230.00
22	\$56,000.00	\$4,984.00
23	\$42,000.00	\$3,738.00
24	\$28,000.00	\$2,492.00
25	\$14,000.00	\$1,246.00
	\$0.00	\$404,950.00
	Avg per year	\$16,198.00
	Avg cust \$/month	\$0.045