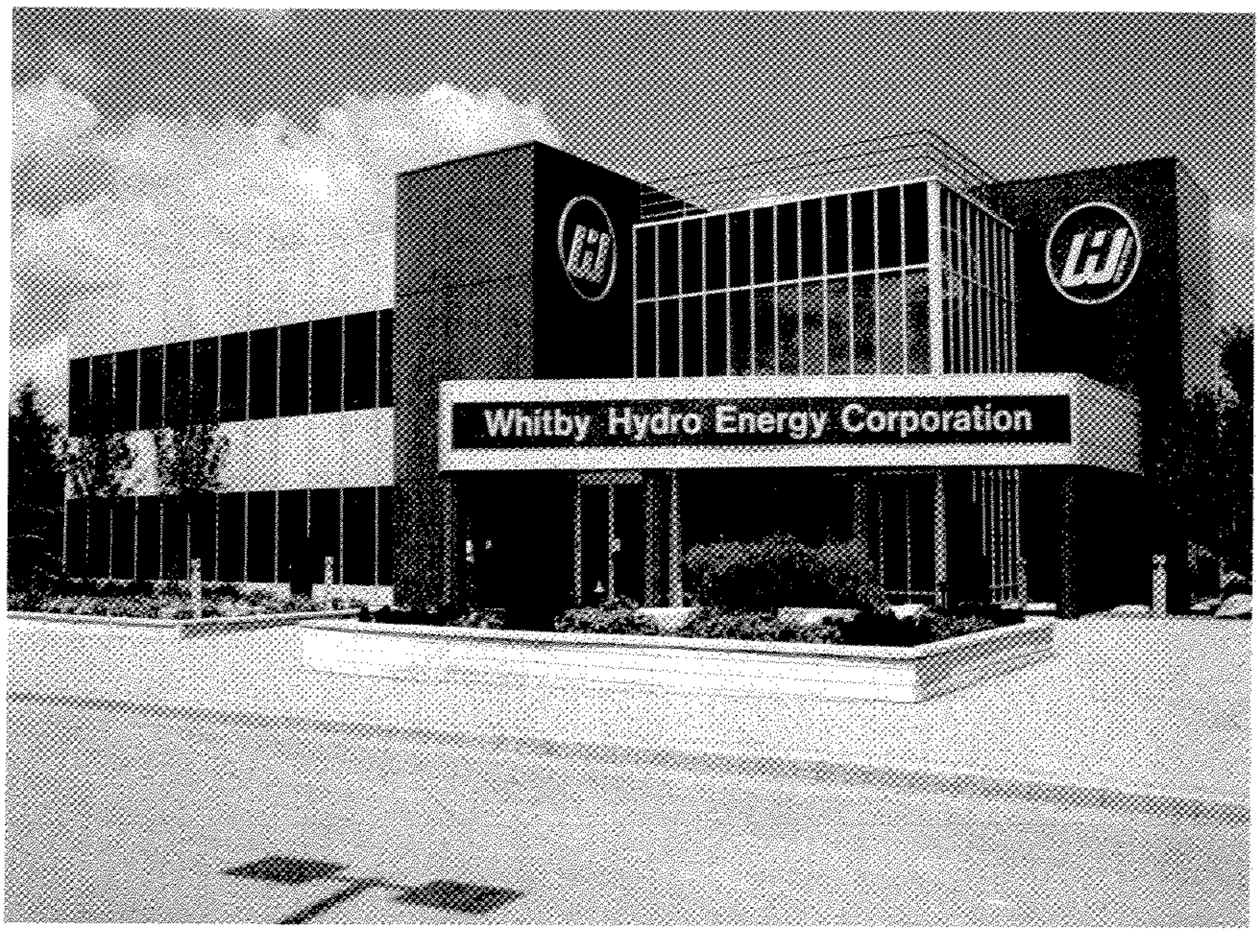
WHITBY HYDRO ELECTRIC CORPORATION

RP-2004-0203\EB-2004-0526

CONSERVATION AND DEMAND MANAGEMENT



2005 ANNUAL REPORT

INTRODUCTION

On February 17th, 2005, Whitby Hydro Electric Corporation ("Whitby Hydro") received Board approval for its Conservation and Demand Management Plan. The plan incorporated eleven different programs totaling $1.3M in the following areas:

- Education and Training
- Research and Pilot Programs
- Distributed Generation Facilities (Bi-Fuel)
- Sub-Metering
- Power Factor Correction
- Load Balancing
- Smart Metering

At the end of 2005, each program was in varying stages of activity. The Whitby Hydro CDM committee meets regularly to review program activity and current/forecasted spending, to re-evaluate programs and share information regarding related developments in the industry. Whitby Hydro also utilized the expertise and model developed by EnerSpectrum Group in completing Total Resource Cost (TRC) calculations.

This annual report has been prepared using the guidelines provided by the Ontario Energy Board as a framework. The intent is to evaluate the benefits of the programs using the best information available. When possible, evaluations include a combination of actual and forecast information as most programs have some activity, but are not fully completed. Where programs have not yet begun or are still in the early start-up phase, quantifiable benefits may not be available.

In recognition of the dynamic nature of the industry and the information learned through the evaluation of different programs, Whitby Hydro will continue to assess its Conservation and Demand Management plan and if necessary, re-allocate funds between existing programs or to new programs as we continue to learn from our experiences.

EVALUATION

Overall, the CDM spending at the end of 2005 was $283,290 (or 22% of the total CDM budget). There has been considerable time and effort invested in developing, designing, marketing, implementing and administering the programs and each program is considered to be an important part of our overall learning process. Information collected, forecasted and analyzed for each program has been summarized in Appendices A and B. Due to the varying degrees of completion of each program, Appendix A has been set up to highlight the various measurements available on a program by program basis. Each program has been categorized as Residential, Commercial/Industrial, MUSH, LDC, or a program which encompasses all customer classes. By taking this approach, we eliminate the distortion of data that may be caused by the summarization of programs which vary significantly in terms of program type, information and stage of completion.

It is important to note that there is only one program that can be considered complete at the end of 2005 – the Research program. Other programs required some degree of estimating or forecasting to determine the measurements required. As a result, the evaluation is seen more as a learning process to increase the understanding of possible program benefits with the understanding that they are based on a series of forecasts and assumptions. The annual reporting exercise is considered useful and even at early stages of a program rollout, has allowed us an opportunity to make modifications to our programs and overall plan going forward in an attempt to increase the benefits of the program from a conservation and demand management perspective.

Appendix A - Evaluation of the CDM Plan

	Research	Peak Shaving Whitby Hydro Bi-Fuel	Peak Shaving Town of Whitby Bi-Fuel	Peak Shaving Bi-Fuel Incentive	Energy Efficiency Durham Non-Profit Housing	Power Factor Correction - Power Medix Residential	Power Factor Correction	Sub-Metering	Education & Training	Load Balancing	Smart Meters
Program Type	Various	Industrial/ Commercial	MUSH	Industrial/ Commercial	Residential	Residential	Industrial/ Commercial	Residential	All	LDC	All
Net TRC value ($):	$ 2,945	$ (14,425)	$ 182,231	N/A	N/A	$ (4,507)	$ 116,753	$ 3,384	N/A	N/A	N/A
Benefit to cost ratio:	1.35	0.76	9.76	N/A	N/A	0.89	3.15	1.23	N/A	N/A	N/A
Number of participants or units delivered:	23	1	1	-	-	17 participants 56.78 kVar	2 participants 485 kVar	2 buildings - 26 units	N/A	N/A	N/A
Total kWh to be saved over the lifecycle of the plan (kWh):	281,860	240,000	900,000	N/A	N/A	20,805	480,510	415,760	N/A	N/A	N/A
Total in year kWh saved (kWh):	14,093	12,000	45,000	N/A	N/A	938	32,034	20,788	N/A	N/A	N/A
Total peak demand saved (kW):	4	40	150	N/A	N/A	0.15	4	1	N/A	N/A	N/A
Total kWh saved as a percentage of total kWh delivered (%):	0.002%	0.001%	0.005%	N/A	N/A	0.000%	0.004%	0.002%	N/A	N/A	N/A
Peak kW saved as a percentage of LDC peak kW load (%):	0.002%	0.022%	0.082%	N/A	N/A	0.000%	0.002%	0.001%	N/A	N/A	N/A
Gross in year C&DM expenditures ($)***:	$ 23,536	$ 32,376	$ 110,149	$ -	$ -	$ 43,318	$ 17,458	$ 9,104	$ 49,404	$ -	$ 17,945
Expenditures per kWh saved ($/kWh)*:	$ 2	$ 3	$ 2	$ -	$ -	$ 46	$ 1	$ 1	N/A	N/A	N/A
Expenditures per kW saved ($/kW)**:	$ 5,884	$ 809	$ 734	$ -	$ -	$ 288,787	$ 4,718	$ 9,104	N/A	N/A	N/A
Utility discount rate (%):	8.565%										

* Expenditures include all utility program costs (direct and indirect) for all programs which primarily generate energy savings.

** Expenditures include all utility program costs (direct and indirect) for all programs which primarily generate capacity savings.

*** Includes LDC gross expenditures for 2004/05 - Excludes $20K of EDA Tomorrow Fund grant recevied for the Power Factor Correction Power Medix Program

PROGRAM DISCUSSIONS AND LESSONS LEARNED

Discussions of the following individual programs are included and supplemented by an Appendix B:

- Research
- Bi-Fuel Peak Shaving – Whitby Hydro
- Bi-Fuel Peak Shaving – Town of Whitby
- Bi-Fuel Peak-Shaving – Customer Incentives
- Lighting Replacement – Durham Non-Profit Housing
- Power Factor Correction – Power Medix Residential
- Power Factor Correction
- Sub-Metering
- Education & Training
- Load Balancing
- Smart Meters

Total Resource Cost (TRC) calculations were prepared using a model developed by EnerSpectrum Group. In addition, EnerSpectrum Group provided a one-day working session to assist the CDM group in the preparation of TRC calculations.

Research

2005 Program Spending To-Date:	**$23,536**
OEB Approved Spending:	**$25,000**
Program Status:	**Completed**

Whitby Hydro's research primarily included an Induction lighting pilot, and Emission testing for diesel and Bi-Fuel technology.

Induction Lighting

Induction lighting provides equivalent lighting levels using much less energy than high pressure sodium lights (HPS). One of the advantages to induction lighting is that the lights have a life expectancy of 100,000 hours compared to 20,000 for HPS lights. During the research study, three different lighting applications were studied: parking lights, street lights, and warehouse lights. Measures and TRC reported for this program are based solely on the Induction Lighting pilot.

Lessons Learned:

Energy savings are significant with the introduction of induction lighting. The NPV however with the highbay (indoor) installations did not show positive results. This is partly due to the fact that the labour to retrofit was more extensive than for the parking lights. A scissor jack also had to be hired to do the highbay retrofit which added to the costs. Meters were also purchased to compare consumption between the new lights and the old lights. The highbay (indoor) installation would be more economical if implemented on a larger scale. It is also apparent that the induction lights would be a very economical installation for new warehouse lighting vs. retrofit. The parking light and street light retrofit required less labour and therefore resulted in a positive NPV.

Emission Testing

In October 2004, Canadian ORTECH Environmental Inc (ORTECH) completed an emission testing program at the Whitby Hydro facility located in Whitby, Ontario. The objective of the testing program was to provide compliance quality data for an emergency power generator using two (2) different types of fuels – diesel and bi-fuel. The average combustion gas concentrations at each condition measured during the test program are tabulated below – see Table 1. The fuel type and generator output is provided.

Lessons Learned:

Overall, the emission testing showed improved levels when using bi-fuel. Comparing the bi-fuel test results with results obtained from the diesel test at similar generator outputs, it can be noted that the carbon dioxide, nitrogen oxides, and sulphur dioxide results were lower during the bi-fuel testing period. However, carbon monoxide and total hydrocarbon concentrations were much higher during the bi-fuel tests. After installation of the catalytic converter, the carbon monoxide concentration decreased by >85% and the sulphur dioxide concentration decreased by >45% for both fuels. This data was submitted to the Ministry of Energy as one of five test sites. Currently the Ministry requires additional data from other test sites before making a decision on how to rate bi-fuel.

Table 1: Emissions Data comparing Diesel vs. BiFuel Operation

		Dry Concentration by Volume					
Test No. & Date	Condition	CO_2 %	O_2 %	CO ppm	NOx ** ppm	SO_2 ppm	THC ppm***
1 - Oct. 26	Bi-fuel, 121 kW	6.36	10.34	1804	573	19.3	5648
2 - Oct. 26	Bi-fuel, 121 kW	6.36	10.32	1813	579	19	5547
3 - Oct. 26	Bi-fuel, 121 kW	6.46	10.19	1843	584	19.7	5396
6 - Oct. 26	Diesel, 121 kW	7.79	10.47	306	805	31.5	124
7 - Oct. 26	Diesel, 121 kW	7.8	10.46	307	809	31.8	124
4 - Oct. 26	Bi-fuel, 60 kW	4.93	12.61	1745	396	18.5	6796
5 - Oct. 26	Bi-fuel, 60 kW	4.92	12.64	1750	396	19.4	6531
Catalytic Converter Installed							
8 - Oct. 27	Bi-fuel, 121 kW	6.91	9.94	181	581	10.6	4987
9 - Oct. 27	Bi-fuel, 121 kW	6.95	9.87	168	605	10.3	4950
12 - Oct. 27	Diesel, 121 kW	7.89	10.4	43	814	17.9	18.4
13 - Oct. 27	Diesel, 121 kW	7.92	10.38	44	820	17.9	15.6
10 - Oct. 27	Bi-fuel, 60 kW	5.32	12.44	128	418	9.8	6475
11 - Oct. 27	Bi-fuel, 60 kW	5.31	12.43	131	416	9.9	6802

Appendix B - Discussion of the Program

Name of the Program: **Research**

A. **Description of the program (including intent, design, delivery, partnerships and evaluation):**

Whitby Hydro's research included an Induction lighting pilot, and emission testing for diesel and Bi-Fuel technology.

Induction Lighting
Induction lighting provides equivalent lighting levels using much less energy that high pressure sodium lights (HPS). One of the advantages to induction lighting is that the lights have a life expectancy of 100,000 hours compared to 20,000 for HPS lights. During the research study three different lighting applications were studied: parking lights, street lights, and warehouse lights. Measures and TRC calculations have been completed based soley on the Induction Lighting pilot.

Emission Testing
In October 2004, Canadian ORTECH Environmental Inc (ORTECH) completed an emission testing program at the Whitby Hydro facility located in Whitby, Ontario. The objective of the testing program was to provide compliance quality data for an emergency power generator using two (2) different types of fuels – diesel and bi-fuel. The fuel type and generator output is provided. Comparing the bi-fuel test results with results obtained from the diesel test at similar generator outputs, it can be noted that the carbon dioxide, nitrogen oxides, and sulphur dioxide results were lower during the bi-fuel testing period. However, carbon monoxide and total hydrocarbon concentrations were much higher during the bi-fuel tests. After installation of the catalytic converter, the carbon monoxide concentration decreased by >85% and the sulphur dioxide concentration decreased by >45% for both fuels.

Measure(s):

	Measure 1	Measure 2	Measure 3
Base case technology:	High Pressure Sodium Lighting	High Pressure Sodium Lighting	
Efficient technology:	Induction Lighting	Induction Lighting	
# of participants or units delivered:	14	9	
Measure life (years):	20	20	
	Parking/Street Lighting	Indoor Warehouse Lighting	

B. **TRC Results (Induction Lighting Pilot only)**

TRC Benefits ($):	11,274
TRC Costs ($):	
Utility program cost (less incentives):	8,329
Participant cost:	
Total TRC costs:	8,329
Net TRC (in year CDN $):	2,945
Benefit to Cost Ratio (TRC Benefits/TRC Costs):	1.35

C. **Results: (one or more category may apply)**

Conservation Programs:

Demand savings (kW):	*Summer*		4
	Winter		4
		lifecycle	*in year*
Energy Saved (kWh):		281,860	14,093
Other resources saved:			
Natural Gas (m3):			

Name of the Program: **Research**

Other (specify):

Demand Management Programs:
Controlled load (kW)
Energy shifted On-peak to Mid-peak (kWh):
Energy shifted On-peak to Off-peak (kWh):
Energy shifted Mid-peak to Off-peak (kWh):

Demand Response Programs:
Dispatchable load (kW):
Peak hours dispatched in year (hours):

Power Factor Correction Programs:
Amount of Kvar installed (Kvar):
Distribution system power factor at beginning of year (%)
Distribution system power factor at end of year (%)

Line Loss Reduction Programs:
Peak load savings (kW):

	lifecycle	*in year*
Energy savings (kWh):		

Distributed Generation and Load Displacement Programs:
Amount of DG installed (kW):
Energy Generated (kWh):
Peak energy generated (kWh):
Fuel Type:

Other Programs (specify)
Metric (specify):

D. **Program Costs*:**

Utility direct costs ($):	Incremental capital:	8,817
	Incremental O&M:	14,719
	Incentive:	
	Total:	23,536
Utility indirect costs ($):	Incremental capital:	
	Incremental O&M:	
	Incentive:	
	Total:	0
Participant costs ($):	Incremental equipment:	
	Incremental O&M:	
	Total:	0

E. **Comments:**

The Total Resource Cost (TRC) modeled using the EnerSpectrum spreadsheet was based on the following assumptions:

1. Kw saved per unit = .21 (outdoor lights), .07 (Indoor lights)
2. Avoided costs included for replacement HPS lights every 5 years.
3. 20 year life of Induction lights.
4. Hours of use = 10-13/day (outdoor lights), 10/day (Indoor lights).

Peak Shaving - Whitby Hydro Bi-fuel

2005 Program Spending To-Date:	**$32,376**
OEB Approved Spending:	**$50,000**
Program Status:	**Active – Remaining work to be completed in 2006.**

This is a Bi-Fuel peak-shaving pilot program to change the transfer switch associated with the Whitby Hydro Bi-Fuel genset with a new switch which will convert the existing "open" transition transfer to "closed" transition and thereby facilitate momentary parallel operation. Remote operation capability of the modified genset will be added whereby automatic peak shaving will be triggered by the price differential between the HOEP price and the cost of Bi-fuel operation. At the present time, the control system has been developed and a new closed transition transfer switch will be added during the first quarter of 2006 to complete the overall installation. Based on 300 hours of annual operation, and 40 kW of load, the annual savings would be 12,000 kWh.

The modification of the controls to facilitate peak shaving and remote dispatch would not have been undertaken without the support of the pilot program since significant funding was required to design and engineer a solution.

Lessons Learned:

By increasing the load on the generator from 40 kWe to 60 kWe, the TRC model calculates a positive NPV. We will investigate feasibility of making modifications required to make this change in 2006.

Appendix B - Discussion of the Program

Name of the Program: **Peak Shaving - Whitby Hydro Bi-Fuel**

A. **Description of the program (including intent, design, delivery, partnerships and evaluation):**

This is a pilot program to change the transfer switch associated with the Whitby Hydro Bi-Fuel genset with a new switch which will convert the existing "open" transition transfer to "closed" transition and thereby facilitate momentary parallel operation. Remote operation capability of the modified genset will be added whereby automatic peak shaving will be triggered by the price differential between the HOEP price and the cost of Bi-fuel operation. At the present time, the control system has been developed and a new closed transition transfer switch will be added during the first quarter of 2006 to complete the overall installation. Based on 300 hours of annual operation, and 40 kW of load, the annual savings would be 12,000 kWh. TRC was also evaluated using 60kW load which resulted in a positive NPV. Consideration will be given to modifications required to make this change in the future.

The modification of the controls to facilitate peak shaving and remote dispatch would not have been undertaken without the support of the pilot program since significant funding was required to design and engineer a solution.

Measure(s):

	Measure 1	Measure 2	Measure 3
Base case technology:	Diesel Genset		
Efficient technology:	Bi-Fuel Genset		
# of participants or units delivered:	1		
Measure life (years):	20		

B. **TRC Results**

TRC Benefits ($):	46,642
TRC Costs ($):	
Utility program cost (less incentives):	61,067
Participant cost:	
Total TRC costs:	61,067
Net TRC (in year CDN $):	(14,425)
Benefit to Cost Ratio (TRC Benefits/TRC Costs):	0.76

C. **Results: (one or more category may apply)**

Conservation Programs:

Demand savings (kW): *Summer*
Winter

	lifecycle	*in year*
Energy Saved (kWh):		
Other resources saved:		
Natural Gas (m3):		
Other (specify):		

Demand Management Programs:

Controlled load (kW)
Energy shifted On-peak to Mid-peak (kWh):
Energy shifted On-peak to Off-peak (kWh):

Name of the Program:	**Peak Shaving - Whitby Hydro Bi-Fuel**		
Energy shifted Mid-peak to Off-peak (kWh):			
Demand Response Programs:			
Dispatchable load (kW):			
Peak hours dispatched in year (hours):			
Power Factor Correction Programs:			
Amount of Kvar installed (Kvar):			
Distribution system power factor at beginning of year (%)			
Distribution system power factor at end of year (%)			
Line Loss Reduction Programs:			
Peak load savings (kW):			
	lifecycle	*in year*	
Energy savings (kWh):			
Distributed Generation and Load Displacement Programs:			
Amount of DG installed (kW):		120	
Energy Generated (kWh):		12,000	annually
Peak energy generated (kWh):		12,000	annually
Fuel Type:		Bi-Fuel	
Other Programs (specify)			
Metric (specify):			

D. **Program Costs*:**

Utility direct costs ($):	Incremental capital:	4,284
	Incremental O&M:	28,092
	Incentive:	0
	Total:	32,376
Utility indirect costs ($):	Incremental capital:	0
	Incremental O&M:	0
	Incentive:	0
	Total:	0
Participant costs ($):	Incremental equipment:	0
	Incremental O&M:	0
	Total:	0

E. **Comments:**

The Total Resource Cost (TRC) modeled using the EnerSpectrum spreadsheet was based on the following assumptions:

1. Summer Peaking utility and generator operating 300 hrs per year only during summer peak hours.
2. Economics forecasted over 20 years.
3. Avoided energy, generation, transmission and distribution capacity and distribution losses factored into economic model.
4. Fuel savings of $0.06/kWh using bi-fuel versus diesel for 12 hours each year to accommodate the maintenance requirements of CSA 282-00 (i.e. generators should be tested monthly for 1 hour as part of regular maintenance).
5. Operating costs of $0.10/kWh on bi-fuel and $0.16/kWh on diesel.
6. Program costs for remote dispatch controls and closed transition transfer switch included.
7. Displaced demand of 40 kWe.

Peak Shaving – Town of Whitby Bi-fuel

2005 Program Spending To-Date:	**$110,149**
OEB Approved Spending:	**$110,000**
Program Status:	**Active – Scheduled for completion by mid 2006.**

The use of standby gensets to relieve pressure on the existing grid is a proven efficient and cost-effective means to utilize existing resources at a fraction of the cost of wholesale expansion.

A Bi-Fuel standby diesel generator will be sited at the Town of Whitby Municipal Building and serve the dual role as a "peak shaver" for demand response and a back-up power supply for the Town of Whitby Emergency Command Centre in the event of a major emergency. At the present time, the diesel generator has been installed and it will be converted to bi-fuel operation during the second quarter of 2006 complete with remote operation capability whereby automatic peak shaving will be triggered by the price differential between the HOEP price and the cost of Bi-fuel operation. Based on 300 hours of annual operation, and 150 kW of load, the annual savings would be 45,000 kWh.

The modification of the generator to facilitate peak shaving and remote dispatch would not have been undertaken without the support of the pilot program since significant funding was required to design and engineer a solution.

Lessons Learned:

By increasing the size of the generator and its associated load, the economics (NPV) of the TRC model for peak shaving with bi-fuel converted diesel generator becomes more positive.

Appendix B - Discussion of the Program

Name of the Program: **Peak Shaving - Town of Whitby Bi-Fuel**

A. **Description of the program (including intent, design, delivery, partnerships and evaluation):**

The use of standby gensets to relieve pressure on the existing grid is a proven efficient and cost-effective means to utilize existing resources at a fraction of the cost of wholesale expansion.

A Bi-Fuel standby diesel generator will be sited at the Town of Whitby Municipal Building and serve the dual role as a "peak shaver" for demand response and a back-up power supply for the Town of Whitby Emergency Command Centre in the event of a major emergency. At the present time, the diesel generator has been installed and it will be converted to bi-fuel operation during the second quarter of 2006 complete with remote operation capability whereby automatic peak shaving will be triggered by the price differential between the HOEP price and the cost of Bi-fuel operation. Based on 300 hours of annual operation, and 150 kW of load, the annual savings would be 45,000 kWh.

The modification of the generator to facilitate peak shaving and remote dispatch would not have been undertaken without the support of the pilot program since significant funding was required to design and engineer a solution.

Measure(s):

	Measure 1	Measure 2	Measure 3
Base case technology:	Diesel genset		
Efficient technology:	Bi-Fuel genset		
# of participants or units delivered:	1		
Measure life (years):	20		

B. **TRC Results**

TRC Benefits ($):	203,045
TRC Costs ($):	
Utility program cost (less incentives):	10,814
Participant cost:	10,000
Total TRC costs:	20,814
Net TRC (in year CDN $):	182,231
Benefit to Cost Ratio (TRC Benefits/TRC Costs):	9.76

C. **Results: (one or more category may apply)**

Conservation Programs:

Demand savings (kW): *Summer*
Winter

	lifecycle	*in year*
Energy Saved (kWh):		
Other resources saved:		
Natural Gas (m3):		
Other (specify):		

Demand Management Programs:

Controlled load (kW)
Energy shifted On-peak to Mid-peak (kWh):

Name of the Program: **Peak Shaving - Town of Whitby Bi-Fuel**

Energy shifted On-peak to Off-peak (kWh):
Energy shifted Mid-peak to Off-peak (kWh):

Demand Response Programs:
Dispatchable load (kW):
Peak hours dispatched in year (hours):

Power Factor Correction Programs:
Amount of Kvar installed (Kvar):
Distribution system power factor at beginning of year (%)
Distribution system power factor at end of year (%)

Line Loss Reduction Programs:
Peak load savings (kW):

	lifecycle	*in year*
Energy savings (kWh):		

Distributed Generation and Load Displacement Programs:

Amount of DG installed (kW):	300	
Energy Generated (kWh):	45,000	annually
Peak energy generated (kWh):	45,000	annually
Fuel Type:	Bi-Fuel	

Other Programs (specify)
Metric (specify):

D. **Program Costs*:**

Utility direct costs ($):	Incremental capital:	0
	Incremental O&M:	110,149
	Incentive:	0
	Total:	110,149
Utility indirect costs ($):	Incremental capital:	0
	Incremental O&M:	0
	Incentive:	0
	Total:	0
Participant costs ($):	Incremental equipment:	0
	Incremental O&M:	0
	Total:	0

E. **Comments:**

The Total Resource Cost (TRC) modeled using the EnerSpectrum spreadsheet was based on the following assumptions:

1. Summer Peaking utility and generator operating 300 hours per year only during summer peak hours.
2. Economics forecasted over 20 years.
3. Avoided energy, generation, transmission and distribution capacity and distribution losses factored into economic model.
4. Operating costs of $0.10/kWh on bi-fuel and $0.16/kWh on diesel.
5. Participant costs for gas line to generator of approximately $10,000.
6. LDC OM&A costs of $1,000/yr to cover software license and communications.
7. Displaced demand of 150 kWe.

Peak Shaving – Bi-fuel Incentive

2005 Program Spending To-Date:	**$0**
OEB Approved Spending:	**$350,000**
Program Status:	**Start-Up Stage. Negotiations underway with two customers. Other prospective customers for this program have been identified.**

Existing diesel engines can be retrofitted to run on a natural gas/diesel fuel mixture (up to 80% natural gas). This not only reduces emissions, operating and fuel costs, it also allows for extended run time on stored fuel (up to five times). In addition, generators can be deployed for use beyond emergency situations to provide reliable operation for peak shaving. Whitby Hydro is proposing an incentive program to modify existing standby diesel gensets to Bi-Fuel operation with a new controller and switch which will convert the existing "open" transition transfer switch to "closed" transition and thereby facilitate momentary parallel operation. Remote operation capability of the modified genset will be installed whereby automatic peak shaving will be triggered by the price differential between the HOEP price and the cost of Bi-fuel operation. The incentive will be up to $50/kW towards the purchase and installation of a Bi-Fuel system and up to $50/kW toward the conversion of the paralleling controls. We are targeting 1700 kW in 2006 and 1700 kW in 2007 and based on 300 hours of annual operation, and 3400 kW of load, the annual savings would be 1,020,000 kWh.

Lessons Learned:

Information learned to-date from the pilot peak-shaving program suggest expected benefits from this program. Forecasted scenarios for prospective customers have been run through the TRC model, producing positive results.

Appendix B - Discussion of the Program

Name of the Program: **Peak Shaving - Bi-Fuel Incentive**

A. **Description of the program (including intent, design, delivery, partnerships and evaluation):**

Existing diesel engines can be retrofitted to run on a natural gas/diesel fuel mixture (up to 80% natural gas). This not only reduces emissions, operating and fuel costs, it also allows for extended run time on stored fuel (up to five times). In addition, generators can be deployed for use beyond emergency situations to provide reliable operation for peak shaving. Whitby Hydro is proposing an incentive program to modify existing standby diesel gensets to Bi-Fuel operation with a new controller and switch which will convert the existing "open" transition transfer switch to "closed" transition and thereby facilitate momentary parallel operation. Remote operation capability of the modified genset will be installed whereby automatic peak shaving will be triggered by the price differential between the HOEP price and the cost of Bi-fuel operation. The incentive will be up to $50/kW towards the purchase and installation of a Bi-Fuel system and up to $50/kW toward the conversion of the paralleling controls. We are targeting 1700 kW in 2006 and 1700 kW in 2007 and based on 300 hours of annual operation, and 3400 kW of load, the annual savings would be 1,020,000 kWh.

Measure(s):

	Measure 1	Measure 2	Measure 3
Base case technology:	Diesel genset		
Efficient technology:	Bi-Fuel genset		
# of participants or units delivered:	0		
Measure life (years):	20		

B. **TRC Results**

TRC Benefits ($):	
TRC Costs ($):	
Utility program cost (less incentives):	
Participant cost:	
Total TRC costs:	0
Net TRC (in year CDN $):	0

Benefit to Cost Ratio (TRC Benefits/TRC Costs): #DIV/0!

C. **Results: (one or more category may apply)**

Conservation Programs:

Demand savings (kW): *Summer*
Winter

	lifecycle	*in year*
Energy Saved (kWh):		
Other resources saved:		
Natural Gas (m3):		
Other (specify):		

Demand Management Programs:

Controlled load (kW)
Energy shifted On-peak to Mid-peak (kWh):

Name of the Program: **Peak Shaving - Bi-Fuel Incentive**

Energy shifted On-peak to Off-peak (kWh):
Energy shifted Mid-peak to Off-peak (kWh):

Demand Response Programs:
Dispatchable load (kW):
Peak hours dispatched in year (hours):

Power Factor Correction Programs:
Amount of Kvar installed (Kvar):
Distribution system power factor at beginning of year (%)
Distribution system power factor at end of year (%)

Line Loss Reduction Programs:
Peak load savings (kW):

	lifecycle	*in year*
Energy savings (kWh):		

Distributed Generation and Load Displacement Programs:
Amount of DG installed (kW):
Energy Generated (kWh):
Peak energy generated (kWh):
Fuel Type:

Other Programs (specify)
Metric (specify):

D. **Program Costs*:**

Utility direct costs ($):	Incremental capital:	0
	Incremental O&M:	0
	Incentive:	0
	Total:	0
Utility indirect costs ($):	Incremental capital:	0
	Incremental O&M:	0
	Incentive:	0
	Total:	0
Participant costs ($):	Incremental equipment:	0
	Incremental O&M:	0
	Total:	0

E. **Comments:**

No measurable benefits at this time. Note that estimated TRC calculations have been done for one prospective customer which indicate favorable TRC.

Energy Efficiency – Durham Non-Profit Housing

2005 Program Spending To-Date:	**$0**
OEB Approved Spending:	**$40,000**
Program Status:	**Active – Agreement to reserve available incentives has been signed by the customer. Awaiting customer "go-ahead" to proceed.**

Durham Non Profit Housing (DNPH) owns and manages over 1100 units in the Durham Region. Three of their largest high rise buildings are located within the Whitby Hydro Service area. These buildings were constructed in an era where capital costs were minimized, often at the expense of higher operating costs. DNPH has experienced higher electricity costs recently and this has placed pressure on their operating budgets as they have limited re-course to increase funding. DNPH has implemented a plan targeted at reducing energy costs by 20% by taking a comprehensive approach to energy management. One of the critical elements of this plan is to replace inefficient lighting and space heating systems. This pilot program will provide incentives to help reduce the capital costs associated with replacing these building systems. An incentive agreement has been signed and assuming the program continues to move forward, conservation measures will be completed by the second quarter of 2006 and the annual energy savings are estimated to be 575,000 kWh.

Lessons Learned:

While there are no actual measurable benefits at this time, several scenarios have been run on the TRC model which indicates positive TRC for this program.

Appendix B - Discussion of the Program

Name of the Program: **Energy Efficiency - Durham Non-Profit Housing**

A. **Description of the program (including intent, design, delivery, partnerships and evaluation):**

Durham Non Profit Housing (DNPH) owns and manages over 1100 units in the Durham Region. Three of their largest high rise buildings are located within the Whitby Hydro Service area. These buildings were constructed in an era where capital costs were minimized, often at the expense of higher operating costs. DNPH has experienced higher electricity costs recently and this has placed pressure on their operating budgets as they have limited re-course to increase funding. DNPH has implemented a plan targeted at reducing energy costs by 20% by taking a comprehensive approach to energy management. One of the critical elements of this plan is to replace inefficient lighting and space heating systems. This pilot program will provide incentives to help reduce the capital costs associated with replacing these building systems.

Measure(s):

	Measure 1	Measure 2	Measure 3
Base case technology:	Incandescent Lighting		
Efficient technology:	CFL Lighting		
# of participants or units delivered:	0		
Measure life (years):	5		

B. **TRC Results**

TRC Benefits ($):	
TRC Costs ($):	
Utility program cost (less incentives):	
Participant cost:	
Total TRC costs:	0
Net TRC (in year CDN $):	0

Benefit to Cost Ratio (TRC Benefits/TRC Costs): #DIV/0!

C. **Results: (one or more category may apply)**

Conservation Programs:

Demand savings (kW): *Summer*
Winter

	lifecycle	*in year*
Energy Saved (kWh):		
Other resources saved:		
Natural Gas (m3):		
Other (specify):		

Demand Management Programs:

Controlled load (kW)
Energy shifted On-peak to Mid-peak (kWh):
Energy shifted On-peak to Off-peak (kWh):
Energy shifted Mid-peak to Off-peak (kWh):

Name of the Program: **Energy Efficiency - Durham Non-Profit Housing**

Demand Response Programs:
Dispatchable load (kW):
Peak hours dispatched in year (hours):

Power Factor Correction Programs:
Amount of Kvar installed (Kvar):
Distribution system power factor at beginning of year (%)
Distribution system power factor at end of year (%)

Line Loss Reduction Programs:
Peak load savings (kW):

	lifecycle	*in year*
Energy savings (kWh):		

Distributed Generation and Load Displacement Programs:
Amount of DG installed (kW):
Energy Generated (kWh):
Peak energy generated (kWh):
Fuel Type:

Other Programs (specify)
Metric (specify):

D. **Program Costs*:**

Utility direct costs ($):	Incremental capital:	0
	Incremental O&M:	0
	Incentive:	0
	Total:	0
Utility indirect costs ($):	Incremental capital:	0
	Incremental O&M:	0
	Incentive:	0
	Total:	0
Participant costs ($):	Incremental equipment:	0
	Incremental O&M:	0
	Total:	0

E. **Comments:**

An incentive agreement has been signed and assuming the program continues to move forward, conservation measures will be completed by the second quarter of 2006 and the annual energy savings are estimated to be 575,000 kWh. While there are no actual measurable benefits at this time, a conservative scenario has been run on the Enerpectrum TRC model which indicates positive TRC for this program.

Power Factor Correction – Residential Power Medix

2005 Program Spending To-Date:	**$23,318**
OEB Approved Spending:	**$125,000**
Program Status:	**Active - Pilot Completed, expect to rollout program targeting new residential subdivisions.**

In 2005, Whitby Hydro carried out a pilot project under the CDM Plan to install capacitors at residential homes to determine the impact on system capacity and generation requirements. The study involved 31 homes within Whitby Hydro's distribution territory. The houses selected were located in a new residential neighbourhood and were consistent in size, age and type of heating. The program received a $30,000 grant from the EDA Tomorrow Fund of which $20,000 was received in 2005.

For the pilot, a bench mark had to be established for the loading of each transformer. The three transformers were metered for a two month period prior to the installation of the capacitors. The information gathered included KW, KVAR, volts and amps. Once the benchmark was established, homes fed from two of the transformers were equipped with capacitors providing 3.34 KVAR into their distribution panel. Readings at the transformer continued for an additional two month period after the units were installed in the homes. In addition, two homes were equipped with metering devices that allowed the measurement of power factor.

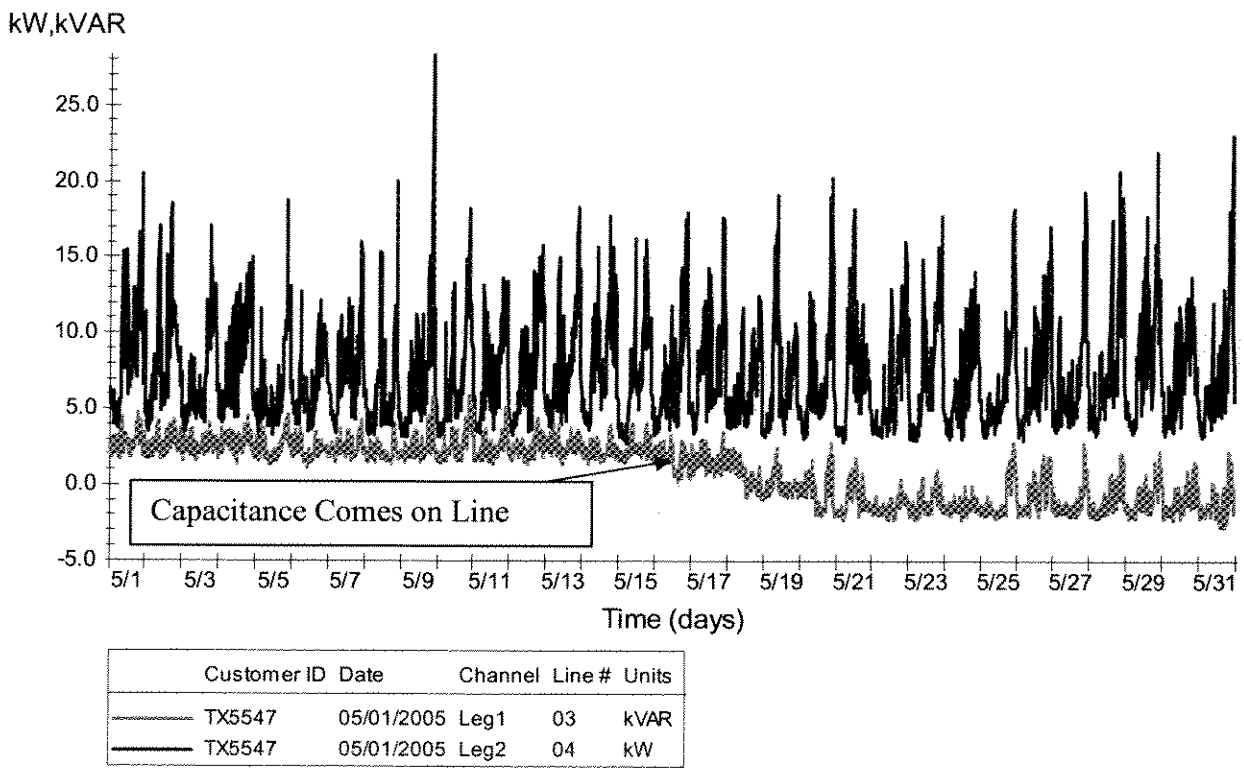
The information gathered allowed analysis to be carried out to determine if the additional capacitance improved power factor at the home as well as at the transformer.

Based on the fact that KW and KVAR were being measured it was easy to see the impact the added capacitance had on KVAR at the transformer. Also because KVAR is a factor when determining generation requirements, this unit of measurement allowed us to determine the impact on provincial generation.

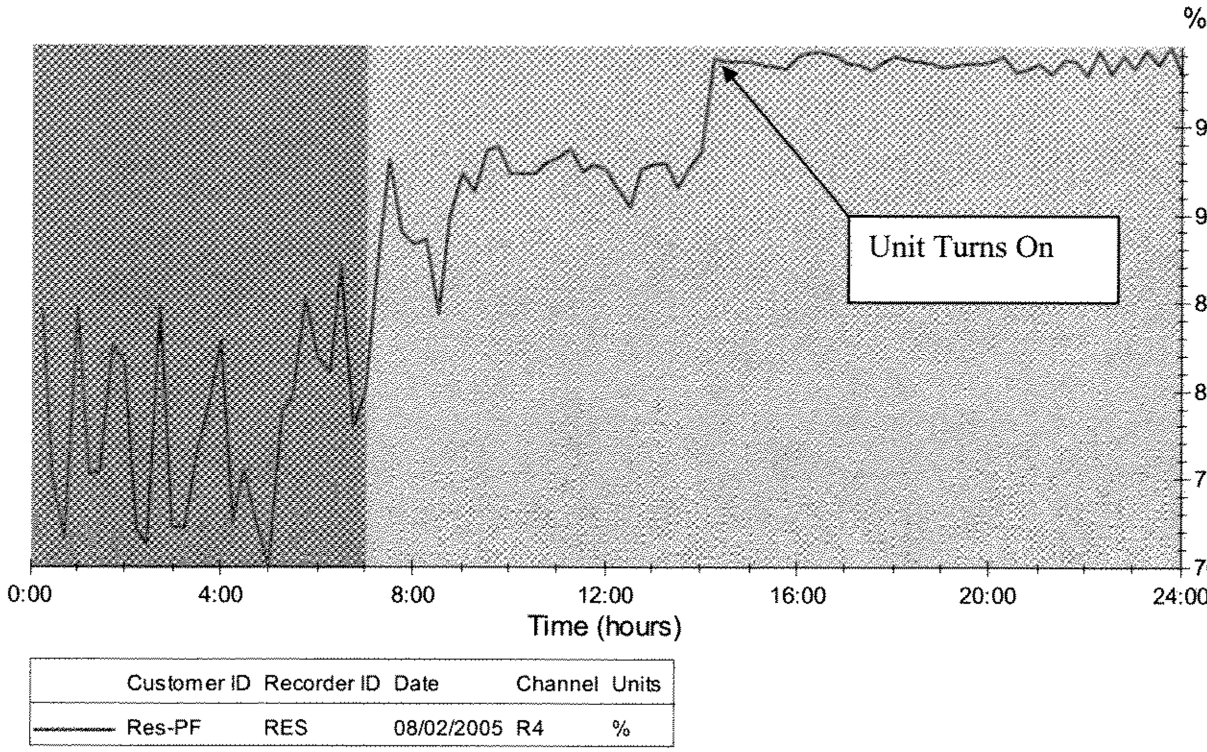
The improvements in KVAR were as follows:

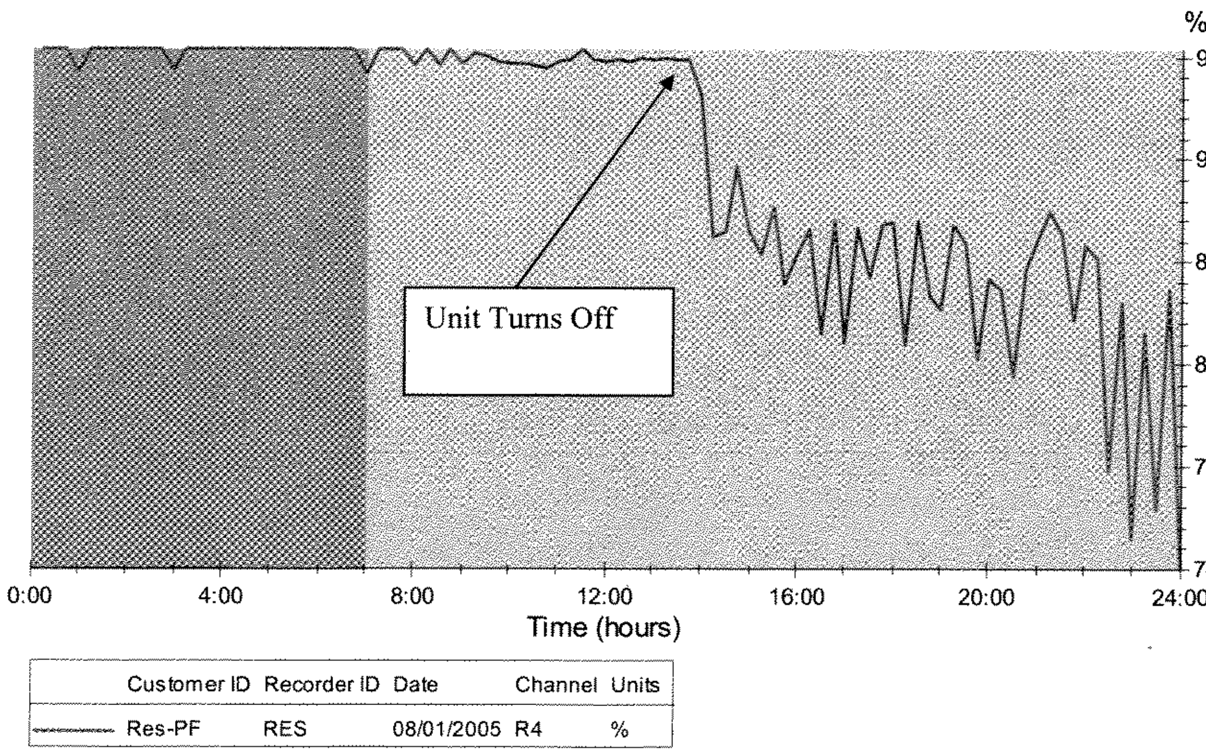
	March	April	May	June	July
TX5545(BM)	4.2041	3.3670	3.0253	7.1944	7.5343
TX5554	2.3756	2.3999	-.9916	-4.3036	-4.0268
TX5547	3.1778	2.6754	.9480	3.0449	2.9364

TX5547 (20.04 KVAR added between May16 and June 7)



To further verify the impact of the capacitance on power factor two homes were measured at the supply panel. These homes where fitted with capacitors that would turn on and off on twenty four hour cycles to show day to day comparison on power factor. Typically, the average power factor when the units where off was 87%. When the units were turned on the power factor was over 99%.


%
95.7
90.7
85.7
80.7
75.7
70.7
0:00
4:00
8:00
12:00
16:00
20:00
24:00
Time (hours)
Unit Turns On
Customer ID Recorder ID Date Channel Units
Res-PF RES 08/02/2005 R4 %


%
99.7
94.7
89.7
84.7
79.7
74.7
0:00
4:00
8:00
12:00
16:00
20:00
24:00
Time (hours)
Unit Turns Off
Customer ID Recorder ID Date Channel Units
Res-PF RES 08/01/2005 R4 %

To get a real understanding of the positive impact power factor correction had on generation, a costs benefit analysis was carried out to see if such a project would make sense on mass. Four assumptions where used in this analysis:

1. A typical home has a 3-5kW demand.
2. The cost of new generation is about $1,000,000 an MVA.
3. A typical home's power factor is improved from 87% to 99% when 3.34 KVAR of capacitance is added.
4. The cost of 1000 Power Medix units is $450,000 installed.

With an example of 1000 homes each using the above information, the generation requirement would be between 3.45 MVA and 5.75MVA (kW/.87PF x 1000). By installing capacitance at the residential level the requirement of the generator for the 1000 homes would now only be between 3.03 MVA and 5.05MVA (kW/.99PF X 1000) or between 420 and 700 KVA less.

Therefore the cost to generate 420 KVA would be $420,000 and to generate 700 KVA would be $700,000 (MVA X $1,000,000). The cost to supply and install capacitance at the residential level to free up the same amount of capacitance would be $450,000. The environment and health costs associated with the generation of electricity are also removed making the economics even stronger.

The pilot project showed that the installation of capacitors at the residential level is a viable option in freeing up capacity within the province if deployed on mass. The savings can also be achieved without having the customer drastically changing their lifestyle.

Line Loss Savings

The addition of capacitors improves voltage and reduces line losses. Assumptions for TRC calculations based on line loss have been included below.

In the case of a residential home, an improved power factor of 87% to 99% would result in the following loss savings:

- % Reduction in I^2R losses = $100-100(87/99)^2$ = 23%
- Estimated original residential system losses of 2% are reduced by .23 X 2 = .46%
- As a result, the monthly kWh billing is reduced by .46%.
- Over a year kWh lost would be reduced by .0046 X 204,000kWh/yr = 938 kWh/yr.
- This is based on 17 homes using 1000 kWh per month.

The next step in the project would to be to install Power Medix units in all homes of a new subdivision.

Lessons Learned:

Power factor correction has been a long proven way to improve efficiency in an electrical system. Because the conversion of power factor to consumption savings is more a mathematical formula, it is difficult to put a true dollar amount to the quantitative savings obtained. There are, however a number of benefits to power factor correction that cannot be easily shown in the TRC model but have been highlighted through the program discussion. Assumptions regarding line loss savings will continue to be reviewed.

Appendix B - Discussion of the Program

Name of the Program: **Power Factor Correction - Power Medix (Residential)**

A. **Description of the program (including intent, design, delivery, partnerships and evaluation):**

In 2005, Whitby Hydro carried out a pilot project under the CDM Plan to install capacitors at residential homes to determine the impact on system capacity and generation requirements. The study involved 31 homes within Whitby Hydro's distribution territory. The houses selected were located in a new residential neighbourhood and were consistent in size, age and type of heating. The program received a $30,000 grant from the EDA Tomorrow Fund of which $20,000 was received in 2005.

For the pilot, a bench mark had to be established for the loading of each transformer. The three transformers were metered for a two month period prior to the installation of the capacitors. The information gathered included KW, KVAR, volts and amps. Once the benchmark was established, homes fed from two of the transformers were equipped with capacitors providing 3.34 KVAR into their distribution panel. Readings at the transformer continued for an additional two month period after the units were installed in the homes. In addition, two homes were equipped with metering devices that allowed the measurement of power factor.

The information gathered allowed analysis to be carried out to determine if the additional capacitance improved power factor at the home as well as at the transformer.

Measure(s):

	Measure 1	Measure 2	Measure 3
Base case technology:	No Capacitors		
Efficient technology:	Power Medix Capacitor		
# of participants or units delivered:	17		
Measure life (years):	15		

B. **TRC Results**

TRC Benefits ($):	37,621
TRC Costs ($):	
Utility program cost (less incentives):	42,128
Participant cost:	
Total TRC costs:	42,128
Net TRC (in year CDN $):	(4,507)
Benefit to Cost Ratio (TRC Benefits/TRC Costs):	0.89

C. **Results: (one or more category may apply)**

Conservation Programs:

		lifecycle	in year
Demand savings (kW):	*Summer*		
	Winter		
Energy Saved (kWh):			
Other resources saved:			
Natural Gas (m3):			
Other (specify):			

Name of the Program: **Power Factor Correction - Power Medix (Residential)**

Demand Management Programs:
Controlled load (kW)
Energy shifted On-peak to Mid-peak (kWh):
Energy shifted On-peak to Off-peak (kWh):
Energy shifted Mid-peak to Off-peak (kWh):

Demand Response Programs:
Dispatchable load (kW):
Peak hours dispatched in year (hours):

Power Factor Correction Programs:

Amount of Kvar installed (Kvar):	56.78
Power factor at beginning of year (%) - per home	87.00%
Power factor at end of year (%)- per home	99.00%

Line Loss Reduction Programs:
Peak load savings (kW):

	lifecycle	*in year*
Energy savings (kWh):		

Distributed Generation and Load Displacement Programs:
Amount of DG installed (kW):
Energy Generated (kWh):
Peak energy generated (kWh):
Fuel Type:

Other Programs (specify)
Metric (specify):

D. **Program Costs*:**

Utility direct costs ($):	Incremental capital:	20,903	
	Incremental O&M:	21,225	
	Incentive:	1,190	
	Total:	43,318	* excludes EDA Tomorrow Fund grant
Utility indirect costs ($):	Incremental capital:	0	
	Incremental O&M:	0	
	Incentive:	0	
	Total:	0	
Participant costs ($):	Incremental equipment:	0	
	Incremental O&M:	0	
	Total:	0	

E. **Comments:**

Power factor correction has been a long proven way to improve efficiency in an electrical system. Because the conversion of power factor to consumption savings is more a mathematical formula, it is difficult to put a true dollar amount to the quantitative savings obtained. The Total Resource Cost (TRC) was modeled using the EnerSpectrum spreadsheet and was based on the assumptions below. There are, however a number of benefits to power factor correction that cannot be easily shown in the model.

Name of the Program: **Power Factor Correction - Power Medix (Residential)**

TRC Assumptions re: Line Loss Savings

The addition of capacitors improves voltage and reduces line losses. Based assumptions to determine kWh savings for TRC calculations based on line loss have been included below.

In the case of a residential home, an improved power factor of 87% to 99% would result in the following loss savings:

- % Reduction in I^22R losses = $100-100(87/99)^2 = 23\%$
- Estimated original residential system losses of 2% are reduced by .23 X 2 = .46%
- As a result, the monthly kWh billing is reduced by .46%.
- Over a year kWh lost would be reduced by .0046 X 204,000kWh/yr = 938 kWh/yr.
- This is based on 17 homes using 1000 kWh per month.

Power Factor Correction

2005 Program Spending To-Date:	**$17,458**
OEB Approved Spending:	**$125,000**
Program Status:	**Active – Program has been rolled out to 2 customers. Several customers are assessing the program.**

Power Factor gives a reading of overall electricity use efficiency. High power factor indicates that the amount of power doing real work is operating at a high level of efficiency. Conversely, low power factor means poor electricity efficiency which is always costly. Improving power factor can reduce billed peak demand and enhance equipment reliability.

An ideal power factor is 100%. Whitby Hydro, under its CDM program offers financial incentives for industrial customers to improve their power factor to above 95%. In 2005, two facilities within Whitby took advantage of the incentives and improved their power factor from 82% to 95% in one case and from 73.4 % to 90% in the other. Although the correction in the second case did not reach 95%, capacitors were sized based on historical data to achieve the targeted 95%. Changes to operation or equipment may have an impact on power factor. Because the 90% represents only one month it is anticipated that the 95% will be reached in the consecutive months based on history.

Whitby Hydro has identified all locations within Whitby where power factor is an issue and educated the customers on the benefits of good power factor. A number of these customers are assessing installation of capacitors for 2006.

There are a number of benefits to improving power factor however, it can be difficult to accurately quantify the full benefits. A couple of measurements can be used to determine savings.

System Requirements

Utilities size their distribution system based on kVA. By improving power factor, demand on the system is reduced and capacity is freed up, which means more services can be supplied by the existing infrastructure. Less loading on a system generally means less strain and less failure. It is however, difficult to quantify the savings. Also, generators are sized to meet kVa requirements not kW. Therefore, by reducing the kVa, generation requirements are also reduced.

Financially, you can also measure the reduction in power factor penalties (to the customer) to quantify the savings. In the case of the two customers who installed capacitors, they reduced their yearly power factor penalties by $17,181.00 per year. It is reasonable to assume that the power factor penalty is based on costs associated with system requirements and maintenance when power factor is poor.

Line Loss Savings

The addition of capacitors improves voltage and reduces line losses. Assumptions for TRC calculations (for the program participants to-date) on line loss have been included below.

Participant 1 - Power factor improved from 73.4% to 90%. Estimated loss savings:

% Reduction in $I^2 2R$ losses = $100-100(73.4/90)^2$ = 33%

The original facility system losses of 2% are reduced by .33 X 2 = .66%

As a result the monthly kWh billing is reduced by .66%.

Over a year kWh lost would be reduced by .0066 X 1,065,013.8 kWh = 7,029 kWh

Participant 2: Power factor improved from 82% to 95%. Estimated loss savings:

% Reduction in $I^2 2R$ losses = $100-100(82/95)^2$ = 25%

The original facility system losses of 2% are reduced by .25 X 2 = .5%

As a result the monthly kWh billing is reduced by .5%.

Over a year kWh lost would be reduced by .005 X 5,001,122 kWh/yr = 25,005 kWh/year.

Lessons Learned:

Power factor correction has been a long proven way to improve efficiency in an electrical system. Because the conversion of power factor to consumption savings is more mathematical formula it may not fully recognize all quantitative benefits. There are however, a number of benefits to power factor correction that cannot easily be reflected in the TRC model. The above explanation of the potential savings best relates the benefits of good power factor.

Appendix B - Discussion of the Program

Name of the Program: **Power Factor Correction**

A. **Description of the program (including intent, design, delivery, partnerships and evaluation):**

Power Factor gives a reading of overall electricity use efficiency. High power factor indicates that the amount of power doing real work is operating at a high level of efficiency. Conversely, low power factor means poor electricity efficiency which is always costly. Improving power factor can reduce billed peak demand and enhance equipment reliability.

An ideal power factor is 100%. Whitby Hydro, under its CDM program offers financial incentives for industrial customers to improve their power factor to above 95%. In 2005 two facilities within Whitby took advantage of the incentives and improved their power factor from 82% to 95% in one case and from 73.4 % to 90% in the other. Although the correction in the second case did not reach 95%, capacitors were sized based on historical data to achieve the targeted 95%. Changes to operation or equipment may have an impact on power factor. Because the 90% represents only one month it is anticipated that the 95% will be reached in the consecutive months based on history.

Whitby Hydro has identified all locations within Whitby were power factor is an issue and educated the customers to the benefits of good power factor. A number of these customers are assessing installation of capacitors for 2006.

Measure(s):

	Measure 1	Measure 2	Measure 3
Base case technology:	No Capacitors		
Efficient technology:	Capacitors		
# of participants or units delivered:	2 participants/485 KVAR		
Measure life (years):	15		

B. **TRC Results**

TRC Benefits ($):	171,138
TRC Costs ($):	
Utility program cost (less incentives):	13,388
Participant cost:	40,997
Total TRC costs:	54,385
Net TRC (in year CDN $):	116,753
Benefit to Cost Ratio (TRC Benefits/TRC Costs):	3.15

C. **Results: (one or more category may apply)**

Conservation Programs:

Demand savings (kW): *Summer*
Winter

	lifecycle	*in year*
Energy Saved (kWh):		
Other resources saved:		
Natural Gas (m3):		
Other (specify):		

Name of the Program: **Power Factor Correction**

Demand Management Programs:
Controlled load (kW)
Energy shifted On-peak to Mid-peak (kWh):
Energy shifted On-peak to Off-peak (kWh):
Energy shifted Mid-peak to Off-peak (kWh):

Demand Response Programs:
Dispatchable load (kW):
Peak hours dispatched in year (hours):

Power Factor Correction Programs:	Participant 1	Participant 2
Amount of Kvar installed (Kvar):	300	185
Customer power factor at beginning of year (%)	73.00%	82.00%
Customer power factor at end of year (%)	90.00%	95.00%

Line Loss Reduction Programs:
Peak load savings (kW):

	lifecycle	*in year*
Energy savings (kWh):		

Distributed Generation and Load Displacement Programs:
Amount of DG installed (kW):
Energy Generated (kWh):
Peak energy generated (kWh):
Fuel Type:

Other Programs (specify)
Metric (specify):

D. **Program Costs*:**

Utility direct costs ($):	Incremental capital:	0	
	Incremental O&M:	13,388	
	Incentive:	4,070	* 1 participant/2nd paid in 2006
	Total:	17,458	
Utility indirect costs ($):	Incremental capital:	0	
	Incremental O&M:	0	
	Incentive:	0	
	Total:	0	
Participant costs ($):	Incremental equipment:	40,997	2 participants
	Incremental O&M:	0	
	Total:	40,997	

E. **Comments:**

There are a number of benefits to improving power factor however, it can be difficult to quantify the full benefits. A couple of measurements can be used to determine savings.

System Requirements
Utilities size their distribution system based on kVA. By improving power factor, demand on the system is reduced and capacity is freed up, which means more services can be supplied by the existing infrastructure. Less loading on a system generally means less strain and less failure. It is however, difficult to quantify the savings.

Name of the Program: **Power Factor Correction**

In addition, generators are sized to meet kVa requirements not kW. Therefore, by reducing the kVa, generation requirements are also reduced.

Financially, you can also measure the reduction in power factor penalties (to the customer) to quantify the savings. In the case of the two customers who installed capacitors, they reduced their yearly power factor penalties by $17,181.00 per year. It is reasonable to assume that the power factor penalty is based on costs associated with system requirements and maintenance when power factor is poor.

<u>TRC Assumptions re: Line Loss Savings</u>
The addition of capacitors improves voltage and reduces line losses. Assumptions for TRC calculations (for the program participants to-date) on line loss have been included below.

Participant 1: Power factor improved from 73.4% to 90%. Estimated loss savings:
% Reduction in I^2R losses= $100\text{-}100(73.4/90)^2 = 33\%$
The original facility system losses of 2% are reduced by .33X 2 = .66%
As a result the monthly kWh billing is reduced by .66%.
Over a year kWh lost would be reduced by .0066 X 1,065,013.8 kWh = 7,029 kWh

Participant 2: Power factor improved from 82% to 95%. Estimated loss savings:
% Reduction in I^2R losses= $100\text{-}100(82/95)^2 = 25\%$
The original facility system losses of 2% are reduced by .25 X 2 = .5%
As a result the monthly kWh billing is reduced by .5%.
Over a year kWh lost would be reduced by .005 X 5,001,122kWh/yr = 25,005 kWh/year.

Power factor correction has been a long proven way to improve efficiency in an electrical system. Because the conversion of power factor to consumption savings is more mathematical formula it may not fully recognize all benefits. For the purpose of the TRC calculation, the above assumptions were made. There are however, a number of benefits to power factor correction that cannot easily be reflected in the TRC model.

Sub-Metering

2005 Program Spending To-Date:	**$9,104**
OEB Approved Spending:	**$250,000**
Program Status:	**Under Review – Low program up-take.**

Sub-metering is a proven method of generating conservation within multi-residential complexes. On average, when tenants are required to pay for their own electricity, consumption in a building reduces by between 15 and 25%.

This program offered financial incentives for multi-residential customers to install sub-meters for units within the complex. In 2005, the two buildings involved in this program had a total of twenty six individual suites sub-metered (well below 100% participation). Although more sites are considering the installation of meters under the incentive program, uptake has not been to anticipated levels.

Participation in sub-metering is a volunteer process for tenants who currently rent their units. Therefore, the number of participants of a sub-metering program must be brought on over a period of time as a result of move in and move out situations. Reported TRC calculations assumed a 100% participation level and reflect estimated savings once all units are participating. Until all units of a building are on sub-metering, actual savings are not truly measurable. Several sub-metering experts in Ontario (Ozz Corp., Stratacon, Intellimeter, and Carma) have estimated that sub-metering savings are 15%-25%.

Lessons Learned:

The sub-metering program has not been as successful as anticipated primarily due to low uptake on the incentive program. This is partly due to the small volume of multi-residential units within Whitby. Sub-metering also appears to have a long sales cycle. It is anticipated that the funds that have been marked for sub-metering program will be redirected to a program that has more potential for results over the allowed third tranche time period.

Appendix B - Discussion of the Program

Name of the Program: **Sub-Metering**

A. **Description of the program (including intent, design, delivery, partnerships and evaluation):**

Sub-metering is a proven method of generating conservation within multi-residential complexes. On average, when tenants are required to pay for their own electricity, consumption in a building reduces by between 15 and 25%.

Whitby Hydro, under its CDM program offers financial incentives for multi-residential customers to install sub-meters for units within the complex. In 2005, two buildings were involved in this program and there were a total of twenty-six individual suites sub-metered (below 100% participation). Although more sites are considering the installation of meters under the incentive program, uptake has not been to anticipated levels.

Measure(s):

	Measure 1	Measure 2	Measure 3
Base case technology:	Bulk Meter		
Efficient technology:	Sub-Meters		
# of participants or units delivered:	2 buildings - 26 units		
Measure life (years):	20		

B. **TRC Results**

TRC Benefits ($):	18,280
TRC Costs ($):	
Utility program cost (less incentives):	6,416
Participant cost:	8,480
Total TRC costs:	14,896
Net TRC (in year CDN $):	3,384
Benefit to Cost Ratio (TRC Benefits/TRC Costs):	1.23

C. **Results: (one or more category may apply)**

Conservation Programs:

Demand savings (kW): *Summer*
Winter

	lifecycle	*in year*
Energy Saved (kWh):		
Other resources saved:		
Natural Gas (m3):		
Other (specify):		

Demand Management Programs:

Controlled load (kW)
Energy shifted On-peak to Mid-peak (kWh):
Energy shifted On-peak to Off-peak (kWh):
Energy shifted Mid-peak to Off-peak (kWh):

Name of the Program: **Sub-Metering**

Demand Response Programs:
Dispatchable load (kW):
Peak hours dispatched in year (hours):

Power Factor Correction Programs:
Amount of Kvar installed (Kvar):
Distribution system power factor at beginning of year (%)
Distribution system power factor at end of year (%)

Line Loss Reduction Programs:
Peak load savings (kW):

	lifecycle	*in year*
Energy savings (kWh):		

Distributed Generation and Load Displacement Programs:
Amount of DG installed (kW):
Energy Generated (kWh):
Peak energy generated (kWh):
Fuel Type:

Other Programs (specify)
Metric (specify):

D. **Program Costs*:**

Utility direct costs ($):	Incremental capital:	0
	Incremental O&M:	6,416
	Incentive:	2,688
	Total:	9,104
Utility indirect costs ($):	Incremental capital:	0
	Incremental O&M:	0
	Incentive:	0
	Total:	0
Participant costs ($):	Incremental equipment:	8,480
	Incremental O&M:	0
	Total:	8,480

E. **Comments:**

Participation in sub-metering is a volunteer process for exising tenants who rent their units. Therefore, the number of participants of a sub-metering program must be brought on over a period of time as a result of move in and move out situations. The calculations for TRC assume a 100% participation level and reflect expected savings once all units are actively participating in the program. Until all units of building are on sub-metering, actual savings are not truly measurable. Several sub-metering experts in Ontario (Ozz Corp., Stratacon, Intellimeter, and Carma) have estimated that sub-metering savings are between 15% and 25%. For the purpose of the TRC analysis, an estimate of 25% savings has been assumed.

Education & Training

2005 Program Spending To-Date: **$49,404**

OEB Approved Spending: **$75,000**

Program Status: **Active**

In 2005 the education and training program focused mainly on industrial and commercial customers. These customers sectors were targeted because they have the greatest potential to make significant reductions in their energy consumption. The education program included 25 one-on-one site visits with target customers to go over the incentive programs available to them as well as to discuss options on to how to improve efficiency without significant capital investments.

To follow up on these meetings, on November 17, 2005, Whitby Hydro, in conjunction with Natural Resources Canada and Enbridge, held a one day training session at our facilities on energy conservation. The session was very well attended with approximately 30 participants and follow–up sessions are planned for 2006. Of the thirty participants, currently four have moved forward with energy efficient programs.

Whitby Hydro has also been running 71 commercial ads per month for the past year on CHEX television. The commercial focuses on residential conservation tips. In 2006, additional effort will be direct towards residential customers in the form of bill inserts and potential training sessions on how to reduce energy consumption within the home.

As this program is intended to provide general information regarding conservation and Whitby Hydro's CDM programs, no measurable quantitative results are reported.

Lessons Learned:

Programs initiated have been well received and we have had numerous requests from industrial/commercial customers to hold follow-up sessions to the NRCan program. TV commercials have had positive recognition throughout the Town. However, it is difficult to measure the actual implementation of general conservation programs. In 2006, we plan to introduce a conservation program through elementary schools as well as enhance our information program through mail inserts.

Appendix B - Discussion of the Program

Name of the Program: **Education & Training**

A. **Description of the program (including intent, design, delivery, partnerships and evaluation):**

In 2005 the education and training program focused mainly on industrial and commercial customers. These customers sectors were targeted because they have the greatest potential to make significant reductions in their energy consumption. The education program included 25 one-on-one site visits with target customers to go over the incentive programs available to them as well as to discuss options on to how to improve efficiency without significant capital investments.

To follow up on these meetings, on November 17, 2005, Whitby Hydro, in conjunction with Natural Resources Canada and Enbridge, held a one day training session at our facilities on energy conservation. The session was very well attended with approximately 30 participants and follow–up sessions are planned for 2006. Of the thirty participants, currently four have moved forward with energy efficient programs.

Whitby Hydro has also been running 71 commercial ads per month for the past year on CHEX television. The commercial focuses on residential conservation tips. In 2006, additional effort will be direct towards residential customers in the form of bill inserts and potential training sessions on how to reduce energy consumption within the home.

Measure(s):

	Measure 1	Measure 2	Measure 3
Base case technology:			
Efficient technology:			
# of participants or units delivered:			
Measure life (years):			

B. **TRC Results**

TRC Benefits ($):	
TRC Costs ($):	
Utility program cost (less incentives):	
Participant cost:	
Total TRC costs:	0
Net TRC (in year CDN $):	0

Benefit to Cost Ratio (TRC Benefits/TRC Costs): #DIV/0!

C. **Results: (one or more category may apply)**

Conservation Programs:

Demand savings (kW): *Summer*
Winter

	lifecycle	*in year*
Energy Saved (kWh):		

Name of the Program: **Education & Training**

Other resources saved:
Natural Gas (m3):
Other (specify):

Demand Management Programs:
Controlled load (kW)
Energy shifted On-peak to Mid-peak (kWh):
Energy shifted On-peak to Off-peak (kWh):
Energy shifted Mid-peak to Off-peak (kWh):

Demand Response Programs:
Dispatchable load (kW):
Peak hours dispatched in year (hours):

Power Factor Correction Programs:
Amount of Kvar installed (Kvar):
Distribution system power factor at beginning of year (%)
Distribution system power factor at end of year (%)

Line Loss Reduction Programs:
Peak load savings (kW):

	lifecycle	*in year*
Energy savings (kWh):		

Distributed Generation and Load Displacement Programs:
Amount of DG installed (kW):
Energy Generated (kWh):
Peak energy generated (kWh):
Fuel Type:

Other Programs (specify)
Metric (specify):

D. **Program Costs*:**

Utility direct costs ($):	Incremental capital:	0
	Incremental O&M:	49,404
	Incentive:	
	Total:	49,404
Utility indirect costs ($):	Incremental capital:	
	Incremental O&M:	
	Incentive:	
	Total:	0
Participant costs ($):	Incremental equipment:	
	Incremental O&M:	
	Total:	0

E. **Comments:**

As the program is intended to provide general information regarding conservation and Whitby Hydro's CDM programs, no measurable quantitative results can be reported.

Load Balancing

2005 Program Spending To-Date: **$0**

OEB Approved Spending: **$50,000**

Program Status: **Planning Stage**

This program involves the balancing of load currents on a phase to phase relationship for each distribution substation and associated feeders in the Town of Whitby. On a typical four-wire distribution system it is not uncommon to incorporate single and two phase connected loads which effectively creates imbalances on the overall three phase symmetry of the feeder. Distribution System Load Balancing must not only balance loads at the buss, but must provide effective load balance along the entire feeder route to obtain the benefits.

The analysis and procedure will consider all possible combinations of phase load changes at each three phase connection point for either single or two phase taps. Consideration will be given to the order in which loads are considered along the entire feeder. When all of the selections have been completed on the particular feeder the best combination of phase load connections will be utilized.

Lessons Learned:

The planning stage has allowed an opportunity to properly analyze the load balancing requirements and processes which will be part of the system planning at Whitby Hydro. The program is expected to commence in the summer of 2006.

Appendix B - Discussion of the Program

Name of the Program: **Load Balancing**

A. **Description of the program (including intent, design, delivery, partnerships and evaluation):**

This program involves the balancing of load currents on a phase to phase relationship for each distribution substation and associated feeders in the Town of Whitby. On a typical four-wire distribution system it is not uncommon to incorporate single and two phase connected loads which effectively creates imbalances on the overall three phase symmetry of the feeder. Distribution System Load Balancing must not only balance loads at the buss, but must provide effective load balance along the entire feeder route to obtain the benefits listed below.

The analysis and procedure will consider all possible combinations of phase load changes at each three phase connection point for either single or two phase taps. Consideration will be given to the order in which loads are considered along the entire feeder. When all of the selections have been completed on the particular feeder the best combination of phase load connections will be utilized.

The program is expected to commence in the summer 2006.

Measure(s):

	Measure 1	Measure 2	Measure 3
Base case technology:			
Efficient technology:			
# of participants or units delivered:			
Measure life (years):			

B. **TRC Results**

TRC Benefits ($):	
TRC Costs ($):	
Utility program cost (less incentives):	
Participant cost:	
Total TRC costs:	0
Net TRC (in year CDN $):	0

Benefit to Cost Ratio (TRC Benefits/TRC Costs): #DIV/0!

C. **Results: (one or more category may apply)**

Conservation Programs:

Demand savings (kW): *Summer*
Winter

	lifecycle	*in year*
Energy Saved (kWh):		
Other resources saved:		
Natural Gas (m3):		
Other (specify):		

Demand Management Programs:

Name of the Program: **Load Balancing**

Controlled load (kW)
Energy shifted On-peak to Mid-peak (kWh):
Energy shifted On-peak to Off-peak (kWh):
Energy shifted Mid-peak to Off-peak (kWh):

Demand Response Programs:
Dispatchable load (kW):
Peak hours dispatched in year (hours):

Power Factor Correction Programs:
Amount of Kvar installed (Kvar):
Distribution system power factor at beginning of year (%)
Distribution system power factor at end of year (%)

Line Loss Reduction Programs:
Peak load savings (kW):

	lifecycle	*in year*
Energy savings (kWh):		

Distributed Generation and Load Displacement Programs:
Amount of DG installed (kW):
Energy Generated (kWh):
Peak energy generated (kWh):
Fuel Type:

Other Programs (specify)
Metric (specify):

D. **Program Costs*:**

Utility direct costs ($):	Incremental capital:	0
	Incremental O&M:	0
	Incentive:	0
	Total:	0
Utility indirect costs ($):	Incremental capital:	0
	Incremental O&M:	0
	Incentive:	0
	Total:	0
Participant costs ($):	Incremental equipment:	0
	Incremental O&M:	0
	Total:	0

E. **Comments:**

There are no measurable results to report at this time.

Smart Meters

2005 Program Spending To-Date: **$17,945**

OEB Approved Spending: **$100,000**

Program Status: **Initial Pilot Completed, current focus is on information gathering.**

An interval meter pilot was implemented in 2004 to test the ability to implement interval meters at the residential level. The pilot placed the meters at the transformer to eliminate theft of power. At the same time tests were carried out to see how the meters operated, how data would be collected and what various communication methods could be used to interrogate the meters. Standard residential meters were placed on the homes to use as a comparator to the new meters and to verify accuracy.

Given the uncertainty with regards to various aspects of the Smart Meter initiative province-wide, a decision was made to defer any significant spending for additional Pilot Programs in 2005. Instead, focus shifted to involvement in groups investigating various technologies and monitoring the results from ongoing Pilot Projects started by other LDCs. In order to facilitate this, Whitby Hydro joined the Ontario Utilities Smart Meter (OUSM) group through Util-Assist to participate in the ongoing Technology and Implementation processes. Significant time is spent on conference calls and attending forums to better understand the products and the pros and cons of implementation of the particular systems.

Lessons Learned:

The pilot provided an opportunity to test and understand meter operation, data collection and communication methods. Whitby Hydro has yet to identify a particular product and methodology for the overall Smart Meter implementation process which will include our residential customers. However, we will continue to investigate in order to select the best possible metering solution for our customers.

Appendix B - Discussion of the Program

Name of the Program: **Smart Meters**

A. **Description of the program (including intent, design, delivery, partnerships and evaluation):**

An interval meter pilot was implemented in 2004 to test the ability to implement interval meters at the residential level. The pilot placed the meters at the transformer to eliminate theft of power. At the same time tests were carried out to see how the meters operated, how data would be collected and what various communication methods could be used to interrogate the meters. Standard residential meters were placed on the homes to use as a comparator to the new meters and to verify accuracy.

Given the uncertainty with regards to various aspects of the Smart Meter initiative province-wide, it was decided that Whitby would not conduct additional Pilot Programs in 2005 in this area, however we would spend significant time investigating various technologies and monitor the results from ongoing Pilot Projects started by other LDCs.

In order to facilitate this, Whitby Hydro joined the Ontario Smart Meter (OUSM) group through Util-Assist in order to participate in the ongoing Technology and Implementation processes. Significant time is spent on conference calls and attending forums to better understand the products and the pros and cons of implementation of the particular systems.

Whitby Hydro has yet to identify a particular product and methodology for the overall implementation process which will include our residential customers. However, we will continue to investigate in order to select the best possible metering solution for our customers.

Measure(s):

	Measure 1	Measure 2	Measure 3
Base case technology:			
Efficient technology:			
# of participants or units delivered:			
Measure life (years):			

B. **TRC Results**

TRC Benefits ($):	
TRC Costs ($):	
Utility program cost (less incentives):	
Participant cost:	
Total TRC costs:	0
Net TRC (in year CDN $):	0

Benefit to Cost Ratio (TRC Benefits/TRC Costs): #DIV/0!

C. **Results: (one or more category may apply)**

Conservation Programs:

Demand savings (kW): *Summer*
Winter

	lifecycle	*in year*
Energy Saved (kWh):		

Name of the Program: **Smart Meters**

Other resources saved:
Natural Gas (m3):
Other (specify):

Demand Management Programs:
Controlled load (kW)
Energy shifted On-peak to Mid-peak (kWh):
Energy shifted On-peak to Off-peak (kWh):
Energy shifted Mid-peak to Off-peak (kWh):

Demand Response Programs:
Dispatchable load (kW):
Peak hours dispatched in year (hours):

Power Factor Correction Programs:
Amount of Kvar installed (Kvar):
Distribution system power factor at beginning of year (%)
Distribution system power factor at end of year (%)

Line Loss Reduction Programs:
Peak load savings (kW):

	lifecycle	*in year*
Energy savings (kWh):		

Distributed Generation and Load Displacement Programs:
Amount of DG installed (kW):
Energy Generated (kWh):
Peak energy generated (kWh):
Fuel Type:

Other Programs (specify)
Metric (specify):

D. **Program Costs*:**

Utility direct costs ($):	Incremental capital:	12,312
	Incremental O&M:	5,633
	Incentive:	0
	Total:	17,945
Utility indirect costs ($):	Incremental capital:	0
	Incremental O&M:	0
	Incentive:	0
	Total:	0
Participant costs ($):	Incremental equipment:	
	Incremental O&M:	
	Total:	0

E. **Comments:**

There are no measurable results to report on the initial pilot as customer consumption will not be impacted until smart meter TOU billing occurs.

CONCLUSION

Conservation and Demand Management programs are for the most part, still in early stages of development, design, implementation and evaluation. However, from the various measurements so far (which for Whitby Hydro include some forecasted information), the activity in the programs to-date have shown the overall CDM plan to be moving forward with some success. 2006 will see an increase in CDM activity and spending is expected to reach 64% of the approved $1.3M by the end of the current year.

Our research and pilot activity has given us the knowledge and experience to promote and deliver solid programs within our service area. The lessons learned so far have also provided us with insights which will help us to modify existing programs and shift spending amongst programs going forward, to ensure that strong CDM initiatives are delivered. It is also important to recognize and promote the ability to increase information sharing amongst LDC's through various forums, and reports which will serve to benefit the overall CDM initiative.