

REFILED DOCUMENTS (IMPROVED PRINT QUALITY)
EB-2008-0227

LIST OF ATTACHMENTS

<u>Appendix</u>	<u>Content of Appendix</u>
ST_IRR_26C-2	Tree Trimming Analysis and Report
SEC_IRR_14	Pole Top Recloser Analysis
SEC_IRR_33A-1	BDR Purchase Order and Contract
SEC_IRR_33A-2	BDR RFP and Terms of Reference
SEC_IRR_33C	Cover Letter – Affiliate Study
VECC_IRR_20A	2007 EWU-WUC MSA

ST_IRR_26C-2



AGENDA SUBMISSION

To: Board of Directors, *ENWIN* Utilities

2008-08-01

M35

From: Shawn Filice

Re: Tree Trimming Analysis & Report

The attached report details the impacts trees have on power reliability to the rate payers in the City of Windsor. The report shows that between 13 and 20% of all outages are due to tree contacts, it also shows that *ENWIN* Utilities allows trees to grow closer to energized conductors than a number of other utilities in the Province of Ontario.

RECOMMENDATION:

It is recommended that tree clearances be increased to match other Utilities at 10ft and that overhanging tree limbs be removed to reduce tree failure related outages. As an approach to minimize expenditures and test the effectiveness of this new trimming procedure it is further recommended to phase it in as follows:

1. **Greater Clearances in three (3) Areas of the City** - It is recommended the new clearances should be focused on the three (3) areas of the City that experience the lowest power reliability resulting from tree contacts.
2. **+ Limb Removal in one (1) of the three (3) Areas above** - In order to test the effectiveness of removing overhanging tree limbs and their impact on tree failures it is recommended that it only be done in only one (1) of the three (3) identified areas of the City.
3. **Educate/Inform the public** - The majority of tree contacts can be avoided if all future plantings are aligned with prescribed guidelines when planting trees near overhead conductors.

A handwritten signature in black ink, appearing to read "S. Filice", written over a horizontal line.

Director of Infrastructure
Attach



2008-08-01

E02 TREE

REPORT

To: Shawn Filice

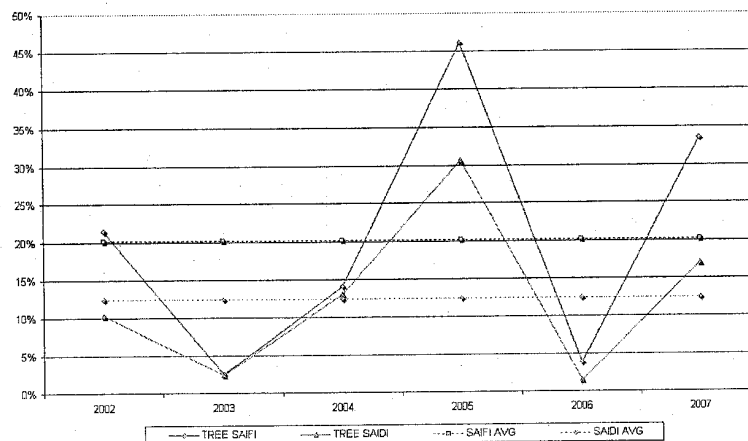
From: Robert Spagnuolo

Re: Effect of Tree Contacts on System Reliability

EXECUTIVE SUMMARY

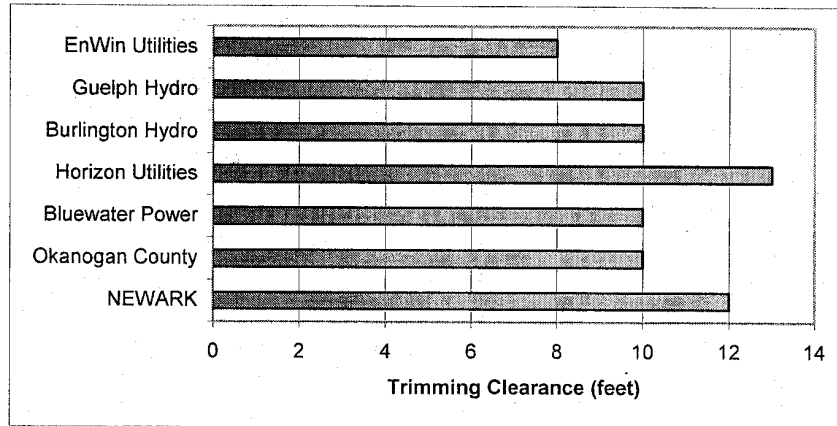
Historical outage statistics show that over the past five years Tree Contacts are the number one cause of outages in Windsor making up on average 20% of the yearly SAIFI statistic and 13% of the SAIDI statistic (see Figure 1).

Figure 1 - Affect of Tree Contacts on System Reliability Statistics



This report was created to recommend ways in which this affect can be reduced. Our current tree trimming policy is to trim one third of the City every year at an 8-foot clearance of the conductor. This clearance distance is the smallest as compared to six (6) other utilities, four (4) of which are located in Ontario (see Figure 2).

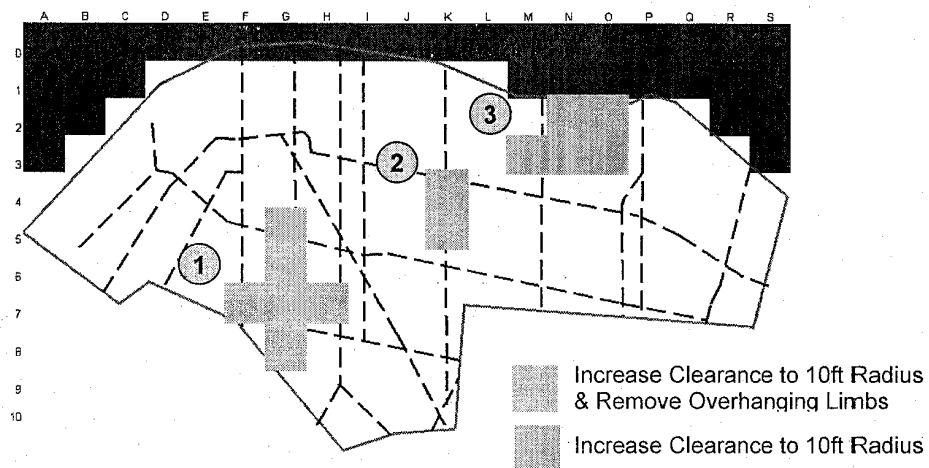
Figure 2 - Comparison of Tree Clearance for Medium Voltage Circuits



Studies have shown that *tree growth* only makes up 15% of tree related outages while *tree failure* makes up the remainder¹. The only way to prevent tree failure such as branches or entire trees from falling into overhead conductor is to increase the ROW (Right-of-Way, the distance between planted trees and the pole) or to remove any overhanging tree limbs. Tree growth failures can be reduced in a number of ways including increased tree trimming clearances/frequency, aerial cable, etc. It is recommended that tree clearances be increased to match other Utilities at 10ft and that overhanging tree limbs be removed to reduce tree failure related outages.

In order to minimize costs, maximize the benefits, and test the effectiveness of the new trimming procedure it is recommended that the new clearances should be focused on the three (3) areas of the City that experience the worst tree outages. In order to test the effectiveness of removing overhanging tree limbs on tree failures it is recommended that it only be done on Area 1 (see Figure 3).

Figure 3 - Recommendation



¹ Siegfried Guggenmoos, July 2003, *Effects of Tree Mortality on Power Line Security*

PURPOSE

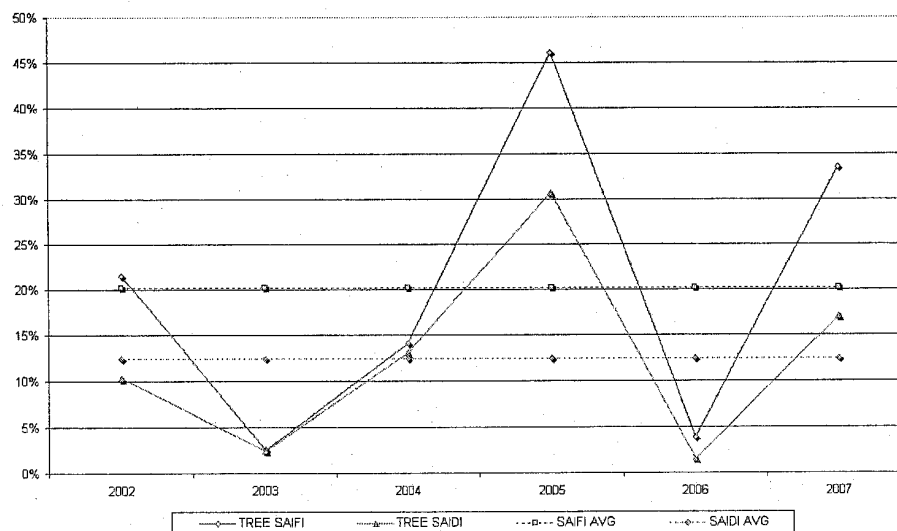
The purpose of this report is to analyse the affect of tree contacts on system reliability and to propose ways in which to reduce their impact. The report identifies areas in Windsor that experience the worst tree related outages so that risk reduction methods can be applied in these areas first. The report also looks at how effective the current tree-trimming program is and proposes possible improvements and their expected impact on reliability.

ANALYSIS

IMPACT OF TREE CONTACTS ON SYSTEM RELIABILITY

Tree contacts have a consistent impact on system reliability. Figure 4 shows that over the past 6 years tree contacts have made up on average 20% of the SAIFI (System Average Interruption Frequency Index) statistics and 13% of SAIDI (System Average Interruption Duration Index) statistic. This category has the greatest percentage impact on system reliability behind equipment failure. This category deserved to be looked into to determine if there is anything we can do differently to help reduce the impact of tree contacts on system reliability.

Figure 4 - Affect of Tree Contacts on System Reliability Statistics

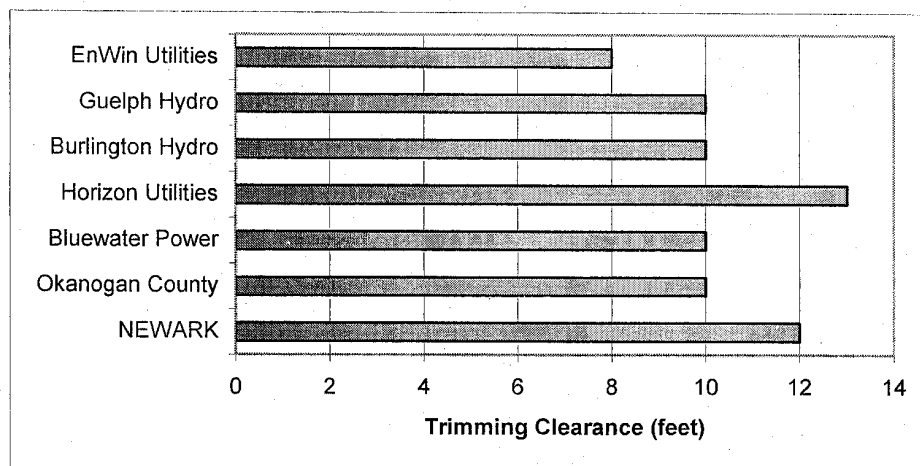


CURRENT TREE TRIMMING PROGRAM

Every year EnWin hires tree trimming contractors to prune trees in one third (1/3) of the City of Windsor. The City is split into three strips from west to east called Area A, Area B, and Area C. The three (3) areas are divided vertically by Dougall Avenue and Central Avenue. Each area is also split in two (2) halves denoted by a number, i.e. A1 and A2. Each half of an area is then contracted out and can either be awarded to the same tree trimming company or to two independent companies. The agreed upon 2008 rates for trimming outside of the planned area are \$125/cut for limbs up to 8" in diameter and \$250/cut for limbs greater than 8" diameter.

EnWin currently requires tree-trimming crews to trim back 8 feet for primary lines and 6 feet for secondary lines. This is the smallest clearance compared to other utilities that participated in a benchmark analysis in 2006 and two American Utilities that had their trimming clearances readily available online (see Figure 5 below).

Figure 5 - Comparison of Tree Clearance for Medium Voltage Circuits



METHOD

This report is based on six (6) years of outage data from the "trouble synopsis" database ranging from 2002 to 2007. This data range was used so that it would cover two (2) complete tree-trimming cycles. The "trouble synopsis" is a database that is used by the Control Operators to record detailed outage information.

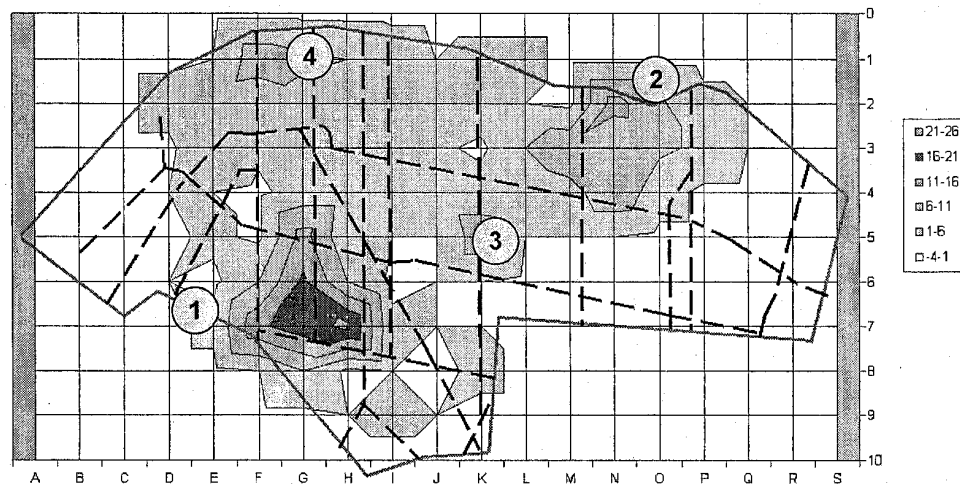
Tree contact outages were extracted from the "trouble synopsis" database and locations for the tree contacts were determined either from the outage descriptions or from the customers affected. The locations were then broken down into map coordinates denoted by a letter and a number. The events and customer-hours of outage were then summed up by coordinate and superimposed over a silhouette of the City of Windsor. (See Figure 6 as an example)

CONCLUSIONS FROM LOCATION STUDY

Events

It was discovered that there are some areas in the city that experience a much higher rate of tree contacts than other areas of the city. These are shown in Figure 6 as dark orange and red. There are four areas in particular that show a higher rate of tree contacts as compared with the rest of the city and are labelled 1 to 4 in Figure 6.

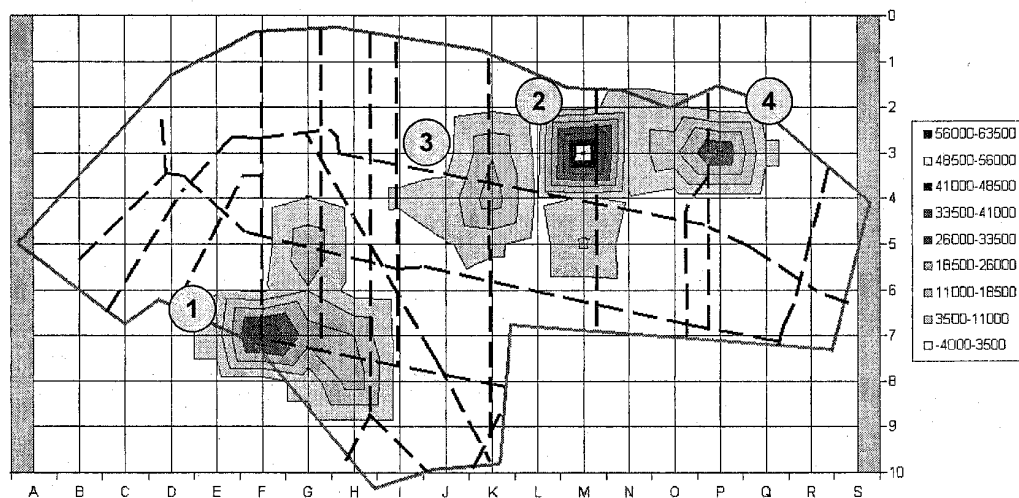
Figure 6 - Areas in the City with Largest Number of Tree Contacts



Customer Hours of Outage

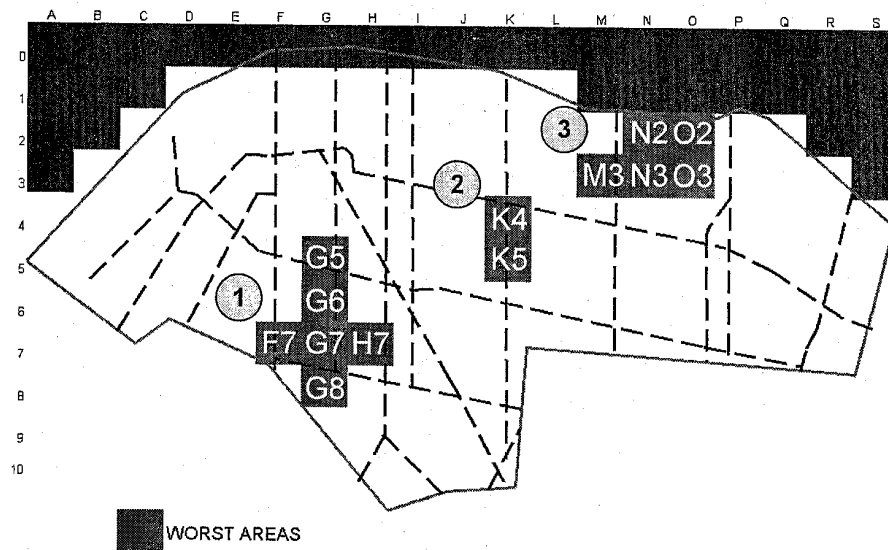
The coordinates were also used to map the total customer-hours of outage on an overlay of the City. It was determined that there are four areas that experience a larger than average customer hours of outage as a result of tree contacts (see Figure 7).

Figure 7 - Tree Contacts that Affect Greatest Number of Customers



The geographic locations were then ranked from worst to best based on their combined customer-hours of outage severity and number of events. This eliminated areas that experienced a large number of outages but affected a small number of customers for a short duration (Figure 6, #4) and areas that experienced one very large outage (Figure 7, #4). The ranking identified the top 10 worst areas in order to look into the causes in more detail. Areas ranked 11, 12, and 13 were also included because they are physically located near the worst 10 locations. Figure 8 shows the areas in question in red. These areas can be grouped into three (3) general areas.

Figure 8 – Areas with the Worst and Highest Frequency Tree Contacts in the City



The three locations above were visited to determine the number, size, and location of trees in the area. See Exhibit 1 for area boundaries.

AREA 1

This area has a large number of mature trees. Sections of the area that were recorded as having tree contacts were visited to determine the severity of tree coverage. It was found that some blocks have only one or two large trees while others are completely covered. The trees have grown above the highest conductor and have overhanging branches that are not trimmed back. As a result, tree branches can fall into the lines if they are broken due to high winds or rot. See Exhibits 3 to Exhibit 8 in the Appendix.

AREA 2 & 3

These two areas have much younger trees as compared to area 1. It was noted that in some areas the trees were planted directly under the conductor and have started growing into the overhead conductor. Tree trimmers have done an excellent job of trimming back the growth, however, contacts due to tree growth require regular maintenance. This area could be improved by increasing the tree trimming frequency or increasing the tree clearances. See Exhibit 2 in the Appendix.

SOURCE OF TREE-RELATED OUTAGES

Tree related outages can be attributed to two types, tree growth and tree failure.

TREE GROWTH

Tree contacts related to *tree growth* were found to make up less than 15% of all tree-related outages according to a number of research studies completed at various utilities². The studies have shown that small tree sprouts are burned off when they make contact with energized conductor due to the heat generated by the electrical discharge. This creates a natural trimming of the tree since small limbs cannot even begin to grow. It is not recommended to rely on this though since dangerous step and touch potentials can be generated around the tree base when these discharges occur. In extreme cases the current can be 15 to 20 times higher than the prescribed safety limits³.

TREE FAILURE

Tree contacts related to *tree failures* have a more severe impact since outages are most likely a result of:

- A tree/branch taking down a conductor.
- A tree/branch causing phases to come in contact with each other.
- A tree/branch creating a bridge between two phases.
- A tree/branch taking down a pole thereby increasing the restoration time & cost

Tree trimming can help reduce tree failures by removing overhangs from large trees in the right of way. However, the majority of tree-caused outages are a result of failure of trees outside the right-of-way (off-ROW).

² Rees, Baltimore Gas & Electric, 2%, (Rees et al. 1994) - TransAlta, 2%-10%, (Guggenmoos 1996) - Niagra Mohawk, 14%, (Finch and Allen 2001) - Puget Sound Energy, 13.5%, (Rogers 2001)

³ Engineering Justification for Tree Trimming, October 1999

TECHNOLOGY

There are a number of ways to try and reduce the risk of tree contacts. Each option has a degree of risk reduction and a cost associated with it.

CONVERT TO UNDERGROUND

Very Low Risk of Contact, 10x Cost

The best way to eliminate the effects of tree contacts is to move the conductor underground (Figure 9). The downside to this option is the immense cost associated with it. The conversion would require the removal of existing overhead infrastructure and the destruction of property, and would not be possible in most locations. Underground cables are exposed to a different type of tree contact through the root system that can extend to a radius equal to the height of the tree. A Growth Limit Zone (GLZ) of 0.5 meters is recommended between the underground cable and the extent of the tree roots (see Figure 10) although this amount of space is usually not available.

Figure 9 - Convert to Underground

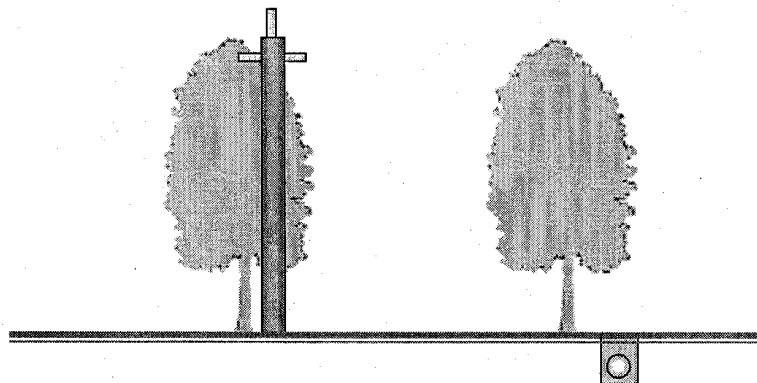
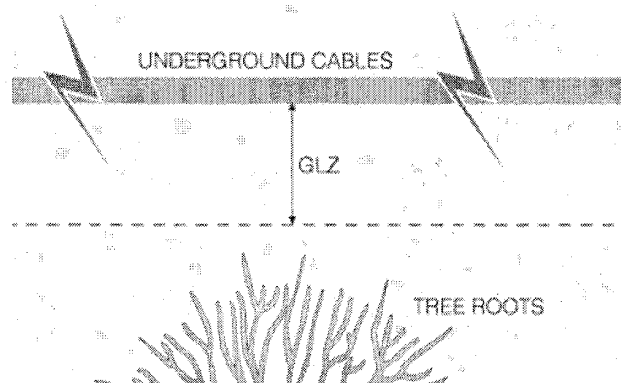
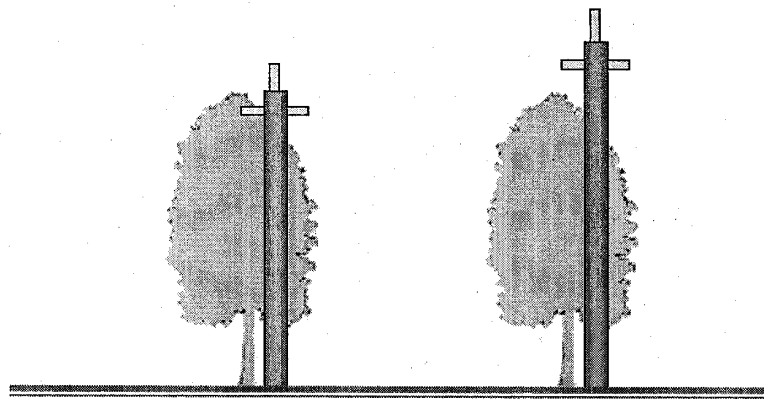


Figure 10 – Underground Clearance from Tree Roots

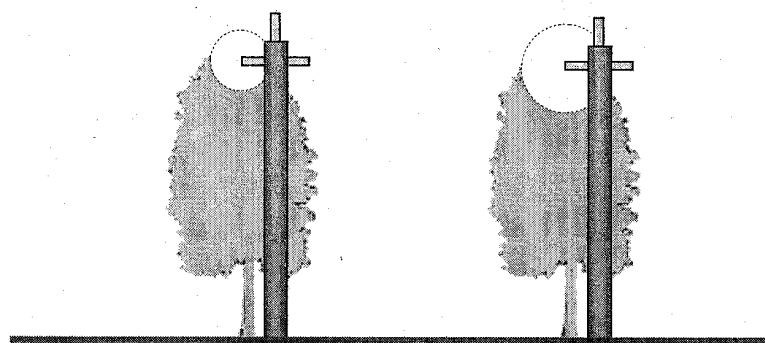


RAISE CONDUCTORS*Expensive, Only Feasible on Rebuilds*

This option involves using taller utility poles so that the conductors are strung higher than the tallest trees and therefore are clear from being damaged by fallen trees or branches (Figure 11). This method could be adopted for rebuilds such as conversion work. An important consideration is that taller poles may require the purchase and replacement of existing vehicles as the majority of the bucket trucks *ENWIN* currently owns cannot work on pole greater than fifty-five (55) feet. In addition to the new vehicles, sixty (60) foot poles also cost 35% more than fifty (50) foot poles (\$1,274 vs. \$939).

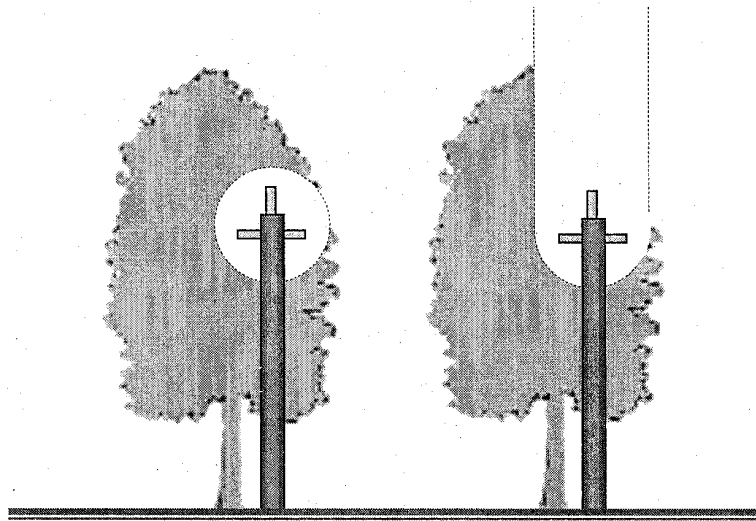
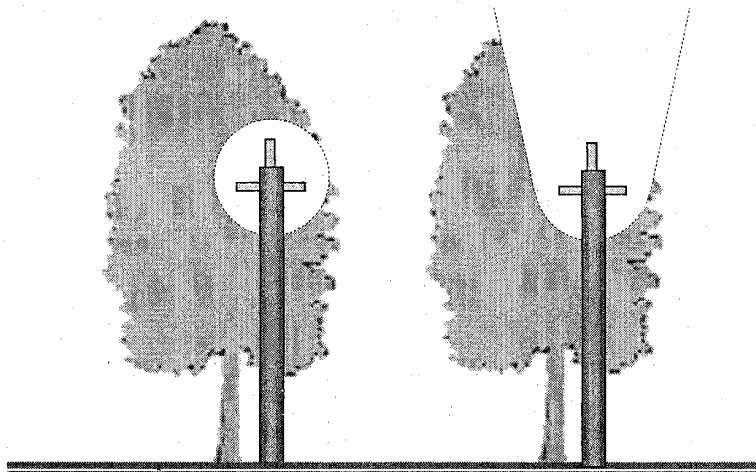
Figure 11 - Raise Conductors**INCREASE CLEARANCES***Minimal Cost, Minimal Effect, Irrate Customers*

Increasing the tree trimming clearances can help reduce outages by providing a larger buffer area for swaying conductors and branches during high winds (Figure 12). It also ensures that faster growing trees do not reach the conductors before the next trimming cycle. The downside to this option is that trimming costs would increase, social political influences may prohibit the change, and customers may be upset when their trees are cut back even further than previous cycles. For example, customers in Area 1 have traditionally complained about the amount of tree trimming and in some cases won't allow access to their property to facilitate the trimming.

Figure 12 - Increase Clearances

REMOVE OVERHANG BRANCHES*Best bang for the buck, Irate Customers*

As mentioned in the analysis, 85% of tree contacts are due to tree failure. Tree failures involve either an entire tree falling into the conductor and pulling it down or a large limb that breaks off the tree and falls into the conductor. Removing overhanging tree limbs will eliminate the possibility of a limb falling down directly into the conductor (Figure 13). By trimming up and out as in Figure 14 would help eliminate limbs that may not directly overhang the conductor but if they were to break would fall into the line. The downside to this option is that it would increase the cost of tree trimming and customers may be upset when more of their tree is removed. Also, it may not be physically possible to remove the branches in this fashion as it would further destroy the structure of the tree.

Figure 13 - Remove Overhanging Branches**Figure 14 - Remove Overhanging Branches on an Outward Angle**

INSTALL AERIAL CABLE*Expensive, Doesn't Eliminate ALL Contacts*

Tree cable is an insulated overhead conductor that can prevent phase-to-phase faults (tree limb across two phases) and phase to ground faults (tree growing into the conductor). However, a tree or tree limb could still fall into the line damaging the insulation or could take the entire conductor down. Therefore tree cable does not protect against all types of tree contacts. This is reflected in the report titled "56M2 Aerial Cable Study" which determined that a section of Aerial Cable that was installed on a section of 56M2 in 2007 does not show any improvement over previous years. The material cost and installation costs are also very expensive. The cable costs over 20 times more than bare conductor⁴ and labour costs are 30% higher.

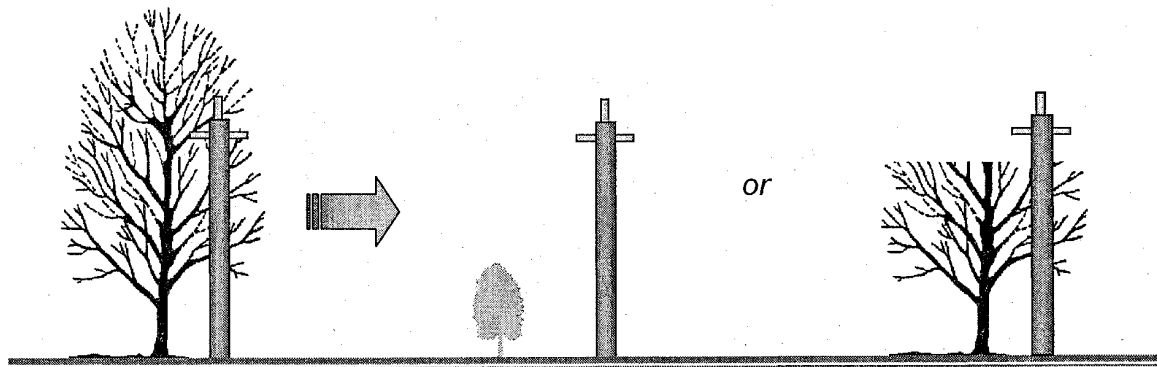
HAZARD TREE REMOVAL*Expensive, Doesn't Eliminate ALL Contacts*

One option to reduce off-ROW tree contacts is to adopt a hazard tree removal program. This entails hiring an individual to patrol the lines and identify potentially hazardous trees that show high risk factors such as: bad lean, poor anchoring medium, poorly formed trees, narrow angle crotches, co-dominant leaders⁵, or other structural defects (see Figure 15). This program would also be valuable in identifying trees that have been killed by the Emerald Ash Borer.

However, it should be noted that only half of the trees that fail show any noticeable defects⁶. Therefore, this program will not eliminate *all* off-ROW tree contacts even if the inspector catches every visibly dangerous tree. Also, the risks associated with the impact of severe weather such as lightning, ice storms, and windstorms on healthy trees are not reduced with this method.

Utilities that use this practice as part of a normal maintenance cycle ranging from 3 to 7 years. Most programs removed about 3 trees per kilometre with the more intense being 6-9 trees per kilometre.

Figure 15 - Hazard Tree Identification and Removal



⁴ \$29.61/meter for 4/0 tree cable vs. \$1.38/meter for bare 4/0 conductor, based on 2007 installation

⁵ When two main branches of a tree are of equal strength & size, leading to the danger of the tree splitting

⁶ Simpson and Van Bossuyt, 1996 and Finch and Allen, 2001

INCREASE FREQUENCY OF TRIMMING*Easy to Implement, Minimal Effect*

Increasing the frequency of trimming effectively does the same thing as increasing the tree trimming clearance but reduces the damage inflicted on the tree. Customers will not notice any difference in the appearance of their tree as opposed to increasing the clearance diameter. However, increasing clearances does give the added benefit of a higher tolerance for conductor and tree swing in windstorms.

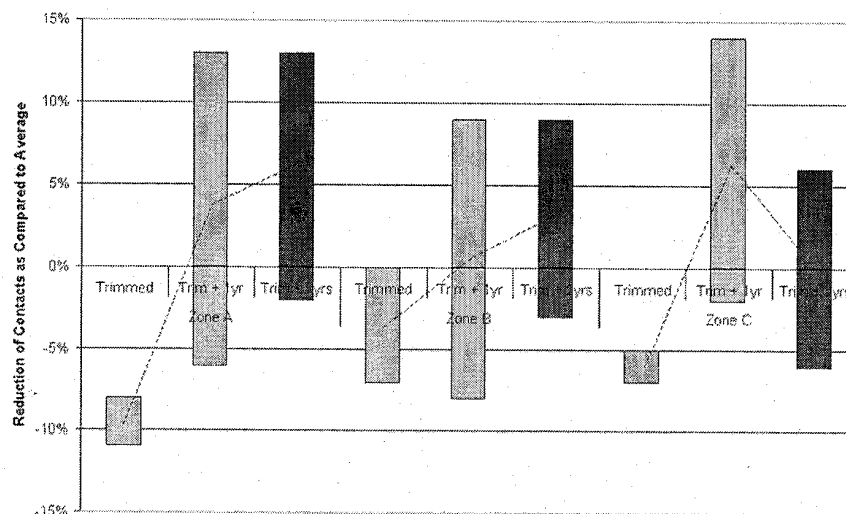
Figure 16 shows the effect that the current tree-trimming program has on the number of tree contacts. It is easily seen that the year the trimming takes place (in green) shows a reduction in tree contacts as compared to the following two years. The bars show the range of what can be expected in the given period. The upper and lower limits of the bar represent values pulled from the two tree trimming cycles between 2002 and 2007.

The number of contacts in an area was divided by the total contacts for the year and then compared to the average for that area over the 6 years in study. This was done in order to normalize the data while still considering the effects of high winds during storms. For Example, in 2006, Area A experienced 25 contacts, Area B experienced 5 contacts, and Area C experienced 8 contacts. Therefore Area A had 66% ($25 / 25 + 5 + 8$) of the contacts of 2006. Area A made up on average 53% of the tree related outages between 2002 and 2007.

$$\frac{47\% ('02) + 51\% ('03) + 45\% ('04) + 66\% ('05) + 66\% ('06) + 42\% ('07)}{6 \text{ years}} = 53\%$$

Area A was trimmed in '04 and '07 so: $53\% (\text{avg}) - 45\% ('04) = -8\%$
 $53\% (\text{avg}) - 42\% ('07) = -11\%$

Figure 16 - Effect of Current Tree Trimming on Frequency of Contact



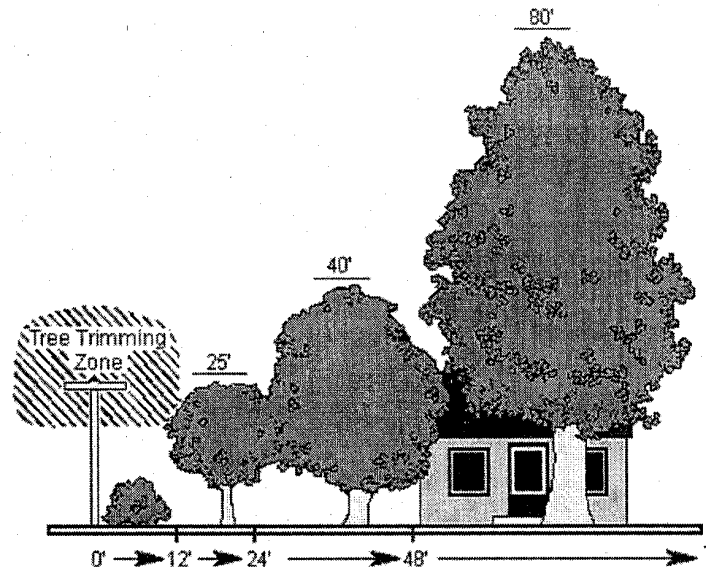
Yearly tree trimming would triple costs resulting in an additional one million dollars more every year. The reliability benefit would only reduce tree contacts by an average of 5% and reduce overall reliability by a little over 1%. Therefore this option would be very expensive for the overall benefit.

EDUCATE THE PUBLIC

Preventative, Involves Customers, Inexpensive

The majority of tree contacts can be avoided if customers would follow some simple guidelines when planting trees near overhead conductors. Fliers can be supplied to tree nurseries so that buyers are well informed before they plant trees. A bylaw can be put in place to enforce these rules to prevent future tree related problems. However, if a bylaw is not created or enforced, there is no guarantee that educating the public will have any affect at all. Also, it would take 20-40 years before any payback is experienced and even then there would be no way to measure the cost savings since they would be a result of avoided costs.

Figure 17 - Arbour Tree Foundation Tree Planting Guidelines



⁷ http://images.google.ca/imgres?imgurl=http://www.wisconsinpublicservice.com/home/images/treeplanting.gif&imgrefurl=http://www.wisconsinpublicservice.com/home/treeplanting.aspx&h=327&w=397&sz=12&hl=en&start=7&um=1&tbnid=q9_w0sRrBXybGM:&tbnh=102&tbnw=124&prev=/images%3Fq%3Doverhead%2Btree%2Bcable%26svnum%3D10%26um%3D1%26hl%3Den

ANALYSIS AND RECOMMENDATIONS

ANALYSIS OF ALTERNATIVES

A summary of alternatives is shown in Table 1. Each option is measured on its ability to reduce tree contacts by tree growth and by tree failure considering its cost. **Option 4, the Removal of Overhanging Branches, was determined to be the best overall alternative.** This alternative had the second largest impact on reliability since it is the fastest and most effective way of reducing tree failure related outages. The option also has one of the lowest costs associated with it, which is estimated at approximately \$250,000 per year or 50% more than the current tree-trimming budget.

However, the best-ranked option does not address the concerns with tree contacts and the lower than average tree clearances in Windsor. **Increasing Tree Clearances, Option 5, is the best alternative for reducing the probability of *tree growth* related outages.** Contractors are already hired to trim trees and would only need to trim an additional 2 feet in order to match standards set by other Utilities. Therefore, the increase in cost would only be approximately \$100,000 or 20% above the current tree-trimming budget.

Option 9 is the combination of option 4 and 5 above. **Increasing Tree Clearances and Removing Overhanging Branches would have the greatest impact on reliability.** The alternative would only cost \$100,000/yr more than option 4, the best overall alternative, and would address both types of tree related outages, *tree growth* and *tree failure*. Adopting this method is estimated to reduce overall SAIDI by 14 minutes in the first year, reduce it another 14 minutes in the second year, and then another 14 minutes the third year. This equates to a 14-25% reduction in SAIDI statistics and 8-25% reduction in SAIFI. Higher reductions are possible in years plagued with storms like 2002 and 2005 where tree outages made up almost half of the statistics for the year. In these years SAIFI and SAIDI could be reduced by as much as 45%.

Finally, Educating the Public is a low cost proactive method to help prevent or even eliminate future outages. The downfall is that only newly planted trees will be affected and most will not grow to a dangerous height for at least another 10-15 years depending on the species. This alternative is not very attractive due to the long-term benefits and would be difficult to justify financially but should be given serious thought since the option is in good business practice, demonstrates good corporate citizenship, and could prevent future corporate liabilities with homeowner privacy and children climbing trees near live conductors.

Table 1 – Analysis of Alternatives

Potential Projects

General Information				Financial Information				Risk if Not Done		Expected Performance Improvement			
Proj.	Opt.	Project Description	Option Description	Initial Cost (\$1000s)	Yearly Cost (\$1000s)	Life (Years)	Discount Factor (pu)	Must Do?	Prob. [0-10]	Severity [0-10]	SAIDI mil/yr	SAIFI /yr	MAIFI /yr
2	1	Tree Contact Reduction	Convert to Underground	4616.00	4616.00	40	0.1	N	\$	\$	1.1336	0.0147	0.0000
2	2	Tree Contact Reduction	Raise Conductors	293.13	293.13	40	0.1	N	\$	\$	0.3581	0.0044	0.0000
2	3	Tree Contact Reduction	Increase Clearances to 10'	100.00	100.00	100	0.1	N	\$	\$	4.6153	0.0567	0.0000
2	4	Tree Contact Reduction	Remove Overhanging Branches	250.00	250.00	100	0.1	N	\$	\$	10.8222	0.1330	0.0000
2	5	Tree Contact Reduction	Install Aerial Cable	1051.00	1051.00	40	0.1	N	\$	\$	0.6863	0.0064	0.0000
2	6	Tree Contact Reduction	Hazard Tree Removal	314.00	314.00	100	0.1	N	\$	\$	5.4111	0.0783	0.0000
2	7	Tree Contact Reduction	Increase Frequency of Trimming	1000.00	1000.00	100	0.1	N	\$	\$	10.8222	0.1330	0.0000
2	8	Tree Contact Reduction	Educate Public	20.00	5.00	100	0.1	N	\$	\$	0.7967	0.0098	0.0000
2	9	Tree Contact Reduction	Increase Clearances to 10' & Remove Overhanging Branches	350.00	350.00	100	0.1	N	\$	\$	14.0848	0.1731	0.0000

Project Ranking

Proj.	Opt.	Project Description	Option Description	Initial Cost	Yearly Cost	SAIDI	SAIFI	SUM	Overall Rank
2	1	Tree Contact Reduction	Convert to Underground	9	9	6	6	30	6
2	2	Tree Contact Reduction	Raise Conductors	4	4	9	9	26	5
2	3	Tree Contact Reduction	Increase Clearances	2	2	5	5	14	2
2	4	Tree Contact Reduction	Remove Overhanging Branches	3	3	2	2	10	1
2	5	Tree Contact Reduction	Install Aerial Cable	8	8	8	8	32	6
2	6	Tree Contact Reduction	Hazard Tree Removal	5	5	4	4	18	4
2	7	Tree Contact Reduction	Increase Frequency of Trimming	7	7	2	2	18	4
2	8	Tree Contact Reduction	Educate Public	1	1	7	7	16	3
2	9	Tree Contact Reduction	Increase Clearances & Remove Overhanging Branches	6	6	1	1	14	2

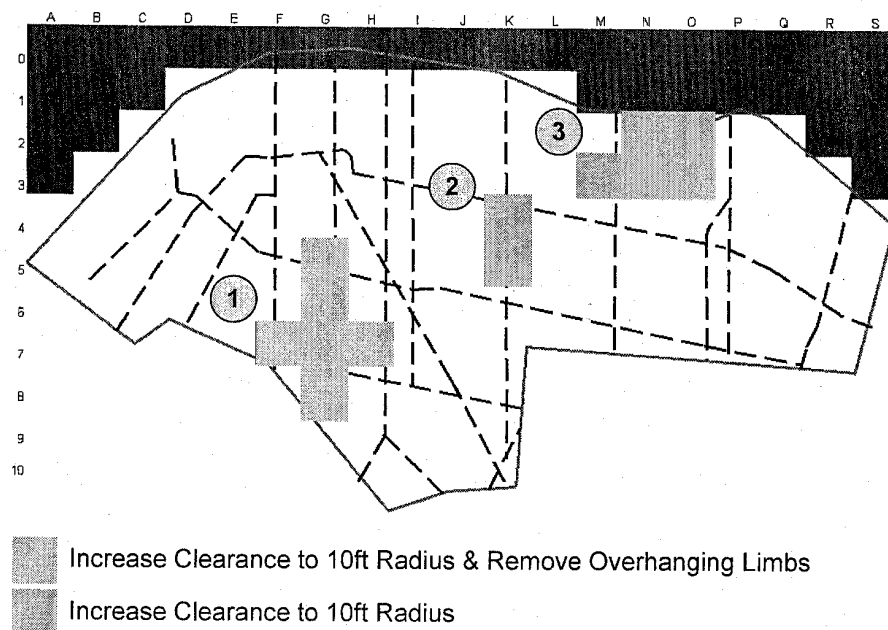
See Exhibit 9 - CUE Estimated Cost for replacing 50ft Wood Pole with 60ft Wood Pole
 See Exhibit 10 - CUE Estimated Cost for replacing 50ft Wood Pole with 50ft Wood Pole
 See Exhibit 11 - CUE Estimated Cost for Replacing Overhead Conductor
 See Exhibit 12 - Estimated Cost to Increase Tree Clearances to 10 feet

RECOMMENDATION

It is clear that EnWin does not trim its trees as far back as other Utilities do. Although tree growth outages are minimal, insufficient clearance can cause contacts during heavy winds if the conductor sags during hot weather and/or heavy loading. In addition to this method of prevention, it was shown that Area 1 has a number of tall, mature trees that overhang the conductor and is therefore at a higher risk of tree failure outages.

In order to test the theory while minimizing expenses and speeding up the time required to see results it is recommended that only the severe areas (Area 1, 2, and 3) have their clearances increased to 10ft and that only Area 1 have its overhanging limbs removed (see Figure 18). This can be done in parallel with the tree-trimming contract for Area C in 2009 since budget dollars will need to be approved before the test can take place. If this action shows a substantial reduction in tree related outages then this action should be taken across the City.

Figure 18 - Recommendation

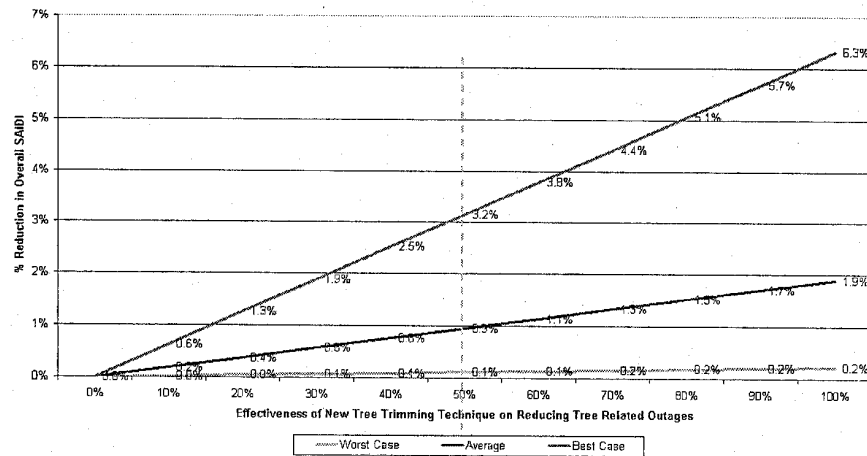


It would also be wise to begin educating the public about where they should plant various species of trees in order to prevent future problems. Pamphlets can be handed out at tree nurseries to distribute to customers. Ultimately a bylaw should be put into place to enforce these rules and allow EnWin to remove trees at the owners cost if the laws are broken.

BENEFITS

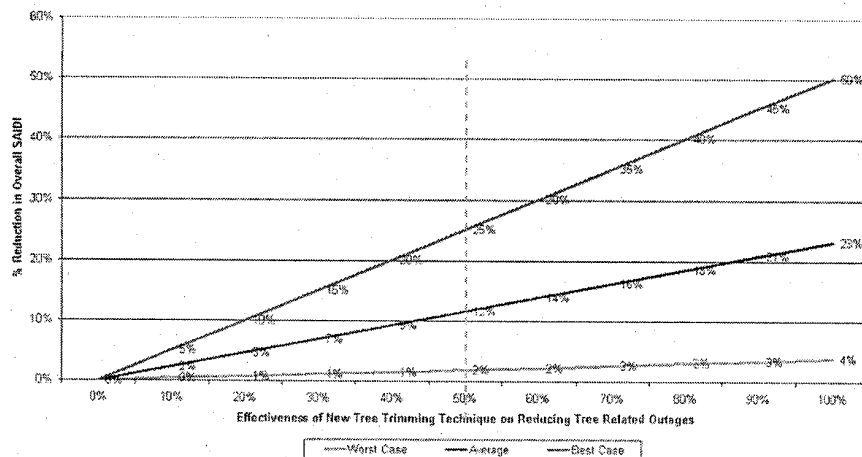
Adopting the new 10ft clearance and the removal of overhanging tree limbs on the trial area is predicted to reduce total tree related outages by 10% and overall SAIDI by 0.9% (9,404 customer-hours) on average if it is only 50% successful. See Figure 19 below.

Figure 19 - Affect of New Tree Trimming Technique on Overall SAIDI - (Trial Area Only)



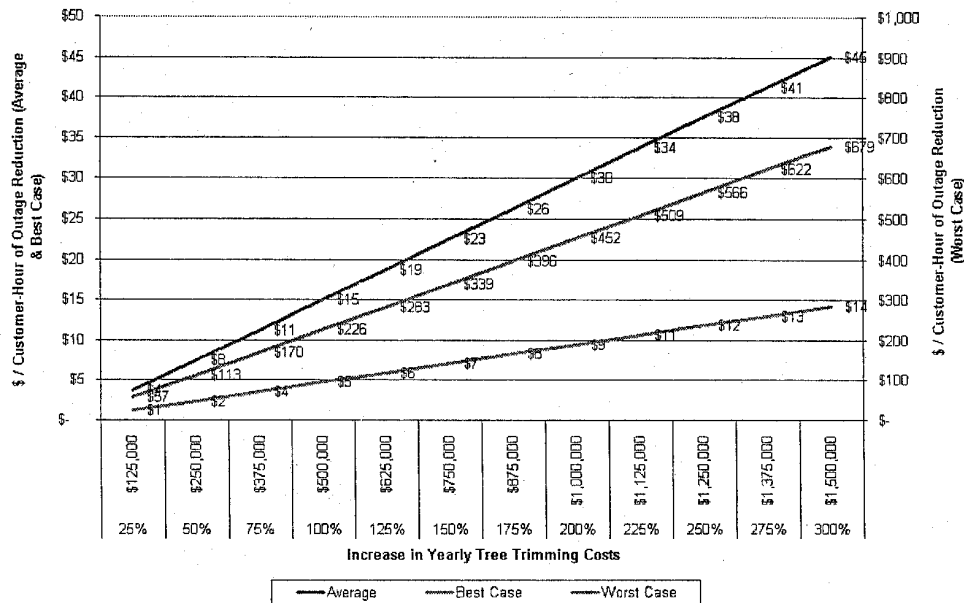
Adopting the plan for the entire city is estimated to reduce overall SAIDI by as much as 25% (105,731 cust-hrs) in severe years or 12% (33,310 cust-hrs) on average if it is 50% effective. Refer to Figure 20 below.

Figure 20 - Affect of New Tree Trimming Technique on Overall SAIDI - (Entire City)



If removing overhanging tree limbs would increase costs by 50% then it would cost \$8 per customer-hour reduction on average. Tree trimming would show the most benefit in a bad storm year which would reduce the per customer-hour cost to \$2. In a relatively calm year with minimal storms, the cost could increase to as much as \$113/customer hour. Refer to Figure 21 for a comparison chart.

Figure 21 - Cost per Customer-Hour Analysis



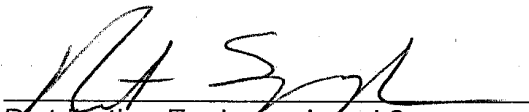
ANTICIPATED DIFFICULTIES

This recommendation has its shortfalls. The biggest of which is that contracted tree trimmers may not get the resident's permission to cut their tree. We already receive approximately 200 customer complaints per year about 8ft clearances so the complaints will increase. Some legal inquiries should be made into creating a policy to charge those customers whose tree damages our lines after they have refused tree trimming.

Discussions with Landgraff, one of *ENWIN's* approved tree trimming contractors, has brought up a few more complications. Estimating the increase in cost for 8 foot to 10 foot clearances and removing overhanging tree limbs is not an easy task. The estimate would require a survey of the area first, which would increase costs. They recommend that *ENWIN* identify specific trees to trim to eliminate survey costs. Trees that are in backyards without an alley would also be more expensive to cut and unfortunately the majority of the worst performing areas in the city fit this criterion.

Dave Landgraff also suggested that *ENWIN* should consider removing and replacing large trees instead of trimming them to the point of deformation. From his experience, the majority of the large trees fit this category.

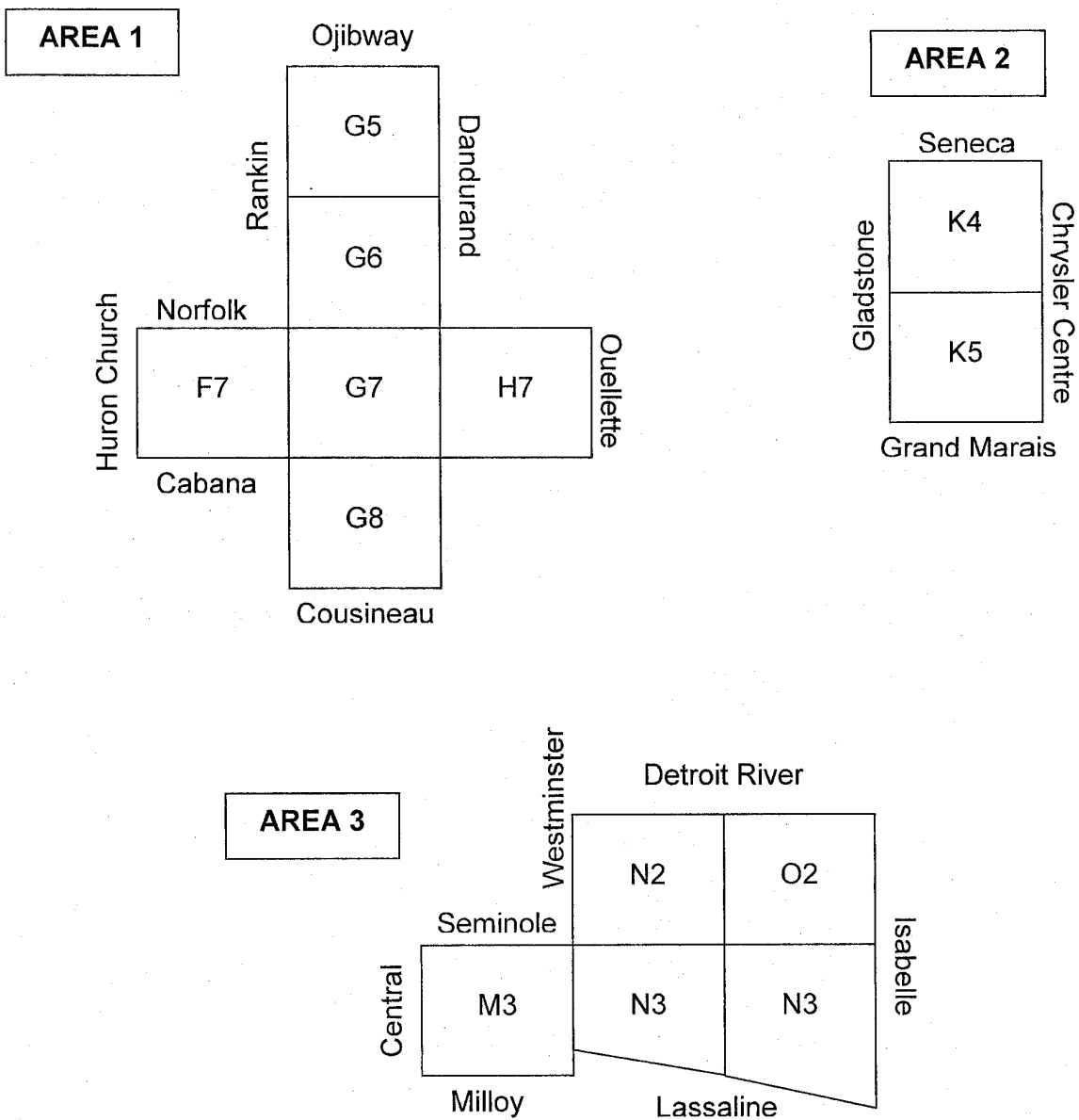
All in all, complication will arise from getting access to trees that require trimming, getting the authority to make the recommended trims, and estimating the total cost of the work unless the work is very specific down to the individual tree.


Distribution Engineer, Level 2
Engineer in Training, M.B.A

Attch: APPENDIX

APPENDIX

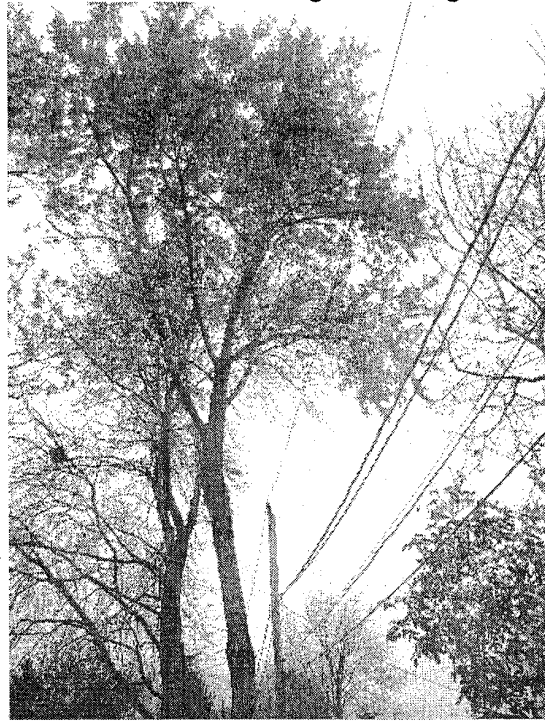
Exhibit 1 - Boundaries of the Three Worst Performing Areas



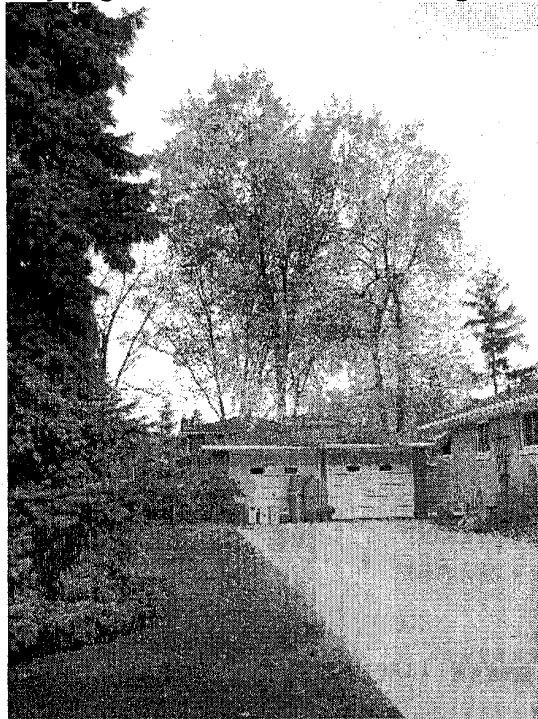
**Exhibit 2 - St.Luke Rd. at Milloy St.
Trees directly below high line circuit**



**Exhibit 3 – 2450 Mark Ave.
Tall mature trees with large overhang**



**Exhibit 4 – Everts Ave. at Labelle St.
Very large mature trees with overhang**



**Exhibit 5 - Curry Ave. at Labelle St.
Tree trim technique**



Exhibit 6– Behind South Windsor Arena
Large trees with a narrow clear path



101

Exhibit 7 – Behind South Windsor Arena
Dense tree coverage with fallen tree



Exhibit 8– Avon Ct. near Sub 69
Dead fallen tree, young section

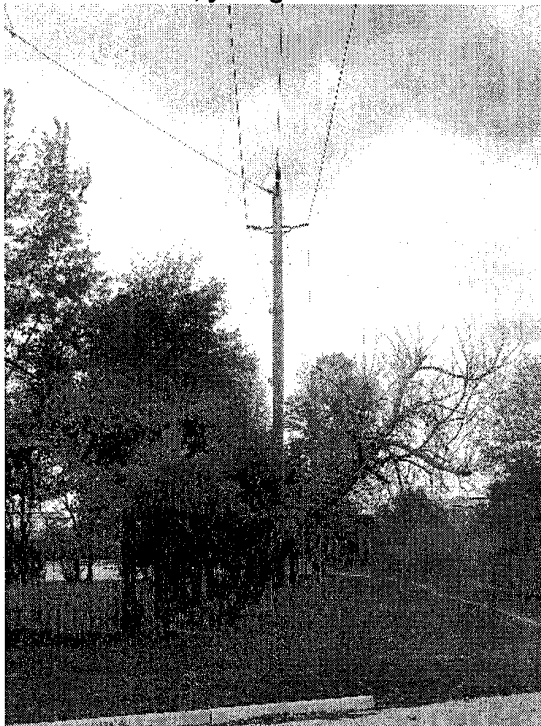


Exhibit 9 – CUE Estimated Cost for replacing 50ft Wood Pole with 60ft Wood Pole

Cost Summary by Resource Category

Labor & Other:	Hours Breakdown		Cost Breakdown		Sub-total
	EWPWR	Contractor	EWPWR	Contractor	
Site Time	11:00	0:00	\$2,277.00	\$0.00	\$2,277.00
Off-Site Adjustment	0:00	N/A	\$0.00	N/A	\$0.00
Sub-Total: Labor	11:00	0:00	\$2,277.00	\$0.00	\$2,277.00
Other Resources			\$84.14	\$0.00	\$84.14
Sub-Total: Labor & Other Resources			\$2,361.14	\$0.00	\$2,361.14
Materials:					
New Materials					\$1,274.29
Estimated Salvage from Removed Materials					\$0.00
Sub-Total: Materials					\$1,274.29
Total Chargeable to Work Order:					\$3,635.43
Total Deferred:					\$0.00
Total Cost of Work Order:					\$3,635.43

Exhibit 10 – CUE Estimated Cost for replacing 50ft Wood Pole with 50ft Wood Pole

Cost Summary by Resource Category

Labor & Other:	Hours Breakdown		Cost Breakdown		Sub-total
	EWPWR	Contractor	EWPWR	Contractor	
Site Time	11:00	0:00	\$2,277.00	\$0.00	\$2,277.00
Off-Site Adjustment	0:00	N/A	\$0.00	N/A	\$0.00
Sub-Total: Labor	11:00	0:00	\$2,277.00	\$0.00	\$2,277.00
Other Resources			\$84.14	\$0.00	\$84.14
Sub-Total: Labor & Other Resources			\$2,361.14	\$0.00	\$2,361.14
Materials:					
New Materials					\$939.68
Estimated Salvage from Removed Materials					\$0.00
Sub-Total: Materials					\$939.68
Total Chargeable to Work Order:					\$3,300.82
Total Deferred:					\$0.00
Total Cost of Work Order:					\$3,300.82

Exhibit 11 – CUE Estimated Cost for Replacing 1 Span (15m/ 50ft) Overhead Conductor**Enwin Powerlines Ltd.**

February 6, 2008 11:36 AM Page: 1

CUE Cost Summary		
Work Order: ROBEX2	Cost of Replacing Overhead Conductor	Status: PRELIMINARY
Version: 1		Date: 02/06/2008
Location:		Map: CUE
Estimator: R_SPAGNU	Primary Contract:	
	Secondary Contract:	

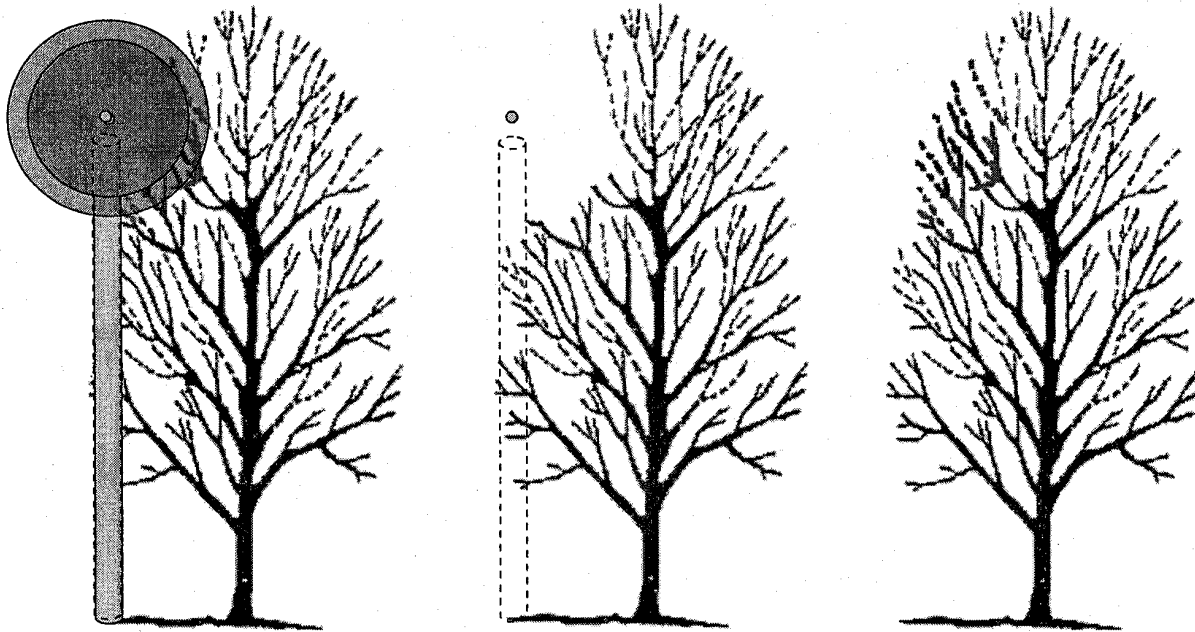
Cost Summary by Resource Category

Labor & Other:	Hours Breakdown		Cost Breakdown		Sub-total
	EWPWR	Contractor	EWPWR	Contractor	
Site Time	0:40	0:00	\$276.66	\$0.00	\$276.66
<u>Off-Site Adjustment</u>	<u>0:00</u>	<u>N/A</u>	<u>\$0.00</u>	<u>N/A</u>	<u>\$0.00</u>
Sub-Total: Labor	0:40	0:00	\$276.66	\$0.00	\$276.66
<u>Other Resources</u>			<u>\$51.75</u>	<u>\$0.00</u>	<u>\$51.75</u>
Sub-Total: Labor & Other Resources			\$328.41	\$0.00	\$328.41
Materials:					
New Materials					\$54.75
<u>Estimated Salvage from Removed Materials</u>					<u>-\$0.55</u>
Sub-Total: Materials					\$54.20
Total Chargeable to Work Order:					\$382.61
Total Deferred:					\$0.00
Total Cost of Work Order:					\$382.61

Exhibit 12 – Estimated Cost to Increase Tree Clearances to 10 feet

Increasing clearances to 10ft would not increase tree-trimming costs significantly since the contractor is already at the location. However, removing overhanging tree limbs would most likely increase costs significantly (see Figure 22).

Figure 22 - Variance from 8ft Clearance to 10ft Clearance



Key		Clearance		Vairance	
Area	Branches	Radius	Area	Area	Percent
		8 ft	201 sqft		
		10 ft	314 sqft	113 sqft	56% more

- 10ft clearance would cover 1.5 times more area than an 8ft clearance.
- Tree contractors price out trims based on the diameter of the branch being trimmed. Branches up to 8" diameter normally cost \$125/cut and branches >8" cost \$250/cut.
- Using the diagram above as a reference, an 8ft clearance would require 4 small trims at \$125/cut and the 10ft clearance would require 2 small trims at \$125/cut and 2 large trims at \$250/cut.
- If both trims take 1 hour then the 10ft clearance would cost \$750 vs. \$500 for the 8ft clearance.
- 10ft clearance would cost 1.5 times more (or 50% more).

REFERENCES ¹⁰⁵

Siegfried Guggenmoos, July 2003, *Effects of Tree Mortality on Power Line Security*, Journal of Arboriculture 29(4):

Seth D. Guikema, Rachel A. Davidson, and Haibin Liu, July 2006, *Statistical Models of the Effects of Tree Trimming on Power System Outages*, IEEE Transactions of Power Delivery, Vol 21, NO. 3, 0885-8977

W.K.Daily, Senior Member IEEE, October 1999, *Engineering Justification for Tree Trimming*, IEEE Transactions of Power Delivery, Vol 14, No. 4

NEWARK Tree Clearance Reference

http://newark.de.us/DOCS/departments/tree_trimming_specs.html

Types of Trimming Growth Rate Clearance	Topping Clearance		Side Clearance		Overhead Clearance	
	Fast	Slow	Fast	Slow	Fast	Slow
	9 ft	7 ft	8 ft	6 ft	12 ft	12 ft

Okanogan County PUD Tree Clearance Reference

<http://www.okanoganpud.org/ttfaqs.htm>

SEC_IRR_14



Reliability Improvement Recloser Loop Scheme Implementation

Prepared by: Shawn Filice

April 3, 2006

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Executive Summary

The City of Windsor requires an affordable and reliable electrical energy distribution system to encourage investment and create economic benefits for the area. This report reviews system reliability in general terms, compares ENWIN's reliability indices against other large utilities in the province and concludes that continued capital spending for recloser installations is required to ensure that system reliability does not diminish. The reader is encouraged to understand the challenges and opportunities facing Powerlines as outlined in this report.

The average age of the existing *ENWIN* Powerlines distribution infrastructure is 30 to 40 years and the average life of distribution infrastructure is approximately 40 to 50 years, based on published reports. Eliminating or substantially reducing capital expenditures necessary to replace deteriorated infrastructure would translate into reduced distribution reliability and increased maintenance expenses. This will result in decreased customer satisfaction and a potential loss of jobs in this increasingly competitive manufacturing market.

As *EnWIN*'s infrastructure continues to age, the probability of equipment failure continues to increase. A looped scheme recloser will automatically restore power to a part of a feeder after a fault condition has occurred and resulted in a power outage. The use of pole-mounted reclosers in a looped configuration can expedite power restoration initiatives and improve reliability statistics while reducing operating and maintenance costs. Similar protective schemes are becoming commonplace amongst Utilities across North America.

The report recommends funding the implementation of a loop scheme distribution automation program for the following reasons:

- It is the option that best balances cost with reliability improvements;
- Improve reliability by 10% & move from a bottom Quartile performer to a Third Quartile performer, just two places behind Horizon (Hamilton) Utilities;
- Reduce outage costs to our large industrial customers by \$1.1Million/year.

Local Development and Industry Needs

The City of Windsor decided to maintain ownership of the distribution assets to ensure affordable and reliable power for industry and residential consumers and to use distribution infrastructure as an asset that can be leveraged to create economic development in the area.

Windsor's high density of manufacturing plants requires reliable power in order to effectively compete in the highly competitive global environment. Power outages, whether short or long in duration, create industry down time, scrap, and lost production since many of the manufacturing processes are highly automated and microprocessor based. The OEB Performance Based Regulation (PBR) has been structured to ensure reliability is not sacrificed for the sake of increased profits. Phase two of PBR will mandate continuous improvement in reliability and service quality levels. OEB working groups have been established to define the service and productivity factors that will be considered. Additionally, local distribution rates must remain competitive in order to ensure that local industry is competitive. A balance must be maintained between distribution rates and the cost of reliability.

Introduction & Purpose

The purpose of the EnWin Powerlines organization is to provide safe, reliable, cost effective electricity to the end use customers and at the same time increase the value of the asset for the shareholder. The shareholder (City Of Windsor) wanted to utilize the asset to successfully enhance economic development in the City of Windsor. When evaluating a prospective site, industry places a high emphasis on electricity reliability and price. The reliability of the electrical distribution system together with the price of electricity (delivery as well as commodity) are primary drivers in the decision making process on whether to locate a heavy manufacturing facility in the region. This is especially true for high energy load operations such as galvanizing and metal casting plants where the impact of interrupted power has severe consequences in the shutdown, purging/waste of material in process and restarting of production. Please refer to Appendix F for a discussion of the issues large manufacturers must consider when evaluating prospective sites.

The EnWin customer base consists of approximately 85,000 residential, commercial, and industrial customers. The Windsor - Essex County area has one of the highest densities of manufacturing industries in Canada. The industrial customers are primarily manufacturing plants that are either directly or indirectly involved in the automotive industry and are using just in time (JIT) processes to compete in this extremely competitive market. Manufacturing plants use computer controlled manufacturing processes, which are dependent on a high degree of electrical distribution reliability. A power outage disrupts the manufacturing process, creating scrap material, lost productivity, damaged tooling and missed delivery schedules. It is very clear that in any economic analysis determining the level of capital spending required to sustain the distribution system, both LDC costs and customer costs should be considered.

Investing in system reliability improvements supports our purpose to provide safe, reliable, cost effective electricity to our customers. The “do nothing option” i.e. do not spend any money on system reliability initiatives, results in increasing customer outage times and frequency as well as substantially increasing manufacturing inefficiencies.

The shareholder has declared that EnWIN Powerlines Ltd. must operate as a safe, efficient and cost effective electricity distribution utility whose performance is “best in class”. The objective of this report is to identify a go forward strategy ensuring EnWIN’s Reliability indices compare favourably with London Hydro and Horizon Utilities (Hamilton Hydro). This report will identify the root causes of power interruptions, the impact these interruptions have on EnWin Powerlines Ltd. (EwP) customers and how this methodology can be employed to improve system reliability.

Background

Current State

In 2004, (See MEARIE report, Appendix B), **EnWin Powerlines Ltd. was a bottom Quartile performer by ranking 13th overall** for Large Utilities in Ontario (out of 16) for outage reliability statistics (See Table 1)*.

	Enwin Powerlines (Rank 13)	Hamilton Hydro (Rank 9)	London Hydro (Rank 14)	2004 PROVINCIAL AVERAGE
SAIDI (hrs.)	1.21	0.77	1.32	0.919
SAIFI	2.73	1.03	2.09	1.337
CAIDI (hrs.)	0.44	0.74	0.63	0.735

Table 1: 2004 Reliability Statistics "AT A GLANCE"

*NOTE: London Hydro did not participate in this study. The London Hydro statistics were obtained via telephone and their rankings were placed in manually for this report.

SAIDI – Defined as the **average interruption duration for customers served during the year**. EnWIN's 2004 SAIDI was 1.21 hours (1 hour and 13 minutes). This compares against the MEARIE 2004 Provincial large users SAIDI value of 0.919 (55 minutes)

SAIFI – Defined as the **average number of times that a customer is interrupted during the year**. EnWIN's 2004 SAIFI was 2.73 interruptions per customer. The 2004 Provincial average is 1.337 interruptions per customer.

CAIDI – Defined as the **average length of an interruption**. EnWIN's 2004 CAIDI was 0.44 hours (26 minutes). The 2004 Provincial average is 0.735 hours (44 minutes).

Future State

EnWin Powerlines has established corporate goals for 2006 to set the stage to become “best in class”. To become best in class, EwP must take steps to become a top quartile “Large Utility” system reliability performer in the Province of Ontario.

Challenges/Issues

The challenge is to balance the costs of reliability with the level of service customer's demand, at a price the customer is willing to pay. In addition to customers demanding better service at lower cost, the regulator (the Ontario Energy Board – OEB) has entered the picture with rate decisions tied to service reliability. This point was exemplified during Hydro Ottawa's rate application hearings on January 23, 2006. The OEB voiced numerous concerns over Ottawa Hydro's proposed Capital Spending reductions and their impact on reliability and service quality levels (Refer to the OEB's website for rate application hearing transcripts http://www.oeb.gov.on.ca/documents/cases/EB-2005-0381/vol01_230106.doc).

When economics associated with reliability is discussed, there are three different perspectives: the electric utility's viewpoint, the customer's viewpoint, and the regulator's viewpoint. Each have different concerns and interests, as such, each will yield a different set of conclusions regarding expenditures on system reliability.

Electric Utility's Viewpoint

From EwP's viewpoint, the economics include expenditures to improve reliability in order to generate an increase in kWh sales (i.e. less than \$4,000 per year). In addition to the quantitative measures there are additional benefits such as improved customer service, decreased customer complaints (examples of customer complaints can be found in Appendix G), better public relations, and decreased pressure from the OEB. Another factor which has not been traditionally considered, is the justification for reliability expenditures to keep existing customers or attract new customers from choosing an alternate site to re-locate and/or build facilities and subsequently purchase power from a competitor. By comparison, the automobile manufacturers in North America have improved the reliability of their products in order to retain existing customers, maintain revenues, attract new customers, etc. EwP is now in a similar situation, forced by customers and the OEB to expend resources on reliability improvement in the face of new competition (competition being other communities where these manufacturers could move/build their facilities).

Customer's Viewpoint

Customer's demand reliable power because outage costs from lost production, scrapped material, and additional cleanup and repairs can be significant. The commercial and industrial customers in the City of Windsor lose approximately \$7.8 Million dollars each year due to unplanned power outages. This calculation is based upon formulas found in the Institute of Electrical and Electronics Engineers (IEEE) Standard 493-1997 (See Appendix A)

These findings are anecdotally supported in the form of a letter (See Appendix G) from one of Windsor's larger manufacturing customers, Kautex Textron. In this letter, Kautex claims that power quality in 2002 cost their facility \$160,000. They also indicated they don't experience the same level of interruptions in other facilities in North America. If Kautex decided to close their doors in Windsor due to inferior power quality, the net **reduction in distribution revenue would be \$195,136.73/yr.**

Similar letters and conclusions can be found in this same appendix where there are a number of referenced complaint letters regarding power quality.

Regulator's View

Performance Based Ratemaking (PBR) seeks to establish an environment that stimulates the utilities to improve efficiency and keep prices in line with inflation. This has the potential of forcing some utilities to sacrifice maintenance and other costs for the sake of providing a reasonable rate of return to their shareholders. As customers are held captive, the OEB is charged with the duty to ensure Utilities do not forfeit reliability for profits. They do this through benchmarking Service Quality Indicators such as those mentioned above (i.e. SAIDI, SAIFI and CAIDI) and any indices over the 3-year average must be explained to the OEB. With this data, rate plans can be compared against annual performance to baseline performance standards. In addition to this, there are talks surrounding penalties being included to discourage deterioration in service with budget cuts.

Root Cause Analysis

EnWIN requires a 60% system reliability improvement to reach the top quartile performers. To move from the current state (13th in the Province) to the planned future state (top quartile performer) the root causes must be identified and addressed. An analysis of the outage statistics for the years 2001 through 2003 identified Lightning, Trees and Adverse Weather as the predominant factors related to unplanned power outages (See Appendix C).

Review of the 2005 Outage statistics, shows the root causes below:

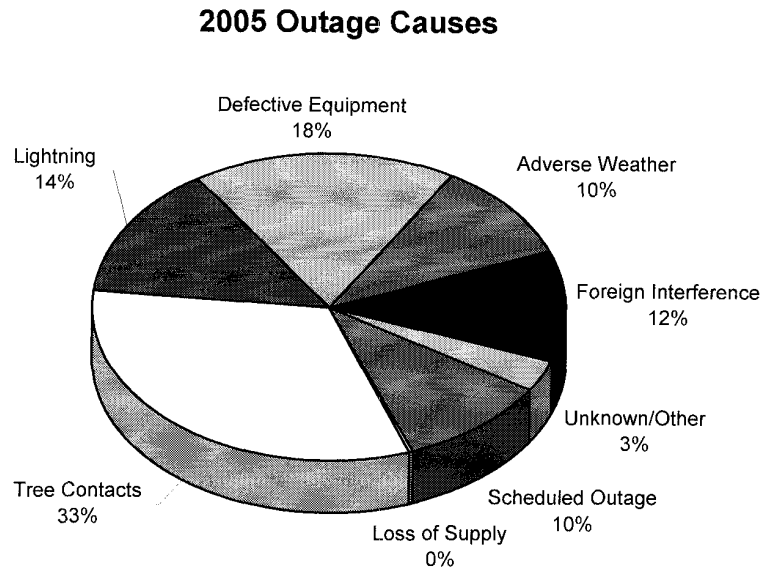


Figure 1: 2005 Root Causes of Outages

To improve System Operating Reliability we must:

- Limit the number of incidents and avoid major incidents (Prevention);
- Limit the consequences of major incidents when they do occur (Response)

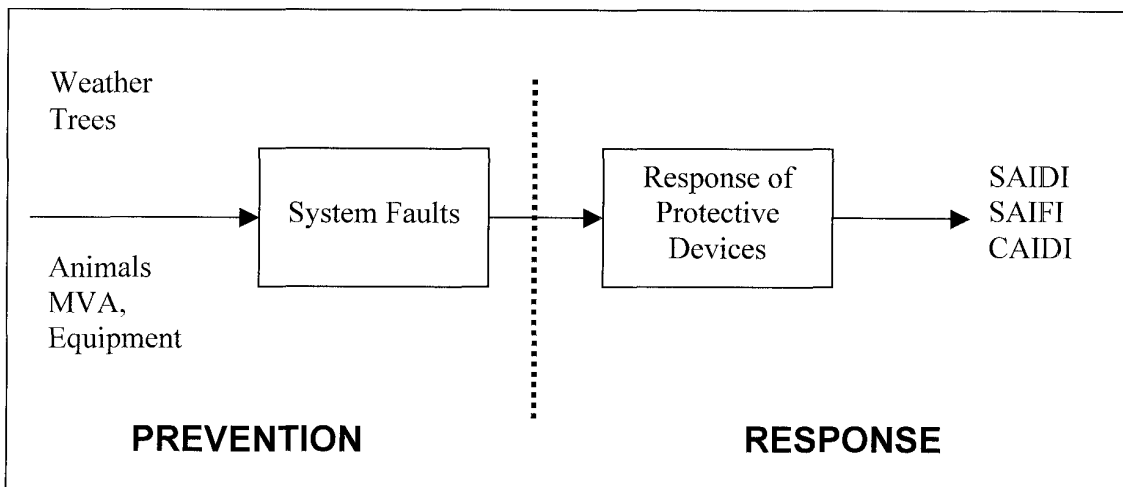


Figure 2: Prevention and Response Initiatives

A number of programs focusing on PREVENTION are already in place and are summarized below:

- Defective Equipment related outages – Infra-Red Scanning, Insulator Washing, System Inspection (Poles, Wires, Grounding, Underground Vaults, etc), Station Maintenance Preventive Maintenance and the Rehabilitation (4.16kV Conversion) program are all initiatives EnWIN undertakes to minimize outages caused by defective plant and equipment.
- Weather & Rodent related outages - Tree Trimming, installation of “squirrel” guards, installation of “tree-proof” cable, installation of lightning arresters and fused taps are all programs aimed at preventing/reducing outages related to weather, trees and animals.

The Recloser Loop Scheme program focuses on RESPONSE, more particularly, how protective devices can be utilized to help improve system reliability.

Proposals

A variety of system reliability improvement proposals along with their corresponding projected reliability improvements are listed below:

Project	SAIDI Improvement (%)	Projected Cost	Cost (\$Millions)/ % Improvement
Loop scheme implementation	10	\$1 M	0.1
More aggressive tree trimming	5	\$300k/yr for 20 years NPV = \$3.7 M	0.74 Not practical, politically sensitive
Tree cable installation on existing 27.6 kV circuits	10	\$4 M	0.4
Replace overhead line with underground cable	30	\$40 M	1.33

Of the proposals mentioned above, the loop scheme implementation offers the largest return on capital employed with respect to reliability improvements. More aggressive tree trimming may not be financially and politically attractive as many residents are very concerned over the aesthetics of aggressive tree trimming. Changing the clearance standard from 8 feet to 16 feet would entail the destruction of many trees within the City limits. Tree cable installations were piloted in 2005 with the rebuild of the Riverside area in the City of Windsor. The benefits related to this program will be presented next year based upon field data expected this year. Replacing overhead lines with underground cable comes at a premium of more than 5 times the current overhead reconstruction costs.

Based upon these factors, it is argued the loop scheme implementation on 27.6 kV feeders is the most economic method to improve system reliability quickly.

Loop Scheme Theory

The theory behind the loop scheme methodology is to allow the system protective devices to operate without human intervention thus allowing the system to restore power to as many customers as possible in as short a time as possible. It is constructed using recloser devices in the middle (mid-point reclosers, denoted by A & B in Figure 3, below) and at the ends (tie-point reclosers, denoted by T) of the circuits. The mid-point reclosers were installed between 2002 and 2004. The loop scheme can provide isolation of faulted sections within a given distribution circuit and simultaneously, re-establish service to all customers unaffected by the faulted section within a relatively short period.

Components and characteristics

Substation circuit breaker - A substation circuit breaker is a mechanical switching device, capable of making, carrying, and breaking currents under normal circuit conditions and also, making, carrying for a specified time and breaking currents under specified abnormal circuit conditions such as those of short circuits.

Mid-Point recloser - A mid-point recloser is a recloser electrically located between a breaker and a tie-point recloser. The mid-point reclosers are normally closed.

Tie-Point recloser - A tie-point recloser is a recloser located at the electrical halfway point between two sources or two distribution feeder circuits. Typically a tie-point recloser is electrically located between two mid-point reclosers. The tie-point reclosers are normally open.

The configuration is shown in Figure 3.

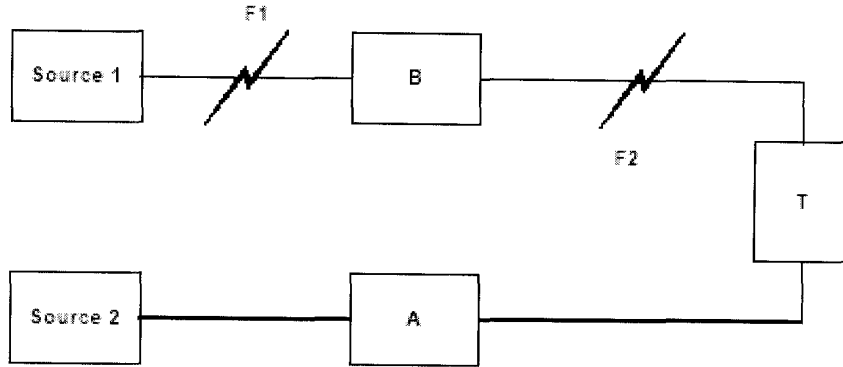


Figure 3: Classical 3-Recloser loop control scheme

Classical 3-Recloser Fault 1 Scenario

A permanent fault exists at location F1 (Figure 3), between the Source 1 circuit breaker and the mid-point recloser B. The Source 1 circuit breaker will recognize the downstream fault and go through its one reclosing shot to lockout. On lockout of the Source 1 circuit breaker at certain time (t_0 , seconds) the mid-point recloser B will recognize a loss of 3-phase voltage at t_1 , seconds, after the initial fault or (Eq.1) and automatically open, isolating the faulted zone, F1, on the source side of the recloser.

$$t_1 = t_0 + 10s \quad (\text{Eq.1})$$

The tie-point recloser T will at the same instant recognize a loss of 3-phase voltage on the Source 1 side of the recloser. After an additional delay time from the initial fault at Source 1 or (Eq. 2), the tie-point recloser T will close. This establishes service from Source 2, to recloser A, and through the tie-point recloser T to the open sectionalizing recloser B.

$$t_2 = t_1 + 10s \quad (\text{Eq. 2})$$

According to the published literature (See Appendix E), utilities employing this technology can significantly improve system reliability. In some test cases, improvements of up to 25% were anticipated. These improvements will vary based upon a variety of factors such as customer class make-up, length and configuration of circuits, etc.

Benefits from Loop Scheme

The improvement can be achieved by reducing the outage time when a fault occurs at F1 in Figure 3. Traditionally, emergency responders are dispatched to isolate faulted sections of line. In many instances this may take up to a couple of hours. By implementing the loop scheme, the load on the healthy sections can be transferred in less than a minute. Outages lasting less than one minute in duration are not counted in the reliability indices.

Based upon the analysis of EnWIN's historical fault data (See Appendix D), system reliability can be improved by 10-15% using a loop scheme. Two scenarios were analyzed using *EnWIN's* 2005 reliability data (NOTE: It would have been too difficult to adjust the 2004 figures for this analysis, as such, 2005 outage data was used). These were, Present System (which includes 32 mid-point pole top reclosers and the Loop Scheme. The following table summarizes the findings of this analysis:

Reliability Index (2005)	Present System	Loop Scheme (% Change)
SAIDI	2.65	2.28 (14.09% Improvement)
SAIFI	3.16	2.70 (14.57% Improvement)
CAIDI	0.84	0.84 (No Change)

In summary, this table shows that had the tie-point reclosers been installed in the system, the reliability would have improved by 14%.

Assuming tie point reclosers had been installed in 2003 and the 10% improvement to reliability indices (a conservative estimate) had been realized for 2004, EnWIN would have improved their provincial ranking to the 11th position. This is squarely in the third quartile, just two places behind Horizon Utilities (former Hamilton Hydro).

Furthermore, this improvement in response time translates to customer cost savings in the order of \$1.1 Million per year (see Appendix A). This is the minimum amount that customers should be willing to pay in rates for improved reliability. Other intangible factors such as inconvenience will result in a higher investment level.

Another concern impacting system reliability is related to cost saving measures being introduced this year with the planned reductions in shift coverage by the trouble department. As exposure related to un-manned shifts increase so do potential liabilities and response times related to power interruptions. The loop scheme proposal will help alleviate some of these pressures.

Other Benefits

The loop scheme, if implemented, will enable quick transfer of load between feeders. A loop scheme recloser has the potential to be used not only for reliability improvements but also for fast load shedding and restoration during emergencies. This provides an added benefit by ensuring EnWIN's most critical customers (i.e. large manufacturers and Hospitals) are protected from extended loss of supply.

Another benefit relates to the provision of better customer service regarding supply voltage inquiries/complaints. Since these tie reclosers will be installed at the ends of the feeders, EnWIN staff can better obtain power quality information, which will enhance the ability of the System Operators and Planning Engineer to address customer supply complaints such as low voltage problems due to long feeder lengths and load increases. The availability of real time information from the reclosers will allow the company to proactively deal with low voltage problems.

An added benefit of the improved power quality is the retention of key customers such as Ford, General Motors, Daimler, Kautex, Windsor Mold, etc. plus the added potential of drawing in or attracting new facilities and/or plant expansions. Again, supporting information relating to these factors can be found in Appendices F & G.

Conclusion and Recommendation

If the improvement to distribution system reliability can't be economically justified through an increase in kilowatt-hour sales, why is it so important to continue to spend in this area? One reason is, pressure from our regulator, the Ontario Energy Board and their threats to establish minimum performance levels measured by SAIDI, SAIFI and CAIDI. Based upon the 2004 MEARIE report, EnWin Powerlines Ltd. ranks 13th out of the 16 large Utilities in the Province of Ontario when it comes to system reliability. OEB pressure to improve may come in the form of penalties for failing to meet established benchmarks accompanied by refusal to allow EnWIN to increase their rates to cover ever-increasing costs.

Another driver is the avoidance of negative public relations. A utility with a reputation for unreliable service cannot attract major industrial customers to its service territory much less maintain its existing customer base.

General customer satisfaction is another factor to consider. A cornerstone of EnWin Powerlines' Ltd. mission statement is to provide reliable electrical service to its customers. EnWin Powerlines Ltd. corporate objectives also include the desire to foster a culture of continuous improvement with an eye toward being "best in class" where possible. This initiative is in keeping with that goal.

The recommendation of this report is to fund the project with the lowest cost providing the maximum improvement to reliability, namely, the loop scheme (distribution automation) plan. This program will cost \$1 Million to be spent over 2 years (i.e. \$500,000 has already been budgeted for 2006 and another \$500,000 will be required in 2007).

By implementing the loop scheme, ENWIN is expecting to:

- Improve system reliability by an additional 10% (see Appendix D-note assumptions and Appendix E). All factors being equal, a 10% improvement in reliability would place EnWIN two places behind Hamilton in 11th place out of 16.
- Reduce impacted customer cost by \$1.1 Million dollars per year (see last page of Appendix A).
- Operate the reclosers remotely thus improving response time.
- Transmit voltage, current, power factor and power quality information through the SCADA system to help system operation and planning.
- Provide quick load shedding and restoration ability during emergencies

Appendix A
**Interruption Costs, Customer Satisfaction and Expectations for
Service Reliability**

IEEE Std 493-1997
(Revision of IEEE Std 493-1990)

IEEE Recommended Practice for the Design of Reliable Industrial and Commercial Power Systems

Sponsor

**Power Systems Reliability Subcommittee
of the
Power Systems Engineering Committee
of the
IEEE Industry Applications Society**

Approved 16 December 1997

IEEE Standards Board

Abstract: The fundamentals of reliability analysis as it applies to the planning and design of industrial and commercial electric power distribution systems are presented. Included are basic concepts of reliability analysis by probability methods, fundamentals of power system reliability evaluation, economic evaluation of reliability, cost of power outage data, equipment reliability data, examples of reliability analysis. Emergency and standby power, electrical preventive maintenance, and evaluating and improving reliability of the existing plant are also addressed. The presentation is self-contained and should enable trade-off studies during the design of industrial and commercial power systems design, installation, and maintenance practices for electrical power and grounding (including both power-related and signal-related noise control) of sensitive electronic processing equipment used in commercial and industrial applications are presented.

Keywords: Designing reliable industrial and commercial power systems, equipment reliability data, industrial and commercial power systems reliability analysis, reliability analysis.

Introduction

(This introduction is not a part of IEEE Std 493-1997, IEEE Recommended Practice for the Design of Reliable Industrial and Commercial Power Systems.)

The design of reliable industrial and commercial power systems is of considerable interest to many people. Prior to 1962, a qualitative viewpoint was taken when attempting to achieve this objective. The need for a quantitative approach was first recognized in the early 1960s when a small group of pioneers led by W. H. Dickinson organized an extensive AIEE survey of the reliability of electrical equipment in industrial plants. The AIEE survey that was taken in 1962 was followed by several IEEE reliability surveys, which were published in 1973 through 1979. These surveys from the the 1970s were the basis for the reliability data contained in IEEE Std 493-1980. Six additional IEEE reliability surveys have been conducted and published during the 1980s and have been updated in this revision of IEEE Std 493-1997. The 1990 edition included pertinent tutorial reliability material and the cost of power interruptions data.

IEEE Std 493-1997 presents two new chapters, Chapter 9, a new methodology for estimating the frequency of voltage sags at industrial and commercial sites, and Chapter 10, a methodology for estimating the number of tests required to demonstrate reliability of emergency and standby systems. New appendixes have been added on high- and low-voltage circuit breaker reliability data, guarantees of gas turbines and combined cycle generating units, transmission line and equipment outage data, interruption costs, and expectations for service reliability. The existing appendixes have been updated.

Tutorial reliability sessions on the design of industrial and commercial power systems were conducted at technical conferences of the IEEE Industry Applications Society in 1971, 1976, 1980, and 1991.

This recommended practice was prepared by a working group of the Power Systems Reliability Subcommittee, Power Systems Engineering Committee, Industrial and Commercial Power Systems Department of the IEEE Industry Application Society.

This IEEE Recommended Practice serves as a companion publication to the following other Recommended Practices prepared by the IEEE Industrial and Commercial Power Systems Department:

- IEEE Std 141-1993, IEEE Recommended Practice for Electric Power Distribution for Industrial Plants (IEEE Red Book).
- IEEE Std 142-1991, IEEE Recommended Practice for Grounding of Industrial and Commercial Power Systems (IEEE Green Book).
- IEEE Std 241-1990, IEEE Recommended Practice for Electric Power Systems in Commercial Buildings (IEEE Gray Book).
- IEEE Std 242-1986, IEEE Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems (IEEE Buff Book).
- IEEE Std 399-1990, IEEE Recommended Practice for Industrial and Commercial Power Systems Analysis (IEEE Brown Book).

- IEEE Std 446-1995, IEEE Recommended Practice for Emergency and Standby Power Systems for Industrial and Commercial Applications (IEEE Orange Book).
- IEEE Std 602-1996, IEEE Recommended Practice for Electric Systems in Health Care Facilities (IEEE White Book).
- IEEE Std 739-1995, IEEE Recommended Practice for Energy Management in Commercial and Industrial Facilities (IEEE Bronze Book).
- IEEE Std 1015-1997, IEEE Recommended Practice for Applying Low-Voltage Circuit Breakers Used in Industrial and Commercial Power Systems (IEEE Blue Book).
- IEEE Std 1100-1992, IEEE Recommended Practice for Powering and Grounding Sensitive Electronic Equipment (IEEE Emerald Book).

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COST OF ELECTRICAL INTERRUPTIONS IN COMMERCIAL BUILDINGS

by

Power Systems Reliability Subcommittee Report
Philip E. Gannon, Coordinating Author^{1/}

Abstract

An IEEE sponsored reliability survey to determine the cost of electrical interruptions in commercial buildings was completed in 1974. The survey form was a simplified version of forms used in 1972 reliability study of industrial plants. The survey included building types and locations, and length and cost of electrical service interruptions. The survey results reflect data from 48 companies covering 55 buildings in the United States. This information is useful in the design of electrical systems for commercial buildings.

Introduction

Knowledge of the cost of power outages, both for normal and critical services, is useful in the design of commercial building power systems, allowing cost-effective judgements to be made with respect to the installation of a second utility company service, an emergency generator, or possibly an uninterruptible power supply.

During 1974, the Reliability Subcommittee of the Industrial and Commercial Power Systems Committee completed a survey of the cost of electrical interruptions in commercial buildings in the United States. Included in this paper are the following results:

- 1 Cost of power outages to commercial buildings (\$ per KWH of undelivered energy).
- 2 Cost of power outages to commercial buildings (\$ per square foot/hr and \$ per employee/hr).
- 3 Critical service loss duration time (length of time before an interruption causes a significant loss).
- 5 Miscellaneous items relative to provision of auxiliary generators, types of electrical service, and other physical data.

Survey Form

The survey form is shown in Appendix A (two pages). A simple multiple choice or single line fill-in form was utilized in an attempt to reduce the time of the responders, but still provide pertinent data for a meaningful analysis.

Response to Survey

A total of 48 companies reporting on 55 buildings responded to the survey with complete data. Incomplete data, omitting the critical outage cost information was received on 121 additional buildings. Unfortunately, this data was of no value in the present survey. Valid data was submitted almost equally for buildings located in the eastern, central, and western regions of the U.S.A.; with 43 percent of the buildings in downtown areas, 17 percent in urban areas, and 40 percent in suburban areas. Forty-six percent of the buildings were used 5 days per week; 39 percent, 6 days per week; and 15 percent, 7 days per week.

Survey Data Preparation

All of the returned survey forms were reviewed. Usable data was punched onto computer cards for use in data processing.

Survey Results -- Cost of Power Outages

Each respondent was asked to report on the cost of power outages as follows:

- 1 Dollars per failure -- 15-minute duration, one-hour duration, and greater than one-hour duration; total value of lost operation including wages, damages for delays, loss of computer time, and loss of retail sales minus cost of goods not sold was to be included.
- 2 Critical service loss duration time -- length of time before an interruption causes a significant loss.
- 3 Building maximum power demand, and usage, as well as area and number of employees.

The data made it possible to calculate the cost of power outages in terms of dollars per kilowatt-hours of undelivered energy at building peak load.

The average cost of power outages from the survey for the buildings surveyed is given in Table 1.

TABLE 1
AVERAGE COST OF POWER OUTAGES
FOR BUILDINGS IN THE UNITED STATES

All commercial buildings	\$7.21/KWH not delivered
Office buildings only	\$8.86/KWH not delivered

The average maximum demand was 3,095 KW for all commercial buildings reporting outage costs. The maximum demand for the office buildings was only 3,035 KW.

Additional details of the cost of power outages are given in Tables 2, 3, and 4. The tables present additional data including:

- 1 Outage costs for "office buildings" as a function of duration of outage for three time periods.
- 2 Effect of computers on outage costs.
- 3 Relationship of outage costs to: KWH not delivered, to cost per 1,000 square feet per hour of building affected, and to cost per employee per hour affected.

^{1/} Other members of Sub-Committee: A.D. Patton Chairman; C.R. Heising, Vice Chairman; C.E. Becker; H.F. Chanov; W.H. Dickinson; M.D. Harris; R.T. Kulvicki; D.W. McWilliams; R.W. Parisian; Stanley Wells

TABLE 2
OUTAGE COSTS FOR "OFFICE BUILDINGS"
AS A FUNCTION OF DURATION
(WITH AND WITHOUT COMPUTERS)

	Sample Size	Maximum	Minimum	Average
<u>15-Minute Duration</u>				
Cost/peak KW hr. not delivered	25	\$ 22.22	\$ 1.50	\$ 7.54
Cost/1,000 sq. ft. of bldg./hr.	26	247.6	10.5	63.8
Cost/employee/hr.	26	52.0	3.0	16.0
<u>1-Hour Duration</u>				
Cost/peak KW hr. not delivered	29	\$ 24.93	\$ 0.64	\$ 6.74
Cost/1,000 sq. ft. of bldg./hr.	32	125.00	5.24	53.12
Cost/employee/hr.	32	34.30	1.25	12.22
<u>Duration 1 Hour</u>				
Cost/peak KW hr. not delivered	13	\$100.00	\$ 0.16	\$ 16.16
Cost/1,000 sq. ft. of bldg./hr.	14	320.00	1.05	64.06
Cost/employee/hr.	14	75.80	0.48	16.41

TABLE 3
OUTAGE COSTS FOR "OFFICE BUILDINGS"
AS A FUNCTION OF DURATION
(WITHOUT COMPUTERS)

	Sample Size	Maximum	Minimum	Average
<u>15-Minute Duration</u>				
Cost/peak KW hr. not delivered	11	\$ 10.70	\$ 1.50	\$ 5.84
Cost/1,000 sq. ft. of bldg./hr.	11	107.4	10.54	49.54
Cost/employee/hr.	11	28.56	3.00	12.56
<u>1-Hour Duration</u>				
Cost/peak KW hr. not delivered	13	\$ 13.33	\$ 0.91	\$ 5.30
Cost/1,000 sq. ft. of bldg./hr.	15	120.0	5.24	49.42
Cost/employee/hr.	15	26.57	1.25	10.64
<u>Duration 1 Hour</u>				
Cost/peak KW hr. not delivered	3	\$100.00	\$ 1.97	\$ 26.66
Cost/1,000 sq. ft. of bldg./hr.	3	320.00	48.00	150.00
Cost/employee/hr.	3	50.00	4.00	27.52

TABLE 4
OUTAGE COSTS FOR "OFFICE BUILDINGS"
AS A FUNCTION OF DURATION
(WITH COMPUTERS)

	Sample Size	Maximum	Minimum	Average
<u>15-Minute Duration</u>				
Cost/peak KW hr. not not delivered	14	\$ 22.22	\$ 1.88	\$ 8.89
Cost/1,000 sq. ft. of bldg./hr.	15	250.00	16.57	78.21
Cost/employee/hr.	15	52.00	4.00	18.53
<u>1-Hour Duration</u>				
Cost/peak KW hr. not delivered	16	\$ 24.93	\$ 1.88	\$ 8.30
Cost/1,000 sq. ft. of bldg./hr.	17	125.00	15.88	54.52
Cost/employee/hr.	17	34.30	4.00	13.62
<u>Duration 1 Hour</u>				
Cost/peak KW hr. not delivered	10	\$ 67.66	\$ 0.16	\$ 9.81
Cost/1,000 sq. ft. of bldg./hr.	11	226.19	1.05	44.08
Cost/employee/hr.	11	75.82	0.48	12.70

TABLE 5
CRITICAL SERVICE LOSS DURATION TIME
FOR "ALL BUILDINGS"

	Service Loss Duration Time								
	1 Cycle	2 Cycles	8 Cycles	1 Sec.	3 Sec.	5 Min.	30 Min.	1 Hour	12 Hours
Percent of buildings with critical service loss duration less than or equal to the time indicated.	31	61	91	151	181	361	641	791	1001

TABLE 6
CRITICAL SERVICE LOSS DURATION TIME
FOR "OFFICE BUILDINGS"

	Service Loss Duration Time								
	1 Cycle	2 Cycles	8 Cycles	1 Sec.	3 Sec.	5 Min.	30 Min.	1 Hour	12 Hours
Percent of buildings with critical service loss duration less than or equal to the time indicated.	51	101	151	231	301	301	701	751	1001

TABLE 7
RELATIONSHIP OF AUXILIARY GENERATORS
AND SINGLE FEEDER SERVICE TO "ALL BUILDINGS"

	Number of Responses	Buildings with Auxiliary Generation	No Auxiliary Generation and Only Single Feeder
Buildings with computers	23	15	1
Buildings without computers	32	13	7
TOTAL	55	28	8

Survey Results -- Critical Service Loss Duration Time

The amount of time an electrical service can be interrupted before it causes significant losses is a question which our profession has not been able to suit-

ably define. The results of the survey indicate that individual requirements for electrical energy are such that it is probably not possible to establish a general critical service loss duration time. The survey results are shown in Tables 5 and 6.

TABLE 8
TYPE OF ELECTRICAL SERVICE
TO "ALL BUILDINGS"

	Number of Responses	Type of Service			
		Single Feeder	Network	Multiple Feeder	Other
Buildings with computers	23	1	8	12	2
Buildings without computers	32	12	10	7	3
TOTAL	55	13	18	19	5

TABLE 9
PHYSICAL DATA -- "ALL BUILDINGS"

Item	Sample Size	Maximum	Minimum	Average
Area, sq. ft. $\times 10^3$	54	2,085	3	400
Number of floors	55	52	1	12
Number of employees	51	7,000	12	1,384
Annual usage - Megawatt hours	52	101,349	210	11,973
Peak Kilowatt demand	52	17,250	95	3,095

TABLE 10
PHYSICAL DATA -- "OFFICE BUILDINGS"

Item	Sample Size	Maximum	Minimum	Average
Area, sq. ft. $\times 10^3$	35	1,600	38	371
Number of floors	35	44	2	13
Number of employees	35	7,000	150	1,651
Annual usage - Megawatt hours	32	51,046	840	9,444
Peak Kilowatt demand	32	17,000	270	3,035

TABLE 11
AVERAGE OF PHYSICAL DATA
FOR "ALL BUILDINGS"
AND FOR "OFFICE BUILDINGS"

Item	All Buildings	Office Buildings
Megawatt hours/1,000 sq. ft. of buildings area/year	35.5	33.5
Megawatt hours/employee/year	26.2	7.5
Peak Kilowatt demand/1,000 sq. ft. of building area	21.3	11.5
Peak Kilowatt demand/employee	5.0	2.5
Employees/1,000 sq. ft. of building area	3.9	4.7

Thirty-six percent of "all buildings" reporting could be without electrical energy for 5 minutes before the lack of energy was considered to be critical, while 6 percent could be without energy for only 2 cycles and 3 percent for only one cycle before significant losses were incurred.

Fifty percent of the "office buildings" reporting could be without electrical energy for 5 minutes before the lack of energy was considered to be critical, while 10 percent could be without energy for only 2 cycles, and 5 percent for only one cycle before significant losses were incurred.

Precautionary measures taken to minimize critical outages in buildings where computers are installed are indicated in Table 7, where 65 percent (15 of 23) of the buildings reporting have auxiliary generating units. Only 4 percent (1 of 23) of the buildings reporting have no auxiliary generation and are served by a single feeder from the utility company. A like com-

parison is shown for buildings not having computers; in these instances, 41 percent of the buildings have auxiliary generation and 22 percent are served by single feeders from the utility company.

Table 8 shows the type of electrical service to all buildings reporting. Eighty-seven percent of the buildings with computers have network or multiple feeder service, while 53 percent of the buildings without computers have network or multiple feeder service.

Survey Results -- Demand and Usage Data

Each respondent was asked to report gross floor area, number of floors, number of employees, and electrical energy usage and demand. While not directly related to the subject of this paper, the data is of interest, and will perhaps allow the reader to make a better judgement of the validity of the data presented previously. The details are given in Tables 9, 10, and 11.

It is believed that the employee data for the "All Buildings" category may not be valid, since it appears that not all employees were reported for some multi-function buildings, the office/retail category in particular.

Conclusions and Discussion of Results

1 Cost of Power Outages (Tables 1, 2, 3, and 4)

a There is a wide spread in the cost of power outages (KWH not delivered) in commercial buildings. Even within like types of buildings, with or without computers, there is a great difference in the costs assigned.

b The cost per KWH not delivered increases greatly when the outage duration time exceeds one hour. An exception to this is buildings with computers.

It is probable that for outages of less than one hour, employees may remain partially productive and the temperature of their environment remains tolerable. For longer outages, employees may have to be furloughed for the remainder of the day.

c The cost of power interruptions for buildings with computers varies from \$1.89/KWH average for outages of 15-minutes duration to \$8.81/KWH for outages of greater than one hour. It is suspected that the small differential is due to the fact that a short duration as well as a long outage renders the computer inoperable, and the employees are either non-productive during this period or repairing possible damage caused by the outage.

d A comparison of the average costs of outages for commercial buildings with that for industrial plants (Reference 1) is shown in Table 12. The data is interpreted to mean that short-term outages in industrial plants could be more costly than those in commercial buildings, while long-term outages are more costly in commercial buildings.

e Additional information on the cost of power outages in Sweden, Norway, and the United States is contained in Reference 3.

2 Critical Service Loss Duration Time (Tables 5 and 6)

a As would be expected, there is a wide spread in the critical time of a power interruption. This is probably due to the wide variations of type of work being accomplished, the type of equipment involved, and the general work environment. For example, a windowless building in which a sensitive computer operation is performed would be more rapidly affected than a window-wall building performing normal office functions.

b It is suggested that a future survey attempt to define the reasons for the wide variances.

3 Demand and Usage Data (Tables 5, 10, and 11)

a Of the "all building" data reported, the areas averaged 400,000 square feet, 12 floors in height, with an annual usage of almost 12,000 megawatt hours, and a demand of 3,095 KW. Minimum and maximum data were not available.

TABLE 12

COMPARISON OF AVERAGE COSTS OF POWER OUTAGES
IN COMMERCIAL BUILDINGS AND INDUSTRIAL PLANTS

Type	Cost
All commercial buildings	\$7.21/KWH not delivered
Office buildings	\$8.86/KWH not delivered
Industrial plants — all	\$1.89/KW interrupted + \$2.68/KWH not delivered

The data for "office buildings" indicate average values within 10 percent of that for "all buildings," except for the number of employees, which is 16 percent greater.

b The average electrical usage for all buildings and for office buildings only is nearly equal when placed on a per unit basis (33.5 KWH/Sq. Ft.) as is the peak demand (11.3 Watts/Sq. Ft. to 11.5 Watts/Sq. Ft.). The relationship of usage and demand to employees does not correlate for all buildings and office buildings only. As mentioned heretofore, the validity of employee data with regard to the Office/Retail category of buildings is questionable. On this basis, no attempt to draw conclusions has been made.

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SURVEY FORM ON COST OF ELECTRICAL INTERRUPTIONS IN COMMERCIAL BUILDINGS



THE INSTITUTE OF
ELECTRICAL AND
ELECTRONICS
ENGINEERS, INC.

INDUSTRY AND GENERAL APPLICATIONS GROUP
RELIABILITY SUBCOMMITTEE OF THE INDUSTRIAL
& COMMERCIAL POWER SYSTEMS COMMITTEE

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our every day life. If it isn't
available -- what is its economic
effect? Please help us to find
out by filling out this form.*

Please address reply to:

A. D. Patton
Texas A & M University
Electric Power Institute
College Station, TX 77843

Date _____

1. COMPANY NAME (Fill in 5-letter abbreviation of name) _____
2. BUILDING NO. (Fill in sequence number 1, 2, 3, etc.
for building(s) reported on) _____
3. BUILDING TYPE (Check type which best describes your building):
☐ Office ☐ Office/Retail Sales ☐ Office/Retail Sales/Apartment
☐ Retail Sales ☐ Other (describe) _____
4. BUILDING LOCATION (Check applicable items):
☐ Downtown; ☐ Urban; ☐ Suburban;
☐ USA: Eastern; ☐ USA: Central; ☐ USA: Western
5. BUILDING DATA - GENERAL
Gross Area, square feet _____
Number of Floors _____
Average Usage of Building: Hours/Day _____ Days/Week _____
Estimated Number of Office Employees (if any) _____
Estimated Annual Retail Sales (if any) _____
Is Auxiliary or Emergency Generation Provided: ☐ Yes ☐ No

SURVEY FORM - COMMERCIAL BUILDINGS IN USA

Page 2 of 2

6. BUILDING ELECTRICAL USAGE DATA

Electrical Energy Usage for 12-month Period _____ KWH

Electrical Maximum Demand for this Period _____ KW

Type of Service: ☐ Single Feeder; ☐ Network; ☐ Multiple Feeders With Automatic Transfer☐ Other (Explain) _____**7. COST OF A TOTAL INTERRUPTION OF ELECTRICAL SERVICE TO YOUR BUILDING**DURING PEAK PERIOD: (Best Opinion - If no interruptions have occurred, assume hypothetical instances)

a) 15-Minute Duration \$ _____

b) 1-Hour Duration \$ _____

c) _____ Hours Duration \$ _____

Does a, b, or c include losses from an "on-line" electronic computer? ☐ Yes ☐ No

For "Office Buildings" loss should include wages of all employees affected, plus any other direct costs incurred including delays, and damage to equipment. This would include any losses from an "on-line" electronic computer.

For "Retail Sales" cost should include estimated loss of sales minus cost of goods not sold, plus cost of any damage incurred.

8. LENGTH OF INTERRUPTION OF ELECTRICAL SERVICEIf there a definitive length of time before an interruption causes a significant loss? ☐ Yes ☐ No

If "Yes", what is maximum time before significant losses will be incurred? _____ Hours _____ Minutes

Table 2. Customer Outage Cost Summary

Market Segment	Generation Outage Mean Outage Cost	Transmission or Distribution Outage Mean Outage Cost
Residential Customers		
Cost Per Event	\$4.91	\$5.39
Cost Per Peak kWh	\$1.88	\$2.07
Commercial Customers		
Cost Per Event	\$604.19	\$1,317.21
Cost Per Peak kWh	\$21.02	\$45.82
Industrial Customers		
Cost Per Event	\$4,443.00	\$9,403.55
Cost Per Peak kWh	\$3.60	\$7.61
System Wide		
Cost Per Event	n/a	n/a
Cost Per Peak kWh	\$7.79	\$16.15

Michael J. Sullivan, "Volume Five: Outage Cost Summary", in Final Report For Value Of Service Study, December 1992

market segment means (i.e., the mean for commercial or industrial customers). For example, multiple R^2 s for regression models predicting outage costs arising from different kinds of outages ranged from .67 to .34. That is, these models explain between 34 and 67 percent of the variation in outage costs about the averages for the market segments — a statistically significant improvement over the predictive power arising from market segment alone.

Since much less information is required to estimate customer outage costs from the parameters in the regression model, it is possible to calculate customer specific outage cost estimates for all large customers (from regression models) and thus to obtain detailed estimates of customer outage costs without the expense of on-site surveys of all customers. This approach is being used by Duke Power Company to calculate circuit specific outage costs including unique estimates for each of its 1,000 largest customers.

Although less of the variation in residential interruption cost is accounted for by variation in other household attributes, significant statistical associations are found between residential customer interruption costs, the size of the

household and the age of its inhabitants. In general, the older the members of a household, the lower the household's average interruption cost. When children are present, customer interruption costs are significantly higher.

Circuit level interruption costs should be used when applying interruption cost information to transmission and distribution planning problems. While system average interruption cost estimates are meaningful and useful for generation planning, significant errors can be made by applying system average figures to particular circuits. Because of the variation that exists across circuits in the distribution of customers by market segment and size, customer interruption costs for particular circuits may deviate dramatically from system averages.

From the individual customer's point of view, generation outages (i.e., those including advance warning) are inherently less costly than transmission and distribution outages (i.e., those without warning). Advance warning significantly lowers the costs of outages for commercial and industrial customers. Table 3. illustrates the effect of advance notice on customer outage costs.

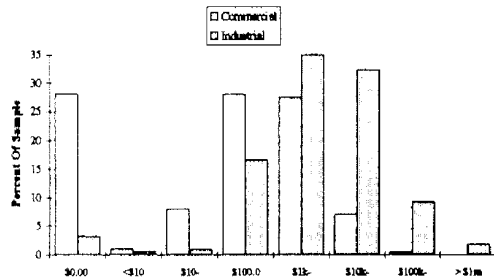


Fig. 2a. Commercial and Industrial Customers

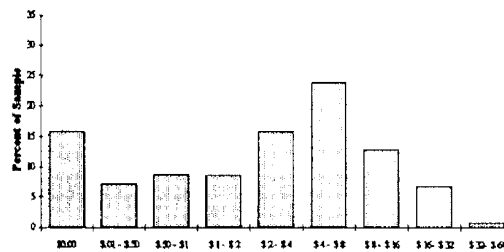


Fig. 2b. Residential Customers

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Calculations showing Customer's lost cost based upon IEEE report:

ENWIN Revenue Loss	
Cust-hour	34,789
Cust interr hour/Cust	0.41
Total cust	85,446
Average Demand	508.1
Loss, MWh	206.9
Loss cost	\$ 3,384.99
Crew	60
Cost of crew	\$ 18,000.00
Total cost	21,384.99
Project cost	\$ 500,000.00

Present- Customer Outage Loss-Cost per year						
<i>Residential</i>		<i>Commercial</i>		<i>Industrial</i>		<i>Total</i>
201,696	kW on total residential cust, demand	120,915.90	kW on total commercial cust, demand	185,438.25	kW on total industrial cust, demand	508,050
\$ 2.07	/kWh	\$ 7.21	/kWh	\$ 7.61	/kWh	
\$ 1,206,566.29	lost per year	\$2,519,431.51	lost per year	\$ 4,078,193.76	lost per year	\$ 7,804,191.55

TotalCust-hour	246,931
Total cust	85,446
hour/Cust	2.89

Projected - Customer Outage Loss- Saving Per Year						
<i>Residential</i>		<i>Commercial</i>		<i>Industrial</i>		<i>Total</i>
201,696	kW on total residential cust, demand	120,915.90	kW on total commercial cust, demand	185,438.25	kW on total industrial cust, demand	508,050
\$ 2.07	/kWh	\$ 7.21	/kWh	\$ 7.61	/kWh	
\$ 169,987.71	lost per year	\$ 354,951.39	lost per year	\$ 574,558.41	lost per year	\$ 1,099,497.51

TotalCust-hour	34,789
Total cust	85,446
hour/Cust	0.41

Appendix B
2003, 2004 and 2005 Utility Performance Management Survey -
By MEARIE Group

Yr. 2004

**R20**

System Average Interruption Duration Index (SAIDI)

Large Utilities

			Rank
Thunder Bay	1.96	1.32 } Q ₄	17
Waterloo North	1.85		16
→ Barrie LONDON	1.35		15
Enwin	1.21		14
Burlington	1.16	} Q ₃	13
Toronto	1.10		12
St. Catharines	0.96		11
Hamilton	0.77	} Q ₂	10
Hydro Ottawa	0.75		9
Hydro One Brampton	0.73		8
PowerStream	0.59	} Q ₁	7
Oakville	0.56		6
Kitchener-Wilmot	0.54		5
Guelph	0.43		4
Greater Sudbury	0.38		3
Enersource	0.37		2
			1
Count	16		
Average	0.919		
Range (min, max)	0.37 to 1.96		

Medium Utilities

Peninsula West	4.60
PUC Distribution	3.61
Haldimand County	3.07
Newmarket	2.04
Peterborough	1.95
Norfolk	1.90
Festival	1.89
Grimsby	1.83
Brant County	1.62
Chatham Kent	1.61
Collus Power	1.38
Halton Hills	1.14
Welland	0.74
Orangeville	0.58
Whitby	0.46
Orillia	0.41
Woodstock	0.34
St. Thomas	0.15
Count	18
Average	1.629
Range (min, max)	0.15 to 4.60

Yr. 2004

**R22**

System Average Interruption Frequency Index (SAIFI)

Large Utilities

			<u>RANK</u>
Enwin	2.73		17
Thunder Bay	2.71		16
→ Waterloo North	2.20	2.09	15
→ St. Catharines	1.70		14
Toronto	1.60		13
Guelph	1.55		12
Barrie	1.33		11
Hydro One Brampton	1.27		10
Hamilton	1.03		9
Oakville	1.03		8
PowerStream	0.99		7
Burlington	0.93		6
Hydro Ottawa	0.66		5
Enersource	0.62		4
Greater Sudbury	0.53		3
Kitchener-Wilmot	0.51		2
			1
Count	16		
Average	1.337		
Range (min, max)	0.51 to 2.73		

Medium Utilities

Norfolk	3.69
Peninsula West	3.55
PUC Distribution	3.27
Welland	2.98
Peterborough	2.42
Haldimand County	1.84
Festival	1.80
Orillia	1.39
Chatham Kent	1.30
Newmarket	1.28
Halton Hills	1.00
Whitby	0.86
Orangeville	0.64
Grimsby	0.47
Woodstock	0.46
Collus Power	0.35
St. Thomas	0.32
Brant County	0.03
Count	18
Average	1.536
Range (min, max)	0.03 to 3.69

**R21**

Customer Average Interruption Duration Index (CAIDI)

Large Utilities

			RANK
Burlington	1.25		17
Hydro Ottawa	1.15		16
Kitchener-Wilmot	1.06		15
Barrie	1.01		14
Waterloo North	0.84		13
Hamilton	0.74		12
Thunder Bay	0.72		11
Greater Sudbury	0.72		10
→ Toronto	0.69	0.63	9
→ PowerStream	0.59		8
Enersource	0.59		7
Hydro One Brampton	0.57		6
St. Catharines	0.56		5
Oakville	0.55		4
Enwin	0.44		3
Guelph	0.28		2
			1
Count	16		
Average	0.735		
Range (min, max)	0.28 to 1.25		

Medium Utilities

Collus Power	3.90
Grimsby	3.87
Haldimand County	1.67
Newmarket	1.59
Peninsula West	1.30
Chatham Kent	1.24
Halton Hills	1.14
PUC Distribution	1.10
Festival	1.05
Orangeville	0.91
Peterborough	0.80
Woodstock	0.73
Whitby	0.54
Norfolk	0.51
St. Thomas	0.46
Orillia	0.29
Welland	0.25
Count	17
Average	1.256
Range (min, max)	0.25 to 3.90

Yr. 2003



R68

System Average Interruption Duration Index (SAIDI) excluding Blackout

Large Utilities

Waterloo North	2.63
Burlington	1.91
Enwin	1.84
LONDON	
Toronto	1.47
Hydro One Brampton	1.40
Hamilton	1.16
PowerStream	1.02
Thunder Bay	1.01
Kitchener-Wilmot	0.97
Oakville	0.92
Guelph	0.68
Greater Sudbury	0.61
St. Catharines	0.53
Enersource	0.39
Count	14
Average	1.181
Range (min, max)	0.39 to 2.63

RANK

15 } Q4

14 } Q4

13 } Q4

12 } Q3

11 } Q3

10 } Q3

9 } Q3

8 } Q2

7 } Q2

6 } Q2

5 } Q2

4 } Q1

3 } Q1

2 } Q1

1 } Q1

Medium Utilities

PUC Distribution	4.41
Bluewater	3.80
Halton Hills	3.49
Festival	3.16
Haldimand County	3.04
Aurora	2.66
North Bay	2.00
Woodstock	1.51
Whitby	1.50
St. Thomas	1.39
Norfolk	1.27
Collus Power	1.06
Peterborough	0.92
Orangeville	0.01
Count	14
Average	2.159
Range (min, max)	0.01 to 4.41

Small Utilities

Kenora	8.45
Lakeland	1.27

YR. 2003



R72

System Average Interruption Frequency Index (SAIFI) excluding Blackout

Large Utilities

Waterloo North	4.31	
Hydro One Brampton	2.43	
Enwin	2.30	2.19
Toronto	1.98	
Burlington	1.92	
Thunder Bay	1.80	
Guelph	1.74	
Kitchener-Wilmot	1.42	
Hamilton	1.28	
PowerStream	1.24	
Oakville	1.10	
Greater Sudbury	1.07	
St. Catharines	1.00	
Enersource	0.76	
Count	14	
Average	1.739	
Range (min, max)	0.76 to 4.31	

RANK

15 } Q₄
 14 }
 13 }
 12 } Q₃
 11 }
 10 }
 9 }
 8 } Q₂
 7 }
 6 }
 5 }
 4 } Q₁
 3 }
 2 }
 1 }

Medium Utilities

Aurora	4.35
St. Thomas	4.07
Bluewater	4.03
Festival	4.02
PUC Distribution	2.78
North Bay	2.57
Haldimand County	1.62
Norfolk	1.31
Peterborough	1.15
Whitby	1.04
Woodstock	1.01
Orangeville	0.39
Collus Power	0.38
Halton Hills	0.01
Count	14
Average	2.052
Range (min, max)	0.01 to 4.35

Small Utilities

Kenora	2.05
Centre Wellington	1.91



"Currie, Don"
<curried@LondonHydro.com>

To: <sfilice@enwinpowerlines.com>
cc:
Subject: London Hydro Reliability Stats

02/03/2005 09:44 AM

Hi Shawn:

Please find attached the reliability stats you have asked for.

The published OEB stats include things like the 2003 blackout and any Hydro One related outages. Last year we had several bad Hydro One operations at Talbot TS which affected our stats.

The internal stats remove all the things that are out of London Hydro's control to manage.

Don Currie
Sub-Stations
London Hydro
519-661-5800 Ext. 5726
Fax: 519-661-5275

-----Original Message-----

From: Sheil, Greg
Sent: Thursday, February 03, 2005 8:13 AM
To: Currie, Don
Subject: Reliability Stats

I must warn you these are our internal stats and not necessarily the stats that are published by the OEB. Major Event Days (MED) have been removed. This is not yet an accepted practice by the OEB, hence the difference in published data. I decided to include the OEB stuff. (some of the MED's are due to



Hydro One) Book1.xls

Appendix C

An Outage Statistic Evaluation of the EWP System, Agenda Submission – Dated 2005 01 19

To: T. Kosnik

2004 03 16
M08/FE

From: K. Damphouse

An Outage Statistic Evaluation of the EWP System

Scope:

This document describes the current outage statistics that EWP has generated for the years 2001, 2002 and 2003 with emphasis on the latter. This document will also analyze these statistics and indicate what indices improvements can be experienced due to recommendations that will follow. These recommendations will be based upon other Utility practices as well as the uniqueness of the EWP system.

The indices in question are as follows:

- SAIDI – Defined as the total outage time that a customer on our system can expect to be out per year (on average).
- SAIFI – Defined as the average number of outages a customer can expect per year.
- CAIDI – Defined as the outage time that a customer will be out PER outage per year (on average).
- ASAI – Defined as the percent time that power was available for the year (on average).
- SAARI – Defined as the average number of momentary outages a customer can expect per year.

Note: The Ice storm of 2002 and Blackout of 2003 were excluded from this study, due to the rarity of their occurrences and the amount of monies required to defeat them.

Strategies:

The main indicators for the EWP outage statistics are:

- Number of Outages
- Number of Customers affected by Outages
- Number of Customer Hours experienced during Outages

These indicators are the factors that must be decreased to improve the EWP indices. The only way to accomplish this is to follow tried and true methods that other utilities have tried (with success) and look for industry standards that we may currently not be following.

Outages:

In looking at the outages in detail for the last 3 years, with an emphasis on 2003 (due to it being the 'closest' to the EWP current time), some rather surprising facts come to light. These are as follows:

1. Some feeders are too large in that when an A/R or A happens, 4000 to 5000 customers are affected. The average number of customers per feeder is 1900.
2. Pole top reclosers had hold offs for months on end, thereby allowing what would have been an A/R to severely affect the EWP 2003 indices.
3. EWP operating practices allow for main station breakers to be opened and left open while repairs are made.
4. The vast majority of Customers affected are due to trees in wires (or windy days with no cause – which indicate trees due to the feeders that experienced the outage having the most tree coverage).
5. Animals are minimal in the problems they cause and are easily rectified.
6. Lightning storms, although severe and impactful, do not cause as much damage as earlier suspected.

Analysis:

We will now look at the above items in detail to see what is actually happening on the EWP system.

Part 1

There are a number of feeders in the EWP system that are too large with too many customers as compared to other feeders. See Appendix A – Part 1 for examples.

These feeders when impacted by a tree branch, squirrel, lightning, etc affect the EWP indices heavily due to the large volume of customers affected. In comparing the outages of these feeders to other feeders (with reduced or more average number of customers), it is clear that more outages will be experienced by the larger feeders due to their increased exposure, thereby compounding the problem. This increased exposure due to size makes having very large feeders detrimental to the EWP indices since they will experience more outages due to exposure (and therefore these outages will have a much larger impact due to the number of customers).

A constraint on this is the Essex TS loading restrictions as well as the financial benefit to EWP of maximizing the load on Walker TS #2 which will be considered in the recommendations section.

Recommendation:

It is recommended that EWP look into balancing some of its feeders to minimize the impact to the indices when a fault occurs and a breaker opens. Most notably is the loading of Walker TS # 2. This loading is in place due to financial benefits, yet there are 4000 customers on 3 separate feeders (12,000 total) and one empty feeder bay (55M21). If financial conditions are such that EWP wants to keep the load on Walker TS #2, than at least the load should be shifted around to make best use of this empty feeder bay and help reduce the indices.

This should be done at other stations as well to draw a balance between station loading and the indices, since most of the past studies have mainly dealt with loading and haven't looked at the indices and the impact moving load around will cause.

Other Utilities have an a maximum of 15 – 20 MVA per feeder (London Hydro for example).

It is therefore **highly** recommended that a detailed study of the EWP system be done to balance the EWP system as best possible, while still maintaining load restrictions.

Analysis:

Part 2

The Joslyn reclosers purchased to sectionalize the EWP system during outages and thereby reduce the indices were not used correctly after the initial installation and therefore caused the EWP indices to dramatically increase. See Appendix A – Part 2 for examples.

The pole top reclosers were a contentious issue with the line staff from an operating perspective and as such they were put in service with a Hold-off in effect on each one of them, thereby not only defeating their purpose, but disabling the main stations breakers from Auto-Reclosing. This in effect had a double effect on the EWP indices, since an A/R that would have occurred, now turned into a sustained outage. In looking at the Appendix A – Part 2 it shows that if the pole top Reclosers were put into service and used as intended, EWP indices would have been much improved. The SAIDI statistic would have dropped by 10%, SAIFI would have dropped by 21%, CAIDI would have increased and the time power was available ASAI would have remained almost the same. The SAIFI dropped due to the outages moving to the SAARI statistic (A/R as opposed to breaker lock-out) and the CAIDI number went up which is insignificant, due to it being an average time per outage experienced with SAIDI, and SAIFI being the important indices.

Recommendation:

It is the recommendation of this report that more pole top reclosers be purchased and that more automation be installed on the EWP system. There will be quicker restoral times due to this automation as well as SCADA and therefore the indices will be improved that much more. These pole top reclosers will minimize the feeder size (thereby simulating Part 1 above) and reduce outage sizes when they do occur.

It is also the recommendation of this report that any and all pole top reclosers that are put in service from this point forward are either put into service fully so that EWP can benefit immediately from them or if a permanent Hold Off is required due to the line staff safety fears, then the overhead ILS bypass must be used, thereby placing the units out of service. This must be done in order to avoid the severe detriment to the indices that was experienced in 2003 due to this permanent Hold Off condition being in place for many months.

It is also a recommendation that EWP investigate a fuse burning strategy as opposed to a fuse saving strategy. EWP should be looking at protecting the larger number of customers from extended outages. This was explained in detail by Gene Liu (see file Outage in 2001 – 2002).

Analysis:

Part 3

EWP operating practices allow for main station breakers to be opened and left open while repairs are made. It is apparent from some outages studied that the practice of the crew arriving upon a fire, accident, wires down or even trees in wires is to call the operating staff and have the main breaker opened. This is logical in that it is usually the quickest way to isolate the problem. However, there are a few outages that show that this is not the best solution to improve the indices. See Appendix A– Part 3 for an example.

In the example it can be seen that the SAIDI drops 5.6%, SAIFI drops 2.1% and CAIDI drops 3.5% due to the removal of 1 outage that was dealt with incorrectly due to bad operating practices. These practices are very detrimental to the EWP indices. This is one outage that caused a 5% increase in the SAIDI statistic, was avoidable and cost EWP almost \$1600 in lost revenue.

Recommendation:

It is apparent that the biggest detriment to the EWP indices (besides trees in wires) are the operating practices of the EWP staff.

It is the recommendation of this report that the staff be gradually shifted from a mentality of a 'repair' utility to a 'restore' utility. What this means is that when staff come upon a fire, accident, trees in wires or anything that they feel requires a

breaker to be opened, they are to have in their minds (line staff and operating staff) that the main purpose is to isolate the problem and then restore as many customers as possible. This is different than existing practices where a breaker is opened, the situation assessed to see how long it might take to repair and then work begins. This is very detrimental to the indices and as such, EWP should implement an arrival, isolate (by breaker if necessary, but the nearest LBS would suffice) then restore as many as possible by opening an LBS, calling the operating staff to have the breaker restored to service, then repairs can begin. When repairs are complete, then the LBS can be closed to pick up the small portion of the feeder. A customer may have to be cut clear, the breaker can be restored, then the repairs can begin. There will be instances where this is slightly overkill, but this may have to be a judgment call on the staff's part (due to years of experience in the field), but the priority after safety **must** be restoration and not repair.

Implementation of this type of work procedure in EWP is going to be difficult due to the increase in work required by field staff, but it is a utility standard in other utilities and is what is required to keep the indices low.

Analysis:

Part 4

The main outage cause on the EWP system that is the most impactful and can be investigated/controlled seems to be trees in the EWP plant. This is mainly due to the large number of overhead feeders in the EWP system that run through heavily treed areas of the city. The number of outages and the stats on these outages are shown in Appendix A – Part 4.

In looking at the Appendix A – Part 4, it can be seen that if all the tree related outages in 2003 could have been reduced to zero, SAIDI would have dropped by 42%, SAIFI would have dropped by 43% and CAIDI would have stayed relatively the same. Eliminating all tree outages is difficult to do, but with these large indices, this is a definite goal that should be strived for. This is the 'biggest bang for the buck' philosophy.

In investigating the outages affecting the EWP system it became apparent that there were a significant number of tree in wire outages which heavily affected our indices as well as outages on very windy days with no apparent cause. These outages occur mainly on feeders in heavily treed areas, indicating tree contact.

Recommendation:

It is the recommendation of this report that the feeders with the most tree coverage be looked at by someone driving the entire length of the feeder and marking on a

map where there is heavy tree coverage. These marked up maps can then be used to have insulated conductors installed in only the areas requiring it (not whole feeders since may be great lengths with no trees anywhere near wires). EWP should use aerial cable or some other type of insulating material to cover these lines and minimize tree contact. If there are single phase run-offs that are heavily treed, than a fused tap should be installed instead as a cost saving measure (which will be effective due to the fuse burning methodology).

Toronto Hydro as well as London Hydro have installed covered wire (aerial cable) in heavily treed areas with great success.

The cost of this covered wire is approximately 35% over the cost of regular wire and as such it should be used where EWP is doing 4.16 kV conversions in heavily treed areas. This would improve the indices even though EWP is increasing 27.6 kV feeder lengths (see Part 1), which is a double bonus.

Tree trimming should be maintained in these areas as well to minimize contact and follow ups should be done to insure the trimming is done properly and to specification. This may be undertaken by a light duty person to minimize cost to EWP.

The following feeders require immediate attention: 24M3, 24M4, 25M7, 55M22, 55M23, 55M25 and 25M10.

Analysis:

Part 5

One outage cause that has been thought to have been a very large factor in the outages experienced on the EWP system has been animals. Animals as a whole do not cause a significant number of outages per year on the EWP system as can be seen in Appendix A – Part 5.

In looking at the Appendix A – Part 5, it can be seen that if all the animal related outages in 2003 could have been reduced to zero, SAIDI would have dropped by 1.5%, SAIFI would have dropped by 2.6% and CAIDI would have increased by 1.2%. Eliminating all animal outages is difficult to do due to the small number of outages occurring, the randomness of them and the small impact they have on the total system.

Recommendation:

Due to the small number of animal outages that are experienced it is recommended that the locations that would most heavily impact the statistics be retrofitted to minimize the damage by animals. This entails covering all exposed terminals on top

of Substation transformers as well as the potheads being fed from the substations with some sort of insulating wrap that will eliminate animal contact.

The animal guards that are currently being installed on pole top transformers is the correct direction for EWP due to the large number of customers involved in an outage on a 27.6 kV feeder.

Any installation of Aerial cable, insulated conductors or better tree trimming in heavily treed areas as outlined in Part 4 will significantly reduce animal contact as well. This is mainly due to the fact that these are the areas most frequented by squirrels, crows, raccoons etc.

Analysis:

Part 6

Lightning storms, although severe, do not cause as much damage as earlier suspected to the EWP system. The analysis of the outage statistics show that there are a number of lightning outages, but most become Auto-Recloses (A/R's) with the rest affecting the system, but not as the worst cause (that would be trees in wires).

In looking at the Appendix A – Part 6, it can be seen that if all the lightning related outages in 2003 could have been reduced to zero, SAIDI would have dropped by 9.7%, SAIFI would have dropped by 11.1% and CAIDI would have increased by 1.5%. Eliminating all lightning outages is near impossible due to the randomness of them as well as the severe nature of a lightning stroke.

Recommendation:

Due to the inconclusive nature of the many studies done by large utilities throughout North America on lightning and surge protection, it is recommended that EWP continue with installing surge arrestors on the system.

Final Conclusions:

To implement the above ideas, techniques and be successful, it will require a dedicated effort on the part of the EWP staff.

The most daunting part will be the requirement of a person to check all outages that occur to confirm if certain methodologies are actually being followed (or not). This person will have to meet with the Trouble Dept, OH, UG and Operating staff to question (in a non accusational tone) the current practices and reinforce the new methods and thinking until such time that the EWP staff's mindset shifts to a restore as opposed to a repair mentality.

An attached Appendix B showing the # of outages caused by Lightning, Animals and Tree contact has been included showing the years 2001, 2002 and 2003 for comparison purposes. In looking at Appendix B, it can be seen that Trees in wires has the largest impact to the EWP indices for all three years, further re-inforcing the need for better tree trimming or covered conductors.

SCADA Manager
Kevin Damphouse

Kd/kd



AGENDA SUBMISSION

To: EnWin Powerlines Ltd. Board of Directors

2005 01 19

M35

From: Shawn Filice

Re: Service Quality – 2004 System Reliability, AS AT JANUARY 1ST, 2005

In 2003, EnWin Powerlines was 12th overall (for both SAIDI and SAIFI), for Large Utilities in Ontario (out of 14) for outage reliability statistics as shown in Table 1.

	2003 Enwin Powerlines	2003 PROVINCIAL AVERAGE	% VARIANCE
SAIDI (hrs.)	1.84	1.181	+ 35.8%
SAIFI	2.30	1.739	+ 24.3%
CAIDI (hrs.)	0.80	0.682	+ 14.7%

Table 1: 2003 Reliability Statistics "AT A GLANCE"

In 2004, EnWin Powerlines Ltd. had established a corporate goal to improve system reliability by 15% for the Calendar year. This was measured by comparing the year's reliability indices against the previous 3-year average (See the attached Outage Summary Statistics for details) reduced by 15%.

	2004 EnWIN POverlines	2004 Goal (15% Reduction)	% VARIANCE	2003 PROVINCIAL AVERAGE	% VARIANCE (Provincial Average)
SAIDI (hrs.)	1.2194	1.3211	- 8.4%	1.181	+ 3.1 %
SAIFI	2.7566	2.0195	+ 26.7%	1.739	+ 36.9%
CAIDI (hrs.)	0.4424	0.5566	- 25.8%	0.682	- 53.4%

Table 2: 2004 Reliability Statistics "AT A GLANCE"

The 2004 statistics in Table 2 show that EnWin customers experienced an increase in the average number of 'outages' experienced (SAIFI up by 26.7%) with a large decrease in the average duration of these outages (SAIDI down by 25.8%) as compared to the 3 year average goal.

Assuming the MEARIE 2004 Provincial large users statistics are the same as 2003, Table 2 draws a comparison between the 2004 Enwin and MEARIE numbers. SAIFI is larger due to the large number of affected customers, yet we realized a 53 % reduction in CAIDI (average length of interruption). This is an upward trend in the quality of power for the Enwin customers.

SAIDI – Defined as the **average interruption duration for customers served during the year**. EnWIN's 2004 SAIDI was 1.2194 hours (1 hour, 13 minutes and 10 seconds). The 2004 benchmark for SAIDI average was 1.3211 hours (1 hour, 19 minutes and 16 seconds). This compares against the MEARIE 2003 Provincial large users SAIDI value of 1.181 (1 hour and 11 minutes)

SAIFI – Defined as the **average number of times that a customer is interrupted during the year**. EnWIN's 2004 SAIFI was 2.7566 interruptions per customer. The 2004 benchmark for SAIFI was 2.0195 interruptions per customer. The 2003 Provincial average is 1.739 interruptions per customer.

CAIDI – Defined as the **average length of an interruption**. EnWIN's 2004 CAIDI was 0.4424 hours (26.5 minutes). The 2004 benchmark for CAIDI was 0.5566 (33 minutes). The 2003 Provincial average is 0.682 hours (41 minutes).

Nearly 44% (100,000 customers) of the SAIFI statistic resulted from weather activity such as lighting and windstorms. Planned Capital (i.e. 4.16kV conversions and connection of new services) and Maintenance activities (i.e. PCB Oil Sampling and isolation of energized conductors for safe work practices) affected approximately 44,000 customers thereby explaining 20% of the statistic. 10% or 42,000 customers were impacted due to the loss of supply from Hydro One and other factors such as defective equipment, public vehicle accidents, animal contacts make up the remaining 26%.

Even though the SAIFI statistic shows there were 26.7% more customers affected in total, these same customers experienced a 25.8% decrease in the average outage duration. We were able to achieve this due to a 'new' (or renewed) philosophy that was implemented in the early part of 2004. Rather than reacting in a "knee jerk" fashion, our staff, now take a

moment to think through the most 'efficient' method of restoration that will have the least impact on the customers prior to dispatching crews.

Analyzing these statistics indicates we met the SAIDI and CAIDI expectations, however, we failed with respect to the SAIFI goal. Being ahead of the SAIDI and CAIDI statistics is very positive considering there was a high volume of system activity due to a number of thunderstorms during the month of May.

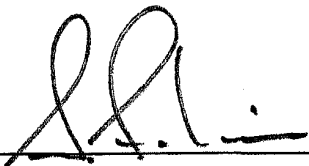
Even though the majority of our outages stem from uncontrollable factors such as the loss of supply from Hydro One, weather and defective equipment. The frequency of these interruptions and the number of customers impacted can be minimized.

We employ a variety of maintenance activities and install specific materials to help us address the tree, animal and pole fire concerns. Our "Annual Insulator Washing program" is in place to minimize the occurrences of pole fires, our "Annual & Area Tree Trimming contracts" are in place to deal with the tree contact incidents, and "Animal Guards" are installed on all transformer bushings to deter animals from getting too close to energized equipment.

Our capital programs such as Recloser and "fused-tap" installations minimize the number of customers impacted when outages occur. There are now 32 pole-mounted reclosers connected to the system, which have helped to improve system reliability by 5% since July.

RECOMMENDATION:

For information purposes only.



Director of Operations

SF/dl

Attach.

Appendix D
Historic Outage Data and Analysis

Historical data analysis on fault sections

Customer-hours caused by faults on first half of 27.6 kV feeders*	44,633.6	
Customer-hours caused by faults on Second half of 27.6 kV feeders	56,131.4	
% First/(First+Second)		44%
% Second/(First+Second)		56%
Total Customer-hours caused by unknown reasons	95,089.4	
Spreading Customer-hours caused by unknown reasons to the first half of 27.6 kV feeders.	42,119.6	
Spreading Customer-hours caused by unknown reasons to the second half of 27.6 kV feeders.	52,969.8	
Total Customer-hours on the first half of 27.6 kV feeders between 2000 and 2003	86,753	
Calculated annual Customer-hours on the first half of 27.6 kV feeders	21,688	
Average annual system customer-hours	125,062	
Percentage of Customer-hours on the first half over total Customer-hours **	17%	

Note: * The historical data used are from 2000 to 2003 database

** Only faults that caused breaker trips are considered in the analysis.

Historical outage data from 2000 to 2003

DATE OFF	HOURS OFF	CUSTOMER	CUST. HOUR	LOCATION	FEEDER	POWER OFF TO CUSTOMERS
20011029	0.75	1368	1026.0	First half	23M1	23M1 CUSTOMERS (INCL. STA. 52 & 55) (EXCEPT SITES 923, P318, AND Y124)
20000509	0.40	2700	1080.0	First half	55M22	ALL 55M22 CUSTOMERS SOUTH OF ALICE ST (INCLUDING SUBS 64 & 53)
20010130	0.03	3633	109.0	First half	15M5	15M5 CUSTOMERS
20030308	0.03	1368	41.0	First half	23M1	23M1 CUSTOMERS.
20030308	0.03	1368	41.0	First half	23M1	23M1 CUSTOMERS.
20021007	0.03	2751	82.5	First half	24M3	24M3 CUSTOMERS.
20020817	0.03	1340	40.2	First half	24M5	24M5 CUSTOMERS
20000203	0.08	2825	235.4	First half	24M6	24M6 CUSTOMERS.
20001110	0.03	3525	105.8	First half	25M10	25M10 CUSTOMERS
20010522	0.03	3525	105.8	First half	25M10	25M10 CUSTOMERS (INCL. STN.58-72, STN.59)
20010622	0.03	1691	50.7	First half	25M11	25M11 CUSTOMERS (INCL. STN.22-71, STN.54)
20010615	0.05	1306	65.3	First half	25M13	25M13 CUSTOMERS (INCL. STA. 68)
20011022	0.03	1306	39.2	First half	25M13	25M13 CUST. (INCLUDING STN. 68, & 24M4 LOAD ON NORTH WOOD)
20010911	0.03	3079	92.4	First half	25M7	25M7 CUSTOMERS (INC. STN 51)
20010414	0.08		0.0	First half	55M21	55M21 CUSTOMERS
20030201	0.05	6	0.3	First half	55M21	55M21 CUSTOMERS
20030201	0.05	5128	286.4	First half	55M22	55M22 CUSTOMERS
20030628	0.05	4071	203.6	First half	55M23	55M23 CUSTOMERS AND 56M2 CUSTOMERS W. OF HOMEDALE
20010414	0.08	197	15.8	First half	55M26	55M26 CUSTOMERS
20010622	0.03	50	1.5	First half	55M5	55M5 CUSTOMERS
20020718	0.03	2130	63.9	First half	55M5	55M5 CUSTOMERS (55M5 CARRYING PART OF 55M22 & 56M2).
20020718	0.08	3573	285.8	First half	55M6	55M6 CUSTOMERS.
20020819	0.07	3164	221.5	First half	56M1	56M1 CUSTOMERS
20030414	0.03	3164	94.9	First half	56M1	56M1 CUSTOMERS
20030612	0.05	3164	158.2	First half	56M1	56M1 CUSTOMERS
20030407	0.05	2311	115.6	First half	56M2	56M2 CUSTOMERS (INCL. STN. 62)
20030407	0.03	1490	44.7	First half	56M3	56M3 CUSTOMERS (INCL. STN. 63)
20000924	0.03	1817	54.5	First half	56M5	56M5 CUSTOMERS

Historical outage data from 2000 to 2003

20010422	0.03	1817	54.5	First half	56M5	56M5 CUSTOMERS
20000204	0.10	727	72.7	First half	56M6	56M6 CUSTOMERS INCLUDING STN 71
20020417	0.03	3024	90.7	First half	56M7	56M7 CUSTOMERS
20020815	0.72	1683	121.8	First half	15M11	15M11 CUST.
20020706	0.20	3633	726.6	First half	15M5	15M5 CUSTOMERS
20020706	0.52	4836	2514.7	First half	15M7	15M7 CUSTOMERS
20030621	0.03	4836	145.1	First half	15M7	15M7 CUSTOMERS
20020815	0.53	1066	565.0	First half	15M8	15M8 CUST.
20020413	0.08	2825	226.0	First half	24M6	24M6 CUSTOMERS (INCL. STN. 72)
20010222	0.05	3525	176.3	First half	25M10	25M10 CUSTOMERS (INCLUDING STN 59, STN 5872)
20010222	0.07	1691	118.4	First half	25M11	ALL 25M11 & 25M12 CUSTOMERS (INCLUDING STN 2271 CUSTOMERS)
20010222	0.07	1306	91.4	First half	25M13	ALL 25M13 & 25M14 CUSTOMERS INCLUDING STN 42 & STN 68
20010222	0.05	3079	154.0	First half	25M7	ALL 25M7 CUSTOMERS (INCLUDING STN 51)
20010121	0.03	50	1.5	First half	55M5	ALL 55M5 CUSTOMERS EXCEPT FORD'S POWERHOUSE.
20000509	0.85	1817	1544.5	First half	56M5	56M5 CUSTOMERS
20020309	0.20	1683	336.6	First half	15M11	15M11 CUSTOMERS
20020625	0.07	2147	150.3	First half	15M11	15M11 CUSTOMERS.
20030623	0.17	1683	286.1	First half	15M11	15M11 CUSTOMERS
20010508	0.15	4003	600.5	First half	15M14	15M14 CUSTOMERS
20000316	2.80	3179	8901.2	First half	24M4	24M4 CUST.
20010905	1.28	3179	4069.1	First half	24M4	24M4 CUSTOMERS
20000318	1.10	3525	3877.5	First half	25M10	25M10 CUSTOMERS INCL. STA. 58 & 59
20000411	0.25	3525	881.3	First half	25M10	25M10 CUSTOMERS INCL. STN 59
20010911	1.30	1691	2198.3	First half	25M11	REMAINING 25M11 CUST. INCLUDING SUB. 54
20000203	0.12	1306	152.4	First half	25M13	25M13 CUSTOMERS
20011024	0.52	1306	679.1	First half	25M13	REMAINING 25M13 CUSTOMERS NORTH OF CAMPBELL AVE. AND TECUMSEH RD.
20020309	0.57	1980	1128.6	First half	55M2	55M2 CUSTOMERS.
20010818	2.00	2000	4000.0	First half	55M22	REMAINING 55M22 CUSTOMERS EAST OF NORMAN, NORTH OF TECUMSEH
20010622	1.73	48	83.0	First half	55M5	55M5 CUST EXCEPT FORD POWERHOUSE (TRANSFERRED TO 55M6 AT ENWIN'S REQUEST)
20020718	0.30	2130	639.0	First half	55M5	55M5 CUSTOMERS (55M5 CARRYING 55M22 & 55M2).
20020718	0.10	2130	213.0	First half	55M5	55M5 CUSTOMERS (55M5 CARRYING PART OF 55M22 & 55M2).
20030407	1.60	2311	3697.6	First half	56M2	56M2 CUSTOMERS (INCL. STN. 62)
20000203	0.40	727	290.8	First half	56M6	56M6 CUSTOMERS INCLUDING STN 71
20010819	0.03	4177	125.3	First half	55M22	55M22 CUSTOMERS INCL. 64

Historical outage data from 2000 to 2003

DATE OFF	HOURS OFF	CUSTOMER	CUST HOUR	LOCATION	FEDER	POWER OFF TO CUSTOMERS
20000618	0.02	473	9.5	Second half	15M15	15M15 CUSTOMERS (INCL. STA. 41 & 57)
20010509	0.05	1066	53.3	Second half	15M8	15M8 CUSTOMERS, (STN. 58 AUTO TRANSFERRED TO 25M10)
20010423	0.03	978	29.3	Second half	23M2	23M2 CUSTOMERS
20010616	0.03	528	15.8	Second half	23M6	23M6 CUSTOMERS
20010725	0.03	16	0.5	Second half	24M1	24M1 CUSTOMERS
20010926	0.03	16	0.5	Second half	24M1	24M1 CUSTOMERS
20010124	0.03	35	1.1	Second half	24M2	24M2 CUSTOMERS
20000728	0.03	1340	40.2	Second half	24M5	24M5 CUSTOMERS
20030201	0.07	2825	197.8	Second half	24M6	24M6-RC1 CUSTOMERS
20030201	0.05	2825	141.3	Second half	24M6	24M6-RC1 CUSTOMERS
20030308	0.03	2825	84.8	Second half	24M6	24M6 CUSTOMERS S. OF LABELLE, E. SIDE OF HURON CHURCH TO DOUGALL.
20031115	0.28	3525	987.0	Second half	25M10	25M10 & 15M5 CUSTOMERS
20031115	0.03	3525	105.8	Second half	25M10	25M10 & 15M5 CUSTOMERS
20010912	0.03	1691	50.7	Second half	25M11	25M11 CUSTOMERS (EXCEPT STN 54)
20000203	0.116667	2983	348.0	Second half	25M14	25M14 CUSTOMERS
20010115	0.03	2983	89.5	Second half	25M14	REMAINDER OF 25M14 CUSTOMERS (EXCEPT SITES 744, 1586)
20010708	2	3079	6158.0	Second half	25M7	25M7 CUSTOMERS INCLUDING STN. 51.
20030201	0.1	3079	307.9	Second half	25M7	25M7-RC1 CUSTOMERS
20020819	0.03	3535	106.1	Second half	55M2	55M2 INCLUDING STATION 27 & 25M14 SOUTH OF SHEPHERD, EAST OF CRAWFORD
20011109	0.03	6251	187.5	Second half	55M22	55M22 CUST. (INCLUDING SUB 64)
20020415	0.03	6251	187.5	Second half	55M22	55M22 CUSTOMERS INCLUDING STATION 64
20030704	3.98	6251	24879.0	Second half	55M22	55M22 CUSTOMERS BTWN WESTMINSTER & NORMAN, N. OF TEC. (POLONIA PARK)
20030704	1.9	6251	11876.9	Second half	55M22	55M22 CUSTOMERS EAST OF WESTMINSTER.
20020602	0.03	1407	42.2	Second half	55M24	55M24 CUSTOMERS, PART OF 24M4 CUSTOMERS & 24M5 CUSTOMERS (INCL. STN 67)
20020721	0.03	2130	63.9	Second half	55M5	55M5 CUSTOMERS (INCLUDING SECT. OF 55M22 & 56M2)
20030316	0.03	3164	94.9	Second half	56M1	56M1 CUSTOMERS
20030320	0.05	3164	158.2	Second half	56M1	56M1 CUSTOMERS
20000203	0.1	4989	498.9	Second half	56M2	56M2 CUSTOMERS INCLUDING STN 62
20010519	0.43	4989	2145.3	Second half	56M2	56M2 CUSTOMERS INCLUDING RHODES DR. OPERATING CENTRE AND STN 62.
20010528	0.03	4989	149.7	Second half	56M2	56M2 CUSTOMERS INCLUDING RHODES DR. OPERATING CENTRE, STN. 61 & 62
20010613	0.03	4989	149.7	Second half	56M2	56M2 CUSTOMERS
20010808	0.55	4989	2744.0	Second half	56M2	56M2 CUSTOMERS (INCL. STA. 62)
20020723	0.57	4989	2843.7	Second half	56M2	56M2 CUSTOMERS EXCL. STN 62
20000327	0.07	1490	104.3	Second half	56M3	56M3 CUSTOMERS
20000614	0.48	1490	715.2	Second half	56M3	56M3 CUSTOMERS
20020422	0.03	1490	44.7	Second half	56M3	56M3 CUSTOMERS
20010224	0.03	1817	54.5	Second half	56M5	ALL 56M5 CUSTOMERS
20010408	0.03	1817	54.5	Second half	56M5	56M5 CUSTOMERS
20010712	0.03	1817	54.5	Second half	56M5	56M5 CUSTOMERS
20030904	0.03	1817	54.5	Second half	56M5	56M5 CUSTOMERS
20020202	0.07	3024	211.7	Second half	56M7	56M7 CUSTOMERS & 56M8 CUSTOMERS
20010422	0.03	2975	89.3	Second half	56M8	56M8 CUSTOMERS INCLUDING 56M7 CUSTOMERS E. OF FLORENCE.
20020617	0.03	1683	50.5	Unknown	15M11	15M11 CUSTOMERS
20021008	0.08	1683	134.6	Unknown	15M11	15M11 CUSTOMERS.
20021103	0.08	1683	134.6	Unknown	15M11	15M11 CUSTOMERS.
20000830	0.03	4003	120.1	Unknown	15M14	15M14 CUST.
20001004	0.03	4003	120.1	Unknown	15M14	15M14 CUSTOMERS

Historical outage data from 2000 to 2003

20010122	0.03	4003	120.1	Unknown	15M14	15M14 CUSTOMERS
20010509	0.03	4003	120.1	Unknown	15M14	15M14 CUSTOMERS.
20020201	0.08	473	37.8	Unknown	15M15	15M15 CUSTOMERS
20020201	0.28	3633	1017.2	Unknown	15M5	15M5 CUSTOMERS
20020201	0.12	3633	436.0	Unknown	15M5	15M5 CUST.
20020201	0.05	4836	241.8	Unknown	15M7	15M7 CUSTOMERS.
20000118	0.266667	1066	284.3	Unknown	15M8	15M8 CUSTOMERS
20021008	0.08	1066	85.3	Unknown	15M8	15M8 CUSTOMERS.
20031112	0.03	1066	32.0	Unknown	15M8	15M8 CUSTOMERS.
20000626	1.88	1368	2571.8	Unknown	23M1	23M1 CUSTOMERS
20020131	0.2	1368	273.6	Unknown	23M1	23M1 CUSTOMERS.
20001212	0.03	528	15.8	Unknown	23M6	23M6 CUSTOMERS
20010209	0.03	528	15.8	Unknown	23M6	23M6 CUSTOMERS
20020309	0.1	16	1.6	Unknown	24M1	24M1 CUSTOMERS
20020131	0.52	35	18.2	Unknown	24M2	24M2 CUSTOMERS.
20020131	0.03	35	1.1	Unknown	24M2	24M2 CUSTOMERS
20020721	0.03	35	1.1	Unknown	24M2	24M2 CUSTOMERS
20020131	0.03	2751	82.5	Unknown	24M3	24M3 CUSTOMERS
20020201	0.82	2751	2255.8	Unknown	24M3	24M3 CUSTOMERS INCL. STN 69
20020201	0.33	2751	907.8	Unknown	24M3	24M3 CUSTOMERS.
20020201	0.18	2751	495.2	Unknown	24M3	24M3 CUSTOMERS INCL. STN 69
20030212	0.03	2751	82.5	Unknown	24M3	24M3 CUSTOMERS INCL. SUB 69
20030212	0.03	2751	82.5	Unknown	24M3	24M3 CUSTOMERS INCL. SUB 69
20031113	13	2751	35763.0	Unknown	24M3	24M3 CUSTOMERS.
20031113	0.2	2751	550.2	Unknown	24M3	24M3 CUSTOMERS
20031113	0.05	2751	137.6	Unknown	24M3	24M3 CUSTOMERS
20031113	0.05	2751	137.6	Unknown	24M3	24M3 CUSTOMERS
20031113	0.03	2751	82.5	Unknown	24M3	24M3 CUSTOMERS
20000728	0.03	3179	95.4	Unknown	24M4	24M4 CUSTOMERS
20020131	0.03	3179	95.4	Unknown	24M4	24M4 CUSTOMERS
20020131	0.03	3179	95.4	Unknown	24M4	24M4 CUSTOMERS
20000703	0.47	1340	629.8	Unknown	24M5	24M5 CUST. INCLUDING SUB 67
20020201	0.97	1340	1299.8	Unknown	24M5	24M5 CUSTOMERS INCL. STN 67
20021204	0.03	1340	40.2	Unknown	24M5	24M5 CUSTOMERS
20000518	0.02	3060	61.2	Unknown	24M6	24M6 CUSTOMERS INCL. SUBS 70 & 72
20020131	0.03	2825	84.8	Unknown	24M6	24M6 CUSTOMERS
20020131	0.03	2825	84.8	Unknown	24M6	24M6 CUSTOMERS
20020131	0.03	2825	84.8	Unknown	24M6	24M6 CUSTOMERS
20020131	0.03	2825	84.8	Unknown	24M6	24M6 CUSTOMERS.
20020201	0.22	2825	621.5	Unknown	24M6	24M6 CUSTOMERS.
20000630	0.3	3525	1057.5	Unknown	25M10	25M10 CUSTOMERS
20010216	0.1	3525	352.5	Unknown	25M10	25M10 CUSTOMERS INCL. SUB 59
20020131	0.03	3525	105.8	Unknown	25M10	25M10 CUSTOMERS
20000730	0.03	1691	50.7	Unknown	25M11	25M11 CUSTOMERS (INCL. SUB 22 A BUS & SUB 54)
20020201	0.03	1691	50.7	Unknown	25M11	25M11 CUSTOMERS.
20021209	0.07	1306	91.4	Unknown	25M13	25M13 CUSTOMERS.
20030721	0.03	1306	39.2	Unknown	25M13	25M13 CUSTOMERS.
20000203	1.966667	341	670.6	Unknown	25M5	25M5 CUSTOMERS.
20000602	0.02	3079	61.6	Unknown	25M7	25M7 CUSTOMERS, INCLUDING STN 51

Historical outage data from 2000 to 2003

20000728	0.03	3079	92.4	Unknown	25M7	25M7 CUSTOMERS (INCL. SUB 51)
20000728	0.03	3079	92.4	Unknown	25M7	25M7 CUSTOMERS (INCL. SUB 51)
20020309	0.33	2956	975.5	Unknown	25M7	25M7 CUSTOMERS
20031111	0.13	3079	400.3	Unknown	25M7	25M7 CUSTOMERS
20020201	0.67	3535	2368.5	Unknown	55M2	55M2 CUSTOMERS
20020201	0.22	3535	777.7	Unknown	55M2	55M2 CUSTOMERS & 15M5 CUSTOMERS
20020201	0.1	3535	353.5	Unknown	55M2	55M2 CUSTOMERS
20020201	0.08	3535	282.8	Unknown	55M2	55M2 & 15M5 CUSTOMERS
20020131	0.17	6251	1062.7	Unknown	55M22	55M22 CUSTOMERS
20020131	0.05	6251	312.6	Unknown	55M22	55M22 CUSTOMERS
20020131	0.05	6251	312.6	Unknown	55M22	55M22 CUSTOMERS
20020201	0.08	3598	287.8	Unknown	55M23	55M23 CUSTOMERS
20020201	0.05	3598	179.9	Unknown	55M23	55M23 CUSTOMERS
20020201	0.03	3598	107.9	Unknown	55M23	55M23 CUSTOMERS
20020201	0.03	3598	107.9	Unknown	55M23	55M23 CUSTOMERS
20020131	0.97	2509	2433.7	Unknown	55M24	55M24 CUSTOMERS INCLUDING SECTION OF 24M4 & 24M5 (INCL. STN 67)
20020131	0.1	2509	250.9	Unknown	55M24	55M24 CUSTOMERS INCLUDING SECTION OF 24M4 & 24M5 (INCL. STN 67)
20021103	0.28	2509	702.5	Unknown	55M24	55M24 CUSTOMERS (INCL. PART OF 24M4 & 24M5 CTS.)
20021125	0.03	2509	175.6	Unknown	55M24	55M24 CUSTOMERS (ALSO CARRYING 24M5 CUSTOMERS S. OF SOUTH CAMERON, FROM
20021209	0.07	2509	501.8	Unknown	55M24	55M24 CUSTOMERS
20030704	0.2	2509	501.8	Unknown	55M24	55M24 CUSTOMERS
20020131	0.3	3194	1916.4	Unknown	55M25	55M25 CUSTOMERS
20030704	0.6	3194	1916.4	Unknown	55M25	55M25 CUSTOMERS & 24M3 CUSTOMERS E. OF HOWARD.
20020131	0.63	4619	2910.0	Unknown	55M3	55M3 CUSTOMERS
20020201	0.15	4619	692.9	Unknown	55M3	55M3 CUSTOMERS
20021110	0.05	4619	231.0	Unknown	55M3	55M3 CUSTOMERS
20020131	0.25	2130	532.5	Unknown	55M5	55M5 CUSTOMERS
20031112	0.03	2130	63.9	Unknown	55M5	55M5 CUSTOMERS
20020131	0.77	3164	2436.3	Unknown	56M1	56M1 CUSTOMERS
20021013	0.42	3164	1328.9	Unknown	56M1	REMAINDER OF 56M1 CUSTOMERS
20021013	0.2	3164	632.8	Unknown	56M1	56M1 CUSTOMERS
20021206	0.03	3164	94.9	Unknown	56M1	56M1 CUSTOMERS
20000928	0.68	4989	3392.5	Unknown	56M2	56M2 CUSTOMERS
20010630	0.02	3164	63.3	Unknown	56M2	56M2 CUSTOMERS INCLUDING SUB 62.
20020131	0.05	4989	249.5	Unknown	56M2	56M2 CUSTOMERS
20000204	2.633333	1490	3923.7	Unknown	56M3	56M3 CUSTOMERS (INCL. STN. 63)
20020201	0.47	1490	700.3	Unknown	56M3	56M3 CUSTOMERS
20020201	0.03	1490	44.7	Unknown	56M3	56M3 CUSTOMERS
20020201	0.03	1490	44.7	Unknown	56M3	56M3 CUSTOMERS
20000629	0.23	3024	695.5	Unknown	56M7	56M7 CUSTOMERS
20000802	0.03	3024	90.7	Unknown	56M7	56M7 CUSTOMERS (INCL. SUB 61)
20020201	0.12	3024	362.9	Unknown	56M7	56M7 CUSTOMERS
20020201	0.08	3024	241.9	Unknown	56M7	56M7 CUSTOMERS
20021013	1.57	3024	4747.7	Unknown	56M7	56M7 CUSTOMERS
20021013	1.07	3024	3235.7	Unknown	56M7	REMAINDER OF 56M7 CUSTOMERS, E. OF SOLIDARITY TOWER
20021013	0.37	3024	1118.9	Unknown	56M7	56M7 CUSTOMERS (INCL. STN. 60)
20020309	0.03	3633	109.0	Unknown	15M5	56M7 CUSTOMERS
20020309	0.03	3633	109.0	Unknown	15M5	15M5 CUSTOMERS

Appendix E
Other Utilities Experience on Loop Scheme



DISTRIBUTION RELIABILITY USING RECLOSERS AND SECTIONALISERS

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I. Introduction

This paper presents a comparative analysis of distribution reliability improvements that can be achieved by using various outdoor distribution devices. There are two objectives for this paper: First, it is to discuss the application of the most common types of devices, including line reclosers, automatic sectionalisers and manual switches. Second, an analysis to quantify the reliability improvements that can be achieved by using each (or a combination) of these devices, as well as a combination of these devices.

As background on distribution reliability and the need for its improvement, one explanation is as follows. De-regulation has resulted in a major cost cutting at many utilities. These cost cuts in equipment, crew size, maintenance, etc., could mean major reductions in reliability. State utility commissions, hearing these concerns, have reacted by requiring the reporting of reliability indices and in some states setting performance standards. In some cases, mandates, penalties and awards have been enacted or are being considered. The question to the utility is, quite frankly, how do I increase reliability at the lowest possible cost? Add to this concern the fact that power quality for sensitive loads has created many new areas of concern (momentaries and sags might be just as bad as sustained feeder interruptions) and you have the dilemma virtually every utility in the world is facing. Reclosers, sectionalisers and switches address these concerns.

In the application section of this paper, mechanical and electrical aspects of each type of switching device will be discussed. For reclosers, by example, the common configurations (i.e., single phase, three phase, loop systems) and ratings will be covered. Advantages and disadvantages of each type of apparatus will be discussed relative to the other types of switching devices. In the reliability section, typical System Average Interruption Duration Index (SAIDI), System Average Interruption Frequency Index (SAIFI), and Momentary Average Interruption Frequency Index (MAIFI) values for several radial and loop configurations utilizing reclosers, sectionalisers and switches will be presented. The Customer Average Interruption Duration Index (CAIDI) will not be covered since there is no significant difference between device selection as it applies to the restoration of permanent faults. I.e., it takes approximately as long to close reclosers after a permanent fault as it does for sectionalisers and switches.

In the comparison section of this paper, three-phase reclosers with single phase tripping capability and single phase switches will be compared to three phase gang operated devices in the same applications. Three phase reclosers with single phase capability devices have become more commonplace with the development of

magnetic actuation, and brought into the market as a tool specifically to improve distribution reliability.

There are a number of papers written on improving reliability directed towards one type of device (i.e., reclosers, sectionalisers or switches) in various configurations. This paper is geared toward comparing and utilizing a combination of these equipment types to gain the highest possible reliability improvements. This includes conventional configurations, as well as some non-conventional configurations worthy of exploration.

II. Distribution Reclosers

Reclosers have been around for a long time and have always been considered one of the "workhorses" of distribution system overcurrent protection. A distribution recloser is designed to interrupt both load and fault current. Also, per its term, it is designed to "reclose" on the fault repeatedly in a predefined sequence in an attempt to clear the fault. Reclosers are predominantly located on the distribution feeder, though as the continuous and interrupting current ratings increase, they are more likely now to be seen in substations, where traditionally a circuit breaker would be located.

Reclosers have two basic functions on the system, reliability and overcurrent protection. While one of the philosophies for the use of reclosers is to increase reliability, in the past their use for many utilities was determined primarily because the feeder breaker did not have protective reach to the end of the feeder. This was due to the fact that high load currents forced the minimum trip setting to a higher value than the fault level at the end of the feeder. Nowadays, reclosers are more frequently applied for reliability reasons, mainly due to three of their benefits: Reclosing capability, single phase reclosing, and automated loop capabilities.

Reclosing: Reclosing, for over 30 years, was normal for virtually all utilities since most lines were overhead and most temporary faults could be cleared by the recloser before the fuse operated (feeder selective relaying). Modern reclosers have open times as low as 100 milliseconds, allowing consumer power quality devices such as microwaves and clocks to not be affected by momentaries.

Single-phase Reclosing: Single phase reclosers for main line feeders are more readily available. Traditionally, single phase reclosers operated as standalone devices with no electrical or mechanical connection between phases, and had lower interrupting ratings. Modern reclosers, however, reclosers with three phase tanks and higher interrupting ratings have been introduced which have 1 phase reclosing capability. Single phase tripping yields significant improvements in reliability, as demonstrated later in this paper.

Automated Recloser Loop Systems: Reclosers can be configured to work together in an automatic restoration system. Automatic restoration provides a significant improvement in the SAIDI and SAIFI index, with common applications including 3, 4 or 5 reclosers. Protection on single phase basis can compliment loop systems to further

improve reliability. This paper is intended to compare reclosers, sectionalisers and switches, in the most common arrangements of up to three devices (2 midpoints and one tie) outside the substation. Using more than 3 units on the system further improves the reliability of a given system.

In addition to the protective and reliability benefits, reclosers with newer, more sophisticated controllers have several additional useful features for application on distribution feeders:

- **Directionality** - The increased use of distributed resources and automation may make the ability to trip in each direction with different settings a requirement.
- **Under/Over Voltage and Frequency** - The ability to monitor, alarm and control on these power quality events. Underfrequency shedding may be necessary or mandated in some regions of the country.
- **Power Quality Monitoring** - Performance based rates will force utilities to monitor their system performance at all levels.
- **Load Monitoring** - Equipment loading will become a much greater issue as higher loading of equipment to reduce costs becomes a factor. The recloser could monitor this.
- **Fault Monitoring** - Information such as coordination success, I^2t , fault levels, success of reclosing sequences, oscillographic capture, etc., provide utilities with data to improve system performance at virtually no cost.
- **Flexibility** - Since no one can predict the future, especially in the environment we find ourselves today, one of the major requirements of any intelligent device is that it must be flexible to changing system needs. Reclosers can easily be reprogrammed with settings to match existing conditions.

III. Sectionalisers

Sectionalisers can either take the form of a cutout with a CT ring around the tube and an electronic actuation module, or they may take the form of a solenoid/actuator driven devices with 6 bushings. Three phase sectionalisers are devices which often look similar to reclosers, but they have different functionality. The term "Sectionaliser" is not to be confused with the generic term "Sectionalising" device, which is sometimes referred to as the first recloser (outside the substation) in an automated loop restoration system. The functionality of this device is significantly different.

The function of a sectionaliser is not to interrupt a faulted line, but instead count the fault occurrences on the line and upon a predefined number of counts, and open up when the line is de-energized. The interrupting device, which allows the counting action, is either an upstream recloser or circuit breaker in the substation.

Sectionalisers are often used in locations where coordination with other devices is difficult due to tight coordination curves, or they can be used in place of fuses in high fault current areas (i.e. single or three phase taps near the substation) where it is difficult to coordinate with the fuse. In either case, sectionalisers perform only as a feeder selective ("save the tap") arrangement, requiring the main line device to operate in order to open. This may be disadvantageous where there are critical loads on the main feeder, where a reduction in MAIFI is important.

Though sectionalisers are generally lower cost than reclosers, they have several features useful for the utility:

- **Discrete Timing** – Detailed coordination study is not required.
- **Independent Phase Operation** – Some models have the capability to sectionalize on a single phase basis.
- **Cold Load Override** – If the recloser has been in the open state for some time, it is possible to have the sectionaliser "count" which can cause a miscoordination event. Newer controls can make the counting dependent on voltage, which can prevent this circumstance.
- **One Shot Mode** – Some sectionalisers can be switched over to one shot mode for safety purposes or to reduce the number of main feeder interruptions.

IV. Switches

Manual and motor operated switches are the most basic type apparatus on the line. These are typically air break devices which are not typically designed for automatic operation and are for local (and occasionally remote) operation. These devices are useful for manual temporary restoration of faulted lines, where if several are used can be useful to reconfigure a line manually to regain as much of the segments as possible after a fault. The problem with switches is mostly time. Without remote capability, a manual switch operation can take up to 1 hour, significantly impacting the overall feeder reliability.

Basic switches are typically lower in cost and provide the following features for the utility:

- **Simple device** – Undoubtedly the simplest device on the system.
- **Motor operation** – Can have motor operation to improve restoration time through SCADA.
- **Provides Visible Break** – External switch blades provide visible break for line work.
- **Often have capacitor ratings or are dedicated for capacitor switching.**

V. Reliability Comparisons

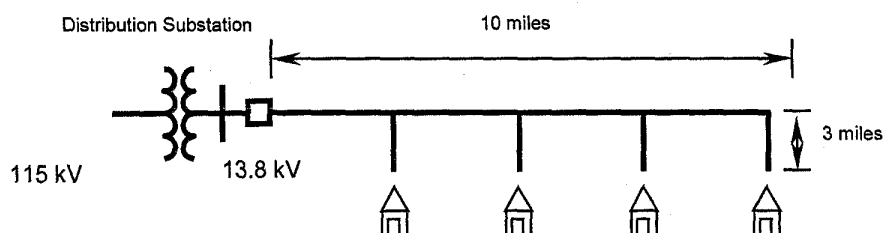
As mentioned previously, in the past feeder reclosers were primarily installed because of the need to see faults further on the line, sectionalisers in place of fuses for more defined protection, and switches were applied for reconfiguration of the feeder due to loads and manual fault restoration.

Now, these devices play a key role in meeting performance measures mandated by PUC's and demanded by customers. The question for the engineer is: Which device(s) will give the greatest reliability benefits? To assist the engineer in making decisions, including types and locations of devices on the feeder, detailed modeling programs are available. A modeling program can determine for a feeder or group of feeders the optimal location and quantity of devices that will yield the greatest reliability, taking the guesswork out of the task.

The reliability values in this paper were obtained using an analytical reliability analysis program created by ABB Consulting, which is designed to determine the best methods for improving reliability of a given feeder or system. For the purposes of this paper, an example feeder (Figure 1) is used for reliability comparisons. The specific parameters and assumptions are for a typical suburban/rural circuits and are as follows:

- 10 miles of 3-Phase 13.8 kV Main Feeder
- 8 single-phase laterals, evenly distributed on the main feeder. Each lateral 3 miles long, and connected to the main feeder through a fuse
- A total of 1800 customers (8 x 225 customers/lateral)
- Parameters doubled for tied circuits
- Manual devices require 1 hour to switch
- Recloser loop tie points take 1 minute to reconfigure
- Faults are distributed along all parts of the circuit
- The model uses 0.12 sustained faults per year per mile and 0.18 temporary faults per year per mile
- There are 0.04 sustained faults per year per mile per phase and 0.06 temporary faults per year per mile per phase

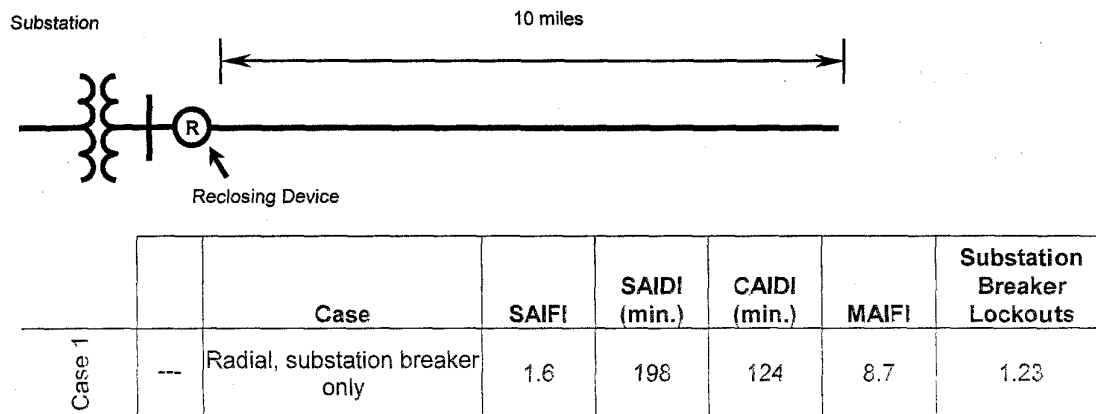
Figure 1 – Typical Distribution Feeder



When quantifying the reliability indices for various configurations, it is important to establish a base case. The base case used in our model is given in figure 2. This

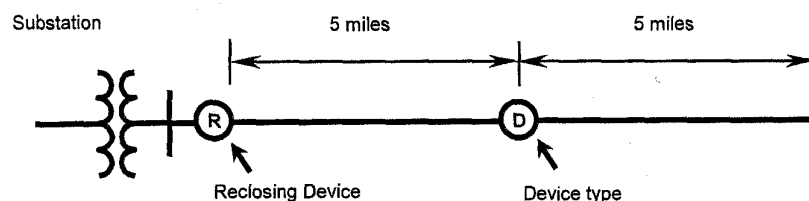
case consists of only one protective device, located at the substation. It assumes that this substation device is either a recloser or a circuit breaker with reclosing capabilities. The reason for this is that it has become un-common to have a substation device without reclosing in the substation for suburban/rural feeders. In each figure, calculated reliability indices for various devices in that arrangement is indicated.

Figure 2 - Substation Breaker or Recloser set to multiple operations (Case 1).



For Case 2, a midpoint device is added to the feeder. Figure 3 identifies all the considered configurations. Note that device type "D" represents several considered devices. This (radial) feeder configuration is most common in rural areas, where tie-points are not typically feasible.

Figure 3 – Addition of Midpoint Devices (Case 2a – 2e).



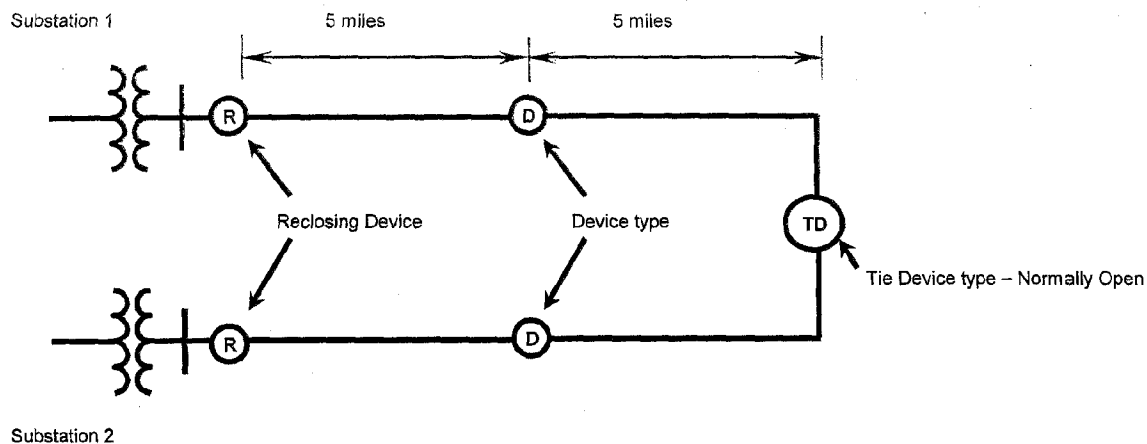
Where Device type "D" is Case:

- 2a. Midpoint switch
- 2b. Midpoint sectionaliser
- 2c. Midpoint recloser
- 2d. Midpoint 1 phase switches
- 2e. Midpoint recloser with single phase tripping and lockout

		Case	SAIFI	SAIDI (min.)	CAIDI (min.)	MAIFI	Substation Breaker Lockouts
Case 2	a.	Radial, midpoint switch (ganged)	1.6	178	105	8.7	1.23
	b.	Radial, midpoint sectionaliser (3 ϕ)	1.3	160	124	9.0	0.62
	c.	Radial, midpoint recloser	1.3	160	124	6.4	0.62
	d.	Radial, midpoint switches (1 ϕ)	1.6	170	105	8.7	1.24
	e.	Radial, midpoint recloser w/1 ϕ reclosing	1.1	139	126	5.0	0.63

For case 3, a tie point device is added to the feeder. Figure 4 identifies all the considered configurations. When considering this type of feeder, all the physical characteristics are doubled, i.e., two times the size feeder considered in Case 1 and 2.

Figure 4 – Addition of Tie Point Devices (Case 3a – 3e).



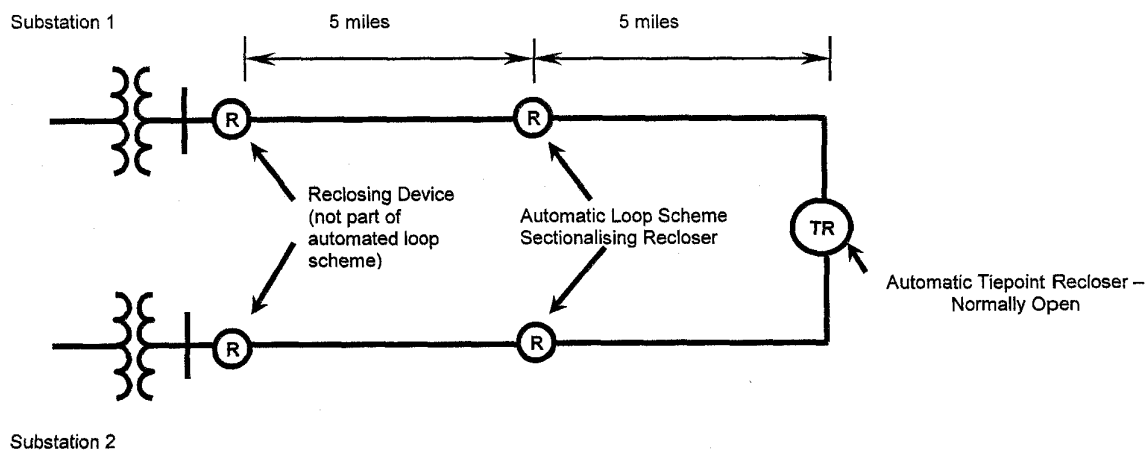
Where Device type "D" is Case:

- 3a. Midpoint switch and tie switch
- 3b. Midpoint sectionaliser and tie switch.
- 3c. Midpoint recloser and tie switch.
- 3d. Midpoint 1 phase switches and tie switch.
- 3e. Midpoint recloser with single phase tripping and tie switch.

		Case	SAIFI	SAIDI (min.)	CAIDI (min.)	MAIFI	Substation Breaker Lockouts
Case 3	a.	Looped, midpoint switch (ganged), w/ tie switch	1.6	177	111	8.7	1.23
	b.	Looped, midpoint sectionaliser (3 ϕ) w/tie switch	1.3	139	126	9.2	0.63
	c.	Looped, midpoint recloser with tie switch	1.3	140	109	6.4	0.62
	d.	Looped, midpoint switches (1 ϕ)	1.6	167	104	8.7	1.25
	e.	Looped, midpoint recloser w/1 ϕ reclosing with tie switch	1.1	118	107	5.0	0.63

For Case 4, automated reconfiguration systems using reclosers are considered. The system shown in Figure 5 is the same size as that given in Case 3. The type of system being considered performs reconfiguration based on voltage, and the only devices that include the automated reconfiguration logic are the three devices outside the substation. Four and five unit loop schemes are also used, which yield improved reliability results, though these are not considered in this paper.

Figure 5 – Automatic reconfiguration systems using reclosers (Case 4a & 4b).



Where all reclosers outside substation (3 total) are set up in Case:

4a. Three recloser automatic loop scheme

4b. Three recloser automatic loop scheme with 1 phase tripping

		Case	SAIFI	SAIDI (min.)	CAIDI (min.)	MAIFI	Substation Breaker Lockouts
Case 4	a.	3 Recloser auto restoration	1.0	122	124	6.7	0.62
	b.	3 Recloser auto restoration w/1 ϕ reclosing	0.8	99	126	5.3	0.63

VI. Reliability Summary

What do all the numbers in Table 1 mean? It is difficult to weigh all the parameters in a cost benefit equation. It is instead useful to separate the data into categories which can be correlated to the specific needs of the utility on a feeder level or on a system level. In other words, if a particular feeder is having problems with frequent interruptions, SAIFI could be of greater importance. SAIDI may be of greater importance where continuity of power is high priority (refrigeration, industrial, etc). In any case, it is in the best interest of the utility to analyze feeder circuits which have the most critical loads and have the worst reliability. These feeders will have the greatest impact on improving the overall system and customer satisfaction.

Table 2 indicates the percentage improvements for each of the cases indicated above. The CAIDI index is not included in the comparison due to the fact that the system configuration has relatively little effect on the value. If there is a permanent fault where a line crew is dispatched, it will take approximately the same amount of time to fix it, regardless of the type devices used.

The examples utilizing reclosers are highlighted as reclosers are typically associated with the highest reliability improvement. Though this is generally the case, each Index/variable will be discussed.

Table 2. Percentage Reliability Improvement Summary and Expected Substation Breaker Lockouts for all Cases (Calculated)

		Case	SAIFI %IMP	SAIDI %IMP	MAIFI %IMP	Substation Breaker Lockouts
Case 1	---	Radial, substa. bkr only	Base	Base	Base	1.23
Case 2	a.	Radial, midpoint switch (ganged)	None	10	None	1.23
	b.	Radial, midpoint sectionaliser (3 ϕ)	19	19	-3	0.62
	c.	Radial, midpoint recloser	19	19	26	0.62
	d.	Radial, midpoint switches (1 ϕ)	None	14	None	1.24
	e.	Radial, midpoint recloser w/1 ϕ reclosing	31	30	43	0.63
Case 3	a.	Looped, midpoint switch (ganged), w/ tie switch	None	11	None	1.23
	b.	Looped, midpoint sectionaliser (3 ϕ) w/tie switch	19	30	-6	0.63
	c.	Looped, midpoint recloser with tie switch	19	29	26	0.62
	d.	Looped, midpoint switches (1 ϕ)	None	16	None	1.25
	e.	Looped, midpoint recloser w/1 ϕ reclosing with tie switch	31	40	43	0.63
Case 4	c.	3 Recloser auto restoration	38	38	23	0.62
	d.	3 Recloser auto restoration w/1 ϕ reclosing	50	50	39	0.63

The following is a summary of these reliability improvement results.

A. SAIFI Improvement

Switches yield no improvement in the SAIFI simply because they do not automatically segment the distribution feeder. The application of a sectionaliser or recloser at the midpoint yields a 31% improvement in SAIFI.

The sectionaliser and recloser provide the same reliability since their functionality is effectively the same for midpoint applications.

Adding a tie switch does not have any effect on SAIFI.

Automatic loop restoration improves the SAIFI due to the fact that less customers are included in outages due to the tie restoring segments of the line. In our example case, the significant improvement is seen for customers downline of the sectionalising recloser, when the fault is between the substation and the sectionalising device. The tiepoint is able to restore that segment of feeder within one minute, avoiding a SAIFI event for those customers.

Single-phase reclosing yields an approximate 12% improvement in SAIFI over three phase reclosing and is generally independent of the system configuration, be it radial, looped or automated loop. Single-phase switches, however, do not have any effect.

B. SAIDI Improvement

SAIDI constitutes the amount of time the average customer is without power over a one year period. The assumption is that a switching operation takes 60 minutes, while an automated recloser operation takes 1 minute. Essentially anything that is placed on the line, whether it is a switch, sectionaliser or recloser will improve SAIDI. As can be seen in Table 2, The effect goes up incrementally from a basic 3 phase switch (10% improvement) to a more sophisticated 3 recloser, single-phase reclosing automated loop scheme (50% improvement). In effect, the decision on which method is best, if SAIDI is the main objective, is a cost/benefit comparison. One notable item is that Case 3, utilizing single-phase reclosing at the midpoint with a basic tie switch (no automatic restoration) actually yields better SAIDI performance than a three-phase automated reclosing system. This suggests that if unless you plan to include single phase reclosing in an automated loop scheme, it may not be worthwhile in terms of SAIDI to incorporate loop schemes.

Single-phase reclosing yields an approximate 11-12% improvement in SAIDI over a comparable system with three phase reclosing.

C. MAIFI Improvement

Momentary interruptions (any interruption in service) are most effectively reduced by using reclosers. The ability to interrupt faults closer to the location of the fault instead of interrupting the whole feeder provides one of the most dramatic improvements in any of the indices discussed. If the feeder has sensitive loads near the substation (often the case on the typical feeder), it is advantageous to place a recloser beyond that segment, vs. a switch or sectionaliser.

Single-phase reclosing yields an approximate 16% improvement in MAIFI over a comparable system with three phase reclosing. This is due to the fact that for most faults, two-thirds of the customers will see no interruption in service.

D. Breaker Lockouts

In all of the cases studied, breaker lockouts are directly related to the number of sectionalisers or reclosers placed on the feeder, assuming equal distribution of customers and equal placement of devices. Though not a consideration in this paper, if the substation breaker is a single-phase capable recloser, lockouts on a customer basis can be significantly improved on a feeder. This technique is applied at many utilities today, made possible by the higher interruption capabilities of today's reclosers.

VII. Combining Devices on Systems

It is often the case that systems have more than one of the above type devices on a given system. There are instances where the system has existing equipment of a certain type that is different than new installed type. Some of these cases are covered in the above comparisons, such as the application of sectionaliser midpoints with manual switch tie points (case 3b) or recloser midpoints with switch tie points (case 3c and 3e). From the model, it is shown that the addition of a switch tie point to a feeder with either a sectionaliser or a recloser will yield a 10% SAIDI improvement. However, adding a switch to these type of systems will have no impact on SAIFI and MAIFI.

VIII. Conclusions

The models given in this paper represent a symmetric system, 10 miles long, with evenly distributed taps. In practical application for actual systems, the model can factor in more parameters, such as including portions of the feeder where faults are more frequent (more trees, for example), and can come up with recommendations for the locations of devices which may provide reliability values even better than those outlined in this paper.

All devices discussed in this paper offer an improvement in reliability. Switches will improve SAIDI. Midpoint switches also possess significant value for tie-point applications where feeder ties are possible. Sectionalisers and reclosers perform relatively closely for the various configurations except that reclosers offer more improvement for MAIFI. The highest possible across the board improvement is achieved by using single-phase reclosers and single-phase reclosing loop schemes.

Acknowledgement:

Portions of this paper are from the ABB paper "The Application of Reclosers on Future Distribution Systems" January, 1999.

Appendix F

The Market Renewal of Major Automotive Manufacturing Facilities in Traditional Automotive Communities

The Market Renewal of Major Automotive Manufacturing Facilities in Traditional Automotive Communities

August 2003

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**Automotive Communities Program
Economics and Business Group
Center for Automotive Research**

Introduction

The major vehicle producers that manufacture in North America operated no less than 330 manufacturing facilities across the continent producing vehicles, components and parts in 1997 (see Table 1). 232 of the 330 facilities were located in the United States and about 31 in Canada. Independent 1st tier component and parts supplier firms owned and operated an additional 4,356 North American manufacturing facilities in 1997 (see Table 2). About 77 percent of these facilities were located in the United States and about 11 percent in Canada (see Table 2). The vehicle firm facility number of 330 has declined marginally somewhat since 1997 especially if we still include plants operated by major "spin-off" parts firms such as Delphi, Visteon, or American Axle.¹³

Table 1: Manufacturing Facilities 1997

	Assembly	Powertrain	Stamping	Parts	Total
N. America	90	43	38	159	330
U.S.	65	30	33	104	232
Canada	13	5	3	10	31
Mexico	12	8	2	45	67

Source: The Harbour Report North America 1998, Harbour and Associates, Troy, Michigan, 1998

¹³ McAlinden, S.P.; Smith, B.S.; Cole, D.E., Future Direction of the Great Lakes Automotive Industry. 1999. The Great Lakes Commission, Ann Arbor

Table 2: Component and Parts Supplier Locations 1997

	Facilities	North American Share
Great Lakes	2,584	59.3%
U.S.	3,366	77.3%
Canada	459	10.5%
Mexico	531	12.2%
N. America	4,356	100.0%

Source: 1998 ELM Electronic Database

The closure of major traditional facilities since the mid-1990's has been almost exactly offset by the opening of new plants operated by the major international producers as well as a handful of new "Big Three" plants. Vehicle firm facilities are still the most attractive economic development targets in manufacturing. It is also true that given the intense competitive pressure of the current North American light vehicle market, almost all of these plants must be renewed with new product manufacturing investment in the next five years. Finally, given the undeniable existence of considerable overcapacity in the North American auto industry – it must be assumed that not all of these plants will be renewed – and that competition between states and communities for renewal investment will be as strong as or stronger than that in any period during the last thirty years.

The Value of Major Auto Production

Many studies of the economic value of traditional automotive production and employment to communities, states and provinces, and national economies have been published in recent years. Research by the Center for Automotive Research (CAR) performed for the Alliance of Automobile Manufacturers (AAM) in 2000 has shown that each job at a major automotive firm contributes about 6.5 other jobs throughout the rest of the U.S. economy.¹⁴ About half of these jobs are located in the manufacturing and non-manufacturing supplier sectors connected to the industry. Another recent study performed by CAR with the Institute of Labor and Industrial Relations at the University of Michigan in 2002,¹⁵ showed that each job created or lost at a powertrain (engine or

¹⁴ McAlinden, Sean P. and George A. Fulton. Contribution of the Automotive Industry to the U.S. Economy in 1998: The Nation and Its Fifty States. A Study Prepared for the Alliance of Automobile Manufacturers, Inc. and the Association of International Automobile Manufacturers, Inc. by the Center for Automotive Research, Environmental Research Institute of Michigan and the Institute of Labor and Industrial Relations, The University of Michigan, Ann Arbor, March 2001. And also see McAlinden, S. P.; Fulton, G.; and Smith, B.C. The Contribution of the International Auto Sector to the US Economy. A Study prepared for the Association of International Automobile Manufacturers, University of Michigan Transportation Research Institute, Office for the Study of Automotive Transportation and The Institute of Labor and Industrial Relations at the University of Michigan, Ann Arbor, MI, March 1998, Report No. UMTRI-98-5.

¹⁵ McAlinden, Sean P. and George A. Fulton, Economic Impact of the Elimination of the Michigan Motor Vehicle Powertrain Industry on the Michigan Economy: A Report to the Michigan Economic Development Corporation.

transmission) facility in Michigan increased or decreased employment by an additional 4.5 jobs throughout the rest of a traditional automotive state economy like Michigan. About 40 percent of these additional supplier and spin-off jobs were located in manufacturing, and the rest in sectors that include wholesale trade, trucking, finance, and retail and services trade.

The essential value of renewing a major automotive facility, of course, is connected to the employment, investment, and wage and salary levels directly associated with such plants. Currently, the production worker and skilled trades wage rates paid by vehicle firm (and major spin-off) firms are 69 percent higher than the average U.S. manufacturing wage rate. Benefits paid to employees are higher than those given in other industries by an even larger margin. Also, the international vehicle firms have exactly matched these compensation levels wherever they located throughout the United States. Company investment in these facilities is also at the highest level in the U.S. economy – over \$330,000 per job. The gain to communities and states in income, sales and property and real taxes is realistically enormous, even when such taxes are significantly abated for the purpose of renewal.

A Report on Policy

This report to the Automotive Communities Program (ACP) membership will entirely concentrate on the renewal and replacement of major, traditional automotive facilities and not those located in the independent supplier sector or facilities operated by the international vehicle firms. Those two subjects will be left to future CAR reports for the ACP. In other words, this report will concentrate on facilities owned by the “Big Three” vehicle firms and their major spin-off supplier firms. Also, this report will not closely examine two of the three major categories of factors involved in facility renewal: the internal economics of the facility and its location, and the constraints placed on the company by its national labor agreement. Instead, we will relay from the firms themselves a list of important elements of state and local community policy that frequently play a final role in the decision to re-invest in a facility. The brutal reality always exists that state and local policies can rarely affect the local business climate of a region, or its geographic location – and public policies can certainly not change the rules of a national labor agreement. However, it is the role of policy and local economic development to sometimes off-set the unfavorable parameters and emphasize the positive factors associated with a location and a region.

The Economics of Facility Renewal

The essential activity for major auto firms in ranking or picking plants for investment or closure is an exercise in cost minimization subject to constraints. All of the major automotive firms employ a standard decision matrix for collecting and analyzing information about locations – but all admit that this matrix and the decision-making

process itself is not mechanical by any means. In fact, the variety of products that must be produced actually forbids the use of a standard model and almost every selection process is largely unique. For example, a decision on a gray iron foundry plant may require access to abundant water, low expected utility rates and minimal investment, discounted over a 20 year time horizon. Two competing locations could be almost equivalent on these "show-stopper" factors, and the decision finally made on less critical factors such as marginal freight costs, relative labor settlement costs, or access to state subsidized training or refundable tax credits. Decisions on different facilities such as a new assembly body shop or the assembly line for heating and air-conditioning components may involve a completely different list of criteria. Policymakers must be thoroughly knowledgeable regarding these plant specific technical criteria in order to gauge their policy strategies for renewal.

Previous research by CAR¹⁶ has shown that the standard list of economic decision factors can be divided into one time costs or features, and recurring costs. The list is long, but the major one-time criteria include the following:

1. Availability of capacity: Will new capacity become or is it available at the existing facility or site?
2. What are the equipment requirements at the site in order to achieve the new production?
3. Is the facility large enough – are the physical characteristics of the facility suitable?
4. Are local prices for construction competitive?
5. If new land is needed – is it available—with clean title, and is it cost competitive?
6. What are the costs of a labor settlement (see below)?
7. How long will the investment process take to result in full production?

The last factor above, timing, has reached a new all-time critical importance in light of the recent pace of automotive competition and the increasing cost of product development.

The criteria listed above, of course, determine the essential size of the company's investment at the site. Recurring costs, however, may be even more important than the size of many initial investments. A classic list – which does not include public policy variables affecting the business environment – follows below:

1. The cost of freight in – or how far away are suppliers? What are local freight rates?
2. The cost of freight out – or how far away are customers? What are local rates?
3. Related to the two factors above: The constraints of local transportation and congestion.

¹⁶ See the discussion in McAlinden, S.P.; Andrea, D. J. Michigan: Still the Automotive State? A Report to the Michigan State Department of Commerce, Office for the Study of Automotive Transportation, Transportation Research Institute, University of Michigan, March, 1993, Report No. UMTRI-92-42.

4. Utility rates for electric, gas, water and sewage.
5. Labor availability, quality, skills, and reputation. Health care costs.
6. Insurance and security costs.

Most recurring private sector costs fall into the three areas of freight, labor and utility costs. Almost all other recurring costs fall into the public sector and, indeed, some of the market factors listed above can be affected by public investment. The labor issue for traditional auto producers is rarely discussed (not surprisingly), yet is absolutely critical and in several different ways. Indeed, missing from the recurring cost list of factors above is the direct cost of labor or wage rates and benefits – a major factor in supplier facility location, but not for large traditional plants.

Labor Constraints and Costs

A major set of constraints on the open selection of facilities or locations for new investment by traditional automotive firms is contained in their national agreement with the International United Autoworkers Union (UAW). It is also thought that this set of constraints gives the international producers, not subject to the union provisions, a major competitive advantage in manufacturing costs. This is somewhat untrue. The internationals have strong, systematic requirements regarding the quality of labor, the absence of other industrial competition in the local labor market, and access to quality training and educational facilities. The internationals also pay the same wage rate, and essentially the same benefits, as traditional unionized firms. These requirements are harsh and constraining, because the internationals know they can never shut a plant and leave a location without seriously damaging both their reputations as employers and their production systems. Labor constraints associated with the UAW fall naturally into two categories – those arising from the national agreement, and those in the local agreement.

The National Agreement

The pattern national agreement applies more or less equally to 312,000 General Motors, Ford, Chrysler Group of DCX, Delphi and Visteon UAW employees. American Axle and several other spin-off companies are also committed to the same pattern agreement. The agreement contains a number of income maintenance benefits and worker displacement provisions that can directly determine much of the cost of company disinvestment in a facility. The UAW expressly negotiated these provisions, it is thought, to actually prevent the closing of plants (forcing their renewal) and, indeed, did negotiate a plant closing moratorium of remarkable effectiveness (compared to those previously negotiated) in the 1999 pattern agreement. No Big Three plants have closed since September 1999, except several plants previously announced to close in earlier national negotiations. However, this pattern is clearly under pressure from all three major employers in the current negotiation where large shutdowns are typically negotiated as “exclusions” to the plant closing moratorium agreement.

The UAW protects its members (and indirectly some of their facilities) through its income maintenance provisions in the contract that apply in the event of layoff. Workers on layoff are eligible for Supplementary Unemployment Benefits (SUB) at a rate of 95 percent of normal take-home-pay for forty two weeks in the event of layoff. If the layoff is not purely a sales or market related layoff, the worker must be brought back into protected status after 42 weeks at 100 percent of their gross pay plus full benefits and seniority privileges. Many billions of dollars have been explicitly guaranteed in the contract to back these two income maintenance funds. No pattern automotive firm can afford to exhaust these funds through layoffs (thus much of the rationale behind the incentive programs for car sales).

If a pattern company closes a plant, laid off workers must accept another job within a fifty mile radius (sometimes up to 100 miles) local area hiring area. Otherwise, workers can refuse job openings at distant plants and continue to receive the income maintenance benefits described above. If a worker does accept a long distance transfer, the contract and other special local provisions can result in a relocation allowance of up to \$62,000 over two years. Also, workers that have experienced a plant shutdown that involves the movement of their product to another plant – can move with full local seniority rights to the new plant and bump an existing worker into layoff (Paragraph 96). Finally, the UAW also reserves hiring at new facilities or new hiring generally for their existing layoffs by seniority¹⁷.

The impact on facilities of the local area hiring rules of the job and income security provisions in the UAW pattern agreement has been largely negative for regions that contain a large number of UAW facilities. Laid off workers from a plant shutdown in Michigan, and the Northern Regions of Indiana and Ohio can frequently be forced to accept a job opening (due to attrition) at a nearby facility almost immediately and without cost to the company. Isolated and distant plant locations raise the specter of enormous labor settlement costs (amounting to hundreds of millions of dollars) in the case of non-renewal. The most traditional of automotive communities with many company plants, then, have suffered the largest share of closures for this very reason.

Communities, however, that rely solely on the layoff provisions of the national agreement as their only security for re-investment are running a serious current risk. Companies have become very adept at buying out workers for the purposes of early retirement or transfer, and a number of remaining Northeast and coastal locations now demonstrate and have demonstrated so many other serious location costs that companies will soon pay the high settlement cost to close them.

Local Labor Constraints

Each traditional automotive facility operates its labor relations according to a local labor agreement negotiated by plant management with officials of the local labor union in the plant. The agreement sets employment levels, the number of job classifications, and

¹⁷ See for example, Appendix A. Agreement Between General Motors Corporation and the UAW, September 28, 1999.

various other local working conditions not covered by the national agreement. Direct representation of workers on the job, especially through the grievance process, is the responsibility of the local union. In other words, actual labor productivity is really determined under provisions of the local, not the national, agreement.

It is now an accepted fact that all traditional automotive firms require, or will soon require, a "modern operating agreement" from the local union as part of any renewal or re-investment plan. These agreements are more notoriously called "living or shelf" agreements which go a long way towards guaranteed productivity conditions in the plant similar to the best of the international vehicle firms. Such contracts typically require a team concept organization of work, very lean staffing requirements, and a severe reduction of skilled trades classifications in the labor force (perhaps only three trades). The agreements also allow a great deal of flexibility in reassigning workers to work throughout the plant, and perhaps the outsourcing of subassembly and construction work to outside suppliers.

Other local labor indicators that play a role in plant renewal include the general state of labor relations, strike behavior, grievance rates, and absenteeism rates of a labor force. Finally, the age and seniority demographics of a given facility may now play an active role in renewal. Plants with older labor forces are cheaper to close than those lucky enough in the recent past to replace many of their retiring workers with new hires.

In summary – labor constraints are a powerful factor in traditional automotive facility renewal. Three of the four firms whose interview responses we discuss below, ascribed a "total power to veto" to the directors of their industrial relations departments of their firms. This veto power can even reverse decisions made by executives as high in status as the CEO or the VP of manufacturing.

The Role of State and Community Policy and Relations

The domestic automobile industry has shut down over 100 major facilities operated in the United States, since 1979. Still operating are approximately 130 plants plus 58 new greenfield plants that survived, presumably, because of their efficiency or strategic value to the parent companies. (see Appendix A) In other words, the less competitive plants/locations have already been closed. Thus, the surviving plants, when compared against each other, are somewhat similar in efficiency, which makes it difficult for the companies to decide where to place new capital expenditures. For this reason, state and local incentives have taken on heightened importance.

It seems that the policy environment for facility renewal begins where the private sector variables leave off. On the other hand, some of the private sector economic variables such as the cost of land or even the utility rate structure can be modified by direct state policy intervention. Other business climate variables such as corporate income taxes, the cost of workman's compensation and unemployment insurance benefits are also direct state policy variables. Also, the strength of a local and state incentive package may prove to be the final determining factor in selection of a facility and its community—

all other factors being equal. Of greatest interest to the ACP, however, is the joint role of the state and the community in formulating and laying the public groundwork for a deal that brings about re-investment or even investment in a brand new facility.

CAR interviewed four major automotive firms primarily for this section of the report: **General Motors, Ford Motor Company, DaimlerChrysler, and Delphi**. Typically, the Director of State and Local Relations from the corporate policy division responded to a prepared list of questions. In several cases, a representative from the real estate or land division also participated significantly in the interview. However, we will not identify the authorship of any of the responses we report below, nor will we identify any of the communities or facilities that may have been used as examples to make certain points in the discussion by our respondents. The questionnaire is attached to this report (see Appendix B).

Who Makes the Decision?

Several of the firms described the actual final meeting regarding the placement of a large new manufacturing investment. The final decision is made in a meeting of a small number of senior executives (always vice presidents) at the division or corporate level. Each participating function including manufacturing, operations, utility cost management, facilities management, labor relations, real estate, legal staff, and policy have already submitted their reports to these company officers who must make the final balancing decision between two or three final alternative locations. They commonly do this alone in a separate room, although other parties may be asked to enter and provide additional information. The senior divisional manager, the VP of Manufacturing, and perhaps the facilities VP seem to constitute a typical final decision group. It seems apparent that it is only the policy staff who may be asked to seek additional "sweeteners" or information to swing the decision one direction or another in the case of a close tie.

Interview results

The corporate staff members interviewed for this report were asked to respond to a series of written questions on the factors that play a primary role in the renewal of automotive facilities. We collect these responses under the four major categories below. Responses were sometimes received in writing and always through a personal interview. These executives and managers were asked to especially comment on community factors balanced against other economic determinants. What follows is a summary of these interviews followed by general conclusions and recommendations.

1. *What are the three main factors your company considers internally in the site selection process? (Before the consideration of specific communities)*

All four companies and most of the respondents demonstrated a remarkable consensus on at least two of the three main internal factors in the site selection process. **Logistics**

or the cost of transporting freight in and completed product out of the facility was strongly emphasized by each firm as a main factor in selection. Freight is regarded as especially costly, and though it was sometimes referred to as "an underlying cost," it was also clearly connected to other local transportation costs such as the state of transportation modes or infrastructure and the presence of congestion (a real deal-killer).

All four companies strongly mention the **workforce** as a second main factor. Under the contract, union workers must be available at the facility or through sufficient transfers of such workers from other locations. The quality and training of the labor force must be adequate, as must be the state of local labor relations. A "partnership must exist with the local union for the purpose of securing the next generation of new products in an era of severe over-capacity." One firm stated that "every plant is expendable for new investment and the partnership must be there – the labor relations must be set." Clearly these statements refer to necessity of achieving a modern operating agreement (described above) with the local union leadership and labor force, that provides required flexibility and productivity levels.

Leading the list of the remaining, non-community factors in site selection is "**the state of the relationship with state government.**" The state's policy and regulatory climate must be competitive on such issues as tax rates, the regulatory environment and, of course, state incentives. In fact, all four responding firms made a clear point of stating the "incentives have never been more important," or "critical (see below)." This clearly refers to the severe competitive state of the North American market that now suffers from record vehicle incentive levels and massive, formal cost-cutting programs at each producer.

State programs, especially tax programs, are very difficult to compare. New York, it was pointed out, "doesn't even tax personal property." The process for setting rules across states, then, is very difficult for corporate decision-makers. It should be pointed out that states with regulatory environments that are burdensome, costly and inflexible such as Massachusetts, Eastern New York, and California (and soon, New Jersey) now contain exactly one automotive plant (NUMMI). The **timely launch** of products, specifically the "construction timetables," is now **the most competitive factor** in the North American auto industry. In fact, one vehicle firm admitted to filing permit applications in a least three states for each project in order to ensure the timely start of a project.

Other non-community factors that were given heavy attention in some of the interviews included utility rates and services, and a variety of factors, such as construction building and leasing costs, under the heading of **site readiness and infrastructure**. This last factor covers the issue of capacity, both in terms of land and the facility. Infrastructure should "already exist" and further land acquisition should not be an issue. Permits should be "available" and existing environmental issues should not be present at the site (we want "fresh, clean dirt"). One vehicle firm stated that a site must be "buildable," and another said that "if we can't build it right, why build it?"

2. *What are the three main community factors in choosing a site?*

The subject of community factors in site selection proved to be the liveliest in the interviews, perhaps because the majority of respondents were most familiar with these issues in the normal course of their work. An initial factor is the **quality of life** associated with a particular community. One respondent simply states that the factors were safety (crime), education, and other quality of life amenities. In fact, quality of life, when compared to other issues that surfaced in the other interviews discussed below, did not clearly stand above the other factors that were discussed.

The overwhelming community specific factors that surfaced in our interviews were the overall **attitude** of the community towards the company and the proposed re-investment, and the presence in the process of a clearly identifiable **decision-maker** with sufficient power to make the deal happen. To a certain extent, the pre-existing reputation of a community stands for its attitude. A poor reputation for being a difficult community was described as "very difficult to shake." One community south of Detroit recently elected a mayor that described the economic package given to an assembly plant as "giving the store away," which caused months of significant political problems for the corporation. Years may pass before the company may grant forgiveness to the community. Another company succinctly divided its communities into three types:

1. "Those that act together as one entity. They have the energy to get the deal completed. They know what is going on at their plant, and they know what is going on in the industry.
2. Communities that have the energy to get the deal done, but have no idea what's going on at their plant or in the industry.
3. Communities (that flat out) don't care (The entire Northeast)."

Needless to say, the third type of community described above rarely has its plant renewed (e.g., GM Framingham, MA, or GM Tareytown and Syracuse, NY). Instead, a "can do attitude" or "approach" is recommended. And a complex decision process for approval that "drags a process on-and-on" is certainly not recommended. Some companies apparently early on, apply a "smell test" on the willingness of a community to do a deal, partially based on past performance. Too many meetings with high-level corporate officers (always very expensive) is a poor indicator, always, of community willingness to do what is necessary to keep a plant.

In particular, a community must demonstrate that it wants to keep a plant and a company. The community must want to partner as much as the local union. The political/community climate must be favorable – "you don't want to go where you aren't wanted." A neighborhood that has gentrified and doesn't care for the supposed "smell" of its automotive plant is a community that doesn't want an automotive plant.

Community relations can become very important to a company, especially since the state incentive package very often depends on community support.

The importance of community support underlines the importance of a **friendly, meaningful, and committed community leadership**. One vehicle firm admits that in negotiation, they try to pick "where the center of power is," but there are "different levels of power." Another vehicle firm eloquently described the power and effectiveness of a **regional champion** – or political figures that their executives recognize who are fully cognizant of industry issues and requirements and who can make it happen. Yet another vehicle firm described such an individual as an "**empowered deal-maker**," or "a single voice who can speak for the community's leadership, for 'the community must speak with one voice.'" Mayors such as those in Lansing and Toledo were such individuals.

Incentive Packages

3. Does the company value incentives based on their direct effect on the bottom line?

Respondents were adamant about the importance of **effective incentives**: "every dollar helps." One respondent directly said that "we look at the incentive's ability to contribute to making the financial business case for an investment at the particular site." Another said that that "packages must go to the bloodstream – the bottom line – where the most benefit to the company is. What will reduce the price of manufacturing an engine?" Of course the incentive environment is largely determined by the state. And clearly, not all incentives are equal in the eyes of the corporation. All-in-all, however, the value of the total package is what matters – especially to the divisional, project staff assigned to net the entire deal.

An important issue is the relative value of various incentives. All of the companies denigrated the value of non-refundable tax incentives that may provide the company, in the end, with virtually nothing. Some company investments, for example, may last for only four or five years (body shops at assembly plants). A twenty-year tax abatement on new personal property investment, then, is only useful for the first five or six years or so. This may or may not reveal the relative industry ignorance of the tax authorities regarding the current speed of the industry product cycle. Another major issue is the value of tax incentives that are directed towards job retention versus new job creation. The Michigan MEGA and Super-MEGA programs are held up by all four firms as model of job retention since only the presence of likely alternatives triggers qualification. Also, super-MEGA now carries an upper limit of \$250 million in payroll taxes and is highly valued by at least three of the four firms.

Property tax abatements are currently less valued in final site decisions because it is felt that such subsidies will be matched across all the alternative sites – and some states do not even carry such taxes. However, the passage of "Proposal A" in Michigan in the

early 1990s was considered epochal for deals done in that state since it removed local school districts from the picture (their funding now guaranteed directly from the state). This made the process of abating property taxes much easier. "Clawback" provisions in public deals, or provisions that mandate the payback of tax breaks if promised new employment doesn't appear or employment levels aren't maintained can result in a severe discounting of the value of tax incentives with this provision. Finally, southern states were described by three of the companies as entirely oriented to new job creation and as providing little in the way of job retention incentives. These companies are primarily interested in incentives for job retention perhaps due to labor contract requirements.

Only one firm rates subsidies that provide new public infrastructure as important in a deal. The other firms clearly felt the infrastructure should already exist or such subsidies merely make up for glaring deficiencies. Communities should already maintain a portfolio of prepared sites with road, rail access, and cheap, reliable power, sewage and water at the property line. Communities, of course, must participate in development of state incentives that do matter or they won't happen. Very often, the ground-work for a deal with the community is performed by the policy staff of the company before the state becomes involved.

4. What can communities do to attract automotive investment?

One responding firm simply states that a community should simply demonstrate good-behavior and a business-friendly attitude. Coalitions of all of the stakeholders (schools and political groups) are impressive when such broad-based groups express their desire to maintain the company in the community. Another vehicle firm was far more specific on the issues of political leadership and community attitudes. This company felt that many communities were trying to compete but were stuck with leaders that lacked the ability to do so. A necessary but not sufficient requirement, was the presence of real **economic development expertise** – usually placed in the staff of a "big-league" growth alliance of communities across a region. Leadership must understand "the big picture of the global business, and to be able to effectively communicate this reality to the community." There should also be one voice for the community, or even better, the entire region.

It was also interesting to note that three of the companies recommend that individual communities not be pro-active in contacting the higher echelons of the company – they should instead work normally through the local plant manager who now must cover economic development as part of his/her mission. Surprisingly, two of the firms thought a large number of traditional communities were still "naive" regarding the continued presence of the company in their area. The company is thought to be a fixed part of the economy and that it "has" to or "always will be there." This was thought to be clearly a demonstration of poor leadership and communication, and/or a lack of industry knowledge.

The firms interviewed were mixed in their responses to building on brownfield sites—due mainly to their technical cultures. In any case, the site should be buildable with all mitigation issues already resolved.

Recommendations and Conclusions

Recommendations to communities are difficult to make because of the diversity of these public entities and the variety of company investments that confront the upper mid-west.

1. It is strongly recommended that every traditional automotive community solidly connect to a representative **regional champion** - a politician that can make solid offers to major automotive firms, understands thoroughly industry issues and deliver without question on bottom-line promises. A regional champion forges partnerships across community stakeholders and delivers this consensus to company managers as a solid asset. Such an individual leader is indeed rare, and this requirement can be largely unfair, especially for smaller communities – but it is necessary.
2. States outside of Michigan should provide tax incentives similar to the model provided by the **MEGA** program in Michigan, or refundable credits that emphasize job retention.
3. States and communities should also make available incentives that lower the actual cost of operation of the plant in their community; and they should **eliminate claw-backs** from their tax incentives; and concentrate on **refundable tax credits** that exactly match the market-life of company investments.
4. Community and state representatives must thoroughly understand industry issues and solid technical expertise in economic development must be available at least in multi-community growth alliances. Some community representative(s) must become familiar with facility personnel and its business situation through frequent contact.
5. Communities and states must demonstrate that the company and its facility is wanted, long-term, in the community. Negative feedback or displays, or even general lack of concern are to be avoided at all costs. In other words, the community is a supplier, not a landlord, and must act like any other competitive automotive supplier who wishes to do business in the North American auto industry.

Appendix A

Table A.1
Vehicle Firm Facilities in the United States: 1979 - 1995

	Total					% of 1995 Total	Total					% of 1979 Total
	1995						1979					
	Assembly	Powertrain	Stamping	Parts	Facilitie s		Assembly	Powertrain	Stamping	Parts	Facilitie s	
U.S. Totals	63	30	24	104	221	100%	72	25	37	124	258	100%
Southeast	3	0	0	9	12	5%	5	0	0	7	12	5%
Southwest	4	0	0	6	10	5%	2	0	0	5	7	3%
Northeast	6	2	2	9	19	9%	11	1	2	16	30	12%
Midwest	35	25	22	74	156	71%	34	24	35	93	186	72%
Midsouth	13	3	0	1	17	8%	13	0	0	1	14	5%
West	2	0	0	3	5	2%	7	0	0	2	9	3%

Table A.2
Vehicle Firm Facility Openings and Closings in the United States

	Assembly			Powertrain			Stamping			Parts			Total		
	Open	Close	Net	Open	Close	Net	Open	Close	Net	Open	Close	Net	Open	Close	Net
U.S. Totals	23	32	-9	12	7	5	0	13	-13	23	43	-20	58	95	-37
Southeast	0	2	-2	0	0	0	0	0	0	4	2	2	4	4	0
Southwest	2	0	2	0	0	0	0	0	0	2	1	1	4	1	3
Northeast	1	6	-5	1	0	1	0	0	0	0	7	-7	2	13	-11
Midwest	12	11	1	8	7	1	0	13	-13	14	33	-19	34	64	-30
Midsouth	6	6	0	3	0	3	0	0	0	0	0	0	9	6	3
West	2	7	-5	0	0	0	0	0	0	1	0	1	3	7	-4

Source: Motor Vehicle Manufacturers Association of the United States, Association of International Automotive Manufacturers.

Vehicle Producer Facility Regions

<u>Region</u>	<u>States:</u>
Southeast	Alabama, Georgia, Mississippi, Virginia
Southwest	Kansas, Louisiana, Oklahoma, Texas
Northeast	Connecticut, Delaware, Massachusetts, Maryland, New Jersey, New York, Pennsylvania
Midwest (Great Lakes)	Illinois, Indiana, Iowa, Michigan, Minnesota, Ohio, Wisconsin
Midsouth	Kentucky, Missouri, Tennessee
West	California

Appendix B

Market Renewal Interview Questionnaire

1. What are the 3 main factors *[company name]* considers internally in the site selection process? (This is before looking at any communities)
2. What are the typical phases of a site selection process and who (title at *[company name]*) is involved in each phase?
3. What are the 3 main community factors in choosing a site?
4. How important are the following:
 - a. Local tax rates?
 - b. Regulatory environment? (e.g. environmental permits)
 - c. Political climate?
5. Does *[company name]* value incentives differently based on their direct effect on the bottom line?
 - a. How do you value incentives that benefit both the company and community, such as infrastructure improvements?
6. Thinking about incentive packages, what makes them attractive?
 - a. Total package amount? or,
 - b. Specific items in the package? What are examples of these?
7. How does *[company name]* choose between communities with two very similar incentive packages?
8. Does *[company name]* have an operating cost calculating tool that can be used to compare the costs of running a plant in various communities? If not, how do you compare these costs between communities?
9. Are incentive packages really the deal-breaker, or do they just get the communities to the table, with something else clinching the deal?
10. What can/should communities do to attract automakers?
11. Are there distinct regional differences in sites and incentive packages that communities offer? (e.g. Midwest versus Southern sites)
12. What about brownfield redevelopment versus greenfield development? Is one type preferred over the other?
13. Is there anything else we haven't asked, but we should know, about the site selection process?

Appendix G

Various letters of concern from large users

- Email dated February 8, 2005 – Mr. Bryan Sellan, Daimler Chrysler
- Email dated January 31, 2005 – Mr. Gordon Hauk, Ford Motor Company
- Letter dated February 24, 2003 – Mr. Robert Simpson, Kautex Textron
- Letter dated July 15, 2004 – Mr. John Bogdanovic, Windsor Mold
- Email dated February 1, 2005 – Listing of customer power quality complaints

Tom A Kosnik

01/31/2005 02:42 PM

To: Shawn C Filice/EWP/Windsor@WINDSOR

cc:

Subject: RE: Information Required - EnWin Powerlines

FYI

Tom Kosnik MASc., P.Eng.

President

EnWin Powerlines

519-251-7304

tkosnik@enwinpowerlines.com

----- Forwarded by Tom A Kosnik/EWP/Windsor on 2005-01-31 02:42 PM -----



"Hauk, Gordon \G.D.\"

<ghauk@ford.com>

2005-01-31 10:37 AM

To: <tkosnik@enwinpowerlines.com>

cc:

Subject: RE: Information Required - EnWin Powerlines

We don't have anything that formal. When a new project is anticipated a note is sent out requesting projected rates and if capacity is in place. My response to that note includes a history of service (outages). Based on all the input management makes a siting decision.

-----Original Message-----

From: tkosnik@enwinpowerlines.com [mailto:tkosnik@enwinpowerlines.com]

Sent: Friday, January 28, 2005 8:54 AM

To: Hauk, Gordon (G.D.)

Subject: RE: Information Required - EnWin Powerlines

Does Ford use a spread sheet that would highlight how much weighting it puts on power quality at a site that is being evaluated or based on the information below it is a go or no go to the next step in site evaluation?

Tom Kosnik MASc., P.Eng.

President

EnWin Powerlines

519-251-7304

tkosnik@enwinpowerlines.com

"Hauk, Gordon \G.D.\" <ghauk@ford.com>

2005-01-28 08:47 AM

To: <tkosnik@enwinpowerlines.com>

cc:

Subject: RE: Information Required - EnWin Powerlines

It will take some time to pull together data but here is the bottom line. Quality of supply has to come first, we can not expand in an area where power is not reliable regardless of price of electricity. What proof do I have on this? I can only point to the amount of investment we have made in two line feed to the plants and discussions we have with every utility before we decide on a location. What is reliable? We have set an internal

target of one outage every two years if we see more than that we need to have discussions with the utility to see if there is any commonality in the outages, is there anything that needs attention. The one outage in two years has some science behind it, according to EPRI that is the number of expected outages on a 5 mile long high voltage transmission line.

I have to think about what documentation to send, I could send some historical information on outage reductions or the amount of investment in the service Ford and the utilities serving us have made in recent years. If you have any ideas let me know.

-----Original Message-----

From: tkosnik@enwinpowerlines.com [mailto:tkosnik@enwinpowerlines.com]

Sent: Friday, January 28, 2005 8:13 AM

To: Hauk, Gordon (G.D.)

Subject: Information Required - EnWin Powerlines

Good morning Gord, I hope everything is going well!

We have been working on a report to the Board of Directors on Distribution System reliability. One of the arguments that must be addressed is how much weighting does Ford(or any other manufacturer) put on the issue of power quality in the decision making process when 1) maintaining and expanding the existing operation, and 2) when deciding on the location of a new plant. What are there basic minimum outage requirements for a plant to remain operational in the Ford family. I realize depending on the product line and the type of plant (assembly or feeder) will have an effect on the requirements.

Gord, any documented information on this subject would be greatly appreciated and may go a long way in the future to insure that the City of Windsor remains competitive in attracting and maintaining a vibrant auto industry now and in the future. I have a tight time line on this report and I would appreciate the information asap. Thanks in advance.

Tom Kosnik MASc., P.Eng.
President
EnWin Powerlines
519-251-7304
tkosnik@enwinpowerlines.com

Tom A Kosnik
02/08/2005 01:32 PM

To: Shawn C Filice/EWP/Windsor@WINDSOR
CC:
Subject: Re: Fw: Information Required: EnWin

Please include in your report
Tom Kosnik MASc., P.Eng.
President
EnWin Powerlines
519-251-7304
tkosnik@enwinpowerlines.com

----- Forwarded by Tom A Kosnik/EWP/Windsor on 2005-02-08 01:32 PM -----



bs17@daimlerchrysler.com
2005-02-08 08:29 AM

To: jlm1@daimlerchrysler.com, tkosnik@enwinpowerlines.com
CC:
Subject: Re: Fw: Information Required: EnWin

In response to this there is no set requirements on paper. DaimlerChrysler requests an occurrence or power quality report for electrical service to a potential site. They use this information to determine what type of power interruption ride through equipment would be necessary for the proposed plant. The cost of this equipment is considered in location of the plant along with the many other considerations. Assembly plants and machining plants are more sensitive to power quality than a stamping plant would be. There is no formal process or standard in place at DCX for this review.

The Building Group requests the same power quality report on the electrical supply for a site for building design purposes. This is usually after the site has been selected. It does not appear that they participate formally in the site selection process.

I hope this is helpful.

Bryan Sellan
Facility Engineering

Lucille M Laviolette/WGOB/DCC/DCX

01/31/2005 10:33 AM

To: Bryan Sellan/WGOB/DCC/DCX@wk-America
CC: john@themanns.ca
Subject: Fw: Information Required: EnWin

Bryan,

John will be out of the office all week. I'm not sure if you should see this in his absence.

Lucille

----- Forwarded by Lucille M Laviolette/WGOB/DCC/DCX on 01/31/2005 10:32 AM -----

Lucille M Laviolette/WGOB/DCC/DCX

01/28/2005 10:41 AM

To john@themanns.ca

cc

Subject Fw: Information Required: EnWin

John,

Please see the following. Shall I forward to Bryan Sellan?

Lucille

----- Forwarded by Lucille M Laviolette/WGOB/DCC/DCX on 01/28/2005 10:40 AM -----

tkosnik@enwinpowerlines.com

01/28/2005 08:39 AM

To jlm1@daimlerchrysler.com

cc

Subject Information Required: EnWin

Good morning John, I hope everything is going well!

We have been working on a report to the Board of Directors on Distribution System reliability. One of the arguments that must be addressed is how much weighting does Daimler Chrysler(or any other manufacturer) put on the issue of power quality in the decision making process when 1) maintaining and expanding the existing operation, and 2) when deciding on the location of a new plant. What are there basic minimum outage requirements for a plant to remain operational in the Daimler family. I realize depending on the product line and the type of plant (assembly or feeder) will have an effect on the requirements.

John, any documented information on this subject would be greatly appreciated and may go a long way in the future to insure that the City of Windsor remains competitive in attracting and maintaining a vibrant

auto industry now and in the future. I have a tight time line on this report and I would appreciate the information asap. Thanks in advance.

Tom Kosnik MASc., P.Eng.
President
EnWin Powerlines
519-251-7304
tkosnik@enwinpowerlines.com



KAUTEX TEXTRON, NORTH AMERICA
SUBSIDIARY OF TEXTRON AUTOMOTIVE

750 STEPHENSON HIGHWAY
TROY, MICHIGAN 48063

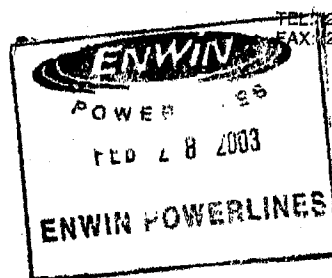
TEL: (248) 616-5100
FAX: (248) 616-5395

February 24, 2003

EnWin Powerlines Ltd.
4545 Rhodes Drive
Windsor ON N8W 5T1

Attention: Klaas DeGroot, President

Dear Mr. DeGroot:



**Re: Reliability of EnWin Electricity Distribution Service to
Kautex Textron's Windsor Plant**

I am the President of North American Operations for Kautex Textron GmbH & Co. ("Kautex"), a world leader in the automotive and packaging industries. Kautex is a division of Textron Inc., multi-industry company with revenues of \$12 billion; 51,000 employees; and a diverse, global customer base. Familiar Textron brand names include Bell Helicopter, Cessna Aircraft and E-Z GO Golf Cars.

Kautex is a leading manufacturer of plastic fuel tank systems, automatic clear vision systems, blow-molded functional components, modular fluid management systems and fuel filler assemblies. Kautex has over 4,800 employees in 31 locations in 16 countries. Five of those locations are in North America. Since 1986, Kautex has had a plant in Windsor, Ontario, located at 2701 Kautex Drive. That plant employs 502 Windsor and area residents, and manufactures fuel system components, including blowmolded plastic gas tanks, for the North American automotive industry.

As with most members of the automotive industry, and many of EnWin's customers, Kautex uses highly automated manufacturing processes. A reliable supply of electricity is essential to Kautex's operations, as outages cause significant downtime for the plant resulting from the need to reset equipment and restart those processes, as well as losses attributable to reduced output, ruined product and wasted material. In recent years, Kautex has viewed with growing concern the lack of reliability of electricity delivery to its Windsor plant. In the four-month period between July and October of last year alone, Kautex experienced nine outages on the following days:

17 July 2002
18 July 2002
21 July 2002
22 July 2002
13 September 2002
16 September 2002
28 September 2002
21 October 2002 (2 outages)

This would likely not be acceptable to any of your electricity distribution customers – it is particularly unacceptable for a modern manufacturing facility. Close to three years ago, in July and August of 2000, we met with EnWin representatives to discuss your excessive outages. At that time, your representatives advised that Kautex was the only company in the EnWin service area experiencing interruptions with this frequency. EnWin installed some lightning protection, but the outages continued. We met with your staff in early October of 2002 to discuss the frequent outages in the preceding months. That meeting was followed by more outages.

We met again late last year with Mayor Hurst of Windsor, who assured us that EnWin would try to avoid further voltage fluctuations. EnWin shared with us the cost of a study to determine whether there were measures that could be taken with Kautex's plant and equipment to increase our resistance to voltage fluctuations. We appreciate EnWin's participation in that study, and we anticipate implementing some of its recommendations. However, the majority of the outages mentioned above would not have been prevented by work on Kautex's equipment, nor would they have been prevented even if Kautex were to install its own on-site back-up generation.

Another particularly damaging example of EnWin's ongoing reliability problems occurred at approximately 4:00 a.m. on Saturday, February 1, 2003. Kautex and, we understand, a number of EnWin's other industrial customers, suffered a complete loss of power. EnWin staff have suggested that it may have been the result of a burnt conductor at one of your substations. In our case, the outage lasted for four minutes, but the impact of the outage was significant. Among the consequences of EnWin's outage were the following:

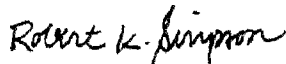
- Kautex's plastic extruders "froze", leaving molten plastic hardening in them (the Kautex plant was in full operation at the time). This necessitated the cleaning of the extruders. Plastic being processed by the extruders had to be scrapped.
- As noted above, Kautex's facilities and processes are highly automated, although this is not unusual among EnWin's industrial customers given the level of automotive manufacturing that takes place in Windsor. As a result of your outage, we had to reboot and "re-home" all of our robotic equipment, as the outage effectively wiped out the robots' memory.
- Kautex's plant was not fully back in operation until Monday, February 3, 2003.
- Because parts are supplied to the automotive industry on a "just-in-time" basis, Kautex was forced to increase its production and ship its product on an expedited basis, at significantly higher cost, to meet its delivery commitments to automobile manufacturers, failing which, they would have had to curtail or suspend their own production. In one case, Kautex had to fly gas tanks to one auto manufacturer's plant in the United States in order to meet that manufacturer's production schedule and enable it to keep its plant running.

- Kautex's estimate of the costs arising out of your outage is over \$160,000.00 in lost production hours, wasted materials and additional shipping costs.

We are extremely concerned that electricity delivery to our Windsor plant in recent years has been less reliable than the electricity delivery to any of Kautex's other North American facilities, in Avilla, Indiana; Wilmington, Ohio; Lavonia, Georgia; or Puebla, Mexico. This is entirely unacceptable. We understand that the Ontario Energy Board's Distribution System Code requires you to "maintain [your] distribution system in accordance with good utility practice and performance standards to ensure reliability and quality of electricity service, on both a short-term and a long-term basis." You must inspect your system and address any defects that you discover during your inspections, within a reasonable length of time. We also understand that EnWin is required to file data on various service quality indices with the Ontario Energy Board on a monthly basis.

We request that you immediately investigate this matter, and advise us as you how EnWin intends to eliminate its service interruptions and provide and maintain reliable electricity delivery service to Kautex. Please contact Daniel Mills, Vice President of Operations, at our Windsor plant, should you require further information regarding Kautex and its operations. If we have not received a response from you within two weeks of the date of this letter, or if your proposed remedial plan is not satisfactory, we may have little choice but to pursue this matter with the Ontario Energy Board and/or the Minister of Energy.

Yours very truly,



Robert Simpson

Windsor Mold, Malden

4035 Malden Road
Windsor, ON N9C 2G4
519-972-9032 Tel
519-972-0510 Fax

Contacts:

Greg Mahoney, General Manager, gmahoney@windsormoldgroup.com
Joe Dumouchelle, Technical Automation Manager, jdumouchelle@windsormoldgroup.com
John Bogdanovic, Maintenance Supervisor, jbogdanovic@windsormoldgroup.com

Windsor Mold, Durham

1628 Durham Place
Windsor, ON N8W 2Z8
519-258-7300 Tel
519-258-0852 Fax

ENWIN Utilities Ltd.

787 Ouellette Avenue
P.O. Box 1625
Station A
Windsor, Ontario
N9A 5T7

Contact: Tom Kosnik

Thursday, July 15, 2004

Request for monitoring solution of supplied power

Error Message/Condition is: Multiple and simultaneous electrical related failures within the above mentioned plants.

To Whom It May Concern:

We are requesting your assistance in trying to identify potential root causes of equipment failures in our manufacturing facilities. While equipment failure occurs under normal operating circumstances we have noted that in the last two months a rash of simultaneous and unexplained equipment failures. We unfortunately cannot identify exact dates and times but for this exercise we will approximate the dates. Understand we are not considering issues during inclement weather conditions.

Malden Issues

Friday July 9, 2004 in the AM hours we experienced multiple hardware failures and various pieces of computer and related equipment at the same time. Weather was a non-issue at this time. Equipment included two computer keyboards and one PC (Personal Computer) based power supply. These computers are located in different areas of the building on different branch circuits. The PC power supply is for a PC based control for a CMM (Coordinate Measuring Machine). We are still experiencing drifting of this machines axis during the nighttime hours which is yet unresolved. These axis's motions are controlled by 12 volts supply on a handheld control, and when the supplied power fluctuates it causes movement in the machine. This machine while monitored during the day does not exhibit this condition.

Friday May 21, 2004 in AM hours we experienced simultaneous equipment failures on three different pieces of equipment on the same branch circuit. That circuit is for the machine bay at Malden. Two large boring mills called the G&L and Kuraki, and the large crane in that bay were affected. The G&L lost a power supply for one of the axis drives. The Kuraki blew a chip on one of the control circuit boards. The large crane had lost its drive parameters. The service technician for the crane offered no explanation as to why this could have happened.

Intermittent failures;

Month of June 2004. We installed a motor drive for a movable Chip Bin Roof. It intermittently was failing causing the motors to oscillate and as such they were not able to perform the function designed. It was identified by the manufacturer that the fluctuation of supplied power was the root cause. They have replaced that motor drive with a new unit that addresses this condition and we have not observed the problem since.

We have observed UPS (Un-interruptible Power Supplies) and line conditioners throughout the plant engaging as required to address voltage fluctuations.

During these minor fluctuations we have one large CNC Milling Machine called the Parpas BF-200 that will lose its position causing a stop for error condition. This machine is sensitive to power fluctuations and as a result it is a good indicator of potential problems to come.

Months of June and July 2004, we have a High Speed CNC machine called the OMV. It has suffered intermittent failures in the graphical display (LCD Screen). We were unable to duplicate the problem during these months, and had outside service people in during these times. The condition would correct itself and we were unable to identify what exactly the issue was. Recently the LCD screen became damaged due to an electrical failure in the power supply. Note this power supply converts the AC 110V source to 12VDC. We cannot identify root cause on this situation but when we consider all other occurrences of late supplied power must be considered.

Durham Issues

Week of June 22, 2004, the Durham plant experienced a brown out causing most of our equipment drives and breakers to trip. One of our wall mounted transformers started to smoke during the brown out.

We have provided this information only to demonstrate that there do currently exist conditions we consider being outside the norm. As such we would appreciate a monitoring solution of our supplied power. We would encourage any technical expertise and assistance to help us identify a possible root cause.

Sincerely

John Bogdanovic

November 22, 2004

Mr. John Bogdanovic
Maintenance Supervisor
Windsor Mold, Malden
4035 Malden Road
Windsor, ON N9C 2G4

Re: Request for monitoring solution of supplied power

Dear John:

We have received your letter issued on July 15, 2004 regarding Monitoring Solution of Supplied Power.

The major concerns indicated in your letter are

1. Voltage fluctuations in Malden plant.
2. Failure of multiple hardware and PC power supply in Malden plant.
3. Week of June 22, 2004, the Durham plant experienced a brown out causing most of our equipment drives and breakers to trip.

To understand the power supply quality to your plants, ENWIN has installed power quality monitors in both Malden and Durham plants. The monitoring results are shown in Table 1.

Table 1

PLANT	VOLTAGE VARIATION, V	THD, %	TDD, %
Malden	564 - 595 , L-L	1.4	10.4
Durham	329 - 360, L-G	2.6	10.2
ENWIN standard	550 - 625, L-L 318 - 360, L-G	1.5	5.0

1. Power Quality at 4035 Malden

Feeder 24M6 supplies the power to this plant through customer owned transformer Y99.

The location was monitored between August 3 and August 10.

There were no interruptions on the customer site and breaker activities on adjacent feeders during the monitored period based on our record.

The recorded information shows that the voltage variations, 564 V to 595 V, in the plant are all within the acceptable range (see Figure 1 and Table 1).

The recorded information also shows that there are power quality problems in the plant because the Total Demand Distortion (TDD) of current is higher than 5% (see Figure 2).

2. Power Quality at 1628 Durham Place

Feeder 55M2 supplies the power to this plant through ENWIN owned transformer P550.

There were no interruptions on the customer site and breaker activities on adjacent feeders during the period based on our record.

In addition, there are no voltage sags recorded on the recloser on 55M2 during the period.

The recorded information shows that the voltage variations, 329 V to 360 V, in the plant are all within the acceptable range (see Figure 3 and Table 1).

The recorded information shows that the currents vary very much from time to time during the monitored period. The variation may cause problems in the plant in the future.

The recorded information also shows that there are power quality problems in the plant because the Total Harmonic Distortion (THD) of the voltages is higher than 1.5% and the TDD of the currents is higher than 5% (see Figure 4 and 5).

3. Harm in Harmonics

The harmonics in both plants are high. Harmonic currents the following undesirable effects:

- a. Significant effects on the performance of computer power supplies.
- b. Heating of magnetic devices, which can cause premature insulation failure and breakdown.
- c. Triple harmonics produce higher than expected neutral currents, potentially resulting in insulation damage and breakdown due to temperature rise.
- d. High frequency fields that can introduce buzz into telephone lines and corrupt data in adjacent data lines.

4. Conclusion

- Voltage fluctuations

There were no voltage fluctuations exceeding the acceptable range during monitored period.

You mentioned that Malden plant voltage has fluctuated from 570 volts to 600 volts in the email on November 22, 2004. The fluctuations are within the acceptable range (see Table 1). Therefore, the equipment should

operate properly. Otherwise, the manufacturers should compensate your damage and improve their products.

- Failure of multiple hardware and PC power supply.
Computer power supplies are usually designed to operate over a range of AC input voltages. They produce a DC voltage that is affected by the waveshape of the AC waveform. Harmonic distortion has the effect of actually reducing the computer power supply's operating voltage. That variation is compounded by the normal variation of 10%.

Other hardware failures may be caused by harmonics or voltage fluctuations. However, the fluctuations were within the acceptable range in the monitored period.

The source of the harmonics is likely from your plant because

- There are a few VFD driven machines like large G&L boring mills and CNC Milling Machine that generate harmonics.
- The reclosers on the supply feeders have not caught any harmonics event.
- Week of June 22, 2004, the Durham plant experienced a brown out causing most of our equipment drives and breakers to trip.

An in-line switch was not closed firmly between 9:06 and 9:40 on June 21. Only two-phase supply powered your plant, which caused the brown out.

5. Recommendations

Harmonics and supply power interruptions have drawn our attention.

For harmonics, it's recommended that further investigation be conducted to find out the source and harmonics filters be installed if the failures happen again.

We can introduce a couple of independent consultants to you if you are interested.

For supply power interruptions, on one hand, ENWIN has and will continue to implement different measures to reduce the interruptions, e.g., recloser program and feeder reconfiguration. However, some of the outages are difficult to eliminate, e.g., lightning strikes. Ten of the twelve outages shown in Table 2 were caused by lightning.

On the other hand, it is suggested that your equipment's robustness be improved to ride through the momentary interruptions. A breaker open and close would take about 200 ms.

The breaker activities on Malden feeders are listed Table 2. The activities occurred on Friday May 21, 2004 in AM hours, Friday July 9, 2004 in the AM hours, and in Months of June and July 2004.

The interruptions caused voltage drops on the feeder and adjacent feeder, which may impact your plant.

Table 2

DATE OFF	DATE ON	TIME OFF	TIME ON	HOURS OFF	FEEDER	WEATHER	CAUSE IN DETAIL
20040707	20040707	1500	1500	0	24M6-RC1	THUNDERSTORM	UNKNOWN
20040521	20040521	2318	2318	0	24M6	THUNDERSTORMS	24M6-RC1 A/R - CAUSE UNKNOWN
20040707	20040707	1500	1500	0	24M6	THUNDERSTORM	UNKNOWN
20040705	20040705	1918	1941	0.38	24M6	CLEAR	HYDRO ONE 230 CCT TRIPPED
20040617	20040617	506	506	0	24M5	THUNDERSTORMS	UNKOWN
20040614	20040614	1608	1608	0	24M5	T-STORM	24M5 A/R
20040609	20040609	2034	2034	0	24M5	RAIN.	24M5 A/R - CAUSE UNKNOWN
20040617	20040617	506	506	0	24M3	THUNDERSTORMS	CCT PATROLLED OK
20040614	20040614	1607	1607	0	24M2	T-STORM	24M2 A/R
20040614	20040614	1608	1759	1.85	24M2	T-STORMS	24M2 A/R/A
20040521	20040521	42	42	0	24M1	STORMS	A/R ON 24M1- CAUSE UNKNOWN
20040614	20040614	1608	1609	0.03	24M1	T-STORM	24M1 A/R/A

I trust that I have covered all of the points that we concern. If you have any questions please give me a call at the number listed below.

We appreciate your comment on our supply quality and we also apologize for the brown out in Durham plant.

Yours truly,

Gene Liu, P.Eng.
System Planning Engineer - *ENWIN* Utilities Ltd.
(519) 251-7300, ext. 246; Fax: (519) 251-7306
Email: zliu@enwinpowerlines.com,

CC: Tom Kosnik
Shawn Filice
James Brown

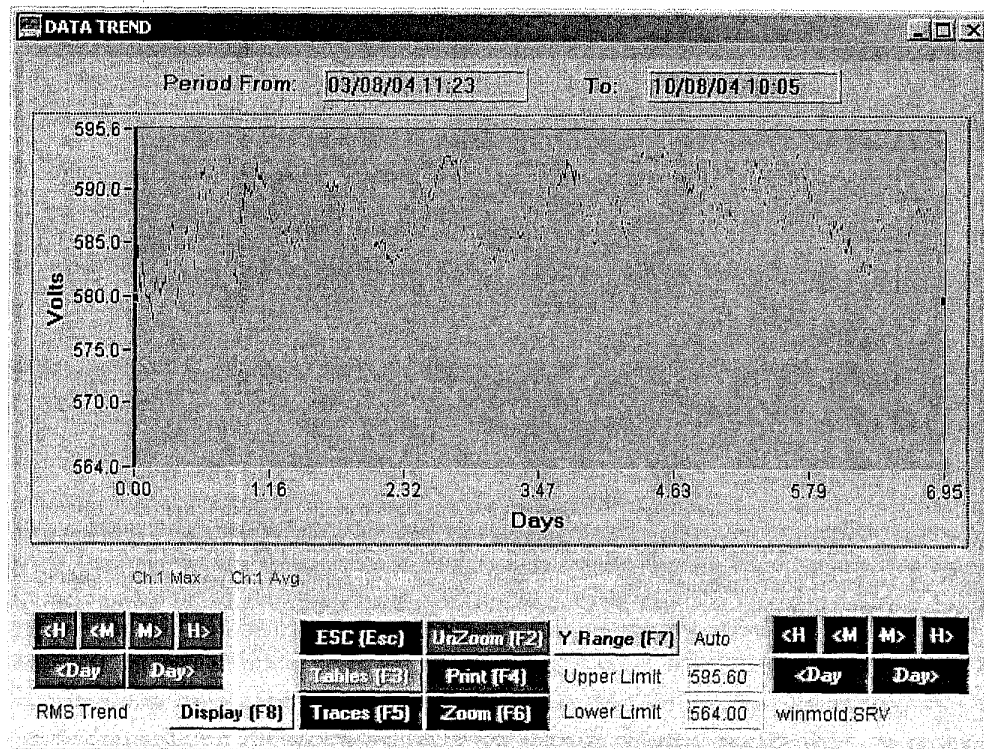


Figure 1: Voltage Profile at Malden

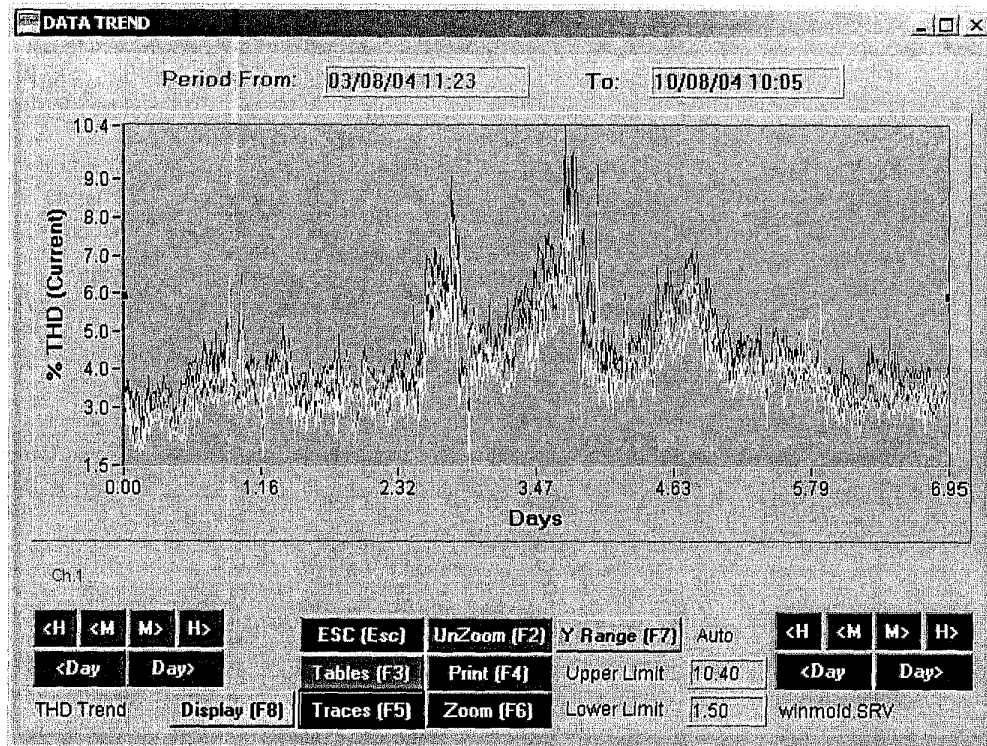


Figure 2: Current TDD Trending

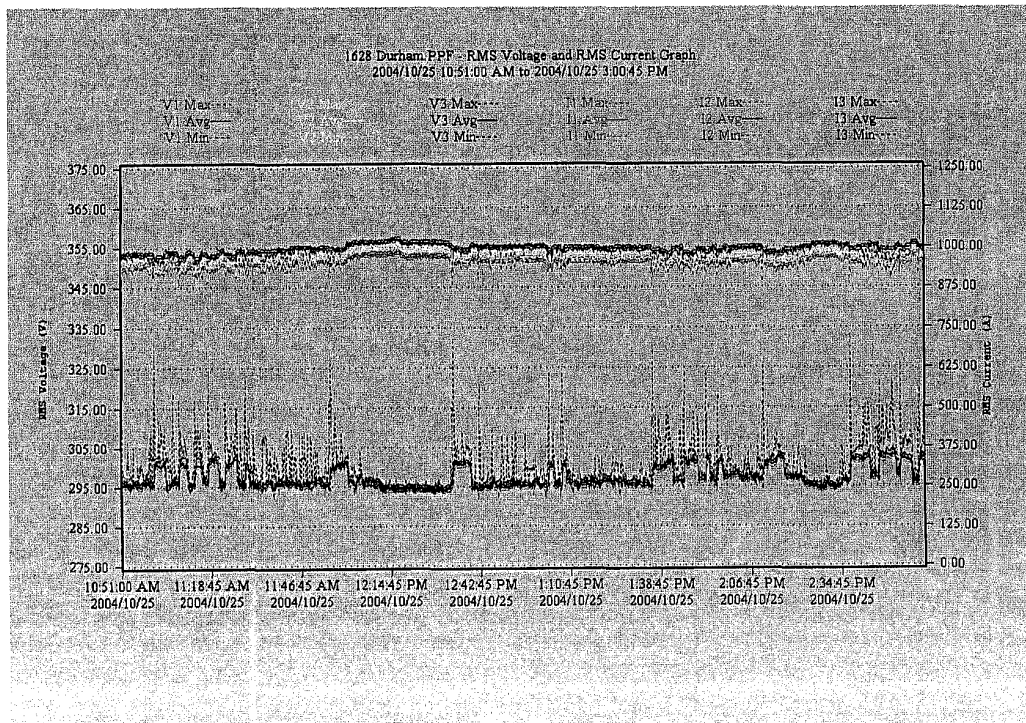


Figure 3: Voltage and Current Profile at Durham

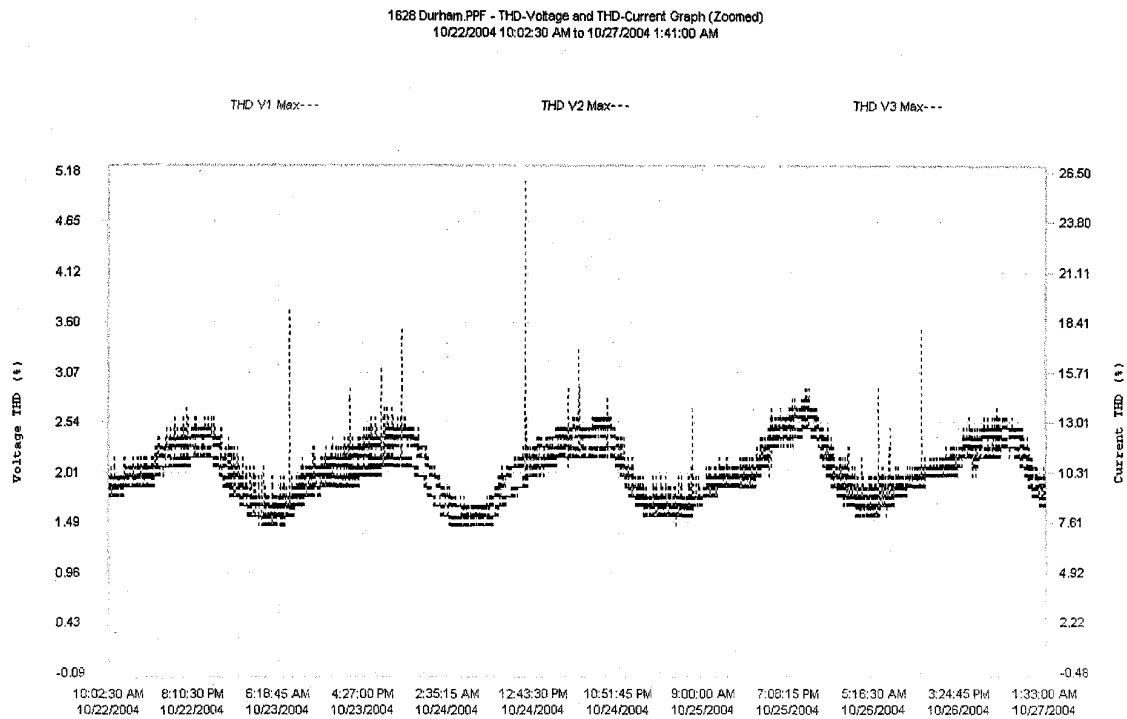


Figure 4: Voltage THD Trending

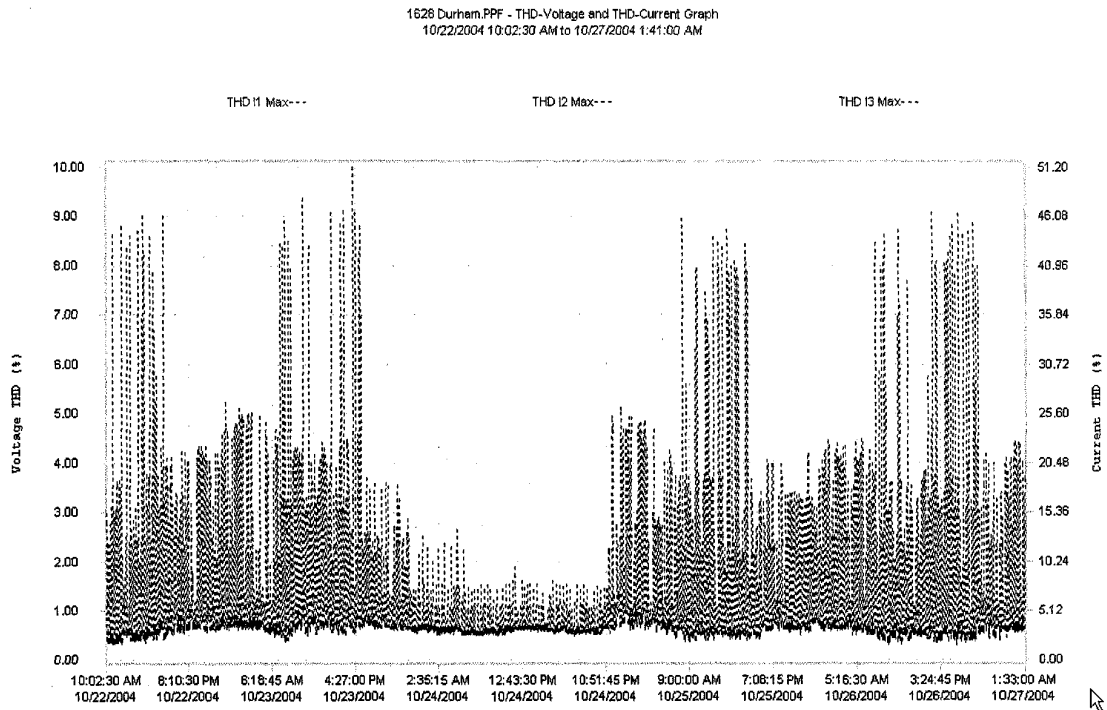


Figure 5: Current TDD Trending

Tom A Kosnik

02/01/2005 10:32 AM

To: Shawn C Filice/EWP/Windsor@WINDSOR

cc:

Subject: Re: Letter to Windsor Mold regarding power quality

Can you arrange to have clerk check for a RMS file called Power Quality - for any recent Commercial customer complaints- for inclusion in your report

Tom Kosnik MASC., P.Eng.

President

EnWin Powerlines

519-251-7304

tkosnik@enwinpowerlines.com

----- Forwarded by Tom A Kosnik/EWP/Windsor on 2005-02-01 10:30 AM -----

John P Temporal

2005-02-01 10:24 AM

To: Tom A Kosnik/EWP/Windsor@WINDSOR

cc: James F Brown/EWP/Windsor@WINDSOR, Marvio C Vinhaes/EWP/Windsor@WINDSOR

Subject: Re: Letter to Windsor Mold regarding power quality 

Hi Tom:

I reviewed the General Complaints file and did not find any letters from commercial or industrial customers complaining about power quality.

I also reviewed the Suite Response Issues back to November 1, 2004 and found the following issues:

3911 Tecumseh E	City of Windsor	 flickering lights
2960 Huron Church	Feel Good Rest.	 Low voltage
1605 Provincial	Pattison Sign	 Low voltage
1004 Garden Court	Garden Crt Condo	 No power
1531 Crawford	City of Windsor	 No power
1531 Crawford	City of Windsor	 No power
3120 Dougall	Wal-Mart	 No power
7877 Tecumseh E	Imperial Oil	 No power
2397 Walker	Valdez Eng.	 No power

John

Tom A Kosnik

Tom A Kosnik

2005-01-31 03:44 PM

To: John P Temporal/EWP/Windsor@WINDSOR

cc: James F Brown/EWP/Windsor@WINDSOR, Marvio C Vinhaes/EWP/Windsor@WINDSOR

Subject: Re: Letter to Windsor Mold regarding power quality 

Do we have any resent letters on file from commercial or industrial customers complaining about power quality?

Tom Kosnik MASC., P.Eng.

President

EnWin Powerlines

519-251-7304

tkosnik@enwinpowerlines.com

John P Temporal

John P Temporal

2005-01-31 12:20 PM

To: James F Brown/EWP/Windsor@WINDSOR

cc: Marvio C Vinhaes/EWP/Windsor@WINDSOR, Tom A Kosnik/EWP/Windsor@WINDSOR



Subject: Re: Letter to Windsor Mold regarding power quality

Hi Jim:
I check our files and could not find the letter referenced by Tom.
John
James F Brown



James F Brown
2005-01-31 09:10 AM

To: John P Temporal/EWU/Windsor@WINDSOR, Marvio C
Vinhaes/EWP/Windsor@WINDSOR
cc: Tom A Kosnik/EWP/Windsor@WINDSOR
Subject: Re: Letter to Windsor Mold regarding power quality

John/Marvio,

Could you review the files on this and see if there are any letters as referenced by Tom, below. If so, please forward him a copy ASAP or advise him that there are none.

thanks.....Jim

James F. Brown, P. Eng.
Director, Engineering
EnWin Powerlines Ltd.
(519) 251-7300 x 267 office
(519) 251-7309 fax
(519) 818-4424 cell

----- Forwarded by James F Brown/EWP/Windsor on 01/31/2005 09:07 AM -----

Tom A Kosnik
01/31/2005 08:14 AM

To: James F Brown/EWP/Windsor@WINDSOR
cc: Debbie J Loeffen/EWP/Windsor@WINDSOR, Shawn C
Filice/EWP/Windsor@WINDSOR, Zhiqiang
Liu/EWP/Windsor@WINDSOR
Subject: Re: Letter to Windsor Mold regarding power quality

Jim, I am looking for any original letters of complaint from our customers regarding power Quality, so that we can we can incorporate copies of them in the Power Quality report to the board on reclosures.

Tom Kosnik MASc., P.Eng.
President
EnWin Powerlines
519-251-7304
tkosnik@enwinpowerlines.com
James F Brown



James F Brown
2005-01-31 08:01 AM

To: Tom A Kosnik/EWP/Windsor@WINDSOR
cc: Shawn C Filice/EWP/Windsor@WINDSOR, Debbie J
Loeffen/EWP/Windsor@WINDSOR
Subject: Letter to Windsor Mold regarding power quality

Tom,

I received Debbie's note asking for information regarding Power Quality at Windsor Mold. I received a copy of the letter below from Gene. I did comment back to Gene on the original letter and suggested some improvements. I believe Gene revised the letter and sent it out. I do not have an electronic copy of the final letter. I believe the gist of Gene's note is that their problem is most likely caused by conditions in

their own plant.

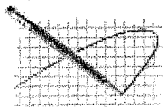
Gene also made a further suggestion internally that we consider obtaining a better quality PQ monitor.

If there is any way I can be of further assistance, please advise.

Thanks.....Jim

James F. Brown, P. Eng.
Director, Engineering
EnWin Powerlines Ltd.
(519) 251-7300 x 267 office
(519) 251-7309 fax
(519) 818-4424 cell

----- Forwarded by James F Brown/EWP/Windsor on 01/31/2005 07:53 AM -----



Zhiqiang Liu

11/23/2004 01:24 PM

To: Tom A Kosnik/EWP/Windsor@WINDSOR
cc: Shawn C Filice/EWU/Windsor@WINDSOR, James F
Brown/EWU/Windsor@WINDSOR
Subject: Letter to Windsor Mold regarding power quality

Could you please review and comment on the attached letter before I send it out?

Thanks.



4035 Malden-1.doc

Gene

SEC_IRR_33A-1



Purchase Order

787 OUELLETTE AVENUE
WINDSOR ON N9A 5T7
CANADA

Vendor: 0000007228
BDR NORTH AMERICA INC
34 KING STREET EAST
SUITE 1000, 10TH FLOOR
TORONTO ON M5C 2X8
CANADA
Fax: () 416-214-1643

Purchase Order	Date	Revision	Page
EWUTL 0000014145	02/13/2008		1
Payment Terms	Freight Terms	Ship Via	
NET 30	WINDSOR, ONTARIO	COURIER	
Buyer: Patterson, Ken		Currency Code: CAD	

Ship To: 4545 RHODES DRIVE
WINDSOR ON N9A 5T7
CANADA

Bill To: 787 OUELLETTE AVENUE
WINDSOR ON N9A 5T7
CANADA

Tax Exempt? N		Tax Exempt ID:					
Line-Schd	Item	Description	Quantity	UOM	PO Price	Extended Amt	Due Date

1 - 1

TO COVER THE COST OF ALL SERVICES AND EXPENSES TO REVIEW AND REPORT ON ITS AFFILIATE COSTS AND REVENUES AND TRANSFER PRICING ARRANGEMENTS. YOUR WRITTEN REPORT WILL DOCUMENT REVIEW OF COST ALLOCATION AND TRANSFER PRICING IN ACCORDANCE WITH THE TERMS OF REFERENCE, AND AGREEMENT FOR SERVICES INCLUDED HEREWITH. THE TERMS OF REFERENCE AND AGREEMENT FOR SERVICES ARE CONSIDERED PART OF THE PURCHASE CONTRACT AS IF THEY WERE WRITTEN AT LENGTH ON THE FACE OF THIS PURCHASE ORDER. IT IS UNDERSTOOD SERVICES WILL BE BILLED AT THE RATE OF \$[REDACTED] PER HOUR FOR THE ASSIGNMENT AND THE PURCHASE ORDER VALUE IS A MAXIMUM, NOT TO EXCEED AMOUNT. KILOMETRAGE AT \$[REDACTED] PER KILOMETRE IS CHARGEABLE FOR TRAVEL TORONTO TO WINDSOR. INCLUDED IN THE PO AMOUNT IS A VISIT TO WINDSOR AT AN ESTIMATED COST OF \$[REDACTED] FOR TWO PERSONS. IT IS ALSO UNDERSTOOD, IF NECESSARY, PAULA ZARNETT IS WILLING TO APPEAR AS A WITNESS IN REGULATORY PROCEEDINGS BEFORE THE ONTARIO ENERGY BOARD. RATE FOR THIS SERVICE IS \$[REDACTED] PER HOUR.

COMPLIANCE WITH THE FOLLOWING LISTED SECTIONS OF THE ENWIN/WUC QUOTATION AND PURCHASE ORDER GENERAL CONDITIONS IS REQUIRED FOR THIS RFQ/RFP. THE SECTIONS

1.00

EACH

Tax Code: GST

Item Total

01/30/2008



Purchase Order

787 OUELLETTE AVENUE
WINDSOR ON N9A 5T7
CANADA

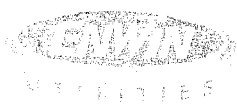
Vendor: 0000007228
BDR NORTH AMERICA INC
34 KING STREET EAST
SUITE 1000, 10TH FLOOR
TORONTO ON M5C 2X8
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Fax: () 416-214-1643

Purchase Order	Date	Revision	Page
EWUTL 0000014145	02/13/2008		2
Payment Terms	Freight Terms	Ship Via	
NET 30	WINDSOR, ONTARIO	COURIER	
Buyer: Patterson, Ken		Currency Code: CAD	

Ship To: 4545 RHODES DRIVE
WINDSOR ON N9A 5T7
CANADA

Bill To: 787 OUELLETTE AVENUE
WINDSOR ON N9A 5T7
CANADA

Tax Exempt? N		Tax Exempt ID:					
Line-Schd	Item	Description	Quantity	UOM	PO Price	Extended Amt	Due Date
		REFERENCED BELOW ARE CONSIDERED PART OF THE RFQ DOCUMENT AS IF THEY WERE WRITTEN AT LENGTH ON THE FACE OF THE REQUEST FOR QUOTATION: SECTION 4.6.17 PAGES 1 AND 2, SECTION 4.6.18 PAGES 1, 2, AND 3. COMPLIANCE WITH THE VENDOR LETTER DATED 2006 01 17 IS REQUIRED. ENWIN/WUC STANDARD TERMS AND CONDITIONS APPLY TO THIS REQUEST FOR QUOTATION/TENDER/ PROPOSAL ISSUED, AND NO ACCEPTANCE, CONFIRMATION, OR SUBMISSION IN RESPONSE TO THIS REQUEST FOR QUOTATION/TENDER/PROPOSAL MAY INTRODUCE ANY ADDITIONAL TERMS BETWEEN THE PARTIES, WHETHER IN CONFLICT OR NOT WITH THE ENWIN/WUC STANDARD TERMS AND CONDITIONS. ALL OF THE TERMS AND CONDITIONS ARE SIGNIFICANT, PARTICULARLY THOSE CLAUSES RELATING TO ARBITRATION, LIMITATION AND JURISDICTION. ENWIN/WUC MAY, IN ITS SOLE AND ABSOLUTE DISCRETION, WAIVE ANY INFORMALITY OR IRREGULARITY. THE CURRENT ENWIN/WUC VENDOR INFORMATION AND GENERAL TERMS AND CONDITIONS MAY BE VIEWED ON OUR WEBSITE, www.enwin.com > vendor> Acrobat Reader 5.0 is required. IMPORTANT TERMS AND CONDITIONS OF QUOTATIONS AND PURCHASES ARE CONTAINED ON WEBSITE. VENDORS ARE EXPECTED TO COMPLY WITH THE INFORMATION AND REQUIREMENTS CONTAINED IN THE GENERAL TERMS AND					



Purchase Order

787 OUELLETTE AVENUE
WINDSOR ON N9A 5T7
CANADA

Vendor: 0000007228
BDR NORTH AMERICA INC
34 KING STREET EAST
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Purchase Order	Date	Revision	Page
EWUTL 0000014145	02/13/2008		3
Payment Terms	Freight Terms	Ship Via	
NET 30	WINDSOR, ONTARIO	COURIER	
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WINDSOR ON N9A 5T7
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WINDSOR ON N9A 5T7
CANADA

Tax Exempt? N		Tax Exempt ID:	
Line-Schd	Item	Description	Quantity UOM PO Price Extended Amt Due Date
		CONDITIONS. QUESTIONS MAY BE DIRECTED TO ENWIN PURCHASING, 519-251-7300 X239.	

Total PO Amount



Authorized Signature

CONSULTING AGREEMENT

THIS AGREEMENT is dated as of the 21st day of February, 2008,

BETWEEN:

EnWin Utilities Ltd.,
(the "Client")

- and -

BDR North America Inc.
(the "Consultant")

WHEREAS the Client desires to engage the Consultant to provide services to the Client for the term of this Agreement and the Consultant has agreed to provide such services, all in consideration and upon the terms and conditions contained herein;

NOW THEREFORE it is hereby agreed as follows:

1. Services

The Client agrees to engage the Consultant to provide the services described in the document titled "Proposal for Affiliate Study Quote Number 0000005958", dated January 28, 2008, attached hereto as Schedule "A", and the Consultant has agreed to perform and provide such services (the "Services").

2. Term

Except as otherwise provided in this Agreement, the Client agrees to engage the Consultant to provide the Services for a term commencing *February 21st, 2008* and ending *October 31st, 2008*. Should the Consultant provide Services at the request of the Client beyond the end of the initial term of the Agreement, the term of this Agreement shall be renewed for an additional term as agreed.

3. Fees

The Client agrees to pay the Consultant fees for the Affiliate Report Phase of the Services provided by the Consultant under this Agreement at the rate of \$~~100~~ per hour, to a maximum of

such that the total cost to the client inclusive of taxes and reimbursable disbursements does not exceed \$[REDACTED]. The Client agrees to pay the Consultant fees for the Expert Witness Phase of the Services as defined at that time, at a rate of \$[REDACTED] per hour, up to such maximum as may be mutually agreed.

The Client also agrees to reimburse eligible out-of-pocket expenses of the Consultant incurred in connection with the Services. Such expenses shall include travel costs incurred at the request of the Client, including \$[REDACTED] per km for use of private vehicle, and parking costs incurred to make such vehicle available.

The Consultant agrees to render an invoice to the Client detailing the Services performed by the Consultant and also detailing the out-of-pocket expenses for which the Consultant is eligible to be reimbursed.

The fees paid to the Consultant under this Agreement shall be increased to take into account any applicable Goods and Services Taxes ("GST") payable in respect of such fees, and all invoices provided by the Consultant shall include the GST registration number of the Consultant.

4. Independent Contractor

The Consultant's relationship with the Client as created by this Agreement is that of an independent contractor for all purposes. It is intended that the Consultant shall have general control and direction over the manner in which its services are to be provided to the Client under this Agreement. Nothing contained in this Agreement shall be regarded or construed as creating any relationship (whether by way of employer/employee, agency, joint venture, or partnership) between the parties other than as one involving an independent contractor as provided herein.

5. Authority

The Consultant acknowledges that it is being retained as a consultant to the Client and that as such it does not have the authority to, and cannot, commit or bind the Client to any matter, contract or negotiation without the prior written authorization of the Client.

6. Key Persons

The parties acknowledge that Paula Zarnett, Neill Winger and Trent Winstone are Key Persons of the Consultant, and such persons are integral to the successful performance of the Services by the Consultant under this Agreement. It is acknowledged by the Consultant that the Key Persons will perform the Services, unless the Client otherwise consents in writing.

7. Conflict of Interest

The Consultant will not engage in any activity or provide any services to others, where such activity or the provision of such services creates a conflict of interest with the provision of the Services to be provided pursuant to this Agreement.

Subject to the above, the Consultant will be free to perform consulting and other services to the Consultant's other clients during the term of this Agreement.

8. Use and Distribution of Deliverables

As part of the Services, deliverables may be provided by the Consultant to the Client in the form of reports and analysis spreadsheets. All deliverables are provided for the Client's use in any manner that the Client deems appropriate. Copies of the written reports in hard form may be distributed by the Client to any party at the discretion of the Client, provided that corporate logos or other identifiers of the Consultant's authorship shall not be removed.

Any spreadsheets originated by the Consultant as part of the Services will on request be provided to the Client in their electronic form for inspection and use by the Client's staff. The Client may print and distribute hard copies of the spreadsheet analysis to any party at its discretion, provided that acknowledgement of the Consultant as the developer is included.

The Client is granted an exclusive licence to use the analysis spreadsheets, reports and other deliverables as delivered by the Consultant, in the original form or as subsequently altered by the Client, in perpetuity in consideration of the fees paid for this assignment. However, the Client shall not transfer the original, copied or altered electronic form of the spreadsheets to any other party, or give access thereto in the Client's own offices or on the Client's computers, without the express written consent of the Consultant. Should access to the electronic form of the spreadsheets, whether original or altered, be required as part of a legal or regulatory process, the Consultant undertakes to provide written consent.

9. Use of Pre-Existing Analysis Tools of the Consultant

In the course of the assignment, the Consultant may make use of analysis spreadsheet models which are already in existence at the date of this Agreement, and which were not developed at the expense of the Client. The Consultant retains all rights to such pre-existing tools and to the methodology, knowledge and data contained therein. No fee shall be charged to the Client for use of such tools in the assignment, except that the normal hourly rates will be charged for any work necessary to input updated or Client-specific information, evaluate results, or make modifications appropriate to the assignment. Such tools shall continue to be considered as pre-

existing analysis tools of the Consultant, and shall not become deliverables of the assignment, notwithstanding any updates or modifications made at the expense of the Client during the course of the assignment.

The Consultant will at the Client's request make available its pre-existing analysis tools, in their electronic form, for inspection by the Client during the assignment. During the assignment, the Client shall exercise due diligence in protecting the confidentiality of the Consultant's pre-existing analysis tools. The Client shall not transfer the original, copied or altered electronic form of the spreadsheets to any other party, or give access thereto in the Client's own offices or on the Client's computers. On termination of the assignment, the Client undertakes to delete all existing copies of the pre-existing analysis tools from its computers. The Client shall not provide to any other party, without the Consultant's written consent, printed hard copies of the Consultant's pre-existing analysis tools, other than summary output tables specifically provided by the Consultant and designated by the Consultant as deliverables of the assignment.

10. Confidential Information of the Client

The Consultant shall keep confidential all proprietary information of the Client, including, without limitation, all unpublished business and technical information, papers or records, however produced. These obligations shall survive completion and/or termination of this Agreement, and shall apply until the earlier of: (a) the date on which the information is disclosed or made public by any party other than the Consultant; or (b) three years from the date of the last invoice submitted by the Consultant hereunder.

11. Termination

In the event that the Consultant fails to perform the Services in accordance with the terms of this Agreement or otherwise breaches this Agreement, and such failure or other breach continues for a period of five (5) days after receipt by the Consultant of written notice from the Client alleging same, the Client may terminate this Agreement by written notice, to take effect immediately.

Upon termination of this Agreement:

- a) The Client's obligations to the Consultant under this Agreement shall terminate except for the Client's obligation to pay any fees and expenses in accordance with the terms of this Agreement, to the date of termination; and
- b) The Consultant's obligations to the Client under this Agreement shall terminate, except any obligations that are specifically expressed to survive the termination of this Agreement.

12. Indemnification

The Consultant will, subject to the limitations set out below, hold the Client harmless from all direct damages, costs and expenses suffered or incurred by the Client, arising from any breach of this agreement or any negligent act, error or omission by the Consultant in the performance of the Agreement.

The Consultant will have no personal liability to the Client, however arising and the Client will bring no claim or action against the Consultant in their personal capacity, other than actions arising out of breach or alleged breach by the Consultant pursuant to the confidentiality provisions which are part of this agreement, or part of any separate agreement made in respect of the Services.

The liability of the Consultant to the Client, however arising, will be absolutely limited to claims brought within 12 months of the completion of the Services, and be absolutely limited to the amount of professional fees for the Services payable to the Consultant, unless the Client shall show that its losses were caused by willful misconduct on the part of the Consultant, in which case the foregoing shall not apply.

In connection with claims initiated by third parties against the Client where the Client claims over against the Consultant, the Client will, indemnify and hold harmless the Consultant from and against all claims, damages, costs and expenses of whatever kind or character arising or alleged to arise out of the Services or the acts or omissions of others.

13. Governing Law

This Agreement shall be governed by the laws of the Province of Ontario and the federal laws of Canada applicable therein.

14. Notices

All notices required or permitted under this Agreement shall be provided in writing to the relevant party at the applicable address as follows:

a) if to the Client:

E-mail:
Fax:

Kenneth F. Patterson, Director, Purchasing Services
EnWin Utilities Ltd.
4545 Rhodes Drive, 1st Floor
Windsor, Ontario, N8W 5T1
kpatterson@enwin.com
519.251.1996

b) If to the Consultant:

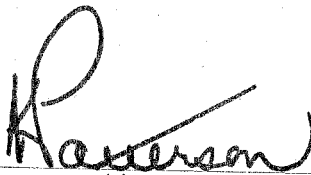
BDR NorthAmerica Inc.
Attn: Paula Zarnett, Vice President
Suite 1000, 34 King St East,
Toronto, Ontario,
M5C 2X8
E-mail: pzarnett@BDRenergy.com
Fax: 416-214-1643

IN WITNESS WHEREOF the parties hereto have signed this Agreement as of the day and year first above written.

EnWin Utilities Ltd.

BDR NorthAmerica Inc.

Per:



Name: **KEN PATTERSON**
Title: **DIRECTOR, PURCHASING SERVICES.**

Per:



Paula Zarnett
Vice President

SEC_IRR_33A-2



Request for Quotation

Request Quote ID.	Date	Buyer	Page
EWUTL 0000005958	12/03/2007	Patterson, Ken	1
Payment Terms	Date/Time Quote Open/	Closing	
NET 30	01/07/2008 01:00:00 PM	01/30/2008 11:30:59 AM	

787 OUELLETTE AVENUE
WINDSOR ON N9A 5T7
CANADA

Ship To: 4545 RHODES DRIVE
WINDSOR ON N9A 5T7
CANADA

Line	Item	DESCRIPTION	Quantity	UM	Unit Price	Amount
1		ENWIN UTILITIES LTD. ("ENWIN") REQUIRES THE SERVICES OF AN INDEPENDENT THIRD PARTY CONSULTANT TO REVIEW AND REPORT ON ITS AFFILIATE COSTS AND REVENUES AND TRANSFER PRICING ARRANGEMENTS. YOU ARE INVITED TO SUBMIT A WRITTEN PROPOSAL TO PROVIDE THE SERVICES REQUESTED IN THE DOCUMENT REVIEW OF COST ALLOCATION AND TRANSFER PRICING INCLUDED HEREWITH. QUESTIONS MAY BE DIRECTED TO ANDREW SASSO, DIRECTOR REGULATORY AFFAIRS. PLEASE SEE PARAGRAPH 9 FOR CONTACT DETAILS.	1.00	EA		

MAILING/SHIPPING DATE AND TIME SHOULD BE CONSIDERED BY SUPPLIERS TO MEET CLOSING REQUIREMENTS. QUOTATIONS RECEIVED IN THE PURCHASING OFFICE AFTER SPECIFIED DUE DATE AND TIME, REGARDLESS OF MARKINGS, WILL BE RETURNED UNOPENED.

RETURN SUBMISSIONS SEALED IN YOUR ENVELOPE, MARK QUOTATION NUMBER BOLDLY ON THE OUTSIDE OF YOUR ENVELOPE.

SUBMIT QUOTATION TO: PURCHASING OFFICE, ENWIN UTILITIES LTD.
4545 RHODES DRIVE, 1ST FLOOR
P.O. BOX 1625
WINDSOR, ONTARIO N9A 5T7

COMPLIANCE WITH THE FOLLOWING LISTED SECTIONS OF THE ENWIN/WUC QUOTATION AND PURCHASE ORDER GENERAL CONDITIONS IS REQUIRED FOR THIS RFQ/RFP. THE SECTIONS REFERENCED BELOW ARE CONSIDERED PART OF THE RFQ DOCUMENT AS IF THEY WERE WRITTEN AT LENGTH ON THE FACE OF THE REQUEST FOR QUOTATION: SECTION 4.6.17 PAGES 1 AND 2, SECTION 4.6.18 PAGES 1, 2, AND 3. COMPLIANCE WITH THE VENDOR LETTER DATED 2006 01 17 IS REQUIRED

ENWIN/WUC STANDARD TERMS AND CONDITIONS APPLY TO THIS REQUEST FOR QUOTATION/TENDER/ PROPOSAL ISSUED, AND NO ACCEPTANCE, CONFIRMATION, OR





Request for Quotation

Request Quote ID.	Date	Buyer	Page
EWUTL 0000005958	12/03/2007	Patterson, Ken	2
Payment Terms	DateTime Quote Open/	Closing	
NET 30	01/07/2008 01:00:00 PM	01/30/2008 11:30:59 AM	

787 OUELLETTE AVENUE
WINDSOR ON N9A 5T7
CANADA

Ship To: 4545 RHODES DRIVE
WINDSOR ON N9A 5T7
CANADA

Line Item	DESCRIPTION	Quantity	UM	Unit Price	Amount
	SUBMISSION IN RESPONSE TO THIS REQUEST FOR QUOTATION/TENDER/PROPOSAL MAY INTRODUCE ANY ADDITIONAL TERMS BETWEEN THE PARTIES, WHETHER IN CONFLICT OR NOT WITH THE ENWIN/WUC STANDARD TERMS AND CONDITIONS. ALL OF THE TERMS AND CONDITIONS ARE SIGNIFICANT, PARTICULARLY THOSE CLAUSES RELATING TO ARBITRATION, LIMITATION AND JURISDICTION. ENWIN/WUC MAY, IN ITS SOLE AND ABSOLUTE DISCRETION, WAIVE ANY INFORMALITY OR IRREGULARITY. THE CURRENT ENWIN/WUC VENDOR INFORMATION AND GENERAL TERMS AND CONDITIONS MAY BE VIEWED ON OUR WEBSITE, WWW.ENWIN.COM > VENDOR> ACROBAT READER 5.0 IS REQUIRED. IMPORTANT TERMS AND CONDITIONS OF QUOTATIONS AND PURCHASES ARE CONTAINED ON WEBSITE. VENDORS ARE EXPECTED TO COMPLY WITH THE INFORMATION AND REQUIREMENTS CONTAINED IN THE GENERAL TERMS AND CONDITIONS. QUESTIONS MAY BE DIRECTED TO ENWIN PURCHASING, 519-251-7300 X239.				



REVIEW OF COST ALLOCATION AND TRANSFER PRICING

TERMS OF REFERENCE

EnWin Utilities Ltd. ("EnWin") requires the services of an independent third party consultant to review and report on its affiliate costs and revenues and transfer pricing arrangements.

1. Introduction

EnWin is an Ontario corporation located in the City of Windsor. EnWin carries on the business of owning and operating electricity distribution facilities in Windsor.

EnWin is regulated by the Ontario Energy Board ("OEB"). EnWin must submit an application to the OEB for approval and establishment of a revenue requirement and associated rates.

EnWin's affiliates are: the City of Windsor, Windsor Canada Utilities Ltd., the Windsor Utilities Commission, and EnWin Energy Ltd.

2. Background

In 2005, EnWin submitted a 2006 Electricity Distribution Rate Application with the OEB to establish a revenue requirement. As a part of the process, EnWin engaged in several settlement issues with OEB technical staff, and other intervenors. As a part of the settlement, EnWin made a commitment to conduct a study and prepare a report related to accuracy and prudence of its affiliate costs and revenues and transfer pricing arrangements (the "Affiliate Report"). The Affiliate Report is to be completed and filed with the OEB and intervenors as part of EnWin's 2009 distribution rate application.

3. Scope of Work

EnWin requires the services of a consulting firm to conduct and complete the Affiliate Report.

The consultant's scope of work will include the following:

- 1) The consultant will review the transfer pricing arrangement between EnWin and its affiliates, and develop an opinion on the appropriateness of the transfer pricing arrangements.
- 2) The consultant will review the costs charged to and by EnWin in respect of its affiliates and develop an opinion on the appropriateness of those costs.
- 3) The consultant will deliver a draft report in writing and by presentation to EnWin regarding the opinions in (1) and (2). The report shall include the following:
 - a. A description of each of the services provided to and by each affiliate,
 - b. Comments on the accuracy and fairness of the allocation of costs, and
 - c. Suggested changes to improve the fairness or accuracy of the costs.

- 4) The consultant will deliver a final report in writing and by presentation to EnWin regarding and including the matters set out in (3).

4. Proposal Requirements

The consultant's submission must not exceed 10 pages in length (excluding appendices) and must include the following:

- A paragraph that demonstrates a clear understanding of the requirements and objectives of the project.
- An overview of the consultant firm, including experience as related to this project and the industry.
- For the individual(s) assigned to carry out this work, a resume of their qualifications and experience as related to this project and the industry.
- A summary of previous projects of a similar nature successfully completed by the consultant. References should be provided.
- A detailed description of the proposed approach and methodology.
- A detailed work plan and project schedule showing the number of person days expected to be spent on the review and report preparation.
- A study budget that includes the number of days and per diem rates for the individual and associated costs including but not limited to technical fees, travel, printing, etc.
- An indication of the consultant's availability to complete the required work during the period of March 3, 2008 to April 30, 2008.
- An indication of the consultant's willingness to appear as an expert witness in proceedings of the Ontario Energy Board, related to the Affiliate Report.
- An expert witness budget that includes the per diem rates for the individual and associated costs including but not limited to preparation, attendance, technical fees, travel, printing, etc.
- A proposed agreement for services.

5. Budget

The total budget for this project should not exceed \$20,000 including all expenses and taxes.

6. Timing

It is expected that it will take the consultant 2-3 weeks to prepare the Affiliate Report. It is expected that the Affiliate Report will be completed by April 30, 2008.

7. Receiving of Proposals

Four (4) copies of the consultant's proposal must be received no later than 11:30:59 a.m. E.S.T., January 30, 2008. Late submissions will be returned unopened. Proposals shall be sealed, addressed to:

Purchasing Department
EnWin Utilities Ltd.
4545 Rhodes Drive, 1st floor

Windsor, ON N8W 5T1

Please follow the instructions detailed in RFP document. Questions concerning receiving proposals may be directed to the Purchasing Department 519-251-7300 ext 239.

Consultants should be prepared to attend an interview, in person or by teleconference, on a date to be determined if deemed necessary to finalize the selection process.

No payment will be made for the preparation and submission of proposals or attendance at an interview.

8. Client and Consultant Agreement

The successful consultant will enter into an agreement for services with EnWin. The agreement will conform to the terms of the EnWin Performance Standards & Retainer Agreement, a copy of which is enclosed as Appendix A.

EnWin shall have the right at any time to cancel the agreement in whole or in part, without further payment except for those services completed prior to cancellation.

The final report and all other materials produced during the completion of this study will become the property of EnWin. The consultants will be required to obtain written approval prior to releasing any study information to other parties.

9. Communication

To confirm receipt of this document please sign and return the Quotation Acknowledgement Form included in the RFP documents.

All inquiries concerning this Request for Proposals should be submitted in writing to asasso@enwin.com or fax: 519-973-7812.

10. Evaluation Process

The proposals will be evaluated based on the following criteria:

- Understanding of the Project Requirements and Objectives
- Corporate Profile of the Firm
- Project Team
- Relevant Past Experience
- Proposed Approach and Methodology
- Proposed Work Plan and Project Schedule
- Study Budget
- Willingness to Appear as an Expert Witness
- Expert Witness Budget

Short-listed proponents may be invited to make a presentation to provide the selection committee an opportunity to ask additional questions.

11. Schedule

- a. Distribution of Request for Proposals: January 7, 2008
- b. Proposal Submission Deadline: January 30, 2008
- c. Consultant Interviews (if required): The week of February 11, 2008
- d. Consultant Selection: The week of February 18, 2008

- e. Start Date and Kick-Off Meeting: No later than March 17, 2008
- f. Draft Report Due and Presented: In advance of Final Report
- g. Final Report Due: No later than April 30, 2008

EnWin reserves the right to alter the dates in (a-f).

12. Notification of Results

Following the completion of the proposal evaluations and confirmation of an approved agreement, all consultants will be advised in writing.

APPENDIX A

EnWin Performance Standards and Retainer Agreement

One of the primary objectives of *EnWin* is to ensure that it receives high quality, cost-effective legal/consulting services from its outside advisors/consultants (hereinafter referred to as 'consultants'). The following reflects the expectations and requirements of *EnWin* in connection with legal/consultant work performed by outside firms engaged by *EnWin*. Only consultants and/or firms licensed to practice in Ontario will be accepted by *EnWin*. Consultants and/or firms must be members in good standing with their respective Professional Association and compliant with that Association's Code of Ethics at all times. Any legal/consulting firm having questions or concerns should advise *EnWin* before accepting an assignment.

Policy Statement

The consultant acknowledges that it will undertake *EnWin*'s work only if it has the appropriate level of skill and ability to perform the work in an expert manner. The consultant will act with the utmost good faith, in the best interests of *EnWin* and without any conflict or potential conflict of interest. The consultant recognizes *EnWin*'s requirement that legal/consulting services be provided in an efficient and cost effective manner. The consultant, in consultation with *EnWin*, will appoint a senior officer to act as the 'manager in charge' of the relationship between *EnWin* and the consultant. The manager in charge will meet with representatives of *EnWin*, without cost, from time to time as required to discuss ways to best achieve these goals.

Fixed Fees

It is *EnWin*'s desire, whenever possible, to have all work performed on a fixed fee basis. All services described in Schedule A shall be performed for a fixed fee as described therein. With respect to any other services, upon receipt of a new matter the consultant will provide *EnWin* with a fixed fee quote. This quote should be in writing and include estimated disbursements. No work on a matter shall commence until *EnWin* approves the fixed fee in writing.

Budgeting

In any case where *EnWin* and the consultant agree that a fixed fee is inappropriate and it appears likely that fees plus disbursements will exceed \$25,000, the consultant will, at no cost to *EnWin*, submit a budget estimating the fees and disbursements. The budget will include the following details (together with any other information which the consultant feels is appropriate): brief outline of work to be performed; name of each employee/partner/associate (the

"professionals") assigned to the matter; his or her hourly rate (which shall be the lowest rate charged by that professional to any client of the consultant); year of call or accreditation; estimated hours required. The consultant will forthwith advise *EnWin*, without request, if it appears that the budget will be exceeded. The budget shall include the cost of providing a preliminary report on the work to be performed with expected outcomes as well as a written report at the conclusion of the assignment.

Staffing

The consultant will assign qualified professionals to do *EnWin*'s work. The consultant will bear in mind the complexity of the matter, expertise of the professionals involved, significance of the matter to *EnWin*, and the need to perform the work in a timely, efficient and cost effective manner. The consultant will not charge *EnWin* for "learning time" or duplication of time. In particular, the consultant will not involve more than one professional in meetings, telephone conferences, or other proceedings unless required. It is also *EnWin*'s position that internal office conferences and reviews of documents, opinions and other material by a number of people, are generally a duplication of time. While maintaining the standards set forth in this Agreement, the consultant will assign the fewest number of professionals possible to any matter or aspect thereof. There will be no changes to the professionals handling a particular matter without prior notice to *EnWin*.

Reports

(a) Usual Course Reports

The consultant agrees to provide a brief status report quarterly, or more frequently if needed, advising as to what steps were taken during the period covered by the report, results achieved, and what is expected to be done in the following period. In addition, in litigation matters, this report should include an assessment of the likelihood of success, together with the firm's recommendations with regard to settlement and the use of an alternative dispute mechanism in lieu of litigation. A more detailed summary of the work done will be set forth in the time dockets that are to accompany the consultant's accounts (as set out below). This report shall be received by *EnWin* within 20 days of the end of the period to which the report relates.

The consultant agrees to provide the primary *EnWin* contact with notice when 75% of the set contract fee or budget (as the case may be) has been reached.

The consultant agrees to provide copies to *EnWin* of all contracts, significant correspondence, memoranda and other materials; such copies to be in electronic format wherever possible.

(b) Urgent Reports

EnWin requires the consultant to immediately notify the primary *EnWin* contact (or delegate) if the consultant becomes aware of any matter that may have a material effect on *EnWin*. By way of example:

-any activity which could result in a criminal or quasi-criminal charge, adverse publicity, or media attention.

Billing

The following is applicable whether the consultant is charging on an hourly rate or fixed fee basis:

(a) Fees:

The account need not contain any detail of the work performed, but should summarize the number of hours and hourly rate of each professional whose work is covered by the account. The account should also identify the total fees and disbursements charged to date on the particular matter (including the account being rendered), the name of *EnWin* employee who retained the consultant. The consultant must also provide with the account its detailed time dockets showing the services performed, the date upon which they were performed, the professional who performed them, the length of time taken for each service, and the fee attributed to the particular service. The Firm understands that *EnWin* will not pay for the following charges without prior approval:

*Charges to prepare the accounts to *EnWin* and to answer questions relating thereto

*Travel time

*Secretarial time, clerical time, or any other item that is overhead in nature

*Increases to hourly rates

*Prior research

*Opening and organizing the file.

In addition, *EnWin* expects docketing to be in increments no greater than one-tenth of an hour and to accurately reflect the productive time spent.

(b) Disbursements:

Disbursements will be charged at no more than the consultant's cost. In any event, photocopying charges shall not exceed 10 cents per page. Commercial printing services should be used when economical and prudent to do so. There shall be no charge for sending or receiving telefax communications or electronic mail other than the actual cost of long distance charges. Any travel on *EnWin's* business shall be undertaken in the most cost effective fashion taking into account discounts or special rates. Staff meals, staff taxis and any other cost that is overhead in nature shall not be charged to *EnWin*. No first class travel may be undertaken at *EnWin's* expense. The account should reflect the total disbursements charged to date on a particular matter.

(c) Submission and Payment of Accounts:

All accounts should be submitted to the primary *EnWin* contact.

Insurance

The following are particulars of the consultant's errors and omissions coverage: The successful Consultant will be required to provide suitable Certificate(s) of Insurance with this document.

The consultant will notify *EnWin* promptly of any changes in coverage.

Date

consultant

SEC_IRR_33C



December 6, 2007

Ontario Energy Board

Suite 2700, P.O. Box 2319
2300 Yonge Street
Toronto, Ontario M4P 1E4
Attention: Board Secretary

Consumers Council of Canada

35 Madison Avenue, Suite 100
Toronto, Ontario M5R 2S2

Energy Probe Research Foundation

225 Brunswick Avenue
Toronto, Ontario M5S 2M6

The School Energy Coalition

c/o Shibley Righton LLP
250 University Avenue, Suite 700
Toronto, Ontario M5H 3E5

Vulnerable Energy Consumers Coalition

c/o Public Interest Advocacy Centre
1 Nicholas Street, Suite 1204
Ottawa, Ontario K1N 7B7

Dear Sir/Madam:

Re: **RP-2005-0200/EB-2005-0359**
Settlement Agreement
Affiliate Report

On February 15, 2006, a Settlement Proposal was filed in respect of the above noted Board proceeding. That Settlement Proposal, attached as Schedule "A", was accepted by the Board and formed part of the Board's Order in the proceeding. Your organization was party to that Settlement Proposal. The settlement of section 2.2 provided, in part, that:

"Prior to filing its next distribution rate application, the Applicant shall conduct a study and prepare a report related to affiliate costs and revenues and transfer pricing arrangements (the "Affiliate Report"). The Affiliate Report shall be provided to the Board and the Intervenor as part of the Applicant's next rate application. The Applicant will undertake a tender for consultant services for the Affiliate Report. The Applicant will contact

the Intervenor in the EDR Application and seek from them input into the issues the Intervenor would like addressed in the Affiliate Report. The Applicant will consider, but will not be required to adopt, the Intervenor's suggestions."

On November 14, 2006, EnWin brought an application to the Board requesting approval under Section 86 (the "MAAD Application") to reorganize the EnWin group of companies. Pursuant to the Board's Decision and Order in EB-2006-0282, dated December 19, 2006, leave was granted for EnWin Powerlines Ltd. to amalgamate with EnWin Utilities Ltd. As was noted in the Board's Decision and Order, one of EnWin's objectives in amalgamating was to address the transfer pricing issues that prompted the request for an Affiliate Report. The companies amalgamated on January 1, 2007.

EnWin intends to file a Cost of Service Application for 2009 rates in August 2008. The 2009 rebasing will allow EnWin to present the new corporate structure using 2007 historical data. The Affiliate Report will form part of EnWin's COS Application.

Accordingly, EnWin will be tendering for a consultant to prepare an Affiliate Report. To satisfy the "input" requirement of the Settlement Agreement, EnWin invites you, as an Intervenor in the above noted proceeding, to provide input into the terms of reference for the Affiliate Report. The proposed terms of reference are enclosed as Schedule "B".

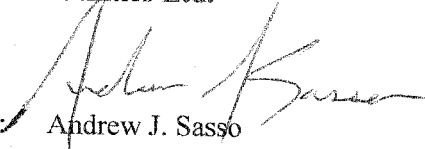
Please provide your input in writing to:

EnWin Utilities Ltd.
P.O. Box 1625, Stn. 'A'
787 Ouellette Avenue
Windsor, Ontario N9A 5T7
Attention: Andrew J. Sasso

Please provide your input no later than **December 21, 2007** in order that the tendering process may begin as soon as possible in January 2008. In the event your organization does not wish to participate in this process, please advise us in writing by the aforementioned date.

Regards,

ENWIN Utilities Ltd.


Per: Andrew J. Sasso

From the Desk of Andrew J. Sasso, B.Comm., LL.B., Director, Regulatory Affairs
P.O. Box 1625, Stn "A", 787 Ouellette Avenue, Windsor, ON N9A 5T7
Tel: 519-255-2735 Fax: 519-973-7812 Email: asasso@enwin.com

VECC_IRR_20A

WINDSOR UTILITIES COMMISSION

- and -

ENWIN UTILITIES LTD.

MANAGED SERVICES AGREEMENT

Effective: January 1, 2007

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MANAGED SERVICES AGREEMENT

This Agreement made to take effect as and from the 1st day of January, 2007 (the “Effective Date”)

BETWEEN:

WINDSOR UTILITIES COMMISSION

a Commission established pursuant to the laws of the Province of Ontario
(hereinafter referred to as “WUC”)

- and -

ENWIN UTILITIES LTD.

a corporation incorporated pursuant to the laws of the Province of Ontario
(hereinafter referred to as “Utilities”)

RECITALS:

R1 The Corporation of the City of Windsor, pursuant to the Section 142 of the *Electricity Act, 1998* caused Enwin Utilities Ltd. (“EUL”) and EnWin Powerlines Ltd. to be incorporated on December 13, 1999;

R2 WUC is a statutory body corporate created by special legislation of the Legislature of Ontario, and is deemed to be as a local board of the municipality;

R3 EUL and EnWin Powerlines Ltd. were amalgamated on December 31, 2006 to create Enwin Utilities Ltd. (“Utilities”);

R4 Utilities, the electricity Local Distribution Company serving the City of Windsor regulated by the Ontario Energy Board, is required to comply with the provisions of its distribution licence including the Affiliate Relationships Code for Electricity Distributors and Transmitters;

R5 WUC has requested that its Affiliate, Utilities provide the managed services described in this Agreement to WUC;

R6 Utilities has agreed to provide the services described in the Schedules to this Agreement on the terms set out in this Agreement and in accordance with the provisions of the Affiliate Relationships Code;

NOW THEREFORE in consideration of the mutual covenants contained herein and for other good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged by each of the parties hereto, the parties hereto hereby agree as follows:

ARTICLE 1

INTERPRETATION

1.01 DEFINITIONS

Unless the context otherwise specifies or requires, for the purposes of this Agreement all capitalized terms herein shall have the meanings set forth below:

"Affiliate", with respect to a corporation, shall have the same meaning as is ascribed to such term in the *Business Corporations Act* (Ontario) and shall be deemed to include the relationship between WUC and Utilities;

"Affiliate Relationships Code" or **"ARC"** shall mean the Affiliate Relationships Code for Electricity Distributors and Transmitters issued by the OEB, as amended from time to time;

"Agreement", **"This Agreement"**, **"The Agreement"**, **"Managed Services Agreement"**, **"hereto"**, **"hereof"**, **"herein"**, **"hereby"**, **"hereunder"** and similar expressions mean this Managed Services Agreement together with all Schedules attached hereto, as they may be amended from time to time;

"Applicable Law" means, collectively, all applicable laws, treaties, statutes, codes, codes of conduct, ordinances, decrees, rules, regulations, municipal by-laws, including, without limitation, policies, codes or guidelines of a Governmental Authority, judicial, administrative, ministerial, departmental or regulatory judgments, orders, decisions, directives or rulings and conditions of any licence, permit, certificate, registration, authorization, consent or approval issued by a Governmental Authority that apply to the Parties to this Agreement;

"Business Day" means any day other than a Saturday or Sunday or a statutory or bank holiday in the Province of Ontario;

"Confidential Information" has the meaning ascribed to such term in Section 10.01;

"Disclosing Party" has the meaning ascribed to such term in Section 10.01;

"Dispute" has the meaning ascribed to such term in Section 12.01;

"Effective Date" means January 1, 2007;

"Event of Default" has the meaning ascribed to such term in Section 8.01;

"Fees" has the meaning ascribed to such term in Section 5.01 and Schedule I hereto;

"Force Majeure Event" has the meaning ascribed to such term in Section 11.01;

“Governmental Authority” means any government, parliament, legislature or any regulatory authority, agency, commission or a board of any government, parliament or legislature, or any political subdivision thereof, or any court or, without limitation to the foregoing, any other law, regulation or rule making entity or any person acting under the authority of any of the foregoing or any other authority charged with the administration or enforcement of laws, including the OEB, IESO, the Privacy Commissioner of Canada and the Information and Privacy Commissioner of Ontario;

“KPMG Cost Allocation Methodology” means the cost allocation methodology prepared by accounting firm of KPMG LLP and approved by both WUC and Utilities on [insert dates] respectively;

“IESO” means the Independent Electricity System Operator for Ontario;

“includes” or **“including”** means includes (or as applicable, including) without limitation;

“Managed Services” has the meaning ascribed to such term in Section 3.01;

“MFIPPA” means the *Municipal Freedom of Information Act and Protection of Privacy Act* of Ontario, as amended from time to time;

“OEB” means the Ontario Energy Board and any successor thereto;

“Party” means a party to this Agreement and any reference to a Party includes its successors and permitted assigns; **“Parties”** means every Party;

“PIPEDA” means the *Personal Information Protection and Electronic Documents Act* of Canada, as amended from time to time;

“Prime Rate” means, in respect of each calendar month, a rate of interest equal to the Prime rate for loans to commercial customers in Canadian dollars as declared by the principal banker from time to time for Utilities as of the first Business Day of such month;

“Prior Agreement” has the meaning ascribed to such term in Section 2.02;

“Representatives” in reference to Party, means the Party's directors, officers, commissioners, employees, agents and contractors;

“Receiving Party” has the meaning ascribed to such term in Section 10.01;

“Term” has the meaning ascribed thereto in Section 2.01.

1.02 PURPOSE OF AGREEMENT

The purpose of this Agreement is to describe the Managed Services provided by Utilities to its Affiliate, WUC, the Fees payable by WUC for the Managed Services and the relationship between Utilities and WUC in respect of such Managed Services.

1.03 CONSTRUCTION OF AGREEMENT

In this Agreement:

- (a) words denoting the singular include the plural and vice versa and words denoting any gender include all genders;
- (b) any reference to a statute shall mean the statute in force as at the date hereof, together with all regulations promulgated there under, as the same may be amended, re-enacted, consolidated and/or replaced, from time to time, and any successor statute thereto, unless otherwise expressly provided;
- (c) any reference to a specific executive position or an internal division or department of a Party shall include any successor positions, divisions or departments having substantially the same responsibilities or performing substantially the same functions;
- (d) when calculating the period of time within which or following which any act is to be done or step taken, the date which is the reference day in calculating such period shall be excluded; and if the last day of such period is not a Business Day, the period shall end on the next Business Day;
- (e) all dollar amounts are expressed in Canadian dollars;
- (f) the division of this Agreement into separate Articles, Sections, Subsections and Schedule(s), the provision of a table of contents and the insertion of headings is for convenience of reference only and shall not affect the construction or interpretation of this Agreement;
- (g) words or abbreviations which have well known or trade meanings are used herein in accordance with their recognized meanings;
- (h) the terms and conditions hereof are the result of negotiations between the Parties and the Parties therefore agree that this Agreement shall not be construed in favour of or against any Party by reason of the extent to which any Party or its professional advisors participated in the preparation of this Agreement.
- (i) In the event of any inconsistency between the provisions set forth in the Schedules and the provisions set forth in the body of this Agreement, this Agreement shall prevail.

1.04 SCHEDULES

The Schedules set out below are attached to and form an integral part of this Agreement:

<u>Schedule</u>	<u>Description</u>
A	Human Resources Management and Support Services
B	Finance and Accounting Services
C	Billing and Collection Services
D	Purchasing and Inventory Managed Services
E	Fleet and Site Managed Services
F	Information Services
G	Technical and Customer Services
H	Other Services
I	Fees

ARTICLE 2

TERM

2.01 TERM

The term of this Agreement shall commence on the Effective Date and the terms, conditions and covenants hereof shall have deemed to have been in force and performed by the Parties from that date. The initial term of this Agreement shall be a period of one (1) year. The term shall automatically be renewed annually for successive one (1) year periods, or for such longer or shorter period as may be agreed in writing by the Parties hereto, unless terminated as provided in Sections 9 of this Agreement or abbreviated pursuant to Section 13.01.

2.02 TERMINATION OF PRIOR AGREEMENT WITH ADJUSTMENTS

The Parties acknowledge that immediately preceding the Effective Date of this Agreement, Utilities was providing certain Managed Services to WUC pursuant to an agreement entered into in 2003 (the "**Prior Agreement**"). The Parties acknowledge that upon Effective Date of this Agreement, the Prior Agreement shall be terminated, and the Parties shall make all closing adjustments as are appropriate and necessary to finalize the accounts pursuant to the Prior Agreement.

ARTICLE 3
MANAGED SERVICES

3.01 MANAGED SERVICES

Subject to the terms, covenants and conditions contained in this Agreement and to the observance and performance by WUC of all terms, covenants and conditions hereof, Utilities will provide or cause to be provided to WUC the following services (collectively, the “**Managed Services**”):

- (a) the Human Resources Management and Support Services described in Schedule A;
- (b) the Finance and Accounting Services described in Schedule B;
- (c) the Billing and Collection Services described in Schedule C;
- (d) the Purchasing and Inventory Managed Services described in Schedule D;
- (e) the Fleet and Site Managed Services described in Schedule E;
- (f) the Information Services described in Schedule F;
- (g) the Technical and Customer Services described in Schedule G; and
- (h) Other Services as described in Schedule H.

3.02 PROVISION OF MANAGED SERVICES & AUTHORITY OF WUC

Utilities shall be responsible for the provision of the Managed Services provided hereunder and the methods employed in providing the same, subject always to Utilities providing such Managed Services in a diligent and competent manner and according to the same standards as Utilities provides for its own use and benefit from time to time. Notwithstanding any other provision in this Agreement, WUC shall have and retain the ultimate authority for ensuring that the Managed Services are performed in accordance with Applicable Law.

3.03 RELATIONSHIP

In performing this Agreement, Utilities shall operate as an independent contractor and not as an agent of WUC, and shall maintain its own organization as a distinct and separate legal entity from WUC. Utilities and its Representatives shall have no authority to legally bind WUC without the prior written authority from WUC to do so. Nothing in this Agreement shall be deemed to constitute a partnership or a joint venture or to create any fiduciary relationship between Utilities and WUC.

3.04 MODIFICATIONS TO THE MANAGED SERVICES

WUC may, from time to time, request modifications to the Managed Services, and Utilities agrees to consider such requests, acting reasonably. If Utilities accepts a request for modification to the Managed Services, the Parties shall negotiate appropriate changes to the descriptions of the Managed Services, the terms and conditions for the provision of those modified Managed Services and the Fees in connection with such changes and shall initial and attach amended schedules hereto.

Utilities may, from time to time, request modifications to the Managed Services, and WUC agrees to consider such requests, acting reasonably. If WUC accepts a request for modification to the Managed Services, the Parties shall negotiate appropriate changes to the descriptions of the Managed Services, the terms and conditions for the provision of those modified Managed Services and the Fees in connection with such changes and shall initial and attach amended schedules hereto.

In the event that the Party requesting modifications is unable to reach agreement with the other Party, the requesting Party shall have the right to terminate in accordance with Section 9.2 the specific Managed Services that modifications are being requested to.

ARTICLE 4 **RESPONSIBILITIES**

4.01 ACCESS

Utilities will maintain all relevant records, including employee records, on behalf of WUC relating to the performance of the Managed Services hereunder. WUC will grant reasonable access by Utilities to WUC's facilities and records, including employee records, in connection with the provision of the Managed Services. Utilities agrees that when performing the Managed Services on the premises of WUC, Utilities' employees will comply with all health and safety rules and regulations which are brought to their attention from time to time.

4.02 CO-OPERATION

The Parties shall cooperate with each other during and after the term of this Agreement to effect a smooth and orderly transition of the Managed Services upon the termination of this Agreement, and also with respect to audits or other inquiries, filings, reports and payment of taxes arising under this Agreement, which may be required, initiated or requested from or by the OEB or any other duly authorized Governmental Authority. In particular, WUC agrees to provide any documentation which may be requested by the OEB or any Governmental Authority to the OEB or Governmental Authority in accordance with this Section.

4.03 NOTIFICATION OF CHANGES OF CIRCUMSTANCES

The Parties shall promptly notify each other of any changes or prospective changes in circumstances that would materially affect the resources required for the performance of the Managed Services, including any anticipated material change in the nature or level of business of WUC, the number of employees of a Party, or any efforts relating to the organization of or collective bargaining by employees of a Party.

4.04 NOTICE OF PROCEEDINGS

The Parties shall promptly give notice to each other of all actual or potential claims, proceedings, notice of regulatory non-compliance from the OEB or any Governmental Authority, disputes (including labour disputes) or litigation which it reasonably believes could have a adverse effect on the fulfillment of any of the terms hereof by either party (whether or not any such claim, proceeding, dispute or litigation is covered by insurance) in respect of its own operations of which any of them is aware. Each Party shall provide the other Party with all information reasonably requested from time to time concerning the status of such claims, proceedings, notices, disputes, or litigation, and any developments relating thereto.

4.05 PERMITS

Each Party shall, at its sole expense, obtain and maintain during the Term, all permits, licenses and approvals required by Applicable Law to perform its duties and obligations under this Agreement and upon request, shall provide the other Party with proof thereof.

4.06 INSURANCE

Each Party shall, during the Term, and at its own expense, maintain and keep in full force and effect general liability insurance on an occurrence basis having a minimum inclusive coverage limit, including personal injury and property damage of not less than five million dollars (\$5,000,000.00) per occurrence, and upon request, shall provide the other Party with proof thereof.

4.07 COMPLIANCE WITH APPLICABLE LAW

Each Party and its Representatives shall comply with all Applicable Laws in performing their duties and obligations under this Agreement and upon request, shall provide the other Party with proof thereof.

ARTICLE 5
FEES AND PAYMENTS

5.01 FEES

In consideration of the provision of the Managed Services, WUC shall pay monthly in arrears to Utilities the Fees set out in Schedule I. The obligation of WUC to pay Fees to Utilities shall commence on the Effective Date of this Agreement.

5.02 PAYMENT

Each calendar month, Utilities shall render to WUC in connection with the Managed Services, an invoice setting forth the Fees due by WUC to Utilities and any other amounts due between the Parties with respect to the immediately preceding calendar month.

Within thirty (30) days from WUC's receipt of such invoice, WUC shall pay the invoice(s) to Utilities by direct deposit to any account designated by Utilities.

5.03 ADJUSTMENT TO THE FEES

The Parties acknowledge that the Fees being charged to WUC have been determined in accordance with the ARC insofar as they are based upon Utilities' cost of providing the Managed Services using the KPMG Cost Allocation Methodology plus a return on its invested capital as specified in the ARC. The Fees set forth in Schedule I shall be reviewed by the Parties and adjusted from time to time as may be necessary to comply with ARC and in any event within three (3) months prior to each anniversary of the Effective Date to account for:

- (a) any changes in the cost of complying with any Applicable Law affecting the provision of Managed Services;
- (b) any changes to the nature or scope of the Managed Services;
- (c) reasonably anticipated changes (based on experience or expected developments) in the historical or reasonably anticipated costs to Utilities of providing Managed Services; and
- (d) any decision by the OEB in respect of any aspect of the ARC as it relates to Utilities or any other licensed distributor in Ontario.

Upon WUC's agreement to the increased cost, the applicable Fee shall be increased effective on the anniversary of the Effective Date or such other date as may be agreed upon by the Parties. In the event that the Parties are unable to agree upon any adjustment, Utilities shall nonetheless have the right to charge the increased applicable Fee as of the date such Fee has been communicated to WUC, but WUC shall have the right to terminate those Managed Services subject to the increase by providing ninety (90) days written notice to Utilities.

5.04 TAXES

In addition to the Fees, WUC shall pay to Utilities an amount equal to any and all applicable taxes under the Excise Tax Act of Canada, sales taxes, value-added taxes or any other taxes (excluding income taxes) properly exigible on the supply of the Managed Services provided for under this Agreement.

5.05 LATE PAYMENT

If WUC fails to pay any amounts payable hereunder when due, such unpaid amounts shall bear interest from the due date thereof to the date of payment at Prime Rate plus one percent (1%).

ARTICLE 6 **REPRESENTATIONS AND WARRANTIES**

6.01 REPRESENTATIONS AND WARRANTIES OF UTILITIES

Utilities hereby represents and warrants to WUC as follows and acknowledges that WUC is relying on such representations and warranties in connection herewith:

- (a) Utilities is a corporation, duly incorporated, validly existing and in good standing under the laws of the Province of Ontario and it has the rights, powers and privileges to execute and deliver this Agreement and to perform its obligations hereunder;
- (b) the execution, delivery and performance of this Agreement has been duly authorized by all necessary corporate action;
- (c) this Agreement has been duly executed and delivered by Utilities and constitutes a legal, valid and binding obligation of Utilities, enforceable against Utilities by WUC in accordance with its terms; and
- (d) Utilities has the necessary resources and expertise to perform the Managed Services.

6.02 REPRESENTATIONS AND WARRANTIES OF WUC

WUC hereby represents and warrants to Utilities as follows and acknowledges that Utilities is relying on such representations and warranties in connection herewith:

- (a) WUC is a Commission, duly organized, validly existing and in good standing under the laws of the Province of Ontario and it has the rights, powers and privileges to execute and deliver this Agreement and to perform its obligations hereunder;
- (b) the execution, delivery and performance of this Agreement has been duly authorized by all necessary corporate actions; and
- (c) this Agreement has been duly executed and delivered by WUC and constitutes a legal, valid and binding obligation of WUC, enforceable against WUC by Utilities in accordance with its terms; and
- (d) WUC has the necessary resources to pay for the Managed Services.

ARTICLE 7 INDEMNIFICATION

7.01 INDEMNIFICATION BY WUC

WUC shall indemnify and hold Utilities and its Representatives harmless from and against any and all claims, demands, suits, losses, damages, liabilities, penalties, obligations, payments, costs and expenses and accrued interest thereon (including the costs and expenses of, and accrued interest on, any and all actions, suits, proceedings for personal injury (including death) or property damage, assessments, judgments, settlements and compromises relating thereto and reasonable lawyers' fees and reasonable disbursements in connection therewith) asserted against or suffered by Utilities and its Representatives relating to, in connection with, resulting from, or arising out of (a) breaches of WUC's obligations herein; (b) any misrepresentation, inaccuracy, incorrectness or breach of any representation or warranty made by WUC contained in this Agreement; (c) any of WUC's acts or omissions, whether negligent or otherwise; and/or (d) the physical infrastructure and assets owned or under the control of WUC including but not limited to the water treatment and water distribution systems.

7.02 INDEMNIFICATION BY UTILITIES

Utilities shall indemnify and hold WUC and its Representatives harmless from and against any and all claims, demands, suits, losses, damages, liabilities, penalties, obligations, payments, costs and expenses and accrued interest thereon (including the costs and expenses of, and accrued interest on, any and all actions, suits, proceedings for personal injury (including death) or property damage, assessments, judgments, settlements and compromises relating thereto and reasonable lawyers' fees and reasonable disbursements in connection therewith) asserted against or suffered by WUC and its Representatives relating to, in connection with,

resulting from, or arising out of (a) breaches of Utilities' obligations herein; (b) any misrepresentation, inaccuracy, incorrectness or breach of any representation or warranty made by Utilities contained in this Agreement; and/or (c) any of Utilities' acts or omissions, whether negligent or otherwise.

7.03 LIMITATION OF LIABILITY

Each Party's liability in connection with this Agreement shall not exceed the aggregate of the Fees paid by WUC during the year for the specific Managed Services in which the event giving rise to the indemnity claim occurred. In addition, each Party's liability in connection with this Agreement will be limited to direct damages and neither Party will be liable to the other for any special, incidental, indirect or consequential damages, lost business revenue, loss of profits, failure to realize expected profits or savings, or any damages or losses, whether based on breach of contract or tort (including negligence) or otherwise, even if the Party causing such loss or damages has been advised of the possibility of same. The foregoing limitations shall not apply in respect of Section 7.01(d).

ARTICLE 8

DEFAULT

8.01 DEFAULT

The occurrence of any one or more of the following shall constitute an event of default on the part of a Party (an **"Event of Default"**):

- (a) if a Party defaults in the payment of any amount due to the other Party under this Agreement and such default shall continue unremedied for thirty (30) days following notice thereof to the defaulting Party by the non-defaulting Party; and
- (b) breach of any material representation or warranty or failure to perform or observe any material covenant or obligation of the Party under this Agreement if such failure is not remedied within thirty (30) days following notice thereof (giving particulars of the failure in reasonable detail) from the non-defaulting Party or such longer period as may be reasonably necessary to cure such failure (if such failure is capable of being cured), provided that:
 - (i) the defaulting Party proceeds with all due diligence to cure or cause to be cured such failure;
 - (ii) the failure can be reasonably expected to be cured or caused to be cured within a reasonable time frame acceptable to the non-defaulting Party, acting reasonably.

ARTICLE 9

TERMINATION

9.01 TERMINATION ON DEFAULT

Upon the occurrence of an Event of Default under this Agreement which is not cured within the permitted time period specified, the non-defaulting Party shall have the right to terminate this Agreement by giving notice of termination to the defaulting Party whereupon this Agreement shall terminate as at the effective date of termination specified in the notice.

9.02 TERMINATION ON NOTICE

In addition to the right of termination on notice provided for in Section 5.03, either Party may terminate this Agreement by giving notice to the other Party no less than ninety (90) days in advance of the termination date of the then current Term. The Party exercising its right to terminate shall provide as much advance notice to the other Party as reasonably possible in the circumstances of its intent to terminate any specified Managed Services in accordance with this section.

9.03 TERMINATION FOR CHANGE IN APPLICABLE LAW

In the event that:

- (a) there is a change in Applicable Law which materially affects Utilities;
- (b) Utilities is advised by the OEB in writing that the provision of any or all of the Managed Services is not acceptable to the OEB;
- (c) Utilities is unable to perform any or all of the Managed Services due to a change in policy, guidelines, codes, directives, order, decision or other regulatory action of the OEB or any other Governmental Authority;
- (d) the OEB amends the Affiliate Relationships Code which amendment materially affects Utilities;

then Utilities shall have the right to terminate any or all of the Managed Services by giving notice of termination to WUC whereupon the specified Managed Services shall terminate as of the effective date of termination specified in the notice. Utilities shall provide as much advance notice to WUC as reasonably possible in the circumstances of its intent to terminate any specified Managed Services in accordance with this section.

9.04 CONSEQUENCES OF TERMINATION

Upon termination of any or all of the Managed Services under this Agreement or upon termination of this Agreement for any reason:

- (a) the relevant provisions of this Agreement shall continue in effect after termination to the extent necessary to provide for any billings, adjustments and payments related to the period prior to termination;
- (b) the termination shall not affect any rights or obligations which may have accrued prior to such termination or any other rights which the terminating Party may have arising out of the termination or the event giving rise to the termination and shall not effect the continuing obligations of either Parties under this Agreement which are expressed to continue after termination of this Agreement; and
- (c) except as provided in (a) or (b) above, the terminating Party shall have no liability whatsoever to the other Party arising from such termination. For greater certainty, the terminating Party shall have no liability whosoever to the other Party for any special, incidental, indirect or consequential damages, lost business revenue, loss of profits, failure to realize expected profits or savings, or any damages or losses, whether based on breach of contract or tort (including negligence) or otherwise, even if the Party causing such loss or damages has been advised of the possibility of same, which the other Party may incur as a result of the termination.

ARTICLE 10

CONFIDENTIALITY

10.01 CONFIDENTIAL INFORMATION

Each Party (the “**Receiving Party**”) shall maintain in strict confidence any and all proprietary and confidential information about the business or operations or customers of the other Party or any of their Affiliates, which it acquires in any form from the other Party (the “**Disclosing Party**”) by virtue of this Agreement (“**Confidential Information**”) and will not disclose to any third party or make use of such Confidential Information (except for the purposes of this Agreement) for itself or any third party without the prior written consent of the Disclosing Party, except as permitted herein and except where required by law. Notwithstanding the foregoing, “**Confidential Information**” shall not include information which:

- (a) is in the public domain at the time of its disclosure to the Receiving Party or which thereafter enters the public domain otherwise than by any breach of this Agreement;
- (b) is already known to or in the possession of the Receiving Party at the time of its disclosure by the Disclosing Party as evidenced by the Receiving Party's records;
- (c) is lawfully acquired at any time by the Receiving Party without restrictions from a third party without breach of confidentiality by such third party;

- (d) required to be disclosed under Applicable Law, judicial decision or by order, decree, rule, regulation or requirement of any Governmental Authority, including the OEB; or
- (e) is required to be disclosed in the course of an arbitration conducted in accordance with Article 12 of this Master Agreement.

10.02 PERMITTED DISCLOSURE

Notwithstanding Section 10.01,

- (a) the Parties hereby acknowledge and agree that Utilities shall be permitted to disclose Confidential Information relating to this Agreement to the OEB and any other Governmental Authority to which Utilities may be required to report under the Affiliate Relationships Code, the Reporting and Record Keeping Requirements ("RRR") and other Applicable Law;
- (b) the Parties hereby acknowledge that they are both subject to the MFIPPA and that as a result either Party may be required to disclose Confidential Information concerning this Agreement or the other Party in accordance with the provisions of MFIPPA;
- (c) in the event that a Receiving Party is required by law to disclose any Confidential Information to a Governmental Authority, or any other person, including, without limitation, any disclosure required pursuant to a request under MFIPPA, such Party may so disclose; provided that it shall, to the extent permitted by law, first inform the Disclosing Party of the request or requirement for disclosure to allow an opportunity for the Disclosing Party to apply for an order to prohibit or restrict such disclosure;
- (d) WUC acknowledges and agrees that the use and disclosure of any information relating to the customers of Utilities is governed by requirements of the *Ontario Energy Board Act, 1998*, and regulations, licences, codes and procedures established by the OEB ("**OEB Requirements**"). WUC agrees and acknowledge that if any information relating to Utilities or the customers of Utilities is disclosed to WUC or its Representatives, WUC shall strictly comply, and shall cause its Representatives to strictly comply with the OEB Requirements, the requirements, policies or procedures of Utilities, and if and to the extent that PIPEDA may be or become applicable, with the requirements of PIPEDA related to or arising from such disclosures;
- (e) If and to the extent that PIPEDA may be or become applicable, Utilities agrees and acknowledges that if any information relating to the customers of WUC is disclosed to Utilities or its Representatives, Utilities shall strictly comply and shall cause its Representatives to strictly comply with the requirements of PIPEDA and such other requirements, policies or procedures of WUC related to or arising from such disclosures.

10.03 LIABILITY FOR BREACH

Except for disclosures made pursuant to Section 10.02 of this Agreement or as required by law, or to the OEB or any Governmental Authority as required pursuant to the policies, codes, directives or other requirements of the OEB or other Governmental Authority, or as required to fulfil the terms of this Agreement, each Party shall be responsible for any breach of this Agreement by the Party, its Representatives and any person to whom it discloses any Confidential Information or personal information as that term is defined in applicable privacy legislation such as MFIPPA and PIPEDA (“**Personal Information**”). The Parties agree that a Disclosing Party would be irreparably injured by a breach of this Agreement by a Receiving Party or by any person to whom it discloses any Confidential Information or Personal Information and that monetary damages would not be a sufficient remedy. Therefore, in such event, the Disclosing Party shall be entitled to equitable relief, including injunctive relief without proof of actual damages, as well as specific performance. Such remedies shall not be deemed to be exclusive remedies for a breach of this Agreement but shall be in addition to all other remedies available at law or equity.

10.04 RETURN OF CONFIDENTIAL INFORMATION

Subject to Applicable Law, upon completion or termination of this Agreement, or upon ten (10) days written notice from the Disclosing Party requesting return of any or all Confidential Information, the Receiving Party shall forthwith return to the Disclosing Party, without retaining any copies thereof, all such information.

ARTICLE 11 **FORCE MAJEURE**

11.01 FORCE MAJEURE

Except for the payment of any monies required hereunder, neither Party shall be deemed to be in default of this Agreement where the failure to perform or the delay in performing any obligation is due to a cause beyond its reasonable control, including, but not limited to, an act of God, act of any Governmental Authority, civil commotion, acts of terrorism including threatened acts, strikes, lockouts and other labour disputes, fires, floods, sabotage, earthquakes, ice storms, tornado, severe and imminent weather warnings and conditions, and epidemics (“**Force Majeure**”).

11.02 NOTICE OF FORCE MAJEURE

Once a Party becomes subject to such an event of Force Majeure, it shall promptly notify the other Party of its inability to perform, or of any delay in performing, due to an event of Force Majeure and shall provide an estimate, as soon as practicable, as to when the obligation will be performed. The Party subject to the Force Majeure event shall also continue to furnish timely reports to the other Party with respect to the Force Majeure event during the continuation of the

said event and the said Party shall exercise all commercially reasonable efforts to mitigate or limit damages to the other Party. The Party subject to the Force Majeure event shall use its commercially reasonable best efforts to continue to perform its obligations under this Agreement and to correct or cure the event or condition excusing performance and when the said Party is able to resume performance of its obligations thereunder, it shall give the other Party written notice to that effect and shall promptly resume performance thereunder. The time for performing the obligation shall be extended for a period equal to the time during which the Party was subject to the event of Force Majeure. The Parties shall explore all commercially reasonable avenues available to avoid or resolve events of Force Majeure in the shortest time possible.

11.03 STRIKES

Notwithstanding the two preceding paragraphs, the settlement of any strike, lockout, restrictive work practice or other labour disturbance constituting a Force Majeure event shall be within the sole discretion of the Party involved in such strike, lockout, restrictive work practice or other labour disturbance and nothing in the two preceding paragraphs shall require the said Party to mitigate or alleviate the effects of such strike, lockout, restrictive work practice or other labour disturbance.

ARTICLE 12 **DISPUTE RESOLUTION**

12.01 DISPUTES

Any controversy, dispute, difference, question or claim arising between the Parties in connection with the interpretation, performance, construction or implementation of this Agreement that cannot be resolved by a director or manager from each Party (collectively, the “Dispute”), shall be settled in accordance with this Article.

12.02 NOTICE OF DISPUTE

The aggrieved Party shall send the other Party written notice identifying the Dispute, the amount involved, if any, and the remedy sought, and invoking the procedures of this Article. A senior officer with authority to bind WUC as selected by the WUC in its discretion and a senior officer with authority to bind Utilities as selected by Utilities in its discretion, shall confer in an effort to resolve the Dispute. If the Dispute cannot be resolved in accordance with this Section 12.02 within thirty (30) days of the date the Dispute arose, the Dispute shall be resolved by arbitration in accordance with Sections 12.03 and 12.04.

12.03 ARBITRATORS

The Parties shall submit any arbitration under this Article to a single arbitrator agreed upon by both Parties. If the Parties cannot agree upon a single arbitrator within ten (10) days after the Dispute is referred to arbitration, each Party shall within ten (10) more days choose one individual who shall sit on a three-member arbitration panel. The two (2) arbitrators appointed shall name the third arbitrator within ten (10) days or, if they fail to do so within that time period,

either Party may make application to a court of competent jurisdiction for appointment of the third arbitrator. Any arbitrator selected to act under this Agreement shall be qualified by education, training and experience to pass on the particular question in Dispute and shall have no connection to either of the Parties other than acting in previous arbitrations.

12.04 ARBITRATION

The arbitration shall be conducted in accordance with the provisions of the *Arbitration Act, 1991* (Ontario). The arbitration shall be conducted in the City of Windsor, Ontario unless the Parties agree otherwise. The decisions of the arbitrator or arbitration panel shall be made in writing and shall be final and binding on the Parties as to the questions submitted and the Parties shall have no right of appeal therefrom. All costs and expenses relating to a Dispute which is finally determined or settled by arbitration, including reasonable legal fees, will be borne by the Party determined to be liable in respect of such Dispute; provided, however, that if complete liability is not assessed against only one Party, the Parties will share the total costs in proportion to their respective amounts of liability so determined. The Parties agree to keep all details of the arbitration proceeding and the arbitral award strictly confidential. Notwithstanding the provisions to arbitrate any Dispute hereunder, either Party may seek from a court any equitable relief (including, without limitation, injunctive relief) that may be necessary to protect such Party's rights.

ARTICLE 13

GENERAL

13.01 CHANGE OF CONTROL

In the event that WUC ceases to serve as a public utility, is no longer a local board of the municipality, and is no longer owned or controlled directly or indirectly by the City or Windsor or Corporation of the City of Windsor, the Parties agree to negotiate diligently and in good faith any amendments to this Agreement necessary or advisable in connection with such event including an early termination.

13.02 ASSIGNMENT

Neither Utilities or WUC shall, without the prior approval of the other Party which shall not be unreasonably withheld, assign or transfer its interest in this Agreement. This Agreement shall be binding on the Parties and their respective successors and permitted assigns. Any purported assignment in contravention of this section shall be void.

13.03 NOTICES

All notices, requests, approvals, consents and other communications required or permitted under this Agreement shall be in writing and addressed as follows:

- (a) if to Utilities:

787 Ouellette Avenue
P.O. Box 1625, Station "A",
Windsor, Ontario N9A 5T7
Attention: Chief Financial Officer

- (b) if to WUC:

4545 Rhodes Drive
P.O. Box 1625, Station "A",
Windsor, Ontario N9A 5T7
Attention: Chief Financial Officer

and shall be delivered to the other Party's address, with the Party sending such notice to telephone to confirm receipt. A copy of any such notice shall also be sent on the date such notice is transmitted by registered express mail or courier with the capacity to verify receipt of delivery. Any Party may change its address for notification purposes by giving the other Party notice of the new address and the date upon which it will become effective in accordance with the terms of this Section 13.03. A notice shall be deemed to have been received as of the date of receipt by the Party to whom the notice is addressed.

13.04 SEVERABILITY

If any provision of this Agreement is held by a court of competent jurisdiction to be unenforceable or contrary to law, then the remaining provisions of this Agreement, or the application of such provisions to persons or circumstances other than those as to which it is invalid or unenforceable shall not be affected thereby, and each such provision of this Agreement shall be valid and enforceable to the extent granted by law.

13.05 WAIVER

No delay or omission by a Party to exercise any right or power it has under this Agreement or to object to the failure of any covenant of any other Party to be performed in a timely and complete manner, shall impair any such right or power or be construed as a waiver of any succeeding breach or any other covenant. All waivers must be in writing and signed by the Party waiving its rights.

13.06 ENTIRE AGREEMENT

This Agreement constitutes the entire Agreement among the Parties with respect to the Managed Services, and there are no other representations, understandings or agreements, either oral or written, between the Parties other than as herein set forth.

13.07 AMENDMENTS

No amendment to, or change, waiver or discharge of any provision of this Agreement shall be valid unless in writing and signed by authorized representatives of each Party.

13.08 GOVERNING LAW

This Agreement shall be governed by the laws of the Province of Ontario and the laws of Canada applicable therein, excluding their rules governing conflicts of laws. Subject to Article 11, the Parties hereby agree that the courts of the Province of Ontario shall have exclusive jurisdiction over disputes under this Agreement, and the Parties agree that jurisdiction and venue in such courts is appropriate and irrevocably attorn to the jurisdiction of such courts.

13.09 SURVIVAL

Section 4.02, Article 5, Article 7, Section 9.03, Article 10, Article 12, Schedule I and this Section 13.09 shall survive the termination of this Agreement and shall remain in full force and effect.

13.10 THIRD PARTY BENEFICIARIES

Each Party intends that this Agreement shall not benefit or create any right or cause of action in or on behalf of any person or entity other than the Parties.

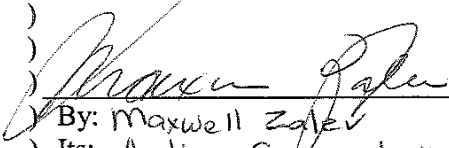
13.11 COVENANT OF FURTHER ASSURANCES

The Parties agree that, subsequent to the execution and delivery of this Agreement and without any additional consideration, the Parties shall execute and deliver or cause to be executed and delivered any further legal instruments and perform any acts which are or may become necessary to effectuate the purposes of this Agreement and to complete the transactions contemplated hereunder.

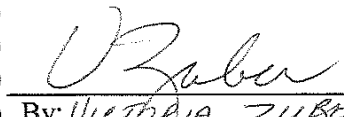
IN WITNESS WHEREOF the parties have executed this Agreement by their duly authorized signing officer in that regard.

SIGNED, SEALED AND DELIVERED

)
)
) WINDSOR UTILITIES COMMISSION
)
)

) 
)
) By: Maxwell Zalev
) Its: Acting General Manager
) I have authority to bind the Commission.
)
)

) ENWIN UTILITIES LTD.
)
)

) 
)
) By: VICTORIA ZUBER
) Its: VAFINANCE & CFO
) I have authority to bind the Corporation.

SCHEDULE A
HUMAN RESOURCES MANAGEMENT AND SUPPORT SERVICES

The following human resources management and support services shall be provided by Utilities Ltd. to WUC in accordance with this Agreement:

- (a) provision, maintenance and administration of management staffing requirements, including:
 - (i) Employee recruitment and selection
 - (ii) Organizational employee training and orientation, excluding WUC provided on-the-job training, first aid training, health & safety, and director approved WUC programs
 - (iii) Employee performance and evaluation
 - (iv) Assisting WUC safety supervisor with compliance matters pursuant to Occupational Health and Safety Act
 - (v) Workplace Safety and Insurance Board filings
 - (vi) Employee termination
 - (vii) Employee retirement
 - (viii) Employee master files
 - (ix) Dispute resolution / arbitration
 - (x) Quality systems (ISO 9001 and Measurements Canada)
- (b) administration of the following management compensation requirements:
 - (i) Salary benchmarking and determination
 - (ii) OMERS Pension Plan
 - (iii) Employee Assistance Program
 - (iv) Employee Benefits Program
- (c) provision, maintenance and administration of unionized staffing requirements, including:
 - (i) Employee recruitment and selection
 - (ii) Organizational employee training and orientation
 - (iii) Employee performance and evaluation
 - (iv) assist Compliance with Occupational Health and Safety Act
 - (v) Workplace Safety and Insurance Board filings
 - (vi) Worksite safety inspections / safety training
 - (vii) Employee termination
 - (viii) Employee retirement
 - (ix) Employee master files
 - (x) Contract interpretation and negotiation
 - (xi) Grievance administration / arbitration
 - (xii) Quality systems (ISO 9001 and Measurements Canada)
- (d) administration of the following unionized employee compensation requirements:
 - (i) Contract administration and negotiation — wage rates
 - (ii) OMERS Pension Plan
 - (iii) Employee Assistance Program

(iv) Employee Benefits Program

- (e) periodic review and evaluation of performance by Utilities under this Agreement [not less than annually], with mandatory input from WUC which input may include WUC's own independent review and evaluation, as to effectiveness of Utilities' senior management group taken as a whole, and the Chief Executive Officer of Utilities in particular, in attaining WUC's established goals and objectives in respect to provision of Managed Services. The review and evaluation shall include co-operative efforts to establish mutually agreed upon goals and objectives for the continuance of Managed Services.

SCHEDULE B
FINANCE AND ACCOUNTING SERVICES

The following finance and accounting services shall be provided by Utilities to WUC in accordance with this Agreement:

- (a) preparation of all financial reports as required, including but not limited to:
 - (i) Annual operating and capital budgets
 - (ii) Monthly reporting package, including monthly and year to date financial statements and variance from budget by category
 - (iii) Special or general purpose reports and analysis as requested
 - (iv) Supporting schedules as required by internal and external auditors
 - (v) Supporting schedules as required to prepare applicable tax, property tax, and other tax filings and returns as may be required by law from time to time
- (b) assistance with our financial needs, including:
 - (i) Cash management
 - (ii) Adequacy and appropriateness of insurance coverage
 - (iii) Processing all daily accounting transactions, including required data entry, payments by due dates and deposits
- (c) administration of periodic management and union payroll, including:
 - (i) Calculation of gross pay and required statutory, contractual, pension, benefit related and miscellaneous deductions per employee, as applicable
 - (ii) Preparation of periodic employee pay stubs and pay cheques / direct deposits
 - (iii) Preparation of periodic remittance forms related to source deductions, Employer Health Tax and Workplace Safety and Insurance Board
 - (iv) Establishment of new employee record on hire
 - (v) Assistance with statutory obligations relating to employee terminations
 - (vi) Payments to all employees
 - (vii) Preparation of all statutory and contractual annual compliance forms including but not limited to, the T4 statement of remuneration reporting forms, the related summary and the Employer Health Tax annual return
- (d) administration of periodic statutory compliance, including:
 - (i) the Federal Goods and Services tax returns and remittances on a monthly basis
 - (ii) Federal and Provincial payments of applicable tax, property tax, and other taxes exigible by law from time to time on a monthly and annual basis, as required

- (iii) funding all payroll related obligations on a periodic basis in conjunction with required compliance deadlines
- (iv) Annual pension and benefit reporting forms, as required
- (v) Provincial Retail Sales Tax compliance and application for exemption, as required

SCHEDULE C
BILLING AND COLLECTION SERVICES

The following billing and collection services shall be provided by Utilities to WUC in accordance with this Agreement:

- (a) Maintenance and periodic updating of all customer master files
- (b) Preparation and distribution of monthly invoices
- (c) Payment in full of amounts received on a monthly basis in respect to billing and collection services on behalf of WUC
- (d) Ensuring rates are in compliance with WUC requirements and any regulating body requirements
- (e) Prepare variance reports
- (f) Advise Directors/Managers of observed inaccurate or questionable readings for further action

SCHEDULE D
PURCHASING AND INVENTORY MANAGED SERVICES

The following purchasing and inventory Managed Services shall be provided by Utilities to WUC in accordance with this Agreement:

- (a) Administration of the purchasing function in conjunction with the existing Purchasing Policy, including the following:
 - (i) Coordinate the procurement of all inventory, non-inventory, purchased services, capital and special needs items
 - (ii) Obtain competitive quotes and select the optimal supplier based on the requirements as indicated on the authorized purchase order
 - (iii) Administer the logistics related to the purchases, including shipping, receiving and expediting as required
 - (iv) Provide draft RFQ as applicable
 - (v) Penalties for expired or late deliveries
- (b) Provision of inventory Managed Services, including the following:
 - (i) Control of purchased items, including receipt, warehousing, release and re-stock as required Monitoring quantities in conjunction with lead times and assistance with requirements planning
 - (ii) Delivery of items from vendor and/or inventory to job sites, as applicable
 - (iii) When required, allocation of items used to the correct project for accounting purposes and processing required adjustments
- (c) Compliance with all industry and statutory requirements as they apply to purchasing and inventory management, including but not limited to annual testing and certification.

SCHEDULE E
FLEET AND SITE MANAGED SERVICES

The following fleet and site Managed Services shall be provided by Utilities to WUC in accordance with this Agreement:

- (a) Assistance with requirements planning
- (b) Provision of all vehicles and equipment as required to operate
- (c) Assistance in management of WUC owned/controlled sites, and provision and management of additional facilities as may be necessary from time to time to meet WUC operations requirements [eg. Meter Shop located at Rhodes Drive facility] and as necessary to support the Managed Services being provided
- (d) Provide after hours Fueling service for WUC vehicles
- (e) Provide inside parking for WUC vehicles and allocate space as required

SCHEDULE F
INFORMATION SERVICES

The following information services shall be provided by Utilities to WUC in accordance with this Agreement:

- (a) Assistance with all purchase decisions related to computer hardware and software in conjunction with the Schedule D
- (b) Installation of all required software updates and upgrades, as required;
- (c) Assistance with respect to all licensing issues regarding hardware and software, except for software and hardware excluded by mutual agreement;
- (d) Coordination of user training, as required
- (e) Provision of a "Help Desk" available for desktop management and trouble shooting during normal business
- (f) Provision and monitoring of WUC Internet policy
- (g) Security, storage and safekeeping of all electronic data
- (h) Application research related new applicable technology and capacity management
- (i) Provision and monitoring of services arising out of privacy and access legislation, including the Municipal Freedom of Information and Protection of Privacy Act to the extent and subject to any conditions as may be delegated by WUC to EnWin or any officer of EnWin from time to time, and arising out of WUC's Privacy Policy, including supervision and assistance regarding WUC compliance with all applicable privacy legislation
- (j) Provision of and assistance with phone system including use of 255-2727 number and use for WUC purposes of 311 System [ownership and licencing rights of both foregoing held by Utilities] including securing of all necessary hardware, software, licencing, and also including training of staff, and ongoing monitoring of system.
- (k) Provide assistance in running queries requested by WUC efficiently

SCHEDULE G
TECHNICAL AND CUSTOMER SERVICES

The following technical and customer services shall be provided by Utilities to WUC in accordance with this Agreement:

- (a) Provision of a call center to accept, log and monitor responses to external requests for service work
- (b) When required, assistance with aspects of Development Servicing, including:
 - (i) Discussions with developers and their representatives to ensure preliminary engineering plans are in compliance with existing municipal codes and standards
 - (ii) Negotiations with developers and their representatives with respect to required or requested changes to the agreements
 - (iii) Approval of final designs
 - (iv) Ensuring that adequate securities are in place
- (c) Provision of meter testing, repair and accreditation services in compliance with all statutory requirements, as requested
- (d) Provision of meter reading services, including periodic and single purpose reads, as required
- (e) To the extent required, control over accuracy and integrity of meter data as it relates to billing, settlement, water management and planning, and provision of general and special purpose reports, as required
- (f) To the extent required, Control over accuracy and integrity of account master files, including processing required changes and updates for names, addresses, meter specific information and deposits held on account (where applicable)
- (g) Monitor the development of and updates to the company website, and assist in the development and implementation of electronic commerce and external communication strategies
- (h) Assist and perform to the extent required, services related to water testing
- (i) Accept other methods of payment for customers/contractors
- (j) Advise WUC of observed inaccuracies in billing/reading data.

SCHEDULE H
OTHER SERVICES

The following services shall be provided by Utilities Ltd. to WUC in accordance with this Agreement:

- (a) Additional Services
 - (i) Sorting and delivering all incoming mail and coordinating the posting and processing of outgoing mail
 - (ii) Forms management, including design as required
 - (iii) Control over office supplies inventory, including disbursements to all areas
 - (iv) Supply of Records Management System, providing for coding, tracking, storage, retention and purging in compliance with all governmental standards and requirements
 - (v) Coordinate communication with the Board of Directors and shareholder, as required
 - (vi) Coordinate communication with outside legal counsel on general corporate issues, as required
 - (vii) Provide corporate secretary and official witness services, as required
 - (viii) Freedom of Information coordinator, as required
 - (ix) Provide President & CEO (General Manager), COO, CFO, and other executive level management as required;
 - (x) Provision of all other Senior Management Personnel as may be required by WUC from time to time to perform, Administrative, and Operational Services, including Director of Engineering, Director of Operations Infrastructure, Director Water Production, Chief Engineer, and other engineering management as required
- (b) Assist with Water Management Related Services including as required
 - (i) Arranging and coordinating Water Engineering Services
 - (ii) Arranging and coordinating Water Lab Services
 - (iii) Arranging and coordinating Water Metering Services
 - (iv) Arranging and coordinating Training Services

SCHEDULE I
FEES

EFFECTIVE AS AT JANUARY 1, 2007

Fees for the services as described in the Agreement shall be calculated based upon Utilities' cost of providing the Managed Services (using the KPMG Cost Allocation Methodology) plus such other return on assets/capital or otherwise permitted in the OEB's Affiliate Relationships Code.

The monthly fee to be paid WUC to Utilities until otherwise mutually agreed shall be \$700,000.00 (plus all applicable taxes), being approximately one-twelfth (1/12) of the annual estimated amounts as follows:

Item	Annual Estimated Amount
Administration	\$1,852,424.00
Corporate Communications	97,547.00
Customer Service and Billing	972,008.00
Employee Future Benefits	742,885.00
Finance	451,002.00
Fleet Management	500,414.00
Human Resources	317,750.00
Information Technology Support	1,244,695.00
Meter Reading	563,019.00
Purchasing and Inventory Management	169,355.00
Site Services	367,308.00
Operating Costs	\$7,278,407.00
Depreciation and Interest	314,316.00
Return on Assets	668,915.00
CIS Asset Charge	296,976.00
Total MSA Fees for 2007	\$8,558,614.00
<u>Notes</u>	
Amounts shown are based on EnWin Utilities Ltd.'s 2007 approved budget and are subject to change based on the actual financial results on EnWin Utilities Ltd. in 2007.	
Amounts shown only represent fees for Managed Services to be charged to WUC.	

Within two months after the end of each calendar year the monthly fee paid by WUC shall be reconciled with the actual costs of Utilities providing the Managed Services in that calendar year. Any adjustments arising out of such reconciliation will be paid by the Party owing such adjustment within thirty days after such reconciliation has been completed. Such reconciliations shall be performed by the Auditors of Utilities, and at the request of WUC verified by the Auditors of WUC.