ATTACHMENT 46 – 2016 ROE (RRR 2.1.5.6) ENERSOURCE RZ

Regulated Return on Equity (ROE) - Summary

Regulated Rate of Return on Deemed Equity (ROE)

A distributor shall report, in the form and manner determined by the OEB, the Regulated Return on Equity (ROE) earned in the reporting year.

The reported ROE is to be calculated on the same basis as was used in the distributor's last Cost of Service (CoS).

Inputs by Distributor: Revenue/gain items are to be entered as negative numbers and expense/loss items are to be entered as positive numbers (to align with RRR 2.1.7 trial balance). Please read the RRR Filing Guide for the detailed guidance on the inputs of the form and appendices.

Information from the distributor's last CoS Decision and Order and the successfully submitted RRR 2.1.7 trial balance have been pre-populated in this form. Please review each input for accuracy and contact Industry Relations Enquiry if you have any questions.

Legend

Calculated cell	
Automated/linked cell	
Input cell	

				Data source:	
The CoS Decision and Order EB number for the ROE	EB-2012-0033		xx	CoS Decision and Order (last CoS establishing the current reporting year's base rates)	
Accounting standard used in CoS Decision and Order	MIFRS		yy	CoS Decision and Order	
Regulated net income					
Regulated net income (loss), as per RRR 2.1.7	$21,786,690.20		a	RRR 2.1.7 - USoA 3046 * (-	
Adjustment items:					
Non-rate regulated items and other adjustments (Appendix 1)	$1,157,912.37		b	Appendix 1 cell (aq)	**Please provide USoAs**
Unrealized (gains)/losses on interest rate swaps (Not applicable if recorded in Other Comprehensive Income)			c		
Actuarial (gains)/losses on OPEB and/or Pensions not approved by the OEB			d		**Please provide USoAs**
Non-recoverable donations (Appendix 2)	$0.00		e	Appendix 2 cell (be)	
Net interest/carrying charges from DVAs (Appendix 3)	-$30,170.15		f	Appendix 3 cell (cc)	
Interest adjustment for deemed debt (Appendix 4)	-$5,000,038.44		g	Appendix 4 cell (dg)	
Adjusted regulated net income before tax adjustments	$17,914,393.98		h=a+b+c+d+e+f+g		
Add back:					
Future/deferred taxes expense	$134,706.57		i	RRR 2.1.7 - USoA 6115	
Current income tax expense (Does not include future income tax)	$1,163,158.00		j	RRR 2.1.7 - USoA 6110	
Deduct:					
Current income tax expense for regulated ROE purposes (Appendix 6)	$136,999.50		k	Appendix 6 cell (fq)	
Adjusted regulated net income	$19,075,259.05		l=h+i+j-k		
Deemed Equity					
Rate base:					
Cost of power	$897,270,594.43		m	RRR 2.1.7 - Sum of USoA 4705 - 4751 inclusive	
Operating expenses before any applicable adjustments	$62,883,054.81		n1	RRR 2.1.7 - Sum of USoA 4505-4640, 4805-5695, 6105, 6205 , 6210, and 6225, then subtract ROE Summary cell (d) and subtract ROE Summary cell (e)	
Other Adjustments:					
Legal and Consulting Fees related to M&A Costs	$2,456,508.11		n2		**Please provide USoAs** *5665*
Adjusted operating expenses	$60,426,546.70		n=n1-n2		
Total Cost of Power and Operating Expenses	$957,697,141.13		o=m+n		
Working capital allowance % as approved in the last Decision and Order	13.50%	%	p	CoS Decision and Order	
Total working capital allowance ($)	$129,289,114.05		q=o*p		
PP&E					
Opening balance - regulated PP&E (NBV) (Appendix 5)	$632,783,020.51		r	Appendix 5 cell (ec)	
Adjusted closing balance - regulated PP&E (NBV) (Appendix 5)	$664,020,095.08		s	Appendix 5 cell (ej)	
Average regulated PP&E	$648,401,557.80		t=(r+s)/2		
Total rate base	$777,690,671.85		u=q+t		
Regulated deemed short-term debt % and $	4.00%	% v	$31,107,626.87	v1=v*u	Cell (v) from CoS Decision and Order
Regulated deemed long-term debt % and $	56.00%	% w	$435,506,776.23	w1=w*u	Cell (w) from CoS Decision and Order
Regulated deemed equity % and $	40.00%	% x	$311,076,268.74	x1=x*u	Cell (x) from CoS Decision and Order
Regulated Rate of Return on Deemed Equity (ROE)					
Achieved ROE%	6.13%	%	y= l / x1		
Deemed ROE% from the distributor's last CoS Decision and Order	8.93%	%	z	CoS Decision and Order	
Difference - maximum deadband 3%	-2.80%	%	z1 = y-z		
ROE status for the year (Over-earning/Under-earning/Within 300 basis points deadband)	Within 300 basis points de		z2		If the distributor is in an over-earning position as indicated in z2 , please complete Appendices 7 & 8. If the distributor is in an under-earning position as indicated in z2 , please complete Appendices 9 & 10.

ATTACHMENT 47 – ICM BUSINESS CASES ENERSOURCE RZ

Business Case

Project Name

The QEW – Evans Avenue to Cawthra Road Project

Project ID

2018-C0531-1

Project Duration

1 Year

Expected In-service Date

Q4 2018

Category

System Access

Background

This project addresses the investment needs arising from a mandatory relocation of electrical distribution assets in the Dixie Road/ QEW area requested by the road authority under the *Public Service Work on Highway Act* ("PSWHA")

As a result of the redesign of the on and off ramps at Dixie Road and the QEW by the Ontario Ministry of Transportation ("MTO"), Alectra Utilities is required to relocate electrical infrastructure to accommodate the road work, as well as the final cloverleaf configuration planned for the area. This mandatory project requires: the removal of 39 poles; the relocation of 72 poles; the installation of three temporary poles; and includes the implementation of an underground crossing of the QEW. In total, 114 poles are affected in this area. The MTO will contribute full expenditure related to all relocation of assets on municipal property and share expenditure based on a 50/50 arrangement for all asset relocation on MTO lands. The 50/50 arrangement is per the PSWHA. The total investment expenditure required to address this need is $1.628MM, less capital contributions of $0.32MM for a net expenditure requirement of $1.29MM. The project is scheduled to start in Q2, 2018 and to be completed and in-service by Q4, 2018.

Scope

Alectra Utilities installs the majority of its electrical distribution infrastructure along road rights of way that are owned and managed by the City of Mississauga and the Region of Peel, at no cost to the utility. Alectra Utilities' distribution equipment occupies road allowances, at no cost. In return, Alectra Utilities is required to remove, relocate, or reconstruct its facilities, in order to accommodate the specific requirements of the road authorities. The road authorities' road works program drives plant relocation scope and timing. Relocation of assets to accommodate road work impacts both overhead and underground distribution plant. Alectra Utilities remains compliant with the PSWHA, in regards to regulatory obligations and recovery of capital contributions. As per the PSWHA, Alectra Utilities recovers capital contributions related to 50% of expenditures from labour and labour saving device costs. Timelines for the execution of the road works at Dixie Road and the QEW are determined by the Region of Peel, the City of Mississauga, and the MTO.

Through active participation in meetings with the City of Mississauga, Region of Peel and the MTO representative, Alectra Utilities monitors road work planning and schedules road widening projects according to the most recent project developments and requests from the road authority. Alectra Utilities also monitors the progress of developments of environmental assessments, site plans and zoning amendments to ensure plans and schedules incorporate the timing and pacing of the investments needed. System access investments related to road work scope is estimated based on preliminary designs, historical expenditure of similar projects and includes consideration of previous phases of multi-year road work projects. Continuous meetings and discussions with the road authority also inform project planning.

As Alectra Utilities does not have discretion on the timing nor scope of relocation of assets for road work, consideration and scheduling constraints are incorporated to ensure mandatory system access investment related projects are completed, as required. If necessary, Alectra Utilities utilizes contractors to balance work load levels and fill resource gaps. Adequate notice is required for all project stakeholders, in order for appropriate resource budgeting, scheduling, material procurement and scope familiarity, system designs and construction standards. Alectra Utilities has already begun the development, planning and resourcing of this project to ensure sufficient lead time.

Options Considered

Option 1: *Status Quo*

This is a mandatory investment. Not proceeding with this project would be contrary to the PSWHA and Section 3.4 of the Distribution System Code.

Option 2: Installation of underground feeder cables in place of an overhead system.

Alectra Utilities examined the option of replacing the overhead system with underground feeders. The benefit of undergrounding an overhead system includes protection from elements, such as: weather related events; animal contacts; and collisions from motor vehicles. However, the option to underground the distribution system was estimated to cost between $9.7MM and $16MM and was determined to be uneconomical, relative to relocating the overhead system.

Option 3: Relocate plant as requested by the road authority

Alectra Utilities will comply with the PSWHA and work with the MTO, the Region of Peel and the City of Mississauga to relocate plant in a safe, cost effective manner.

Recommended Option

The recommended solution is Option 3, to relocate the plant as requested by the road authority. Road projects are mandatory obligation under Section 3.4 of the DSC, which requires that Alectra Utilities address the relocation of its assets when requested by a road authority.

The total investment expenditure required to address this need is $1.62MM less capital contributions of $0.32MM, for a net expenditure requirement of $1.29MM. The project is scheduled to start in Q2, 2018 and to be completed and in-service by Q4, 2018.

The primary benefits with proceeding with the project include:

- Regulatory/Public Policy Responsiveness - Alectra Utilities is obligated to relocate assets in order to meet its regulatory obligations to the City of Mississauga, the Region of Peel, and the MTO.
- Reputational Risk - Execution of requests to move assets ensures Alectra Utilities is not held responsible for delaying projects issued by the road authorities.

If the OEB does not approve this project, this mandatory work will still need to be completed, in order for Alectra Utilities to be compliant with the DSC and the PSWHA. Alectra Utilities would need to reassess other planned projects, and whether, and to what extent these would have to be deferred and the consequent impact on customers.

Business Case

Project Name

Glen Erin Drive & Montevideo Road Subdivision Rebuild

Project ID

2018-C0505-1

Project Duration

1 Year

Expected In-service Date

Q4 2018

Category

System Renewal

Background

Alectra Utilities distribution system in the Enersource RZ, is comprised of 65% underground and 35% overhead assets. Key components of the underground distribution system include: cables; padmount transformers; and padmount switchgear. Of the key underground distribution system components, underground primary cables have been identified by Kinectrics in the 2016 ACA as the distribution asset with the highest percentage of poor and very poor asset condition Health Index ("HI"). Alectra Utilities categorized underground cables into separate categories for main feeder and distribution cables. The HI assessment of the main feeder cables identified that 12% of main feeder cables have a very poor or poor health index, which relates to approximately 256km of 2,239 m feeder cable in-service. The HI assessment of the distribution feeder cables identified that 21% of distribution cables have a very poor or poor health index, which relates to approximately 851km of 4,076km distribution cable in-service.

From 2013 to 2016, Alectra Utilities has experienced an increasing trend in the number of underground cable failures. In 2016, the former Enersource experienced 223 feeder cable failures resulting in 4.98 million customer outage minutes ("COM[1]"), i.e., 50% of the total system

[1] COM is referred to as CIM in the PowerStream RZ business cases.

COM. More specifically, underground cable failures are consistently the leading cause of outages in the defective equipment cause code.

In 2016, underground cable failures accounted for 84% of outages caused by defective equipment in the former Enersource service area. A large number of double cable faults occurred in 2016, involving both the original and backup loop feeders failing, simultaneously. As a result, restoration time increased since the cables providing the alternate supply source also failed.

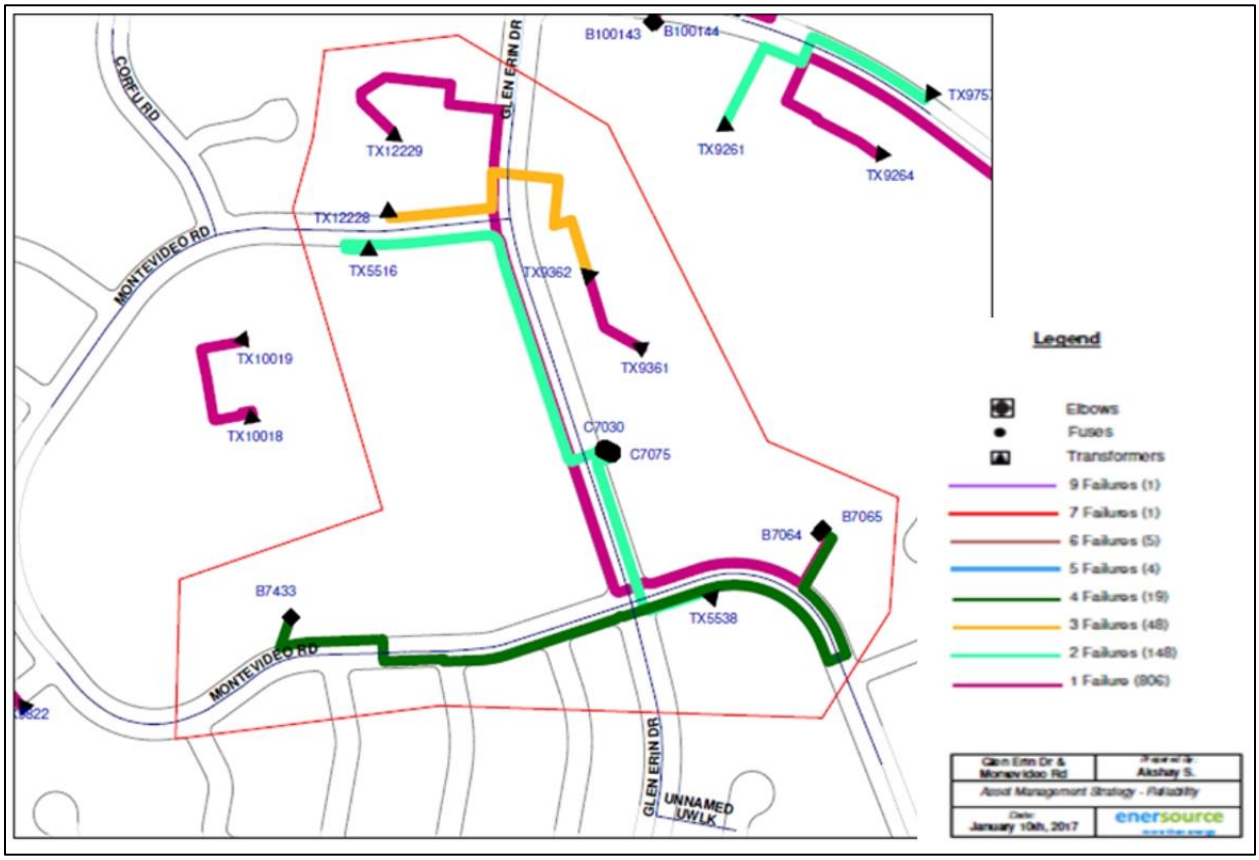
To address the increasing trend of underground cable failures, Alectra Utilities has applied an overlay methodology, which examines specific system areas which have experienced multiple failures and may also include other renewal needs. The approach of identifying system areas enables Alectra Utilities to target and prioritize poor performing system areas that may not be evident by examining the asset HI condition, alone. For underground cable renewal, Alectra Utilities considered and selected areas based on: underground system assets with historical failures; the type of underground cable installed; the condition of the cable; as well as other renewal needs related to transformers and service configurations.

A large portion of underground cables installed in Mississauga before 1989 were either unjacketed (i.e., did not have a protective sheath) and/ or direct-buried, consistent with early generation underground system implementations. A failure analysis completed by Alectra Utilities has identified that 83% of cable failures over the last five years has occurred on unjacketed Polyethylene (“PE”) or Cross-linked Polyethylene (“XLPE”) cables. This failure analysis identified the impacts of condition deterioration on early generation underground system assets. Increasing failure rates experienced on early generation underground systems are now adversely impacting system reliability and increasing operational risks.

Based on the overlay methodology, Alectra Utilities utilizes a consistent asset management process to identify system renewal investment needs and identifies specific system areas which have demonstrated persistent poor performance relative to the system average.

Analysis based on the overlay methodology identified an underground system renewal investment need in the Glen Erin Drive and Montevideo Road area of Mississauga, which has experienced a high number of underground system failures as shown in Figure 1.

Figure 1 - Overlay Map of the Underground System Renewal Investment Needs in Glen Erin Drive and Montevideo Road Area

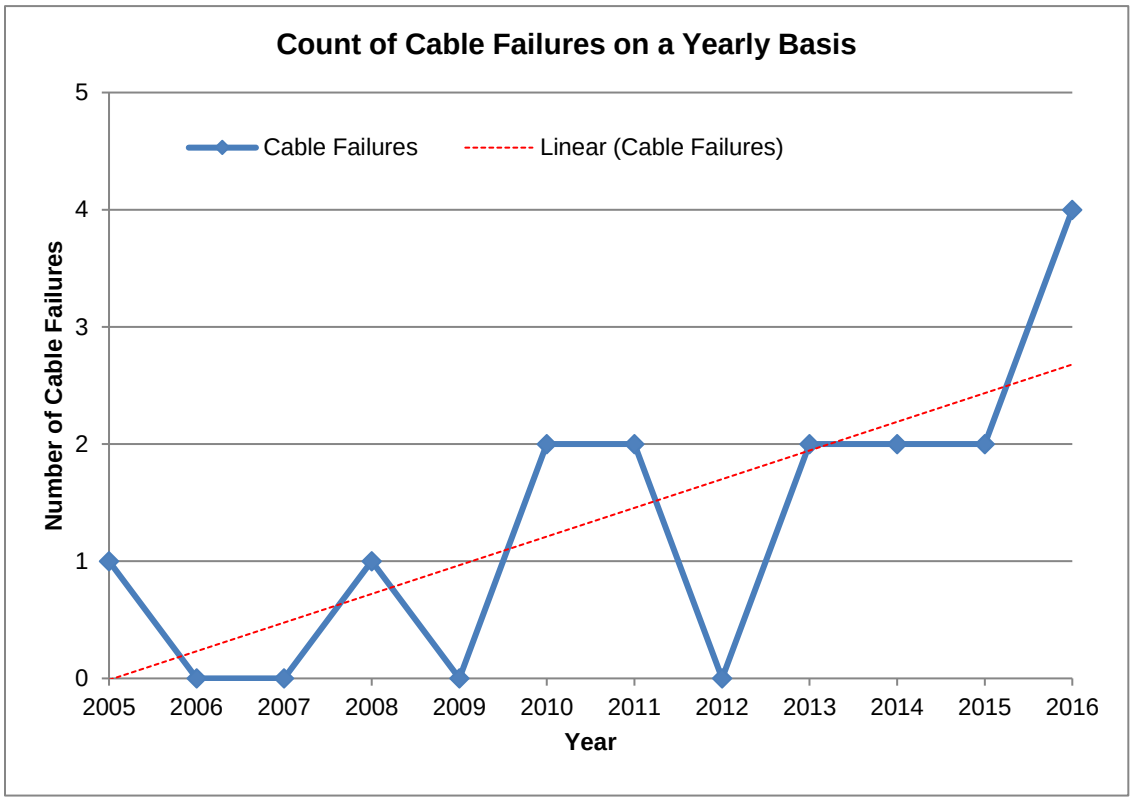


Scope

There are multiple 1/0 underground direct buried cables failing in a section of the Meadowvale West section, specifically the Glen Erin Drive and Montevideo Road area. This area directly effects 91 residential and two commercial customers. Since 2005, there have been sixteen cable failures in this area affecting 3,064 customers for a total of 308,531 COMs. Since 2013 the SAIDI for this area has been four times higher and the SAIFI two times higher than the three year system average. Many of these customers have received multiple outages in the same year. Some of the same cables have failed numerous times. The cables and the transformers are approximately 40 years old and have reached the end of useful life. Cables are no longer able to provide reliable power or backup to customers and present a significant amount of operational risk. To date, Alectra Utilities has been reactively addressing underground system faults but over the years the cables have experienced an increasing rate of failure as illustrated in Figure 2. The asset condition HI of the underground cables in this area have been identified as being in very poor

condition. The elbows and inserts in these transformers are also in very poor condition; in some cases, the elbows cannot be safely operated, which therefore requires the transformer to be replaced.

Figure 2 - The Number of Outages per Year (2005-2016) in the Glen Erin Drive and Montevideo Road Rebuild Area



Options Considered

Option 1: Defer investment and operate with existing underground cables.

Under this option, the underground cables will continue to experience faults and will lead to power outages, resulting in deteriorating service reliability for the area. It is also possible that the cable may no longer be repairable and useable, which poses significant operational risk and cost to Alectra Utilities. Reactive repair of cables in an emergency situation is very time consuming and costly.

Given the history of cables failing in this area, Alectra Utilities has determined the looped supply cables, which provide an alternative supply upon a system fault, are also no longer reliable.

Based on recently increasing failure trends in the area, Alectra Utilities anticipates further failures in the near term. In addition, continued failure of this cable may result in the cable and elbows ultimately being inoperable. Substantial resources would be required to replace segments on an emergency basis.

For each cable failure in the area, Alectra Utilities estimates that 139 customers will be affected for approximately 15,000 COMs.

Option 2: Rehabilitate the cable with cable injection to extend operational life

Alectra Utilities has reviewed the possibility of rehabilitating the cable with cable injection technology but has determined that this area is not suitable for cable injection since the cables at issue contain solid-type conductors, which cannot be injected.

Option 3: Renew the underground distribution system in the Glen Erin Drive and Montevideo Road to present day standards

This option includes renewing the early generation underground distribution system which has been determined to be of poor condition; has had increasing failures and has reached the end of the useful life. Through the renewal of the underground system in the area, Alectra Utilities will bring the system to present day standards and optimize the configuration to minimize the replacement cost.

Through configuration optimization, Alectra Utilities plans to replace the existing 6km of underground system with 4.5km of new infrastructure, thereby eliminating approximately $1.5MM of renewal costs when compared to a like-for-like replacement. The cables will be installed in PVC duct, which will facilitate less costly future cable replacement. The project includes the installation of new cables in four inch ducts and the replacement of eight padmount transformers.

Recommended Option

The recommended solutions is Option 3, to renew the underground distribution system in the Glen Erin Drive and Montevideo Road to present day standards

Benefits of utilizing system renewal by area include: leveraging economies of scale, minimizing customer disruption and outages; and addressing areas with outlier performance history, not evident through the examination of overall system average reliability statistics.

The expenditure required to address the recommended solution is estimated $1.96MM and is scheduled to be completed by the Q4/2018. The benefits of the renewal investment include:

- System reliability - The underground cables supply a large number of residential, commercial and institutional customers which, in case of a failure, would result in a significant negative impact to reliability indices. For each cable failure in the area, Alectra Utilities anticipates approximately 139 customers will be affected, for a total of approximately 15,000 COM. In addition, each time a cable fails, there is a resulting auto-reclosure from the operation of the fuse, which also affects a larger number of customers on the same main feeder.
- System renewal - As per the 2016 ACA results, this cable section was flagged to be in very poor condition and requires immediate replacement.

If the project is not approved by the OEB, Alectra Utilities will not replace the cable and will continue to maintain and reactively address system area faults. Since the cable is deteriorated, it has a very high probability of failure and is expected to adversely impact reliability in the area with the potential of longer outage minutes. In some cases, the cables are beyond repair. The only option is such cases is replacement under emergency conditions, which is less economic when compared to planned replacement.

Business Case

Project Name

Glen Erin Drive and Battleford Road Subdivision Rebuild

Project ID

2018-C0505-5

Project Duration

1 year

Expected In-service Date

Q4 2018

Category

System Renewal

Background

Alectra Utilities distribution system in the Enersource RZ is comprised of 65% underground and 35% overhead assets. Key components of the underground distribution system include: cables; padmount transformers; and padmount switchgear. Of the key underground distribution system components, underground primary cables have been identified by Kinectrics in the 2016 ACA as the distribution asset with the highest percentage of poor and very poor asset condition HI. Alectra Utilities categorized underground cables into separate categories for main feeder and distribution cables. The HI assessment of the main feeder cables identified that 12% of main feeder cables are very poor or poor health index, which related to approximately 256km of 2,239km feeder cable in-service. The HI assessment of the distribution feeder cables identified that 21% of distribution cables are very poor or poor health index, which relate to approximately 851km of 4,076km distribution cable in-service.

From 2013 to 2016, the former Enersource experienced an increasing trend in the number of underground cable failures. In 2016, Enersource experienced 223 feeder cable failures resulting in 4.98 million COM, which accounted for 50% of the total system COMs. More specifically, underground cable failures are consistently the leading cause of outages in the defective

equipment cause code. In 2016, underground cable failures accounted for 84% of outages caused by defective equipment in Enersource's service area.

A large number of double cable faults occurred in 2016, involving both the original and backup loop feeders failing simultaneously. Restoration time increased, since the cables providing the alternate supply source also failed.

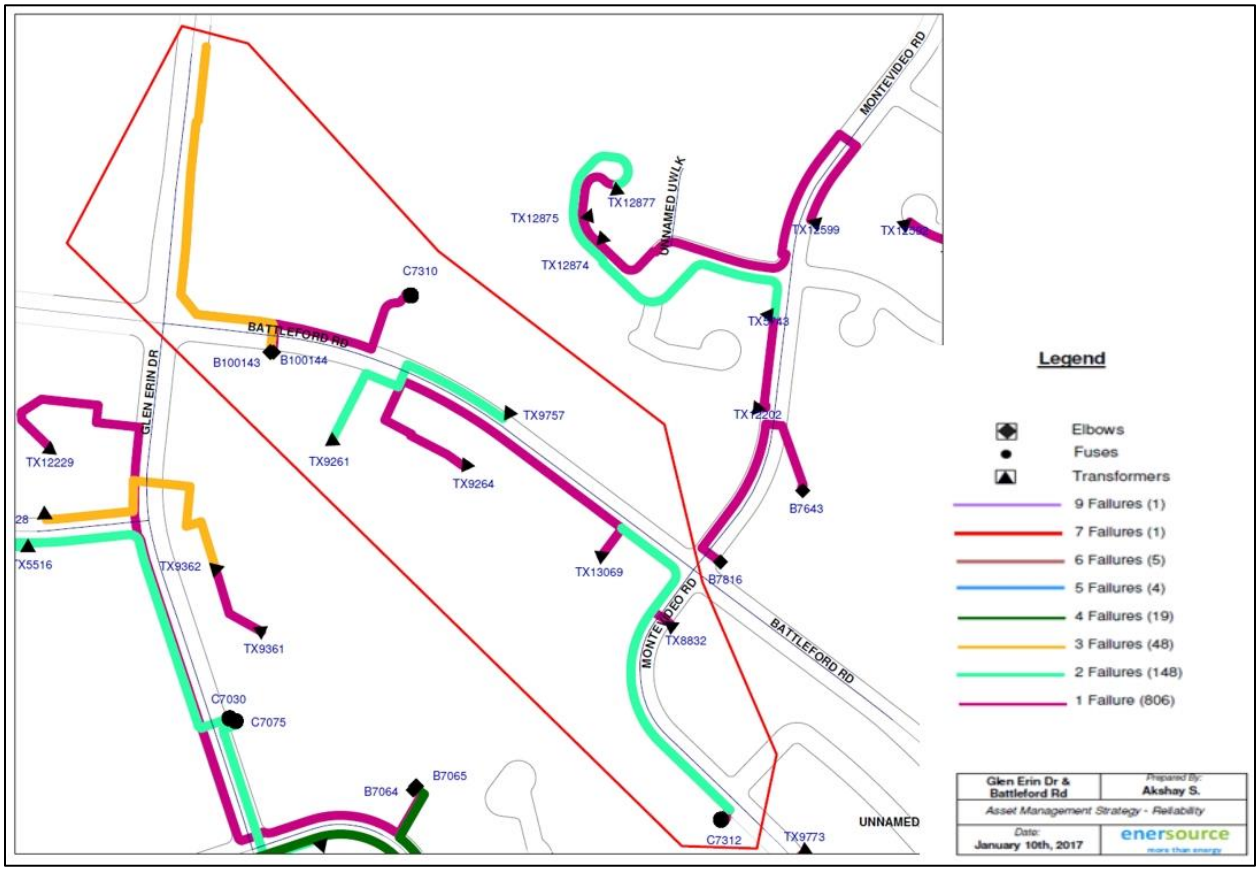
To address the increasing trend of underground cable failures, Alectra Utilities has applied an overlay methodology, which examines specific system areas which have experienced multiple failures and may also include other renewal needs. The approach of identifying system areas enables Alectra Utilities to target and prioritize poor performing system areas that may not be evident through the examining of just asset HI condition alone. For underground cable renewal, Alectra Utilities considered and selected areas that included underground system assets with historical failures, the type of underground cable installed, the condition of the cable as well as other renewal needs related to transformers and service configurations.

A large portion of the underground cables installed in Mississauga before 1989 were either unjacketed and/ or direct-buried, consistent with early generation underground system implementations. A failure analysis completed by Alectra Utilities identified that 83% of cable failures over the last five years have occurred on unjacketed PE or XLPE cables. This failure analysis identified the impacts of condition deterioration on early generation underground system assets. Increasing failure rates experienced on early generation underground systems are now adversely impacting system reliability and increasing operational risks.

Based on the overlay methodology, Alectra Utilities utilizes a consistent asset management process to identify system renewal investment needs and identifies specific system areas which have demonstrated persistent poor performance relative to the system average.

Analysis based on the overlay methodology identified an underground system renewal investment need in the Glen Erin Drive and Battleford Road area of Mississauga, which has experienced a high number of underground system failures as illustrated in Figure 4.

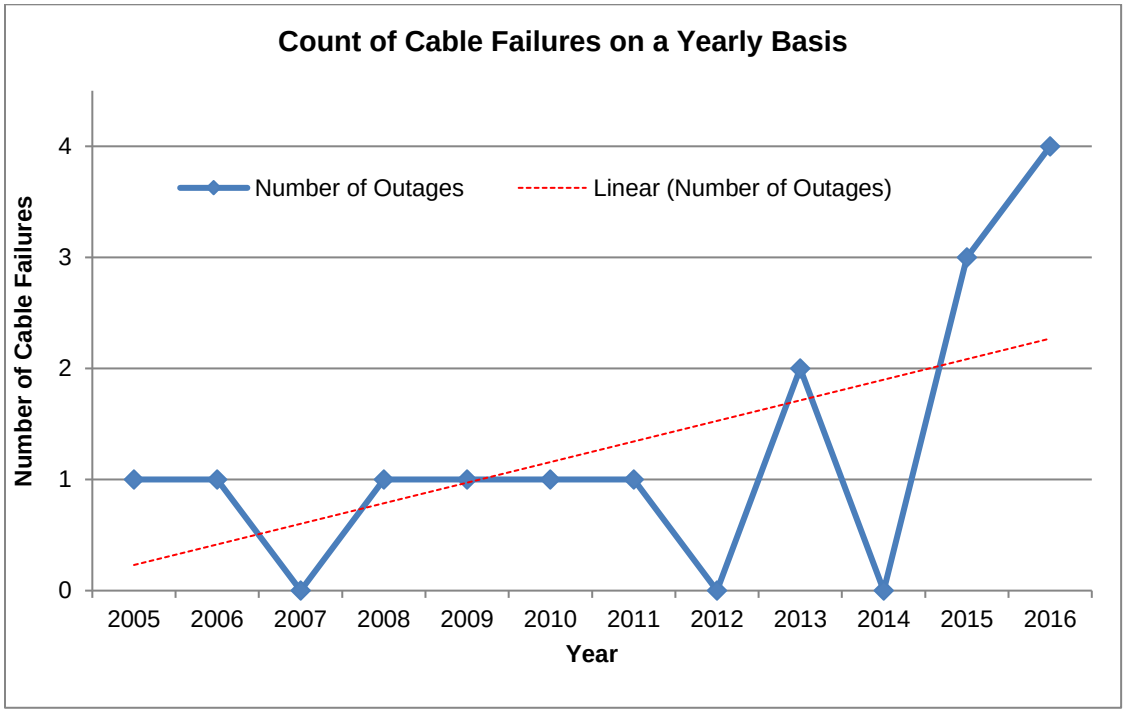
Figure 3 - Overlay Map of the Underground System Renewal Investment Need at Glen Erin Drive and Battleford Road Area



Scope

There are multiple direct buried distribution cables failing in a section of the Meadowvale West area. This area directly affects 34 residential customers and one commercial customer. There have been thirteen distribution and four main feeder cable failures in this area affecting 2,572 customers for a total of 191,139 customer minutes. The cables and the transformers are approximately 40 years old and have reached the end of useful life. The cables are no longer able to provide reliable power to customers and present a significant amount of operational risk. As per the 2016 ACA results, this section of cable was flagged as being in very poor condition and requires immediate replacement.

Figure 4 - The Number of Outages per Year (2005-2016) in the Glen Erin Drive & Battleford Road Rebuild Area



Options Considered

Option 1: Operate with existing underground cables

Under this option, the underground cables will continue to fail and cause power outages, resulting in deteriorating service reliability for the area. It is also possible that the cable may no longer be repairable and useable which poses a significant amount of operational risk.

Reactive repair of cables in an emergency situation is very time consuming and costly. Given the history of cables failing in this area, Alectra Utilities has determined the loop supply cables, which provide an alternative supply upon a system fault, are also no longer reliable.

Based on recently increasing failure trends in this area, Alectra Utilities anticipates further failures in the near term. In addition, continued failure of this cable may result in the cable being inoperable; it would require substantial resources to replace segments in on an emergency basis.

For each cable failure event in the area, Alectra Utilities anticipates 40 customers will be affected for approximately 5,300 customer minutes.

Option 2: Rehabilitate the cable with cable injection to extend operational life

Alectra Utilities has reviewed the possibility of rehabilitating the cable with cable injection technology. However, this area is not suitable for cable injection, since the cables at issue contain solid-type conductors, which cannot be injected.

Option 3: Renew the underground distribution system in the Glen Erin Drive and Battleford Road to present day standards.

This option includes renewing the early generation underground distribution system which: has been determined to be of poor condition; demonstrated increasing failures; and has reached the end of the useful life. Through the renewal of the underground system in the area, Alectra Utilities will bring the system to present day standards and optimize the configuration to minimize the replacement cost. Through configuration optimization, Alectra Utilities plans to replace the existing 11.5km of underground system with 6.5km of new infrastructure, thereby eliminating approximately $0.7MM of renewal costs when compared to a like-for-like replacement. The cables will be installed in PVC duct, which will allow future cable replacement to be much less costly. The project includes the installation of new cables in four inch ducts and the replacement of 5 padmount transformers.

Recommended Option

The recommended solution is Option 3, to renew the underground distribution system in the Glen Erin Drive and Battleford Road area to present day standards.

Benefits of utilizing system renewal by area include: leveraging economies of scale; minimizing customer disruption and outages; and addressing areas with outlier performance history not evident through the examination of overall system average reliability statistics.

The expenditure required to address the recommended solution is estimated $2.06MM and is scheduled to be completed by Q4, 2018. The benefits of the renewal investment include:

- System reliability - The underground cables supply a large number of residential, commercial and institutional customers which, in case of a failure, would result in a significant negative impact to reliability indices. For every cable failure on cable, Alectra Utilities anticipates that approximately 40 customers will be affected for a total of 5,300 customer minutes. Further, every time a cable fails, there is a resulting auto-reclosure from the operation of the fuse, which also affects a large number of customers on the same main feeder.
- System renewal - Through the ACA and inspections, various underground equipment was determined to be of poor condition and is proposed for replacement.

If the OEB does not approve the project, Alectra Utilities will not replace the cable and will continue to maintain and reactively address system area faults. Since the cable is deteriorated, it has a very high probability of failure and is expected to adversely impact reliability in the area with the potential of longer outage minutes. In some cases, the cables are beyond repair. The only option is such cases is replacement under emergency conditions, which is less economic when compared to planned replacement.

Business Case

Project Name

Credit Woodlands Court and Wiltshire Lane Subdivision Rebuild

Project ID

2018-C0505-2

Project Duration

1 Year

Expected In-service Date

Q4 2018

Category

System Renewal

Background

In recent years, the former Enersource increased the frequency and level of detail captured in annual distribution system inspections, to improve knowledge regarding the condition of its in-service distribution assets. These inspections capture important information regarding the continued safe operation of its assets and identify substandard conditions that require follow up inspection/ remediation, as appropriate. These inspections are carried out on a three year cycle such that the entire distribution system is inspected once every three years, in alignment with the Minimum Inspection Requirements of the Distribution System Code.

Alectra Utilities currently owns and operates 25,329 distribution transformers, in the Enersource RZ, which are installed in various public locations including: rights-of-way; rear lots of private properties; on commercial lands near high traffic areas; and in designated indoor customer-owned vault locations. From 2013 to 2016, the former Enersource inspected its fleet of distribution transformers and found that a large number of transformers indicated signs of oil leakage, with some transformers containing polychlorinated biphenyl (“PCB”) oil.

Electrical utilities in Ontario are governed by environmental legislation including the *Environmental Protection Act* RSO 1990 – Ontario (Regulation 675/98) and the Canadian *Environmental Protection Act* - PCB Regulations (SOR/2008-273), in regard to managing oil spills

occurring from any in-service oil filled asset. Under the *Environmental Protection Act*, Alectra Utilities is required to report all spills of 100 litres or more of oil into the environment.

In those instances, per legislation and regulation, Alectra Utilities is required to make immediate arrangements for remediation of the site where the transformer oil leak occurred. Under the Canadian *Environmental Protection Act* - PCB Regulations (SOR/2008-273), Alectra Utilities is required to report any spills involving more than one gram of PCB into the environment. Under this scenario, Alectra Utilities is required to carry out full environmental remediation of the site where the transformer oil leak occurred.

Alectra Utilities distribution system in the Enersource RZ is comprised of 65% underground and 35% overhead assets. Key components of the underground distribution system include: cables; padmount transformers; and padmount switchgear. Of the key underground distribution system components, underground primary cables have been identified by Kinectrics in the 2016 Asset Condition Assessment as the distribution asset with the highest percentage of poor and very poor asset condition HI. Alectra Utilities categorized underground cables into separate categories for main feeder and distribution cables. The HI assessment of the main feeder cables identified that 12% of main feeder cables are very poor or poor health index, which relates to approximately 256km of 2,239km feeder cable in-service. The HI assessment of the distribution feeder cables identified that 21% of distribution cables are very poor or poor health index, which relates to approximately 851km of 4,076km distribution cable in-service.

From 2013 to 2016, the former Enersource experienced an increasing trend in the number of underground cable failures. In 2016, the former Enersource experienced 223 feeder cable failures resulting in 4.98 million COM, which accounted for 50% of the total system COMs. More specifically, underground cable failures are consistently the leading cause of outages in the defective equipment cause code. In 2016, underground cable failures accounted for 84% of outages caused by defective equipment in the Enersource distribution system. A large number of double cable faults occurred in 2016, involving both the original and backup loop feeders failing simultaneously. As a result, restoration time increased since the cables providing the alternate supply source also failed.

To address the increasing trend of underground cable failures, Alectra Utilities has applied an overlay methodology, which examines specific system areas which have experienced multiple

failures and may also include other renewal needs. The approach of identifying system areas enables Alectra Utilities to target and prioritize poor performing system areas that may not be evident through the examining of just asset HI condition alone.

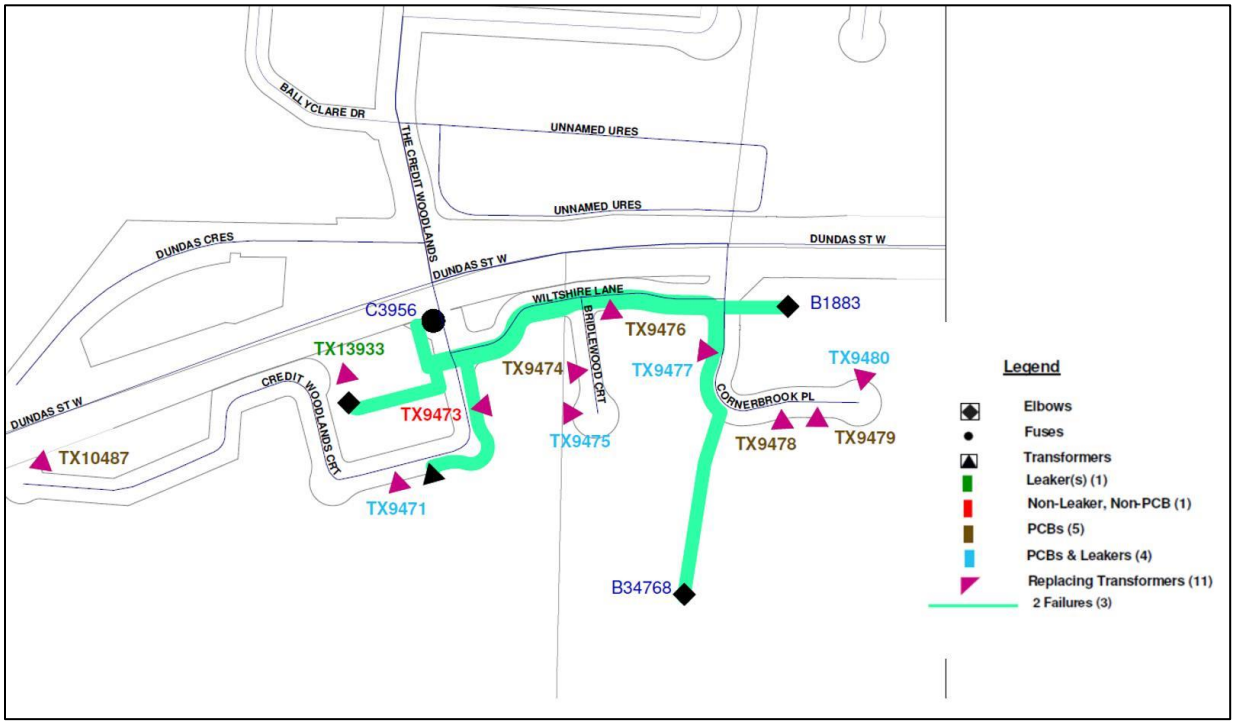
For underground cable renewal, Alectra Utilities considered and selected areas that included underground system assets with historical failures, type of underground cable installed, condition of the cable as well as other renewal needs related to transformers and service configurations.

A large portion of the underground cables installed in Mississauga before 1989 were either unjacketed and/ or direct-buried, consistent with early generation underground system implementations. Failure analysis completed by Alectra Utilities has identified that 83% of cable failures over the last five years has occurred on unjacketed Polyethylene ("PE") or Cross-linked Polyethylene ("XLPE") cables. This failure analysis identified the impacts of condition deterioration on early generation underground system assets. Increasing failure rates experienced on early generation underground systems are now adversely impacting system reliability and increasing operational risks.

Based on the overlay methodology, Alectra Utilities utilizes a consistent asset management process to identify system renewal investment needs and identifies specific system areas which have demonstrated persistent poor performance relative to the system average.

As a result of analysis based on PCB/leaking transformers and cable faults, it is clear that underground system renewal investment is needed in the Credit Woodlands Court & Wiltshire Lane area of Mississauga, as illustrated in Figure 5.

Figure 5 - Overlay Map of the Underground System Renewal Investment Need in Credit Woodlands Court and Wiltshire Lane Area



Scope

A total of 11 transformers are located within the Credit Woodlands & Wiltshire area, as seen in Figure 1 above. There are nine transformers containing PCB oil, of which, five are leaking. Of the remaining two non-PCB units, one transformer was identified as leaking. There have been six underground direct-buried cable failures in this area affecting 814 customers, for a total of 22,531 customer minutes. The affected cables are identified in Figure 1 with a green highlighted line. The SAIDI for this area has been increasing since 2014. In 2015, it was 45% higher than the system average; in 2016, it was 99% higher (in comparison to SAIDI without Major Event Days ("MEDs") and Loss of Supply events).

The cables and the transformers are approximately 37 years old and as per the 2016 ACA results, this cable section was flagged to be in very poor condition and requires immediate replacement. The area to the north of this subdivision was previously rebuilt and other areas around this subdivision are scheduled for rebuild, as part of a larger project to rebuild the entire area.

Options Considered

Option 1: Defer investment and operate with existing underground cables and transformers

Under this option, the underground cables will continue to fail and cause power outages, resulting in deteriorating service reliability for the area. Reactive repair of cables in an emergency situation is very time consuming and costly.

Based on failure trends and deteriorated condition of the cables, Alectra Utilities anticipates further failures in the near term. In addition, continued failure of this cable may result in the cable being inoperable and would require substantial resources to replace the cable in emergency. For each cable failure event, Alectra Utilities projects that approximately 90 customers will be impacted for approximately 4,300 COM.

Under this option, Alectra Utilities (Enersource RZ) will continue to operate these transformers to failure and will address any resulting oil spills and environmental contamination upon replacement. As a number of transformers in the area contain PCB oil and indicate signs of leaking, it is highly probable that extensive environmental clean-up and remediation obligations will be triggered based on applicable regulations.

Option 2: Rehabilitate the cable with cable injection to extend operational life, replace poor condition transformers.

Alectra Utilities has reviewed the possibility of rehabilitating the cable with cable injection technology. It has determined that this location is not a candidate for such remediation, due to the large portion of solid type conductors, which cannot be injected; high probability of corroded neutrals; and the uncertainty of the large number of splice locations in the area. Upon the investigation of 124 cable faults in 2014-2015, 62.1% of the failed cables were solid conductors, thereby confirming that cable injection is not a possibility. Moreover, 95.2% of the failed cables are direct buried (i.e., not in ducts) and unjacketed; some of these outages were the result of corroded neutrals and not just the cable itself. Finally, the average age of the investigated cable failures is 37 and as per the 2016 ACA results, this cable section was flagged to be in very poor condition and requires immediate replacement.

This option includes the replacement of transformers that are in poor condition and that are leaking oil before contamination triggers environmental remediation to be required.

Option 3: Renew the 11 transformers in Credit Woodlands Court and Wiltshire Lane to present day standards.

This option includes replacing the 11 transformers, of which nine contain PCB oil. As per regulation, any sites that require environmental remediation will be completed promptly. This option does not include any cable replacements and therefore reactive cable outages will continue. By undertaking the replacement of the transformers alone, there will be missed opportunities to simultaneously undertake the cable replacement. Mobilization charges will be incurred for each reactive cable repair and future rebuild. Lastly, residents in the area will be negatively impacted and question the effectiveness of the work being completed as outages would still occur despite the transformer replacement.

Option 4: Renew the underground distribution system in Credit Woodlands Court & Wiltshire Lane to present day standards.

This option includes renewing the early generation underground distribution system, which has been identified as being in poor condition in need of immediate replacement. Through the renewal of the underground system in the area, Alectra Utilities will bring the system to present day standards and optimize the configuration to minimize the replacement cost. Through configuration optimization, Alectra Utilities plans to replace the existing 6.5km of underground system with 5 km of new infrastructure, thereby eliminating approximately $0.5MM of renewal costs when compared to like-for-like replacement. The project also includes the installation of new cables in four inch ducts, which will make future replacements less costly. The nine transformers containing PCB greater than 2ppm along with two transformers will also be replaced and any environmental remediation will be completed.

Recommended Option

The recommended solution is Option 4, to renew the underground distribution system in the Credit Woodlands Court and Wiltshire Lane to present day standards.

Benefits of utilizing system renewal by area include: leveraging economies of scale; minimizing customer disruption and outages; and addressing areas with outlier performance history not evident through the examination of overall system average reliability statistics.

The expenditure required for the recommended solution is estimated to cost $1.55MM and is scheduled to be completed by Q4, 2018. The benefits of the renewal investment include:

- System reliability - The underground cables and transformers supply 200 residential, and one commercial customer; in case of a failure it would result in a negative impact to reliability indices.
- System renewal - Various underground equipment proposed to be replaced were rated as very poor, as per the ACA analysis.
- Environmental impact/risk – There are a number of pad mounted transformers with PCB greater than 2ppm installed and/ or showing evidence of leaking, which poses a risk of environmental spill and/ or soil contamination.
- System expansion - Higher rated underground pad mounted transformers and cables will be installed, in order to support future increase in consumption and avoid potential over loading issues.

If the OEB does not approve the project, it is recommended that Option 3 to replace the transformers proceed due to the environmental impact and high remediation costs that would be incurred if the transformers were to leak. Should an underground cable system fault occur (e.g., a double cable fault) which removes the feasibility of reactive cable remediation, then Alectra Utilities will be required to undertake emergency cable repairs or replacement at higher costs and without notice to customers in the area.

Business Case

Project Name

Tenth Line Main Feeder Subdivision Rebuild

Project ID

2018-C0505-3

Project Duration

1 Year

Expected In-service Date

Q4 2018

Category

System Renewal

Background

Alectra Utilities' distribution system in the Enersource RZ is comprised of 65% underground and 35% overhead assets. Key components of the underground distribution system include cables, padmount transformers and padmount switchgear. Of the key underground distribution system components, underground primary cables have been identified by Kinectrics in the 2016 ACA as the distribution asset with the highest percentage of poor and very poor asset condition HI. Alectra Utilities categorized underground cables into separate categories for main feeder and distribution cables. The HI assessment of the main feeder cables identified that 12% of main feeder cables are very poor or poor health index, which relate to approximately 256km of 2,239km feeder cable in-service. The HI assessment of the distribution feeder cables identified that 21% of distribution cables are very poor or poor health index, which relates to approximately 851km of 4,076km distribution cable in-service.

From 2013 to 2016, the former Enersource has experienced an increasing trend in the number of underground cable failures. In 2016, it experienced 223 feeder cable failures resulting in 4.98 million COM, which accounted for 50% of the total system COMs. More specifically, underground cable failures are consistently the leading cause of outages in the defective equipment cause

code. In 2016, underground cable failures accounted for 84% of outages caused by defective equipment in the Enersource distribution system.

A large number of double cable faults occurred in 2016, involving both the original and backup loop feeders failing simultaneously. As a result, restoration time increased since the cables providing the alternate supply source also failed.

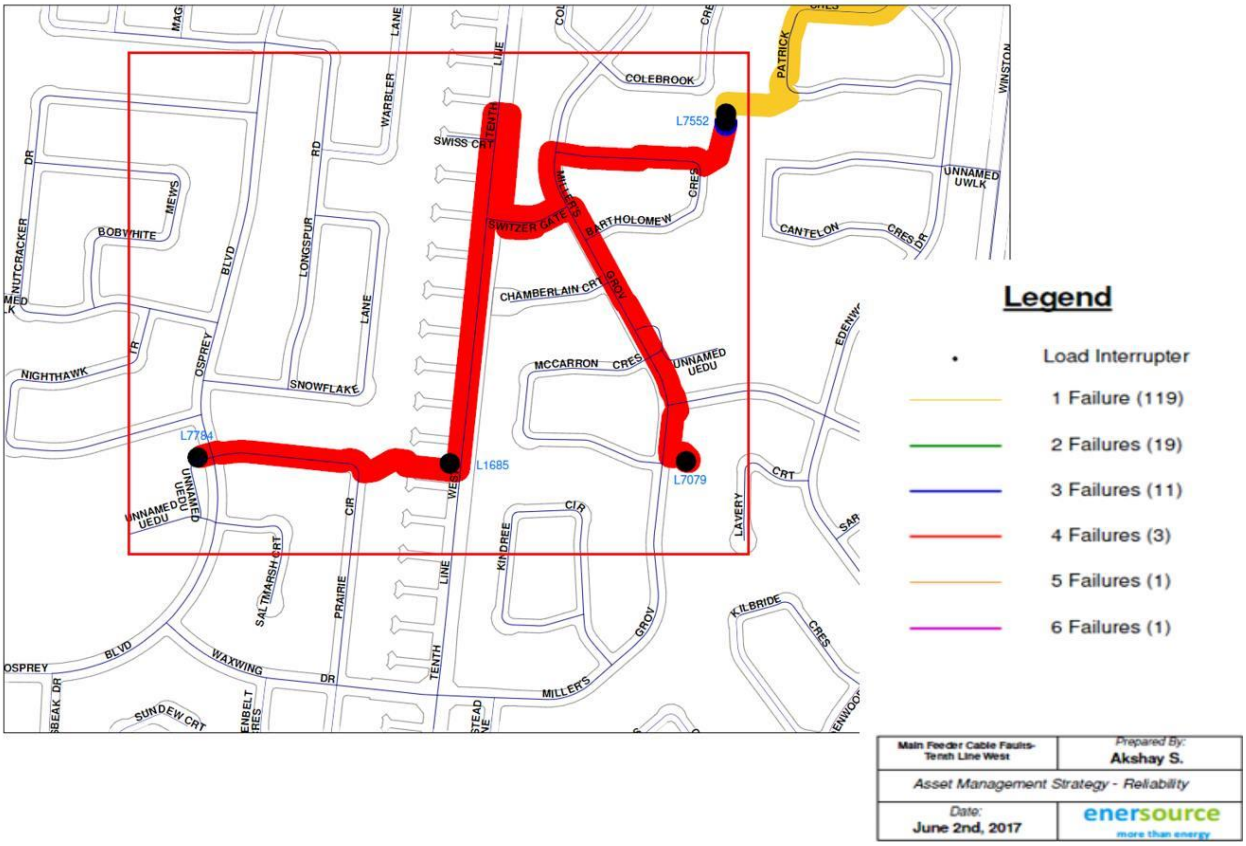
To address the increasing trend of underground cable failures, Alectra Utilities has applied an overlay methodology, which examines specific system areas which have experienced multiple failures and may also include other renewal needs. The approach of identifying system areas enables Alectra Utilities to target and prioritize poor performing system areas that may not be evident through the examining of just asset HI condition alone. For underground cable renewal, Alectra Utilities considered and selected areas that included underground system assets with historical failures, type of underground cable installed, condition of the cable as well as other renewal needs related to transformers and service configurations.

A large portion of underground cables installed in Mississauga before 1989 was either unjacketed and/ or direct-buried, consistent with early generation underground system implementations. A failure analysis completed by Alectra Utilities identified that 83% of cable failures over the last five years have occurred on unjacketed PE or XLPE cables. The failure analysis identified the impacts of condition deterioration on early generation underground system assets. Increasing failure rates experienced on early generation underground systems are now adversely impacting system reliability and increasing operational risks.

Based on the overlay methodology, Alectra Utilities utilizes a consistent asset management process to identify system renewal investment needs and identifies specific system areas which have demonstrated persistent poor performance relative to the system average.

Analysis based on the overlay methodology identified an underground system renewal investment need in the Tenth Line West area of Mississauga, which has experienced a high number of underground system failures on two main feeder cables, as illustrated in Figure 6.

Figure 6 - Overlay Map of the Underground System Renewal Investment Need in Tenth Line West area



Scope

The two sections of underground direct-buried main feeder cable, which run between switches L7784 to L7079 and L1685 to L7552, are approximately 35 years old and have reached the end of useful life. The 4km cable running between L7784 to L7079 has failed four times, affecting 7,074 customers, for a total of 334,797 customer minutes. Moreover, the 3km of cable running between L1685 to L7552 has also failed four times, affecting 3,684 customers for a total of 177,215 customer minutes. There is an additional 7km of underground cable in the same area that can be removed from service, if the supply configuration is optimized. These cable segments also have outages and are affecting additional customers. Portions of these cables are rear lot and therefore make it significantly more difficult to make repairs. Both the cables shown in Figure 1 are no longer able to provide reliable power to customers and present a significant amount of operational risk and cost to Alectra Utilities. As per the 2016 ACA results, this section of cable was flagged to be in very poor condition and requires immediate replacement.

Options Considered

Option 1: Defer investment and operate with existing underground cables

Under this option, the underground cables will continue to fail and cause power outages, resulting in deteriorating service reliability for the area. Reactive repair of cables in an emergency situation is very time consuming and costly. Based on failure trends and deteriorated condition of the cables, Alectra Utilities anticipates further failures in the near term. In addition, continued failure of this cable may result in the cable being inoperable and would require substantial resources to replace the cable in emergency.

Some of the cable is in rear lot, which adds further complexity, increasing both time and cost of reactive repairs. For every failure on cable running between L7784 to L7079, Alectra Utilities estimates that 2,638 customers will be affected for approximately 114,039 customer minutes. In addition, for every failure on cable running between L1685 to L7552, Alectra Utilities estimates that 952 customers will be affected for a total of approximately 44,426 customer minutes.

Option 2: Rehabilitate the cable with cable injection to extend operational life

Alectra Utilities has reviewed the possibility of rehabilitating the cable with cable injection technology but has determined that this area is not suitable for cable injection based on cable service quality, condition and age. Moreover, 95.2% of the failed cables were direct-buried (not in ducts) and unjacketed; some of these outages were the result of corroded neutrals. Finally, the average age of the investigated cable failures is 39 and as per the 2016 ACA results, this cable section was flagged to be in poor condition and requires immediate replacement.

Option 3: Renew the underground distribution system in the Tenth Line area to present day standards.

This option includes renewing the early generation underground distribution system, which has been determined to be of poor condition, demonstrating failures and has reached the end of the useful life.

Through the renewal of the underground system in the area, Alectra Utilities will bring the system to present day standards and optimize the configuration to minimize the replacement cost.

Through configuration optimization, Alectra Utilities plans to replace the existing 14km of underground system with 7km of new infrastructure eliminating approximately $1.0MM of renewal costs, when compared to a like-for-like replacement. Additionally, the switchgear has also reached its end of useful life and will also be abandoned, resulting in another $0.075MM in cost savings, when compared to a like-for-like replacement. The project includes installation of new cables in four inch ducts, which will make future replacements less costly.

Recommended Option

The recommended solution is Option 3, to renew the underground distribution system in the Tenth Line area to present day standards.

Benefits of utilizing system renewal by area include: leveraging economies of scale; minimizing customer disruption and outages; and addressing areas with outlier performance history not evident through the examination of overall system average reliability statistics.

The expenditure required to address the recommended solution is estimated $1.14MM and is scheduled to be completed by Q4, 2018. The benefits of the renewal investment include:

- System Reliability - The underground cables supply a large number of residential, commercial and institutional customers which, in case of a failure, would result in a significant negative impact to reliability indices. For every failure on cable running between L7784 to L7079, Alectra Utilities estimates that 2638 customers will be affected for approximately 114,039 customer minutes. In addition, for every failure on cable running between L1685 to L7552, Alectra Utilities estimates that 952 customers will be affected for a total of approximately 44,426 customer minutes. Moreover, every time a cable fails, there is a resulting autoreclosure from the fuse blowing, which also affects many customers on the same feeder. Optimizing the underground system configuration further improves system performance with the elimination of 7km of cable segment and one switchgear unit.
- System Renewal - Various underground equipment proposed to be replaced was determined through the asset condition assessment and inspections to be of poor condition. In addition, there is a significant cost avoidance through the reconfiguration of the system with cable renewal.

If the project is not approved by the OEB, Alectra Utilities will not replace the cable and will continue to maintain and reactively address system area faults on all 14km of the underground distribution system. Since the cable is deteriorated, it has a very high probability of failure and is expected to adversely impact reliability in the area with the potential of longer outage minutes. In some cases, the cables are beyond repair. The only option is such cases is replacement under emergency conditions, which is less economical when compared to planned replacement.

Business Case

Project Name

Folkway Drive and Erin Mills Parkway Main Feeder Subdivision Rebuild

Project ID

2018-C0505-4

Project Duration

1 Year

Expected In-service Date

Q4 2018

Category

System Renewal

Background

Alectra Utilities distribution system in the Enersource RZ is comprised 65% underground and 35% overhead assets. Key components of the underground distribution system include: cables; padmount transformers; and padmount switchgear. Of the key underground distribution system components, underground primary cables have been identified by Kinectrics in the 2016 ACA as the distribution asset with the highest percentage of poor and very poor asset condition HI. Alectra Utilities categorized underground cables into separate categories for main feeder and distribution cables. The HI assessment of the main feeder cables identified that 12% of main feeder cables are very poor or poor health index, which relates to approximately 256km of 2,239km feeder cable in-service. The HI assessment of the distribution feeder cables identified that 21% of distribution cables are very poor or poor health index, which relates to approximately 851km of 4,076km distribution cable in-service.

From 2013 to 2016, the former Enersource experienced an increasing trend in the number of underground cable failures. In 2016, the utility experienced 223 feeder cable failures resulting in 4.98 million COM, which accounted for 50% of the total system COMs. More specifically, underground cable failures are consistently the leading cause of outages in the defective

equipment cause code. In 2016, underground cable failures accounted for 84% of outages caused by defective equipment in Enersource's service area.

A large number of double cable faults occurred in 2016, involving both the original and backup loop feeders failing simultaneously. As a result, restoration time increased since the cables providing the alternate supply source also failed.

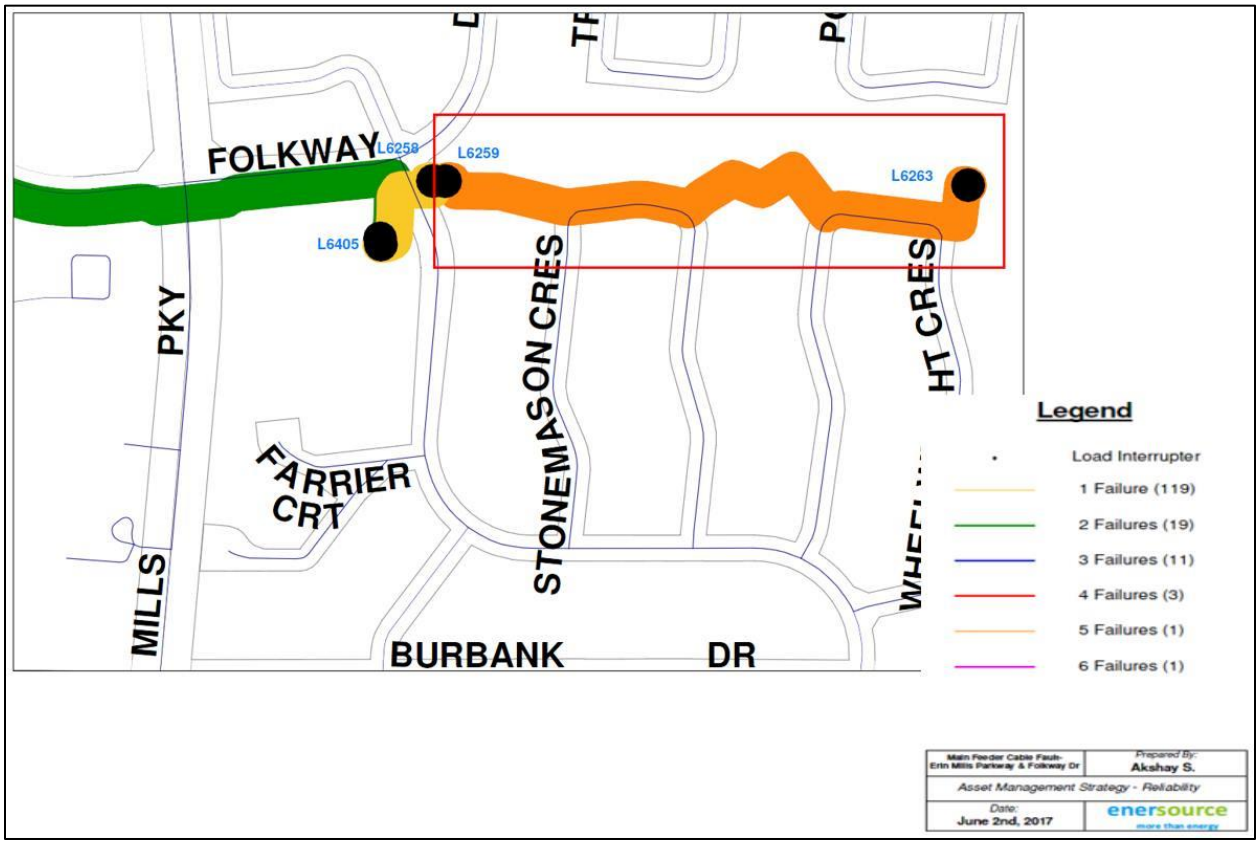
To address the increasing trend of underground cable failures, Alectra Utilities has applied an overlay methodology, which examines specific system areas which have experienced multiple failures and may also include other renewal needs. The approach of identifying system areas enables Alectra Utilities to target and prioritize poor performing system areas that may not be evident through the examining of just asset HI condition alone. For underground cable renewal, Alectra Utilities considered and selected areas that included underground system assets with historical failures, type of underground cable installed, condition of the cable as well as other renewal needs related to transformers and service configurations.

A large portion of underground cables installed in Mississauga before 1989 were either unjacketed and/ or direct-buried, consistent with early generation underground system implementations. A failure analysis completed by Alectra Utilities identified that 83% of cable failures over the last five years have occurred on unjacketed PE or XLPE cables. This failure analysis identified the impacts of condition deterioration on early generation underground system assets. Increasing failure rates experienced on early generation underground systems are now adversely impacting system reliability and increasing operational risks.

Based on the overlay methodology, Alectra Utilities utilizes a consistent asset management process to identify system renewal investment needs and identifies specific system areas which have demonstrated persistent poor performance relative to the system average.

Analysis based on the overlay methodology identified an underground system renewal investment need in the Folkway Drive and Erin Mills Parkway area of Mississauga, which has experienced a high number of underground system failures on a main feeder, as illustrated in Figure 7. This main feeder supplies 1,235 residential customers and 23 commercial/industrial customers.

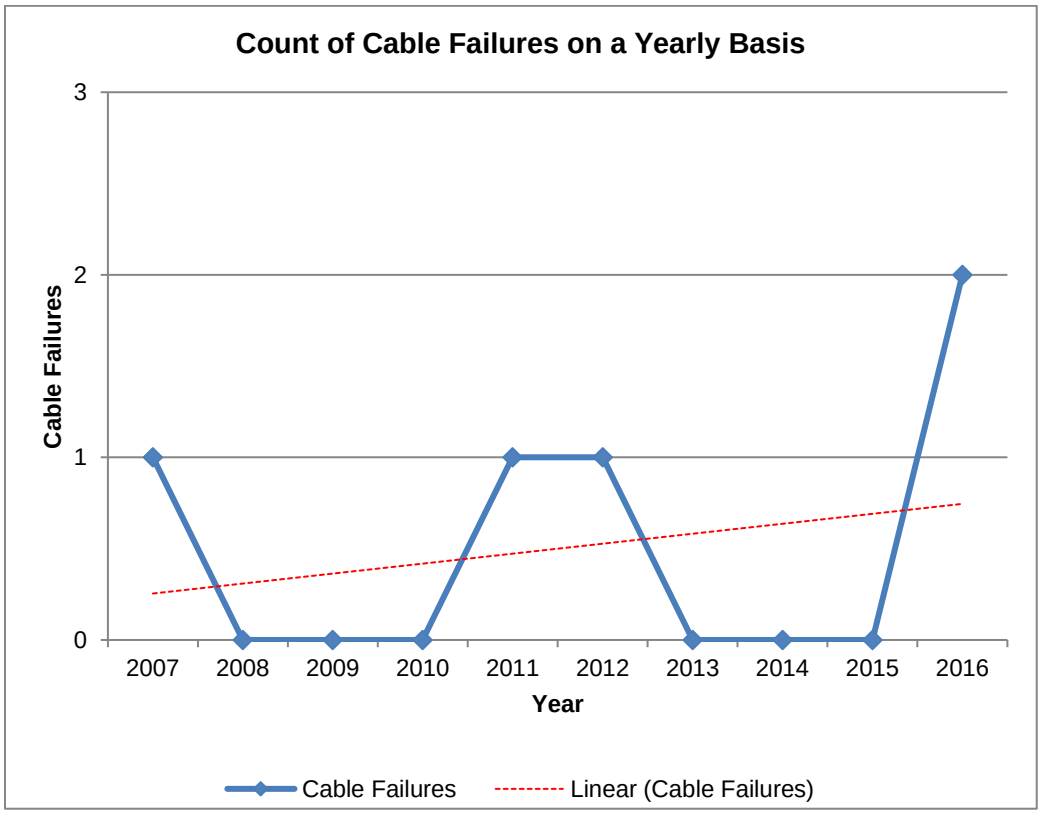
Figure 7 - Overlay Map of Underground System Renewal Investment need in the Folkway Drive and Erin Mills Parkway area



Scope

This 1.4km underground direct-buried main feeder cable which runs between switches L6263 and L6259, is approximately 39 years old and is in very poor condition. It has failed five times, affecting 6,220 customers, for a total of 278,119 customer minutes. This area directly affects 1,235 residential and 23 commercial/industrial customers. As seen in Figure 8, the number of outages is indicating an increasing trend. Since this is main line feeder cable, Alectra Utilities anticipates that approximately 1,260 customers will be affected for approximately 47,300 customer minutes, each time an outage occurs. Portions of this cable run in rear lot; this further complicates repairs and increases outage duration. This cable is no longer able to provide reliable power to customers and presents a significant amount of operational risk and cost to Alectra Utilities. As per the 2016 ACA results, this section of cable was flagged to be in very poor condition and requires immediate replacement.

Figure 8 - Count of Cable Failures on a Yearly Basis



Options Considered

Option 1: Operate with existing underground cables

Under this option, the underground cables will continue to experience faults and cause power outages, resulting in deteriorating service reliability for this area. It is also possible that the cable may no longer be repairable and useable, which poses a significant amount of operational risk and cost to Alectra Utilities.

Reactive repair of cables in an emergency situation is very time consuming and costly. Given the history of cables failing in this area, Alectra Utilities has determined the looped supply cables, which provide an alternative supply upon a system fault, are also no longer reliable.

Based on recently increasing failure trends in this area, Alectra Utilities anticipates further failures in the near term. In addition, continued failure of this cable may result in the cable ultimately being inoperable and would require substantial resources to replace the segments in an emergency situation.

For each cable failure in the area, Alectra Utilities estimates that 1,260 customers will be affected for a total of approximately 47,300 COMs.

Option 2: Rehabilitate the cable with cable injection to extend operational life

Alectra Utilities has reviewed the possibility of rehabilitating the cable with cable injection technology, but has determined that this area is not suitable for cable injection based on cable service quality, condition and age. Moreover, 95.2% of the failed cables are direct-buried (not in ducts) and unjacketed; some of these outages were the result of corroded neutrals and not just the cable itself. Finally, the average age of the investigated cable failures is 39 and, as per the 2016 ACA results, this cable section was flagged to be in very poor condition and requires immediate replacement.

Option 3: Renew the underground distribution system in the Folkway Drive and Erin Mills Parkway to present day standards.

This option includes renewal of the early generation underground distribution system, which has been determined to be of poor condition, demonstrating increasing failures and has reached the end of the useful life. Through the renewal of the underground system in the area, Alectra Utilities will bring the system to present day standards and optimize the configuration, to minimize the replacement cost. New four inch ducts will be installed along with new 28kV rated cable. The installation of the ducts will allow for future repairs of this cable to be much quicker and, therefore, more cost effective.

Recommended Option

The recommended solution is Option 3, to renew the underground distribution system in the Folkway Drive and Erin Mills Parkway to present day standards.

Benefits of utilizing system renewal by area include: leveraging economies of scale; minimizing customer disruption and outages; and addressing areas with outlier performance history not evident through the examination of overall system average reliability statistics.

The expenditure required to address the recommended solution is estimated $1.03MM and is scheduled to be completed by Q4, 2018. The benefits of the renewal investment include:

- System reliability - The underground cables supply a large number of residential, commercial and institutional customers which, in case of a failure, would result in a significant negative impact to reliability indices. For every cable failure, Alectra Utilities expects approximately 1,260 customers will be affected for a total of about 47,300 customer minutes. Also every time a cable fails there is a resulting auto-reclosure from the fuse blowing, which also affects many customers on the same feeder.
- System renewal - Various underground equipment proposed to be replaced was determined through the asset condition assessment and inspections to be of poor condition.

If the OEB does not approve the project, Alectra Utilities will not replace the cable and continue to maintain and reactively address system area faults. Since the cable is deteriorated, it has a very high probability of failure. This is expected to adversely impact reliability in the area, with the potential of longer outage minutes. In some cases, the cables are beyond repair. The only option is such cases is replacement under emergency conditions, which is less economical when compared to planned replacement.

Business Case

Project Name

City Centre Drive Rebuild

Project ID

2018-C0505-6

Project Duration

1 Year

Expected In-service Date

December 31, 2018

Category

System Renewal

Background

Alectra Utilities distribution system in the Enersource RZ is comprised of 65% underground and 35% overhead assets. Key components of the underground distribution system include: cables; padmount transformers; and padmount switchgear. The necessity of the civil chambers and duct structure used to house the cables and equipment are often overlooked in condition assessments.

While a large proportion of underground cables installed in Mississauga before 1989 were either unjacketed and/ or direct-buried, portions of this system servicing large customers or large commercial/ industrial areas were installed in duct with chambers.

During inspection, issues with this infrastructure are identified; for example, rusted lids; spalling of the concrete access restrictions;, separation of the foundation;, cracks;, collapse. These items are included as part of the overlay methodology Alectra Utilities utilizes to identify system renewal investment needs and to identify specific system areas which have demonstrated persistent poor performance relative to the system average. Similar to other project assessments, analysis based on the overlay methodology identified an underground system renewal investment need in City Centre Drive area of Mississauga.

This investment need is driven by a significant operational risk, which is based on the condition and physical configuration of underground civil assets located on City Center Drive. There are two subgrade utility chambers (CC1119 and CC1057) through which 15 medium voltage feeder cables pass. These chambers impose a significant constraint on access to the components within them. The chambers were constructed in the early 1970s and incorporate an older style access hatch leading to a chimney, both of which are undersized and do not meet current standards.

Confined space entry requirements govern any work to be performed within this type of facility. Moreover, access to the chamber requires persons working in the chamber to be tethered to a lanyard and a tripod configured hoist for emergency rescue. The configuration of the chamber, chimney and access way is very restrictive and impedes the ability to perform any type of emergency rescue effort in a safe manner. The need is compounded by the aforementioned constraints when responding to a cable failure or to operate devices in the vault to sectionalize cables in the event of a cable failure.

The cables passing through this vault supply one large user in the area. These cable are approximately 35 years old and have reached the end of their useful life. Alectra Utilities has experienced failures of cables of similar make and vintage in another area.

Figure 9 illustrates the cables and civil assets that will be replaced.

Figure 9 - Map of City Centre Drive Cables

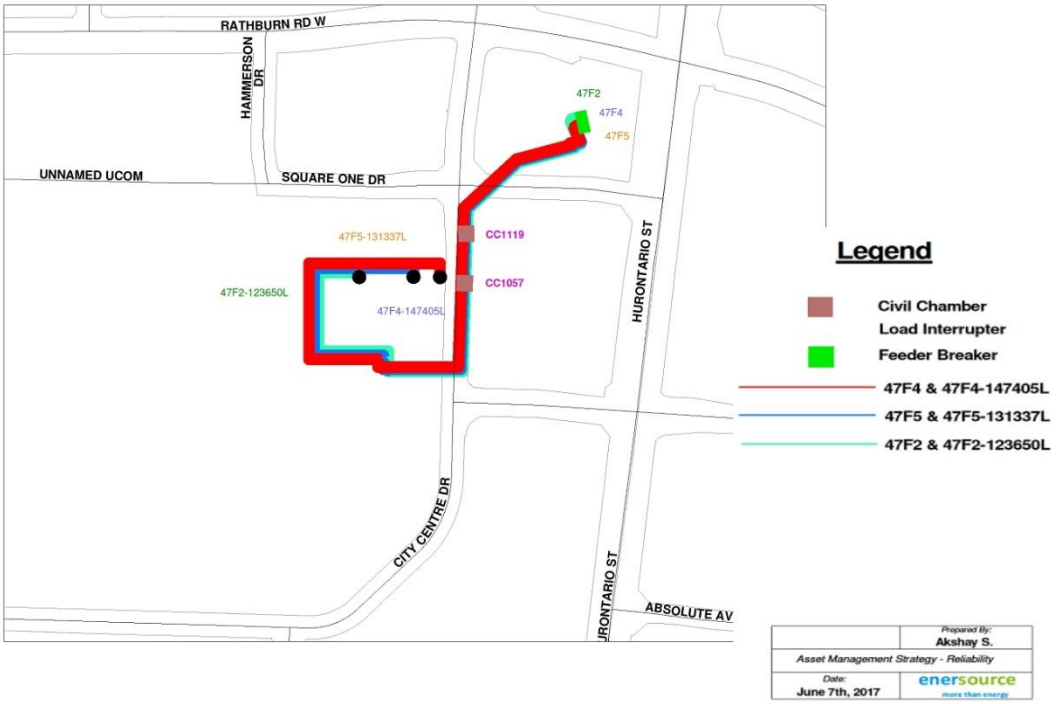


Figure 10 and Figure 11 illustrate the opening on grade and the narrow entrance through which Alectra Utilities' staff must travel to access the cables.

Figure 10 - Opening of Chambers

Figure 11 - Chamber View from Grade

To access the cables, the entire chamber must be made safe by isolating the cables passing through this chamber. It takes considerable time to perform all the necessary switching as there are 15 medium voltage feeder cables in this chamber. These conditions pose a hazard to Alectra Utilities staff, as there is little room to maneuver. Further, since the only means of entry is through the on grade hatch, Alectra Utilities staff must enter overtop of the equipment used to provide protection. This equipment has not been utilized since installation, and elbow connections of this vintage are known to have issues with partial vacuum flashover during use. These cables were installed in the 1970s when work practices and methods were very different in comparison with present day safety practices. As an example, Figure 12 illustrates the use of back-to-back elbows as a splice to bond the cables.

Figure 12 - Cable Connections

Connections that are made in this manner complicate repairs since the middle connection requires more time to access, thereby increasing the length of time for the repair. The chambers are also not of standard size creating difficult working conditions in the chambers. Finally, the cables are laying in congested cables in trays, where several of the cables lie directly against each other, as seen in Figure 13. In the event of a cable fault, this leads to an increased risk of damage and failure to adjacent cables from the faulted cable.

Figure 13 - Cables Laying Side-by-Side in Cable Tray

Scope

Three circuits of underground main feeder cable running between switches 47F4-147405L to 47F4, 47F5-131337L to 47F5 and 47F2-123650L to 47F2, as well as civil infrastructure, are required to be replaced to provide proper working conditions. These 4km long cables supply one large user in the area. These cables are approximately 35 years old and have reached the end of useful life. While a failure has not occurred, due to the difficulties with the civil infrastructure, a failure would take significantly longer to repair. Alectra Utilities has experienced failures of cables of similar make and vintage in another area.

Options Considered

Option 1: *Status Quo* - Operate with existing underground cables

Under the *status quo* option, the cables may fail resulting in a significant outage to a Large Use customer. In the current configuration, all cables run via a common manhole chamber, with poor working conditions making repairs far more difficult and lengthy.

Option 2: Inject the cable in order to potentially increase its operational life

The cables at this location are already in ducts. Consequently, it is uneconomical to inject them. Further, injection does not resolve the civil infrastructure issue which is the most significant contributor to a lengthy restoration time. It is cost-effective to remove the old cables and install the new cables in the existing ducts.

Option 3: Replace the existing cable and update the civil infrastructure to present day standard

Replacing the existing cables and civil infrastructure with new civil infrastructure would resolve the issue of the civil infrastructure creating a safety concern and increasing the outage duration. It also ensures that the supply to the Large Use customer will remain reliable, without requiring reactive repair due to outages.

Recommended Option

The recommended solution is Option 3, to replace the existing cable and update the civil infrastructure.

The recommended option is that the existing cables should be replaced, in order to avoid a major outage to a Large Use customer. The existing 750 kcmil cable will be removed and new 4km segment of 1000 kcmil (present day standard cable) 28kV cables will be installed in the new ducts.

The recommended solution is expected to cost $1.55MM and will be in service by December 31, 2018. The primary benefits are in:

- System reliability - The underground cables supply a Large Use customer which, in case of a failure, would result in a significant negative impact to this customer and related businesses.
- System renewal - Replacing the existing cables and civil infrastructure with new civil infrastructure would resolve the issue of the civil infrastructure creating a safety concern and increasing the outage duration.
- System expansion - Higher rated cables will be installed, in order to support the future increase in consumption and avoid potential over loading issues.

If the OEB does not approve the project, Alectra Utilities will not replace the cables or renew the civil infrastructure, the cables may fail resulting a significant outage to a Large Use customer. In the current configuration, all cables run via a common manhole chamber, creating poor working conditions and constraining repairs and resulting in more lengthy outages.

Business Case

Project Name

Lakeshore Boulevard/John Street Overhead Rebuild

Project ID

2018-C0561-1

Project Duration

1 Year

Expected in-service Date

December 2018

Category

System Renewal

Background

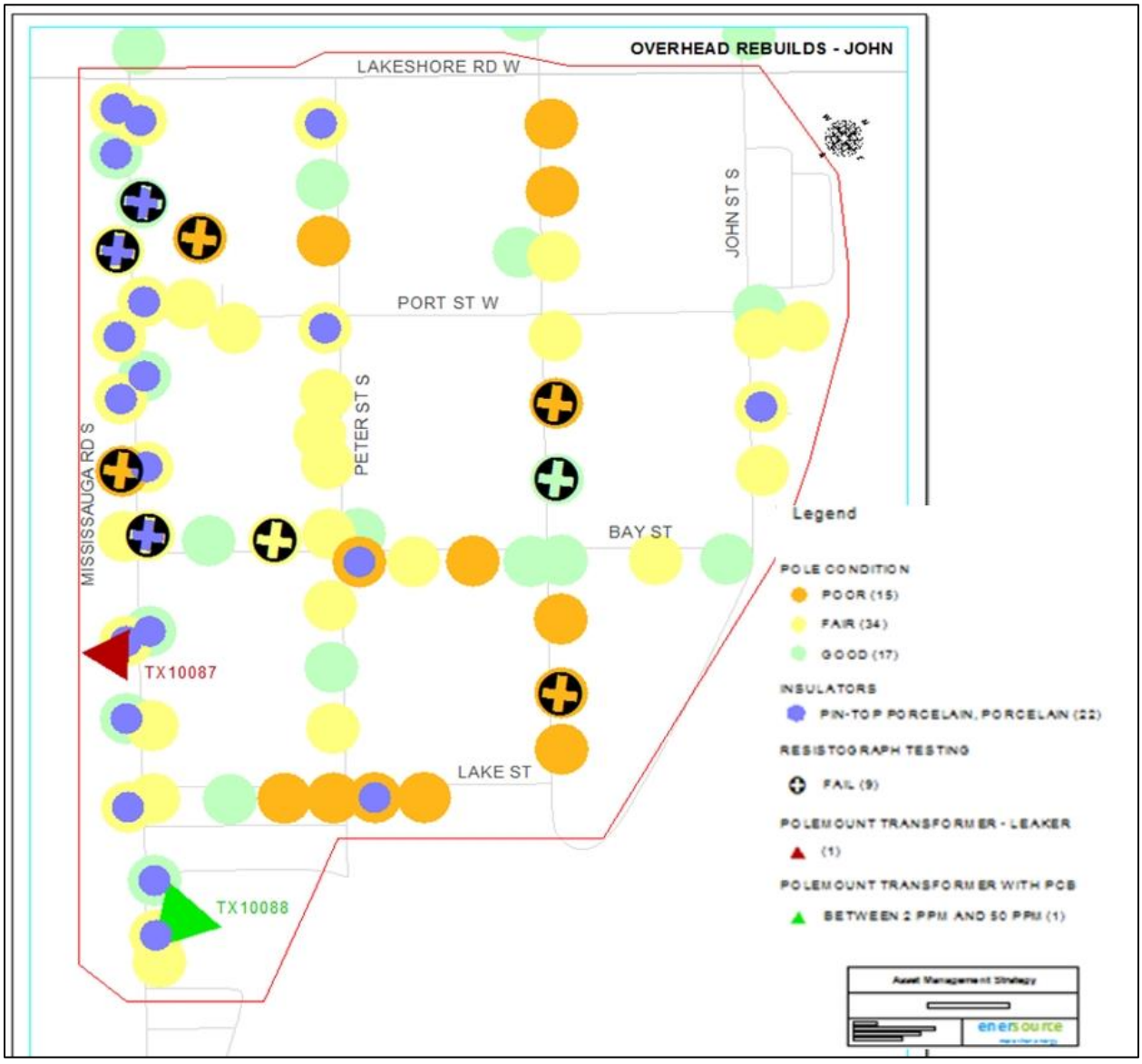
In recent years, the former Enersource increased the frequency and level of detail of inspections; reviewed outage data more rigorously; and has implemented additional analytical methods to guide the pacing of asset replacements. By leveraging the increased asset data that was collected and analyzed, Alectra Utilities has developed a renewal investment plan, provided in the DSP, based on condition and performance assessment. From 2014 to 2015, Enersource inspected all of the distribution poles in service. During the inspection, a number of poles were found to be in poor condition. The poles were found: to be rotting; to have mechanical damage; to show evidence of insect infestation; to be cracking. In addition, through field inspections a number of overhead mounted transformers were found to be leaking oil or containing oil with PCB.

As pole lines deteriorate with utilization and time, their strength is reduced. With reduced strength, the risk of failure under adverse weather conditions increases. As a result, there is a need to renew the sub-standard asset. Not only do pole line failures introduce operational risks related to reliability but they also pose a public safety hazard. Health Index (HI) assessment of the wood poles completed by Kinectrics in 2016 identified that 16% of poles were very poor or poor HI.

Based on field inspection, asset health index assessment and awareness of sub-standard system configurations, Alectra Utilities applied an overlay methodology for overhead renewal. The overlay method examined specific system areas with assets of sub-standard condition which were then used to identify and prioritize areas with renewal investment needs. Areas with a high concentration of multiple sub-standard findings, system configuration and loading demands as well as business values (regulatory responsiveness, operational effectiveness, customer focus, financial performance) are used to prioritize investment needs for overhead system renewal. Assessment of risk relating to overhead system renewal failure is also utilized to determine pacing of investments to address the identified renewal needs. In addition to investment needs driven by pole conditions, configuration and criticality, the overlay methodology for overhead system renewal also considers other investment needs such as insulators with a high propensity of failure and leading causes for pole top fires. Benefits of utilizing overhead system renewal by area include: leveraging economies of scale; minimizing customer disruption and outages; and addressing multiple investment needs.

To supplement and enhance the overhead system inspection, Alectra Utilities conducted additional testing of wood poles utilizing the resistograph technology, which provides Alectra Utilities with the ability to determine remaining pole strength through the detection of decay and cavities in wood poles. Based on: the poor condition of the overhead assets: the number of failed poles; the pin-top porcelain insulators; and the identification of leaking transformer; the area south of Lakeshore Road West between John Street and Mississauga Road was identified as requiring renewal investment.

Figure 14 - Overlay Map of the Overhead System in the Lakeshore Boulevard and John Street Service Area



Scope

The scope of the project is to renew the overhead system to present day standard configuration. This project will involve the replacement of approximately 50 poles of which the average age of the poles exceeds 40 years. From inspection data, 74% the poles have been assessed as poor or fair condition, while 14% of the poles failed resistograph tests. All poles that assessed to be in good condition will be maintained where possible.

Figure 14 above provides the overlay map of the overhead system in the Lakeshore Boulevard and John Street service area. This area impacts 90 residential and 32 commercial customers. The commercial customers include a fire station and a school.

In addition, two (2) transformers were identified as needing replacement. One transformer was identified as leaking and the other transformer contains oil with PCB. A further 22 of the poles have been identified has having pin top and/ or standoff porcelain insulators. These types of insulators are known to develop hairline cracks over time that will deteriorate, leading to a potential catastrophic failure, if the insulators crack or disintegrate.

The overhead distribution system in the Lakeshore Boulevard and John Street service area was constructed starting in 1960s, based on an open bus secondary distribution system. Such sub-standard distribution configuration is susceptible to limited clearances and possibility of down lines.

Inspections of the overhead system also identified vandalism due to copper theft. Copper ground wires that are necessary in order to ground the overhead distribution system continue to be a prime target for thieves. Alectra Utilities is addressing the copper theft issue with the installation of a copper clad alternative that has no scrap value, by securing the grounding wire with a steel guard and by identifying the wire with signage that indicates that it has no scrap value.

Through inspection, a number of the poles in the area have also been identified as leaning. Leaning poles are a result of highly tensioned conductors and guy wires extracting forces on the poles. With reduced pole strength, leaning poles are more susceptible to failure and breakage during extreme weather.

During the warm weather months, the Lakeshore Boulevard and John Street area has experienced numerous outages caused by animal contacts. This can be attributed to the large population of squirrels that inhabit the old trees in the area, combined with the older style steel cut-out brackets utilized by the distribution system. Various methods of animal contact mitigation have been tested over the years with minimal impact. Alectra Utilities' present standard is to replace insulated steel cutout brackets with insulated fiberglass cutout brackets. This change has proven to be successful in other renewal projects, in order to mitigate outages caused by animal contacts.

Options Considered

Option 1: Renew overhead system in the Lakeshore Boulevard/John Street area

Proceeding with this option will renew the overhead system in the area, complete with: new wood poles; framing; insulators; and replacement of transformers. The renewal of the overhead system will bring the distribution system in the area to present day standards. Benefits of system renewal include: addressing the condition of the poles; removing leaking transformers; mitigating possible environmental risks; improving outages due to animal contacts; updating the system to the most current standard; and providing opportunity for the design group to right size a solution to meet current and future needs of the area. Benefits of addressing the distribution of the service area include: the benefit of economies of scale: minimizing returns for piecemeal and ad-hoc replacements: and minimizing the number of interruptions and outages in the area, necessary to complete reactive based work. The estimated cost of the overhead renewal in the Lakeshore Boulevard/John Street area is $0.9MM.

Option 2: Replace the overhead system with an underground in the Lakeshore Boulevard/ John Street area

This option was evaluated and it was determined that based on the estimated costs of $5.4MM to $9MM that an upgrade to an underground distributions was not economical.

Option 3: *Status quo* - Defer the renewal and continue to maintain the existing overhead system.

With this option, the pole line would eventually fail and would have to be repaired under emergency conditions, which is not economical when compared to scheduled construction. Further, a number of the poles in poor condition are clustered together, which increases the risk of a prolonged outage due to cascading failures. Pole failures could result in an unsafe situation for the public or cause damage to private property. A transformer in this area has also been identified as leaking. Deferral of replacing the transformer increases the probability that level of oil leaking increases therefore increasing the environmental contamination necessitating an expensive environmental remediation and notification to the Ministry of the Environment and Climate Change (“MOECC”). Without modifications to the existing overhead systems, the probability of animal contacts is expected to continue, resulting in decreased reliability.

Option 4: Replace only hazardous conditions in the system at Lakeshore Boulevard/John Street

This option includes: the replacement of poles rated poor and very poor; replacement of poles that have failed pole testing; the installation of additional animal guards; replacement of missing grounding infrastructure; and the replacement of the leaking transformer. Minimal and ad-hoc replacement of only imminent hazards introduces increased number of trips, higher per unit replacement costs, increased number of scheduled outages and interruptions necessary to complete the work and higher probability that emergency repairs will be required at higher costs. Multiple and repeat visits including crew mobilization and set up costs have been determined to increase the costs of renewal initiatives. In addition, like-for-like ad-hoc replacement prohibits the configuration of the distribution system in the area to be upgraded to present day standards. This option has lower near term costs, but will result in increasing maintenance, inspection and long term replacement costs.

Recommended Option

The recommended solution is Option 1, to renew the overhead system in the Lakeshore Boulevard/John Street area. This is due to operational effectiveness, benefit of economies of scale, as well as the mitigation of safety and environmental risks.

The recommended option is estimated at $0.93MM; it is to be completed and in-service by December 2018. The primary benefits include:

- System reliability – The investment will address the sub-standard overhead system and mitigate the risk of outages in the area. Addressing the condition and open bus configuration of the overhead system will mitigate outages from failures in event of higher winds or storms. Renewing the area to present day standards will address the risk of animal contacts which are known to cause the main feeder to auto reclose or possibly lead to a sustained outage which impacts a higher number of customers beyond that of Lakeshore Blvd./John St. The impact of each overhead system failure event in the area is estimated at 80,000 customer minutes of outage or more.

- System renewal - Various overhead equipment has been determined to be in poor condition and at end-of-life and is in need of replacement. All poles that tested 'good' will be maintained where possible.
- Environmental impact/risk - One transformer was identified of leaking and a second transformer was identified as containing oil with PCB content. Alectra Utilities has determined that the transformer with leak will deteriorate, causing an increasing environmental contamination which would necessitate an expensive environmental remediation.
- Public and Employee Safety - Failure of the deteriorated overhead system may result in poles or equipment crashing to the ground. This introduces a hazard with a potential risk of damage, public safety and injury.

In the event that the OEB does not approve this project, Alectra Utilities will, at the minimum, be required to replace all the poles in the area identified as poor or very poor, which includes poles that have failed pole testing.

In addition, Alectra Utilities will be required to replace the leaking transformer and continue to monitor the transformer with oil containing PCBs. Should the leaking transformer trigger a need for environmental remediation, Alectra Utilities will notify the MOECC and Climate Change and take immediate steps to remedy the situation, likely at an increased expense. Alectra Utilities will place animal guards in targeted areas to mitigate animal contacts. Investment to repair the vandalized system and repair the damaged system grounds will be required. In addition, poles found to be leaning (beyond acceptable standards) will need to be re-tensioned or re-seated. Should those poles fail during the adjustment, they will need to be replaced under emergency conditions.

Business Case

Project Name

Church Street Area Overhead Rebuild

Project ID

2018-C0561-2

Project Duration

1 Year

Expected In-service Date

December 2018

Category

System Renewal

Background

In recent years, Enersource increased the frequency and detail level of inspections, reviewed outage data more rigorously, as has implemented additional analytical methods to guide the pacing of asset replacements. By leveraging the increased asset data that was collected and analyzed, Alectra Utilities developed the renewal investment plan, provided in the DSP, based on condition and performance assessment. From 2014 to 2015, Enersource inspected all of the distribution poles in service. During the inspection, a number of poles were found to be in poor condition. The poles were found: to be rotting; to have mechanical damage; to show evidence of insect infestation; to be cracking. In addition, through field inspections a number of overhead mounted transformers were found to be leaking oil or containing oil with PCBs.

As pole lines deteriorate with utilization and time, their strength is reduced. With reduced strength, the risk of failure under adverse weather conditions increases. As a result, the sub-standard asset requires renewal. Not only does pole line failure introduce operational risks related to reliability, but it also creates a public safety hazard. HI assessment of the wood poles completed by Kinectrics in 2016 identified that 16% of poles were in the very poor or poor health index.

Based on field inspection, the asset health index assessment and the utility's awareness of existing sub-standard system configurations, Alectra Utilities applied an overlay methodology for overhead renewal.

The overlay method examined specific system areas with assets of sub-standard condition which were then used to identify and prioritize areas with renewal investment needs. Areas with high concentration of multiple sub-standard findings, system configuration and loading demands as well as business values (regulatory responsiveness, operational effectiveness, customer focus, financial performance) were used to prioritize investment needs for overhead system renewal. Assessment of risk relating to overhead system renewal failure is also utilized to determine pacing of investments to address the identified renewal needs. In addition to investment needs driven by pole conditions, configuration and criticality, the overlay methodology for overhead system renewal also considers other investment needs, such as insulators with a high propensity of failure which are one of the leading causes for pole top fires. Benefits of utilizing overhead system renewal by area include: leveraging economies of scale; minimizing customer disruption and outages; and addressing multiple investment needs.

To supplement and enhance the overhead system inspection, Alectra Utilities conducted additional testing of wood poles utilizing the resistograph technology. This provided Alectra Utilities with the ability to determine remaining pole strength through the detection of decay and cavities in wood poles. Based on the poor condition of the overhead assets, the number of failed poles, the identification pin-top porcelain insulators and the identification of a leaking transformer, the Streetsville area east of Queen Street along Church Street was identified as being in need of renewal investment.

Figure 35 - Overlay Map of the Overhead System in the Church Street Service Area

Scope

The scope of the project is to renew the overhead system to the present day standard configuration. This project will involve the replacement of approximately 55 poles of which the average age of the poles exceeds 40 years. From inspection data, 64% the poles have been assessed as poor or fair condition with 10% of the poles failed resistograph tests. Figure 15 above provides the overlay map of the overhead system in the Church Street service area. This rebuild area directly affects 68 residential and 95 commercial customers, which include two schools, a few apartment buildings and a community center. Portions of this project (main overhead line on Church Street) will benefit an additional 204 residential customers and four commercial customers beyond the renewal area of outlined in Figure 15. In addition, six transformers were identified as needing replacement. One transformer was identified as leaking. A further nine of the poles have been identified as having EPAC or pin top and/ or standoff porcelain insulators which have been determined to be problematic. In Alectra Utilities' experience, EPAC insulators to degrade and result in failures from flashovers. The porcelain type of insulators are known to develop hairline cracks over time, that will progressively deteriorate, leading to a potential catastrophic failure when the insulators crack or disintegrate.

The overhead distribution system in the Church Street service area was constructed in the 1980s based on an open bus secondary distribution system. This sub-standard distribution configuration is susceptible to limited clearances and the possibility of down lines.

Inspections of the overhead system also identified vandalism by copper theft. Copper ground wires that are necessary in order to ground the overhead distribution system continue to be a prime target for thieves. Alectra Utilities is addressing the copper theft issue with the installation of a copper clad alternative that has no scrap value, by securing the grounding wire with a steel guard and by identifying the wire with signage that indicates that it has no scrap value.

A number of the poles in the area were also identified as being inaccessible during the inspection. As development occurred in the area, the construction of structures near electrical distribution poles and lines created an access issue, which requires additional investment to address. In addition to accessibility issues, encroachment to electrically energized equipment creates a safety risk to the public and employees. Overhead system renewal investment in the Church Street area is required to address the inaccessible overhead system and redesign the overhead distribution to facilitate a safe and reliable distribution system.

Figure 16 - Image of Pole Structures Encroached Upon by New Development

During the warm weather months, the area along Church Street has experienced outages caused by animal contacts. This can be attributed to the large population of squirrels that inhabit the old growth trees in the area combined with the older style steel cut-out brackets utilized by the distribution system. Various methods of animal contact mitigation have been tested over the years with minimal impact. Alectra Utilities' present standard is to replace insulated steel cutout brackets with insulated fiberglass cutout brackets. This change has proven to be successful in other renewal projects, in order to mitigate outages caused by animal contacts.

Options Considered

Option 1: Renew overhead system in the Church Street area

Proceeding with this option will renew the overhead system in the area, complete with new wood poles, framing, insulators, and replacement of transformers. The renewal of the overhead system will bring the distribution system in the area to present day standards. Benefits of system renewal include: addressing the condition of the poles; removing the leaking transformer, thereby mitigating any possible environmental risks; alleviating outages due to animal contacts; updating the system to the most current standard; and providing the opportunity for the design group to right size a solution to meet the current and future needs of the area. Benefits of addressing the distribution of the service area include the benefit of economies of scale; minimizing returns for piecemeal and ad-hoc replacements; and minimizing the number of interruptions and outages in the area necessary to complete reactive based work. The estimated cost of the overhead renewal in the Church Street area is $1.02MM.

Option 2: Replace the overhead system with an underground in the Church Street area

This option was evaluated; it was determined that based on the estimated costs of $6.0MM to $10MM, an upgrade to an underground distribution system was not economical.

Option 3: Defer the renewal and continue to maintain the existing overhead system.

With this option, the pole line would eventually fail and would have to be repaired under emergency conditions, which is not economical when compared to scheduled construction. A number of the poles in poor condition are clustered together thereby increasing the risk of a longer outage due to cascading failure. With a pole failure, there is an increased risk that it could result in an unsafe situation to the public or damage to private property. Prolonged outages are expected should a failure occur in a location where accessibility is an issue. Six transformers have been identified as identified as leaking. Deferral of replacing the transformer increases the probability that the level of oil leaking increases, thereby increasing the environmental contamination, and necessitating an expensive environmental remediation and notification to the MOECC. Without modifications to the existing overhead systems, the probability of animal contacts is expected to continue, resulting in decreased reliability.

Option 4: Replace only hazardous conditions in the system at Church Street area

This option includes the replacement of poles in the area identified as poor and very poor, which includes poles that have failed pole testing, the installation of additional animal guards, relocation of inaccessible assets and replacement of the leaking transformer. Minimal and ad-hoc replacement of only imminent hazards introduces increased number of trips, higher per unit replacement costs, increased number of scheduled outages and interruptions necessary to complete the work and higher probability that emergency repairs will be required at higher costs. The cost of the renewal initiatives will increase due to multiple and repeat visits including crew mobilization and set up costs. In addition, like-for-like ad-hoc replacement prohibits the configuration of the distribution system in the area to be upgraded to present day standards. Option 4 has lower near term costs but increasing maintenance, inspection and long term replacement costs.

Recommended Option

The recommended solution is Option 1, to renew the overhead system in the Church Street area. This is the recommend solution due to: operational effectiveness; the benefit of economies of scale; as well as the mitigation of safety and environmental risks.

The recommended solution is estimated at $1.02MM; it is estimated to be completed and in-service by December 2018. The primary benefits include:

- System reliability – Reduced risk of power interruptions through lower risk of pole line failure, in the event of higher winds or storms, as well as a lower probability of animal contacts, which would cause the main feeder to auto reclose or possibly a lock out affecting a population much larger area than outlined at Church Street. Anticipated impact of a pole line failure is estimated at 80,000 customer minutes of outage or more.
- System renewal - Various overhead equipment has been identified as being in poor condition and at end-of-life and in need of replacement. All poles that tested ‘good’ will be maintained where possible.

- Environmental impact/risk - Six transformers have been identified as identified as leaking. Deferral of replacing the transformer increases the probability that the level of oil leaking increases, thereby increasing the environmental contamination, and necessitating an expensive environmental remediation and notification to the MOECC
- Public and Employee Safety - Failure of the deteriorated overhead system may result in poles or equipment crashing to the ground. This would introduce a hazard with a potential risk of damage, public safety and injury.

In the event that the OEB does not approve this project, Alectra Utilities must, at a minimum, replace all the poles in the area that have been identified as poor and very poor ,which includes poles that have failed pole testing. In addition, Alectra Utilities must replace the leaking transformers. Should the leaking transformers trigger a need for environmental remediation, Alectra Utilities will notify the MOECC and take immediate steps to remedy the situation, likely at a considerable expense.

In addition, Alectra Utilities will place animal guards in targeted areas to mitigate animal contacts and will relocate overhead assets that are currently inaccessible, in order to address the accessibility issues, as well as the safety clearances required for energized plant. In addition, poles found to be leaning (beyond acceptable standards) will need to be re-tensioned or re-seated. Should those poles fail during the adjustment, they will need to be replaced under emergency conditions. Finally, the sections of the distribution system that have been vandalized will need to be repaired.

Business Case

Project Name

Leaking Transformer Replacement Project

Project ID

2018-C0563-2

Project Duration

5 Years - 2017-2021

Expected In-service Date

The scope of work identified for 2018 is projected to be in-service by December 2018.

Category

System Renewal

Background

In recent years, Enersource increased the frequency and the level of detail captured through annual distribution system inspections, in order to gain more insight into the condition of its in-service distribution assets. These inspections capture important information regarding the continued safe operation of its distribution assets and identify substandard conditions requiring follow up activities. The inspections are carried out on a three year cycle, such that the entire Alectra Utilities distribution system in the Enersource RZ is inspected once every three years, in compliance with the Minimum Inspection Requirements of the DSC.

There are currently 25,329 distribution transformers located at various sites throughout Alectra Utilities' service territory, including public locations (e.g. rights-of-way), rear lots of private properties, commercial lands near high traffic areas, as well as designated in-door customer-owned vault locations. Due to the minimal impact of a distribution transformer failure on system performance, Alectra Utilities' typical asset lifecycle management approach is to run such assets to failure before replacement.

However, given the initiation of a more comprehensive asset inspection process and the utility's heightened awareness of environmental obligations and liability, the overall risks associated with distribution transformer failure and potential oil spills have been reassessed. From 2013 to 2016, Enersource inspected its fleet of distribution transformers, resulting in the identification of a large number of transformers showing signs of oil leaks and/or containing PCB oil.

Oil spills from distribution assets would trigger various reporting and remediation obligations pursuant to applicable statutes and regulations, including the *Ontario Environmental Protection Act*, the *Canadian Environmental Protection Act*, and applicable regulations, thereunder. Based on O. Reg. 675/98 under the *Environmental Protection Act*, Alectra Utilities is required to report all spills of 100 litres of oil or more into the environment. In those instances, Alectra Utilities must also make immediate arrangements for mitigation and remediation of the impacted site. Based on the PCB Regulations (SOR/2008-273) under the *Canadian Environmental Protection Act*, Alectra Utilities must report any spills involving more than one gram of PCB into the environment and carry out remediation of the impacted site as required.

Alectra Utilities is committed to environmental stewardship and regulatory compliance, and is highly cognizant of the impact of oil spills on the environment, on customers and on the general public. In order to minimize the risk of environmental contamination and regulatory non-compliance, from 2013 to 2016, Enersource replaced 2,052 transformers that were identified as showing signs of oil leaks and/ or containing PCB. Over this time period, environmental remediation and transformer replacements were completed at 103 sites impacted by oil leaks. Enersource incurred approximately $5.6MM in environmental remediation costs and $19.4MM in capital expenditures for replacements that have not been included in rates. Figure 17 provides an image of the environmental remediation work being undertaken to address oil contamination from a leaking transformer. Table 1 identifies the number of transformers replaced from 2013 to 2016.

Figure 17 - Environmental Remediation due to Oil Contamination

Table 1 - List of Transformers Replaced from 2013 to 2016

Transformer Type	2013	2014	2015	2016	Total
Kiosk	2	4	5	2	13
Padmount	92	179	372	274	917
Padmount-3ph	5	2	18	12	37
Polemount	29	57	237	275	598
Vault	29	143	103	212	487
Total	157	385	735	775	2052

Scope

As of January 1, 2017, 2,244 transformers have been identified as showing signs of oils leaks and/ or containing PCB, as part of the multi-year transformer replacement project. These transformers pose significant environmental, reliability, safety, regulatory and financial risks that need to be addressed on a timely basis. Alectra Utilities has developed a multi-year replacement project to address the remaining 2,244 transformers, which will minimize environmental, reliability, safety, regulatory and financial risks before any major contamination and liabilities materialize. Failure to replace these transformers in a timely manner means that reactive replacements and environmental remediation will be needed should any major spills and contamination occur. Both would carry environmental and public safety risk, and give rise to significant financial liabilities on the part of the utility.

Table 2 identifies the breakdown of the 2,244 transformers to be replaced through the transformer replacement project.

Table 2 - List of Transformers to Replace (as of January 1, 2017)

Transformer Type	**PCB Transformers Indicating Leaking Oil**	**Non-Leaking Transformers with PCB Oil**	**Transformers (Non-PCB) Indicating Signs of Leaking**	**Total**
Single-Phase Pad Mount	3	95	733	**831**
Three-Phase Pad Mount	2	6	71	**79**
Vault Transformers	15	38	717	**770**
Pole Mount Transformers	0	31	533	**564**
Total	**20**	**170**	**2,054**	**2,244**

In 2016, Kinectrics completed an ACA for Enersource, identifying, among other things, the HI condition assessment of in-service assets (including transformers). Based on asset information available as of December 2015, the HI asset condition assessment showed that 1,629 distribution transformers were in poor or very poor condition. Further to that assessment, the Enersource RZ continued with detailed inspections of transformers in 2016. The difference between the 1,629 distribution transformers flagged by Kinectrics's ACA and the 2,244 distribution transformers requiring replacement as of January 1, 2017 is attributed to the identification of additional transformers needing replacement based on 2016 inspections, including units that have experienced excessive thermal conditions (resulting in oil overflowing the transformer containment) and those with oil leaks categorized as minor.

Over time and without remediation, transformers will continue to deteriorate, and minor leaks would become moderate or major leaks. Therefore, these units were included in the transformer replacement project, which is prioritized and paced on a multi-year basis to carry out the required replacements before extensive and disruptive environmental remediation becomes necessary.

Options Considered

Option 1: *Status quo* - Continue to operate transformers showing signs of oil leaks until failure.

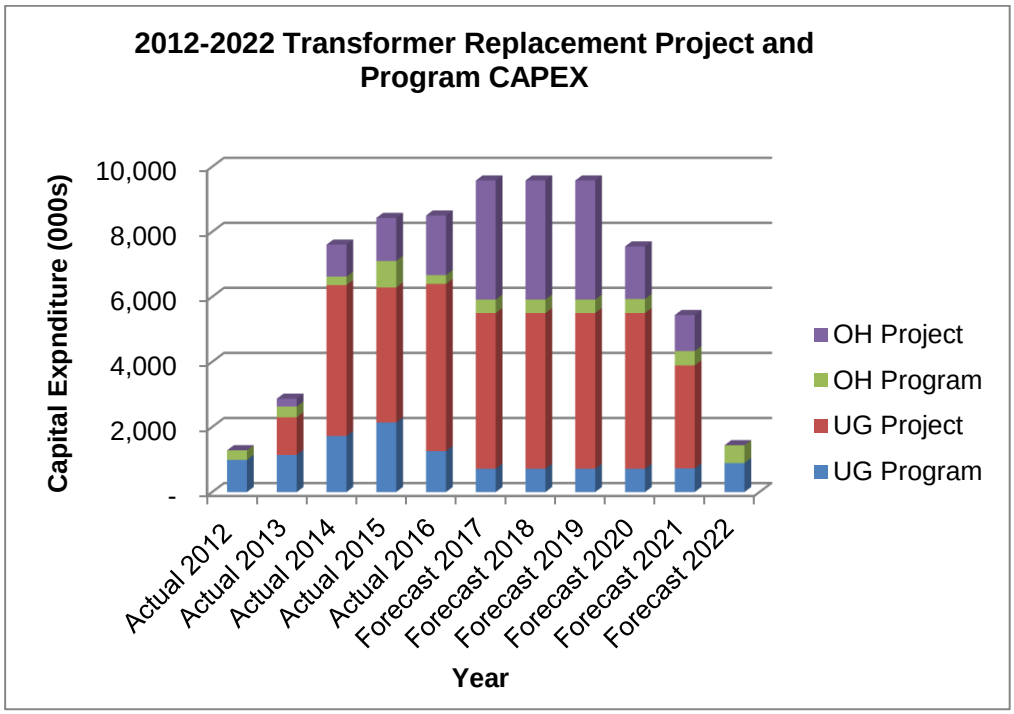
Under this option, Alectra Utilities will continue to operate these transformers to failure, and will address any resulting oil spills and environmental contamination upon replacement. As a majority of the identified transformers contain more than 100 litres of oil, it is highly probable that extensive environmental clean-up and remediation obligations will be triggered based on applicable regulations.

Option 2: Address the backlog of 2,244 transformers identified as indicating signs of oil leaks and/or containing PCB through a multi-year project.

As of January 1, 2017, 2,244 transformers that have been identified as showing signs of oils leaks and/or containing PCB as part of the Alectra Utilities' multi-year transformer replacement project. This option entails the implementation of a multi-year project to replace these transformers, in order to maintain regulatory compliance with environmental regulations and prevent the need for extensive and disruptive environmental remediation. Under this option, Alectra Utilities will also seek opportunities to carry out required replacement during the planning of underground or overhead system renewal projects.

Under this option, the project plan is prioritized and paced on a multi-year basis to mitigate the risks associated with significant environmental damage, including expensive remediation costs and significant disruptions to customers and the general public in Mississauga. This multi-year project is proposed in addition to the existing transformer replacement program, which, in contrast, addresses the investment need to replace rusting or damaged transformers on a reactive basis. Figure 18 illustrates the 2012 to 2022 transformer replacement project capital expenditure relative to the transformer replacement program.

Figure 18 - 2012-2022 Transformer Replacement Project and Program CAPEX



The multi-year replacement project is scheduled to be completed in 2021, with paced annual expenditures of $8.4MM in 2017; $8.4MM in 2018; $8.4MM in 2019, $6.4MM in 2020 and $4.3MM in 2021. In contrast, the transformer replacement program entails a consistent annual expenditure of $1.1MM from 2017 to 2019, increasing to $1.4MM in 2022.

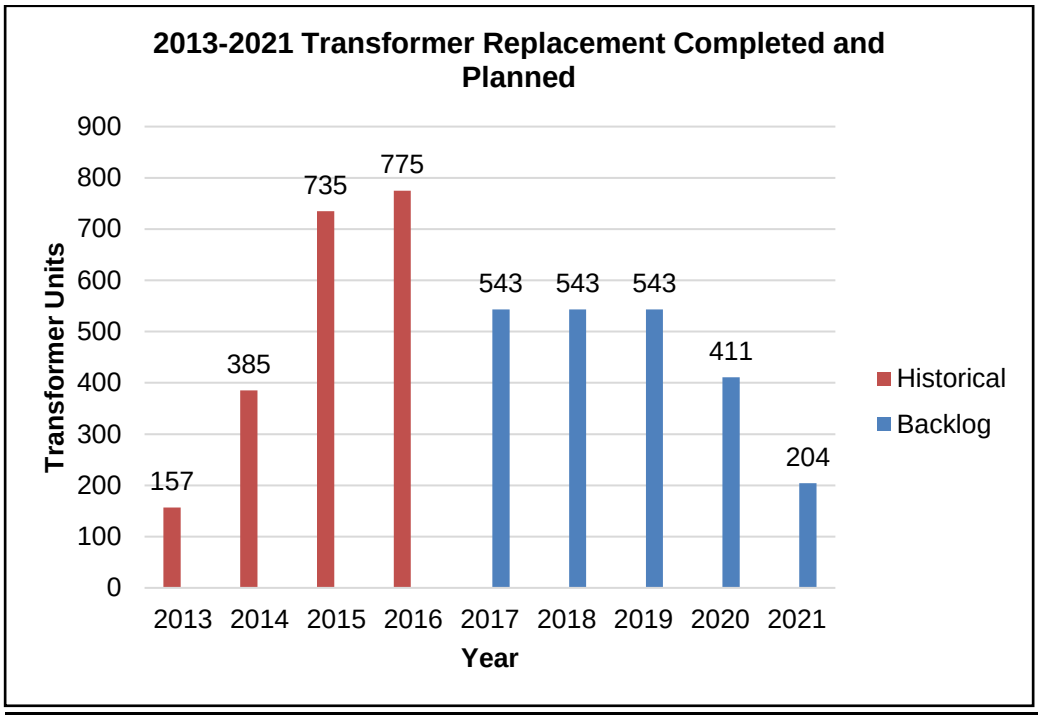
Recommended Option

The recommended solution is Option 2, to address the backlog of 2,244 transformers identified as indicating signs of oil leaks and/or containing PCB through a multi-year project is recommended. It is imperative that transformers identified as showing signs of oil leaks are replaced before significant spills occur, leading to environmental damage, expensive remediation, and significant disruption to customers and the general public. Through a paced and well-planned approach to proactive transformer replacements over the span of a few years, the project can be implemented in an efficient and cost effective manner, with a view to minimize reactive replacement costs (e.g., overtime labour costs in emergency situations).

Option 1 is not recommended. Since 2013, Enersource has completed environmental remediation at 103 sites impacted by transformer oil leaks, incurring approximately $5.6MM in environmental remediation costs (i.e., over $0.05MM per site). Such environmental remediation work caused significant disturbances and interruptions to residential and business customers. Option 1 exposes Alectra Utilities to risks associated with environmental contamination, and does not align with its commitment to environmental stewardship. Moreover, this option does not demonstrate sound asset management and is likely to raise public and regulatory concerns over the company's asset management practices. While adopting this option would result in lower capital expenditures in the near term, the eventual oil leaks and required environmental remediation would quickly offset any near-term cost avoidance and deferral. Finally, this option does not address the reputational risks associated with potential oil spills and environmental contamination. It is imperative that Alectra Utilities is able to maintain public confidence in its ability to effectively manage distribution assets and to continue to serve customers in a responsible and sustainable manner.

The multi-year replacement project is scheduled to be completed in 2021, with paced annual expenditures of $8.45MM in 2017, $8.45MM in 2018, $8.45MM in 2019, $6.40MM in 2020 and $4.27MM in 2021. The scope of work identified for 2018 is projected to be in-service by December 2018. Figure 19 illustrates the quantities of completed transformer replacements from 2013 to 2016 and planned transformer replacements to clear out the backlog from 2017 to 2021.

Figure 19 - 2013-2021 Transformer Replacement Completed and Planned



The primary benefits of selecting Option 2 are summarized below:

- Regulatory/Public Policy Responsiveness – Transformer oil leaks involving more than 100 litres of oil or more than 1 gram of released PCB would trigger extensive reporting and remediation obligations pursuant to applicable laws and regulations. Through proactive replacement before major spills occur, Alectra Utilities can avoid costly environmental remediation and potential regulatory penalties.
- Environmental impact/risk – If not prevented or mitigated at an early stage, major oil spills can lead to significant environmental damages and negative impact on public health and safety.
- Financial impact – Through the recommended option, costly site clean-ups and remediation (approximately $0.05MM per site) can be avoided.
- Reputational Risk – Addressing this problem proactively would demonstrate Alectra Utilities' strong commitment to environmental stewardship and prudent asset management. It is imperative that Alectra Utilities is able to maintain public confidence in its ability to effectively manage distribution assets and serve customers in a responsible and sustainable manner.

In the event that the OEB does not approve this project, Alectra Utilities must still replace all leaking transformers. Should the leaking transformers trigger a need for environmental remediation, Alectra Utilities will notify the MOECC and take immediate steps to remedy the situation, likely at considerable expense. Alectra Utilities would need to reassess other planned projects, to determine which of these would have to be deferred and the potential impact on customers.

Business Case

Project Name

York MS

Project ID

2018-C0504-1

Project Duration

Some long-lead time preparation activities will be underway in 2017, with construction taking place in 2018.

Expected In-service Date

Q4 2018

Category

System Service

Background

Investment at York Municipal Substation ("MS") is driven primarily by growth demand in the Meadowvale Business Park Area. A secondary driver for the investment is the requirement to update the sub-standard equipment at York MS to present day standard and configuration.

The investment requirement at York MS is firstly driven by the projected growth of commercial, industrial and institutional demand in Meadowvale Business Park area as well as system capacity necessary to provide reliable back-up for Argentia, Century and Winston municipal substations.

Located in North West section of Mississauga, the Meadowvale Business Park area is bounded to the south by Britannia Road West, Highway 407 to the north, Creditview Road to the east and 9th Line to the west. As the second largest employment district in Mississauga, the Meadowvale Business Park the location was the area of business for 47,600 employees.

In November 2013, the City of Mississauga released a long-range growth forecast of population, housing and employment based on forecasts prepared by Hemson Consulting in September 2013. Furthermore, the City of Mississauga Council adapted the "Steady Growth" scenario of the forecast in November 2013. Under the "Steady Growth" conservative scenario, the employment

growth projections for the Meadowvale Business Park project an increase of 11,700 total employment by 2026.

As the build out of the area is projected by 2041 with a total employment of the area projected to be 63,000, which represents an increase of 15,400 employment positions relative to the 2011 census count.

As a result of the projected employment growth, the total load in the Meadowvale Business Park area is projected to increase by approximately 20 MVA in the next five years. Alectra Utilities plans that based on distribution system configuration, approximately 50% of the new load will be required to be supplied from York MS. The present demand on York MS is 14MVA; in the near term, load on the station will exceed the normal operating rating of 20MVA, as established by the station planning criteria. Recently, Alectra Utilities has been unable to accommodate customer requests to connect larger facilities on the 13.8kV system supplied by York MS substation and required to construct distribution connection onto the 44kV system.

The secondary driver for the York MS project is to mitigate the reliability issues associated with the cable egress, protection and sub-standard station configuration.

York MS is required to continue providing reliable service to the commercial, industrial and institutional services in the area as well as to provide back-up for the Argentia, Winston and Century Municipal Substations. The York MS area is constrained from the surrounding system in the area due to the proximity and geographic layout of Highway 401 and Mullett Creek.

The existing equipment located at York MS station is sub-standard. The station was commissioned in 1998 as temporary station to serve the industrial services. The station is one of two remaining outdoor 44kV/13.8kV Municipal Substations in the Mississauga. Outdoor station equipment is susceptible to contamination from nearby highways, animals, and weather, which introduces operating risks and increased maintenance as well as inspection costs.

Furthermore, due to the temporary configuration of station, the protection arrangement for the power transformer is sub-standard without high voltage switchgear and limited to the utilization of fuses rather than the standard configuration of breakers. This sub-standard configuration introduces a higher risk of equipment damages should the transformer fail. In addition, the

present sub-standard configuration does not contain any environmental contamination which introduces environmental risks should a transformer failure occur.

York MS provides back up to the three other stations in the Meadowvale Park Business area. As additional loading is placed on the station, the capability to transfer supply and back up the other stations given will be constrained by the capacity of the station.

A power transformer failure at York MS would affect over 600 commercial, industrial and institutional customers, potentially subjecting customers to prolonged outages. Due to the substandard transformer protection configuration, a risk of catastrophic failure (such as rupture) is increased in the event of an internal fault within the transformer. Should a transformer internal failure occur, there is an increased probability of environmental risk, due to the lack of oil containment set-up at the station. This may lead to expensive environmental remediation costs.

The current equipment and configuration at York MS includes:

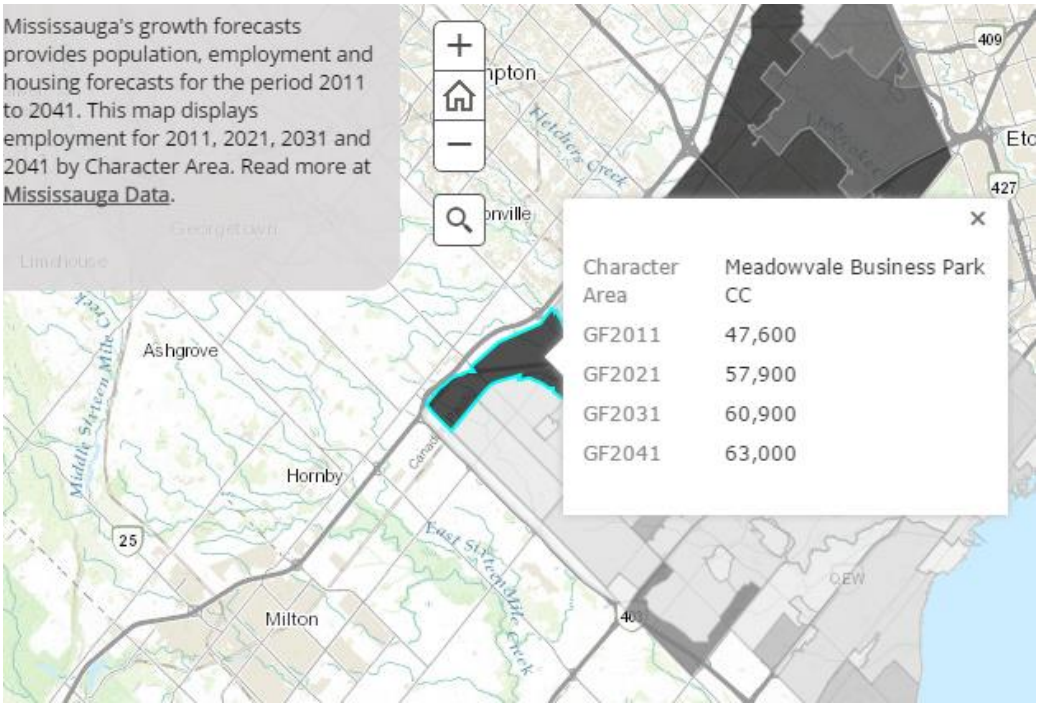
- One (1) 20 MVA, 44kV - 13.8kV power transformer of 1973 vintage;
- Pole mounted power fuses which provide transformer protection; and
- Four (4) pole-mounted G&W reclosers (4 feeders) of 2007 vintage.

Scope

York MS serves the industrial customers in Meadowvale Business Park area and provides back-up for Argentia, Century and Winston municipal substations.

The City of Mississauga growth forecast for Meadowvale Business Park projects over 10,000 jobs over the 10 year period starting from 2011-2021. Refer to Figure 20 below.

Figure 20- Meadowvale Business Park Employment Forecast



The total load in the Meadowvale Business Park area is projected to increase by approximately 20 MVA in the next five years; out of which approximately 50% of the new load will be required to be supplied from York MS. The station will be loaded over the normal rating in near term.

The station currently provides back up to the three other stations in the area and as the station load increases it can no longer back up the other stations given the limitations of the feeder egress cable. The station's substandard protection scheme (i.e. no high voltage switchgear; use of fuses; lack of differential protection) increases the risk of equipment failure and damage. The station equipment (i.e. primary bushings, lighting arrestors) are also directly exposed to environmental elements such as contamination from nearby highways, animals and weather which further increase the risk of failure and damage.

A power transformer failure at York MS would affect over 600 industrial/commercial customers, and potentially subjecting customers to prolonged outages. Due to the substandard transformer protection, should a transformer internal failure occur, there are chances of high environmental and financial risks, from the possible oil spills and the subsequent environmental remediation.

In order to meet the expected load growth and to provide reliable back-up to Century MS, additional capacity is required at York MS.

At present, the major power equipment housed in the temporary substation consists of the following:

• One (1) 20 MVA, 44 kV - 13.8 kV power transformer – vintage 1973;
• Pole mounted power fuses which provide transformer protection; and
• Four (4) pole-mounted G&W reclosers (4 feeders) - vintage 2007.

This project consists of the following:

• Acquisition of a pre-engineered Electrical House ("E-House"), which will house the 15kV low voltage switchgear;
• Acquisition, installation and commissioning of two new 46kV High Voltage Switchgear units;
• Civil work - duct bank, concrete pads for power transformers, E-House and HV switchgear units; and
• De-commissioning of the existing 20MVA power transformer from the temporary substation and re-commissioning in the new substation, adding one additional 20MVA transformer.

Options Considered

Option 1: Upgrade York MS to standard and increase station capacity

This project consists of the following scope:

- Procure and install a pre-engineered E-House, which will contain low voltage switchgear (15kV rating).
- Procure, install and commissioning of two new High Voltage Switchgear units (46kV rating).
- Implement necessary civil work which includes duct bank, concrete pads for power transformers, E-House and High Voltage switchgear units
- De-commission the existing 20 MVA power transformer from the temporary substation and re-commissioning in the new substation and add one additional 20MVA transformer.

This option will provide the required capacity for additional loads, provide reliable back-up for other substations in the area and also offer required substation transformer protection.

Preliminary engineering and procurement of long-lead material are to proceed in 2017 for a budgeted expenditure of $1.04MM. The budgeted cost for completing construction and commissioning of this project in 2018 is $2.23MM for a total capital expenditure for the first option is $3.27MM.

Option 2: Upgrade York MS to standard configuration and defer station capacity increase

This project consists of the following scope:

- Procure and install a pre-engineered E-House which will contain low voltage switchgear (15kV rating);
- Procure, install and commissioning of one new High Voltage Switchgear units (46kV rating); and
- Implement necessary civil work which includes duct bank, concrete pads for E-House and High Voltage switchgear units and future transformer.

This option does not provide additional capacity for the projected growth, but would permit the addition of a second transformer, in the future. The required substation transformer protection configuration would be attained. Total capital expenditure for the second option is $ 2.3MM.

Option 3: Do not upgrade the substation

This option consists of deferring the upgrade and continuing to maintain the existing equipment.

This option does not provide additional capacity for the projected growth. Furthermore, this option does not enable Alectra Utilities to operate the York MS to present day standards necessary to supply reliable power to the commercial, industrial and institutional customers in the area. The risk of an internal fault of the power transformer may lead to extensive damage due to lack of differential protection. Should a transformer internal failure occur, there is an increased probability of environmental risk, due to the lack of oil containment set-up at the station. This may lead to expensive environmental remediation costs.

Recommended Option

The recommended solution is Option 1, to upgrade York MS to standard and increase station capacity.

The recommended solution is to proceed with option 1 to upgrade York MS to standard and increase station capacity. An upgrade of York MS would include installation of new E-House low voltage switchgear, new high voltage switchgear units and installation of an additional 20MVA power transformer. This option will provide the required capacity for the projected growth, provide reliable back-up for Century MS and area as well as the required substation transformer protection.

The recommended solution is budgeted at $3.27MM and will be in service by December 31, 2018.

The primary benefits are as follows:

- System expansion - The upgraded station capacity that the new 20MVA transformer will provide addresses the system needs driven by the expected load growth in the area.
- System reliability – The station will provide reliable back up to other stations in the Meadowvale Business Park, as well as mitigate the current reliability concerns associated with the outdoor substation equipment.
- Environmental risk – York MS does not presently house oil contamination infrastructure. Substation transformers contain approximately 18,000 litres of oil and a transformer failure resulting in spillage or fire would trigger an extensive and expensive environmental remediation.

In the event that this investment is denied, Alectra Utilities will not be able to service the new loads in the Meadowvale Business Park area without exceeding the current established planning loading limits. The failure of a power transformer may result in a prolonged outage to approximately 600 commercial, industrial and institutional customers which would negatively impact system reliability. Should a catastrophic failure of a power transformer at York MS occur, Alectra Utilities would incur the high costs of an environmental remediation.

ATTACHMENT 48 – ICM REVENUE REQUIREMENT BY PROJECT ENERSOURCE RZ

Alectra Utilities - Enersource Rate Zone
ICM Revenue Requirement by Project

Project Description	Return on Rate base	Amortization	Incremental Grossed Up PIL's	Total Revenue Requirement
Road Widening Project - QEW (Evans to Cawthra)	$82,551	$25,295	($11,856)	$95,990
System Access				**$95,990**
Overhead Rebuild - Lake/John	$58,782	$23,816	($6,518)	$76,080
Overhead Rebuild - Church	$64,660	$26,198	($7,169)	$83,688
Leaking Transformer Replacement Project - Overhead	$232,818	$84,506	($29,078)	$288,246
Leaking Transformer Replacement Project - Padmount/Vault	$302,182	$139,053	($27,998)	$413,237
Subdivision Rebuild - Credit Woodlands Crt/Wiltshire	$98,250	$38,032	($11,495)	$124,787
Subdivision Rebuild - Glen Erin & Montevideo (Section 1)	$124,450	$48,174	($14,561)	$158,063
Subdivision Rebuild - Tenth Line Main Feeder	$72,050	$27,890	($8,430)	$91,510
Subdivision Rebuild - Folkway & Erin Mills Main Feeder	$65,500	$25,355	($7,664)	$83,191
Subdivision Rebuild - Glen Erin & Battleford	$131,000	$50,710	($15,327)	$166,383
Subdivision Rebuild - Walmart Cables	$98,250	$38,032	($11,495)	$124,787
System Renewal				**$1,609,973**
Substation Upgrade - York MS	$208,590	$62,142	($14,585)	$256,147
System Service				**$256,147**
Total Distribution Capital & Incremental Revenue Requirement				**$1,962,111**

ATTACHMENT 49 – 2018 CAPITAL SPENDING BY PROJECT ENERSOURCE RZ

2018 Capital Project Listing - Enersource Rate Zone

SYSTEM ACCESS	
Roads Project - Creditview - Britannia to Argentia	967,366
Roads Project - QEW - Evans To Cawthra	1,294,220
LRT - Underground	1,450,000
LRT - Overhead	1,450,000
New Subdivisions	1,000,000
Industrial/Commercial Services	1,300,000
Metering Renewal	764,000
New Metering Installations	620,000
New IMS	1,054,000
Sub-Total Material Projects	9,899,586
Miscellaneous Projects (under materiality threshold)	1,779,214
Total System Access	**11,678,800**
SYSTEM RENEWAL	
Gananoque - Section 1	1,961,142
Boughbeeches - Section 1	1,238,616
Copenhagen - Section 1	2,374,014
Appledore - Section 1	1,238,616
Credit Woodlands Crt/Wiltshire (design complete)	1,548,270
Glen Erin & Montevideo - Section 1	1,961,142
Tenth Line Main Feeder	1,135,398
Folkway & Erin Mills Main Feeder	1,032,180
Glen Erin & Battleford	2,064,360
City Centre Drive Cable Renewal	1,548,270
Equipment Replacement	1,545,617
Pole Installations	1,236,494
Munden/Pear Tree	741,896
Holburne/Ogden	1,020,107
Lake/John	927,370
Church	1,020,107
Courtney Park - Dixie To Ordan	778,309
Stanfield - North Service to Queensway	1,245,294
Southdown - ROW to Lakeshore	1,171,237
Underground Transformer & Equipment Renewal	716,044
Transformer Replacement Project - Underground & Overhead	8,447,243
Pad Mounted Switchgear Replacement	1,686,335
Cable & Splice Replacements	2,485,399
Sub-Total Material Projects	39,123,459
Miscellaneous Projects (under materiality threshold)	1,786,335
Total System Renewal	**40,909,794**

2018 Capital Project Listing - Enersource Rate Zone

SYSTEM SERVICE	
City Centre N	1,449,332
Bloor MS	724,666
Hensall MS	828,190
Western MS	776,428
Park Royal	1,035,237
York MS	2,225,760
Churchill Meadows Feeder Egress - TS to Winston Churchill	1,040,375
Derry – WCB to Argentia	1,186,027
U/G installation of SCADA/Automation switches	716,824
O/H installation of SCADA/Automation switches	808,987
RTU System Enhancements & Equipment Upgrades	1,085,477
WiMAX Wireless Network Project	768,026
Sub-Total Material Projects	12,645,329
Miscellaneous Projects (under materiality threshold)	776,849
Total System Service	**13,422,178**
GENERAL PLANT	
Program - Cars/Light Trucks/Vans	1,290,000
Program - Heavy Trucks/RBDs/Buckets	1,180,000
Project - Mavis Building Envelope	600,000
Other Non-Material Projects	1,025,000
Sub-Total Material Projects	4,095,000
Miscellaneous Projects (under materiality threshold)	2,577,000
Total General Plant	**6,672,000**
Total 2018 Capital Projects	**72,682,772**