EB-2015-0065

IN THE MATTER of the *Ontario Energy Board Act 1998*, Schedule B to the *Energy Competition Act*, 1998, S.O. 1998, c.15;

AND IN THE MATTER OF an Application by Enersource Hydro Mississauga Inc. for an Order or Orders approving just and reasonable distribution rates and other service charges for the distribution of electricity, effective January 1, 2016.

TECHNICAL CONFERENCE QUESTIONS AND ISSUES

FROM THE

SCHOOL ENERGY COALITION

1-SEC-1
[2-Staff-4 and AMPCO-12] SEC would like to explore further the differences between the current capital plan, and the capital plan proposed by the Applicant in EB-2012-0033, as set out in the attached 2012 Asset Management Plan. We have prepared a breakdown (also attached) of 2016 forecast capital from the 2012 AMP and the current Application, and would ask that the witnesses take us through it, line by line, and explain the changes in circumstances that justify each material change in the capital forecast. Also, in light of the statements on page 2 of the response, we will want further clarification on whether additional ICM applications can be expected before their next rebasing.

1-SEC-2
[Supp-Staff-11] SEC would like to explore further the capital planning prioritization. Among other things, we would like to understand better the categories of spending that are included in Regulatory-Mandatory, to see how much of that spending is truly mandatory, and how much of that spending is driven by regulatory requirements. We also will be interested in an explanation as to why the Financial Performance criteria are in dollars rather than in percentages. We would also like assistance with respect to the apparent inconsistencies between the System Reliability criteria and the response to Supp-Staff-12.

1-SEC-3
[Supp-Staff-14] SEC will ask for a fuller explanation for this response. In particular, we will ask the witnesses to walk us through the spreadsheet attached to Supp-Staff-11 and explain the need and timing of each project, and in each case the “significant influence” on operations.

1-SEC-4
[CCC-10, 2-SEC-3, and 2-SEC-9] We would like to have a better understanding of how M&A strategy is factored into capital forecasts. In particular, we will ask the witnesses to go through the major projects and explain how they could be affected by either actual or possible M&A transactions, and how contingencies or scenarios have been built into the capital planning process to avoid wasted spending or stranded assets.

1-SEC-5
[2-SEC-1] SEC would like to better understand the reasons this Application was not filed sooner, in order to better understand whether it is reasonable for the Board to allow changes in rates starting January 1, 2016.

1-SEC-6
[2-SEC-4] We would like a better understanding of how Enersource's accounting methods prevent it from reporting capital additions using the categories required by the Board, both generally and in the ICM process.

1-SEC-7
[2-SEC-6] SEC would like to be able to compare the spending, timing, and contribution amounts for the LRT for both of the LDCs involved, and thus would like to follow up and understand what information is available from the Applicant to assist with this.

1-SEC-8
[2-SEC-8] SEC is unable to discern from the response how the proposed incremental capital revenue would be allocated to rate classes on a cost of service basis, and would like further assistance in that regard.

1-SEC-9
[AMPCO-14] SEC would like further explanation of the difference in cost between planned and reactive pole replacements, including past cost data and any benchmarking the company has available.

1-SEC-10
[AMPCO-15(a)] We were unable to find the requested information in AMPCO-10 and 11, and would like the witnesses to walk us through it.

SEC will likely also have follow-up questions on issues identified by Board Staff and other intervenors.

Submitted by the School Energy Coalition December 21, 2015.

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Jay Shepherd
Counsel for School Energy Coalition

Asset Management Plan

Overview and Objective

Enersource has prepared an Asset Management Plan ("AMP") which is provided at Appendix 1 of this exhibit. The AMP outlines the asset management practices which are part of an optimized lifecycle strategy for Enersource's distribution system assets. The scope of the AMP encompasses programs and major projects that are required to sustain Enersource's electrical distribution system.

The objectives of the AMP are to:

- Report on the performance of the distribution system;
- Identify risks and challenges that would adversely affect the ability to deliver economically reliable power to Mississauga; and
- Present a multi-dimensional over-arching strategy and tactical plan for investing in and maintaining assets in order to effectively achieve the lowest long-term owning costs.

The AMP details how Enersource manages, maintains, and reinforces the electrical distribution system in a cost-effective manner. The AMP outlines the programs, projects, and capital expenditures for the next five years, beginning January 1, 2012. In addition, the AMP reviews the capital, operating, and reliability trends over the past five years.

In pursuit of Enersource's mission, the organization will ensure to meet legal, regulatory, and environmental compliance and strive to continuously improve overall customer satisfaction. Enersource is committed to the activities outlined in the AMP and intends to continue to build on the many successes achieved to date.

Challenges Facing the Enersource Distribution System

Managing aging infrastructure and system capacity requirements will continue to present challenges in both the short- and long-term. Enersource's distribution system assets range in age from new to over 50 years old. The management of these assets is critical to providing safe, reliable, and efficient electricity distribution services to its customers.

The AMP emphasizes a continued focus on managing the aging infrastructure, particularly in the management of poles, underground cables, distribution transformers, substation transformers, and substation switchgear. Given the large expansion of the system during the City of Mississauga's development boom years of the 1970's, 1980's, and 1990's, a considerable amount of asset replacement is expected within the next five to twenty years.

The asset replacement approach must be prudently managed, to achieve the lowest long-term owning cost of the distribution equipment while conforming to industry standards and requirements, and meeting the needs and expectations of Enersource's customers in terms of rates, performance, and reliability. This is particularly important given that a considerable portion of the expansion experienced in Mississauga's boom years was funded with significant amounts of capital contributions from developers. This will not occur as the system assets are replaced, placing significant pressures on rates.

To address the impending increase in the number of assets that are expected to reach their useful life over the next two decades, the AMP also identifies several initiatives under development and consideration to closely monitor, analyze, and evaluate asset management activities in order to refine the approach needed to meet the expected increase in replacement rates.

Information and Inputs Used to Prepare the AMP

Enersource used several sources of data to assess the status of the assets in its distribution system and to assist with determining the capital and operational investments to be made in the system. This data included, but was not limited to, an asset condition assessment, reliability information, as well as, system criticality, environmental, and customer impacts. The sources of data included:

- an Asset Condition Assessment ("ACA), prepared by Kinectrics Inc. ("Kinectrics");
- a load forecast of system capacity;
- Testing and Inspection Programs;
- Integrated Operating Model ("IOM"); and
- Automated Mapping / Facilities Management / Geographical Information System ("AM/FM/GIS").

The data was computed and analyzed using various tools and techniques to produce a priority list of projects by asset classes.

Risks need to be controlled and mitigated to support Enersource's corporate governance needs and due diligence responsibilities. The AMP includes a risk assessment that identifies and prioritizes risks associated with managing and expanding the distribution system assets. As a part of the planning process, risk evaluations were completed for each asset class.

Asset Condition Assessment

Conducting an ACA is a process whereby the condition of all key asset categories owned by Enersource is assessed. In early 2011, Enersource selected and engaged Kinectrics to complete the ACA. Kinectrics has a wide range of experience in assessing the condition of utility assets. Enersource utilized the Kinectrics' ACA in developing the 2012 AMP.

Kinectrics provided its ACA in late-2011 which included the development of a health index (the "Health Index") for eleven asset classes, determined the Health Index distribution for the entire population of assets in each class, and developed a forty-year condition-based replacement plan. Based on Kinectrics' formulations and industry-accepted methodologies, equipment replacement rates for all of the asset classes were developed. Each is discussed in detail in the AMP.

The findings of the ACA are provided in the AMP. The ACA identified two asset groups to be of particular concern, three-phase padmounted transformers and padmounted switch gear. These asset groups were found to have 13% and 14% of the population in poor or very poor condition, respectively.

Other asset classes identified by the ACA for action include circuit breakers, single-phase padmounted transformers, and vault transformers. For each asset class, various charts are provided. Samples of these charts for one asset class, single-phase padmounted transformers, are shown below in Figures 1 and 2.

Figure 1 provides a sample age distribution of the specific asset type. Figure 2 shows the recommended replacement rates of the asset type. These figures are provided in the AMP for each asset type.

Figure 1: Single-Phase Padmounted Transformer Age Distribution

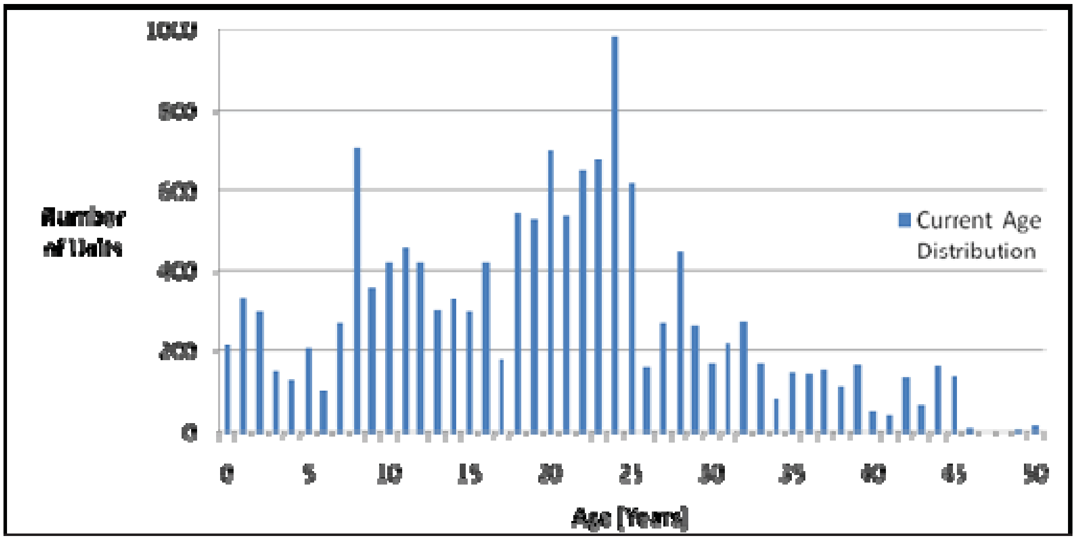
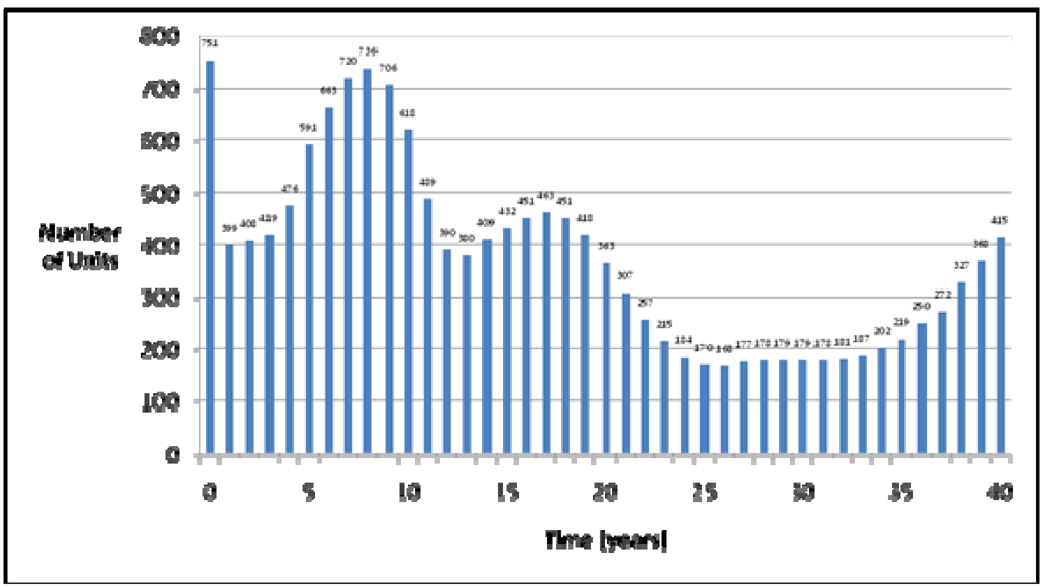


Figure 2: Single-Phase Pad Mounted Transformers - Recommended Replacement Rate



The ACA report was one of several key inputs for the AMP. It evaluated Enersource's existing programs and emphasized the immediate need for the development of new initiatives to address the required replacement rates for all asset groups. These new initiatives are summarized below and discussed further in the AMP.

Future Planning Initiatives

Enersource will enhance its current methods and techniques with many future planning initiatives discussed in the AMP. These new initiatives will provide significant value to customers and are expected to enable Enersource to make more-informed decisions and optimize its asset decisions in order to enhance system reliability. The ultimate goals of these initiatives are to minimize long-term owning costs, and to refine the optimized lifecycle strategy for distribution system assets. Please refer to Exhibit 4 Tab1 Schedule 5 for further discussion on the operating costs associated with these asset management efforts.

The future planning initiatives discussed in detail in the AMP include:

- System Planning Software (CYMDIST);
- Transformer Loading Tool;
- Pole Testing Pilot Program;
- Ten Worst Feeder Study; and
- Major Outage Cause Study.

AMP Investment Program

A summary of the investments identified in the AMP are provided in Table 1 below. Table 1 summarizes the capital program by Enersource's five major investment categories. These five investment categories are identified and described briefly below. Further detail on the programs, projects, and costs within each category is provided within the AMP.

Overall, the AMP investment plan over the next five years is consistent with recent Enersource investment activities and suggests a continuation of programs and developments. To address the impending number of assets that are expected to reach their useful life in the near and medium terms, the AMP also identifies several initiatives under development and consideration to closely monitor, analyze, and evaluate asset management activities in order to refine the approach needed to meet the expected increase in replacement rates.

Table 1: AMP Capital Budget Expenditures, 2007 to 2016 ($000s)

Description	Actual					Forecast				
	2007 CGAAP	2008 CGAAP	2009 CGAAP	2010 CGAAP	2011 IFRS	2012 IFRS	2013 IFRS	2014 IFRS	2015 IFRS	2016 IFRS
System Capacity – Growth Driven Investment	9,320	10,299	15,791	10,207	10,385	9,312	11,134	10,329	10,507	10,686
System Systainment – Reliability Driven Investment	13,457	15,790	19,291	16,316	12,707	14,483	16,326	18,329	19,319	20,939
System Expansion & Upgrades – Customer Driven Investment	6,537	6,888	5,363	11,899	6,269	6,274	5,342	5,749	5,037	4,975
Non-System Requirements - Regulatory Driven Investment	8,279	6,157	9,410	8,763	3,747	4,401	183	219	256	293
Non-System Requirements – Internally-Driven Investment	8,588	11,603	8,456	5,530	9,052	29,472	13,187	10,725	9,646	9,317
TOTAL CAPITAL EXPEDITURES	**46,180**	**50,737**	**58,310**	**52,714**	**42,159**	**63,942**	**46,173**	**45,351**	**44,766**	**46,209**

System Capacity – Growth Driven Investment

Growth-driven capital projects ensure the continuation of Enersource's capability to provide a secure and reliable supply of electricity to its customers. Growth is predicted through the combined use of growth projections, historical growth patterns, and load forecast models.

The System Capacity – Growth Driven Investment category has two components:

- Subtransmission and Distribution Program; and
- Municipal Substation Construction and Upgrades Program.

System Sustainment – Reliability Driven Investment

Maintaining reliability is one of the key success factors of Enersource. To maintain reliability Enersource actively tracks outage causes and effects. Based on this information Enersource has ongoing rebuild, upgrade, and replacement programs.

The System Sustainment – Reliability Driven Investment category has five components:

- Subdivision Rebuilds Program;
- Overhead Distribution Sustainment;
- Underground Distribution Sustainment;
- Transformer Replacement; and
- Automated Switches / SCADA Program.

System Expansion and Upgrades – Customer Driven Investment

Customer driven investment projects are required for the connection of new customers or to modify or upgrade a customer's current service. Projects of this nature are not discretionary but mandatory, and include work such as new residential connections, industrial/commercial connections, and metering equipment upgrades and installation.

The System Expansion and Upgrades – Customer Driven Investment category has five components:

- Industrial and Commercial Services;
- New Subdivisions;
- Road Projects;
- Metering Equipment; and
- Individual Metered Suites in Condominiums.

Non-System Requirements – Regulatory Driven Investment

Regulatory driven investment projects are mandated by industry regulations. Projects of this nature include wholesale metering upgrades per IESO market rules, and OEB-sponsored initiatives such as smart metering and time-of-use rates (“TOU”) and the Green Energy and Green Economy Act (“GEA”).

The Non-System Requirements – Regulatory Driven Investment category has three components:

- Wholesale Metering;
- Smart Metering; and
- Green Energy and Feed-in Tariffs.

Non-System Requirements – Internally Driven Investment

The Non-System Requirements – Internally Driven Investment category has eight components:

- Engineering and Asset Systems;
- Rolling Stock;
- Information Technology;

- JDE / ERP System;
- Meter to Cash;
- Grounds and Buildings;
- Acquisition of Administration Office; and
- Major Tools.

A list of projects and expenditures for this category are provided in the AMP.

Appendix of Major Projects

An appendix accompanies the AMP which provides further detail for major projects. These details are found at Exhibit 2 Tab 2 Schedule 2 Appendix 2.

Enersource Hydro Mississauga Inc.

Asset Management Plan

2012

April 2012

Executive Summary

The objective of Enersource's asset management plan ("AMP") is to present a multi-dimensional investment strategy and plan for investing in electricity infrastructure, equipment and intangible assets required by Enersource in order to effectively fulfill and exceed customer needs and stakeholder requirements. Enersource's AMP involves a centralization of key decision making to maximize the effectiveness of investments, while maintaining performance levels. The AMP was developed on the principle of investing in and maintaining assets to achieve the lowest long-term owning costs while conforming to system design standards/requirements, construction standards/codes, system performance standards and prescribed set of manufacturing specifications.

The AMP aligns with Enersource's strategy to provide acceptable long term reliability performance of the subtransmission and distribution systems while keeping personnel, service providers and the public safe. In pursuit of Enersource's mission, the organization will ensure to meet legal, regulatory and environmental compliance and strive to continuously improve overall customer satisfaction. Enersource is committed to the activities outlined in this AMP and intends to continue to build on the many successes achieved to date.

The structure of this report was developed from the chronological activities that were undertaken in its development. To provide context of the organization and the culture, the report introduces the corporate strategy, mission and vision and brief overview of the history of the organization. Enersource's service territory and high level description of the subtransmission and distribution systems are illustrated to provide context of the topographical outline before the discussion of system performance and reliability history.

The comprehensive and balanced AMP is based on multitude of inputs including, but not limited to, asset condition assessment ("ACA"), system capacity load forecast and asset information extracted from testing and inspection reports, information from the Integrated Operating Model ("IOM") as well as the Automated Mapping/Facilities Management ("AM/FM") and Geographical Information Systems ("GIS").

The ACA was completed by Kinetrics Inc. in November 2011 in order to evaluate and determine the asset health index and to develop and report a condition-based replacement schedule for each key distribution asset group. The ACA identified that three phase pad mounted transformers and pad mounted switch gear asset groups were found to be of concern due to the number of units in poor or very poor condition, found to be at 13% and 14% of the population respectively. Other asset classes identified by the ACA for action include circuit breakers, single phase pad mounted transformers and vault transformers. Enersource has examined, evaluated and prioritized programs and projects to address these findings, analysis is summarized in ACA asset class finding section of this AMP.

It is important to note that although the ACA does reflect the benefits of Enersource's historical maintenance and sustainment practices which ensured the a good proportion of distribution system assets are currently in acceptable operational state, a large number of asset classes are expected to require replacement at increasing rates over the near and mid-term outlooks. This can be evidenced by the waves of asset populations installed during times of rapid growth in Mississauga that are soon expected to approach the end of the useful life. This AMP outlines the tactics and activities that Enersource will undertake in order to optimally address these increasing rates of replacement through proactive planning, risk evaluation and continuation of existing programs and projects outlined here within.

The methodology applied in the development of the AMP is founded on the management of key factors including system planning, prioritization and execution of capital projects and sustainment programs. The objective of these activities is to select the projects and programs that deliver the required functions at the desired sustainable level of performance. These projects and programs are classified in to categories that include requirements for capacity, service quality, customer demands and strategic initiatives. Capacity requirement investments are required to maintain and expand the distribution system in an efficient manner. Service quality requirement investments ensure that performance of the distribution system is maintained in regard to reliability, power quality and support customer value. Investments pertaining to customer requirements are required to achieve compliance standards, new connection and to promptly respond to customer inquiries. Investments regarding strategic activities include those that pursue optimal operations, effective maintenance programs and development of distribution system while minimizing the environmental impact in support of good corporate citizenship.

To improve previous system planning outlooks developed under a needs-based framework, this AMP enhances on the planning process by implementing an additional stage which includes a risk-based assessment of the asset classes. The risk assessment was completed for each asset class as it pertains to economic, service quality, regulatory/legal compliance, environmental, reputational and employee/public safety. The risk assessment results are used to aid in evaluating and prioritizing project and program planning.

Based on the multitude of inputs outlined, program activities and projects based on developed business cases and risk assessment, an investment plan was developed which underpins the near term capital budget of this AMP. The investment plan describes the major projects and outlines the ongoing programs through this period captured into investment capital categories. Overall, the investment plan presented stays consistent with previous Enersource investments activities and suggest a continuation of programs and developments. To address the impending wave increases of assets that are expected to reach the useful life in the near and medium terms, this plan also identifies several initiatives under development and consideration to closely monitor, analyze and evaluate asset management activities in order to refine the approach needed to meet the expected increases in replacement rate. These asset management and planning initiatives include utilization of additional tools such as system planning software to perform comprehensive distribution system analysis, development of a transformer loading analysis tool to monitor the loading of distribution transformers and several maintenance pilot programs such as pole testing and cable field assessment testing. Further studies such as ongoing evaluation of the worst performing feeders and enhanced analysis of major outage caused are to be further developed and incorporated in future AMP developments.

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HISTORY AND BACKGROUND INFORMATION

1. Corporate Strategy

Enersource Hydro Mississauga Inc. ("Enersource" or "the Company") has prepared a comprehensive and robust corporate strategic plan (the "Strategic Plan") that provides for asset investment initiatives with financial and operational returns on those investments. A key consideration of the Strategic Plan, and reflected within this asset management plan (the "AMP"), is the concept of balancing customer expectations with stakeholder requirements, in the most cost effective manner. This balance must consider financial, operational and regulatory constraints.

While utilities are permitted to earn a rate of return on their rate base investment, the timelines of recovery of those investments are predicated upon the expected useful lives of the asset. Therefore, Company management must ensure that appropriate funding is available to undertake those long-term investments.

Also, management must ensure that properly trained and certified workers are available to construct and maintain Enersource's assets through directly-employed staff or by utilizing subcontracting firms. As this expertise is specialized, industry competition for these resources is strong.

Enersource's Strategic Plan is validated annually and its corporate goals are translated into each employee's personal annual performance goals and objectives. Many of the strategic initiatives within the Strategic Plan have been assigned to cross functional teams thereby ensuring a successful outcome for Enersource. The focal points of the Strategic Plan include:

Business Engagement:	External Engagement:	Organizational Engagement:
• Strategic capital flexibility • Strategic investments • Revenue stabilization	• Communications enhancement • Distribution rate design • Enersource brand enhancement	• Resource development • Organizational enhancement • Health and safety • Business risk mitigation

Table 1.1: Focal Points of the Strategic Plan

Enersource's Strategic Plan is a balanced and comprehensive. Enersource remains committed to this comprehensive plan and will continue to build on the many successes achieved to date.

To complement the development of the Strategic Plan and budgets of the company, the capital plans of Enersource are assessed in a comprehensive manner and are evaluated to ensure alignment with the corporate strategies. Risk assessment is conducted on projects to help develop solutions to mitigate risks and to prioritize.

Business Outcome	Key Success Factor	Key Indicator Groups	Key Performance Indicators
System Reliability and Long Term Sustainability	Acceptable long term reliability performance of subtransmission and distribution systems	• Reliability	SAIDI
			SAIFI
			CAIDI
		• Maintenance costs	Within Budget
Health and Safety	Keep personnel, service providers, and the public safe	• Employee safety incidents • Service provider safety incidents • Public safety incidents	Lost Time Incidents
			Medical Aid Injuries
			First Aid Injuries
			Vehicle Accidents
			Property Damage
			Property Theft
Legal, Regulatory, and Environmental Compliance	Meet all compliance standards	• Regulatory service quality indicators results • Legal violations • License conditions violations	Connection of New Services
			Appointment Scheduling
			Appointments Met
			Rescheduling a Missed Appointment
			Telephone Accessibility
			Telephone Call Abandon Rate
			Written Responses to Enquiries
			Emergency Response
Customer	Improve overall customer satisfaction	• Customer satisfaction result	Customer satisfaction survey

Table 1.2 – Enersource Business Outcomes and Success Factors

PERFORMANCE MEASUREMENTS	OEB / ESA Target	Enersource Target
SAFETY:		
Number of Preventable Lost Time Injuries (If "LTI" result =1, then achieved = 10%)	N/A	0
RELIABILITY: Annual Average Outage per Customer		
OEB Requirements		
SAIDI [System Average Interruption Duration Index] Outage Minutes/Customer/year	(High 53.3), (Low 36.7)	41.10
SAIFI [System Average Interruption Frequency Index] Outage Interruptions/Customer/Year	(High 1.97), (Low 1.18)	1.41
Customer Restoration Targets:		
CAIDI [Customer Average Interruption Duration Index] Annual Average of Minutes / Interruption	(High 31.1), (Low 26.5)	36.00
SERVICE QUALITY: Electricity Service Quality Requirements (ESQRs)		
Connection of New Services		
<750 volts connected within 5 working days from the day on which all conditions of service are satisfied	90%	95%
>750 volts connected within 10 working days from the day on which all conditions of service are satisfied	90%	95%
Customer Service		
Incoming calls answered by Customer Service Representative within 30 seconds [Telephone Accessibility]	65%	80%
Incoming calls abandon by Customer [Telephone Call Abandon Rate]	≤10%	≤10%
Appointments		
Scheduled of appointments within 5 days of a customer's request	90%	90%
Appointments at customer's premises met within appointed time [am or pm]	90%	90%
Rescheduled of missed appointments within 1 day	100%	100%
Cable Locates completed within 5 working days of a customer's request (ESA)	90%	90%
Written Response to Inquiries		
Written response to inquiries from customer or agent of customer, within 9 working days following receipt of request	80%	95%
Emergency Response		
Emergency trouble calls response within 60 minutes.	80%	95%
Reconnection Standards		
Post disconnection due to non-payment, reconnect within 2 business days of full payment or arrears payment agreement	85%	85%
CONSOLIDATED PRE-TAX NET INCOME (120% OF BUDGET on Modified IFRS*)		
Pre-Tax Net Income		
Target to follow subsequent to Board approval of 2012 Budget numbers	N/A	TBD
** Modified IFRS: IFRS based net income adding back Regulatory Asset & Liability activity and settlement.*		

Table 1.3 – Enersource 2012 Corporate Performance Target

2. Corporate Mission Statement and Vision

Mission Statement

Consistently fulfill and exceed customer needs and stakeholder requirements.

Enersource Vision

To be a leading energy solution provider through integrity, innovation, teamwork and excellence.

Core Corporate Values

We conduct business in a manner that results in the reliable, safe and efficient delivery of electricity and energy solutions while ensuring environmental and fiscal integrity in our operations. These are listed, and described more fully, below:

Integrity

- we interact with customers, stakeholders, and each other honestly and respectfully
- we conduct ourselves consistently with core principles and values
- we strive to provide maximum customer and shareholder value and return on investment
- we say what we mean. We do what we say

Innovation

- we encourage open dialogue and recognize initiative and creative thinking
- we provide innovative products and service solutions

Teamwork

- we provide a healthy environment for our employees and the communities we serve
- we work together openly, honestly, and respectfully to achieve our mission

Excellence

- we protect ourselves, each other and the community from harm by operating in a safe manner, always
- we operate in a manner that inspires confidence and secures the support of all of our customers and stakeholders

3. Enersource History

Enersource owns and operates the electricity distribution system in the city of Mississauga (the "city" or "Mississauga") and serves approximately 196,000 homes and businesses. Including Hydro One data, Enersource is the sixth largest electricity distributor by number of customers, and the fourth largest distributor by both peak load and energy consumed in the Province of Ontario. Enersource is governed by the *Electricity Act, 1998,* and regulated by the Ontario Energy Board.

Enersource is 90% owned by the city and 10% owned by BPC Energy Corporation ("Borealis"), a subsidiary of the Ontario Municipal Employees Retirement System. Enersource, or its predecessors, continue to deliver "more than energy"[1] to Mississauga residents and businesses, and have done so for almost a century.

The current city, incorporated in 1974, was formed through the amalgamation of the Town of Mississauga and the villages of Port Credit and Streetsville, together with portions of the Townships of Toronto Gore and Trafalgar.

It was a vast rural area in 1917, with farmers slowly discovering the benefits of electricity. Simple hydro and telecommunication lines appeared on the landscape linking family farms with life in the township's commercial hubs, the villages of Streetsville and Port Credit. It was in this setting, following special legislative approval, that the Toronto Township Hydro Commission was formed. That fledgling Commission later merged with the two village hydro utilities becoming Mississauga Hydro Electric Commission. In the year 2000, the new name "Enersource" emerged, associated with the commercial restructuring of the Company, introducing several Enersource affiliates including Enersource Hydro Mississauga Inc.

Enersource and its founding hydro utilities achieved many innovations over the years. From the early 1900's as the first township to contract for electricity with Ontario Hydro, to the 1950's as it began to innovate with underground distribution through residential neighbourhoods, and set records as a municipality supporting the development of 1,000 electricity heated homes.

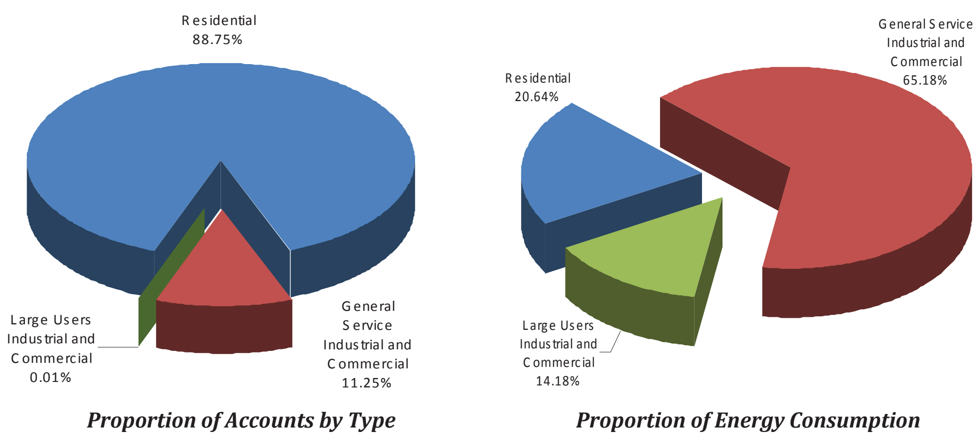


Figure 3.1 – Proportion of Enersource's Customer Types and Energy Consumption

[1] This is Enersource's brand tagline, representing its pledge to provide customers with more than the reliable delivery of electricity but also fast, courteous service, and good community citizenship.

Enersource's territory covers 287 square kilometers which includes 1,807 km of overhead lines, 3,360 km of underground lines and approximately 25,000 distribution transformers. A map of Enersource's service territory is shown in Figure 3.2.

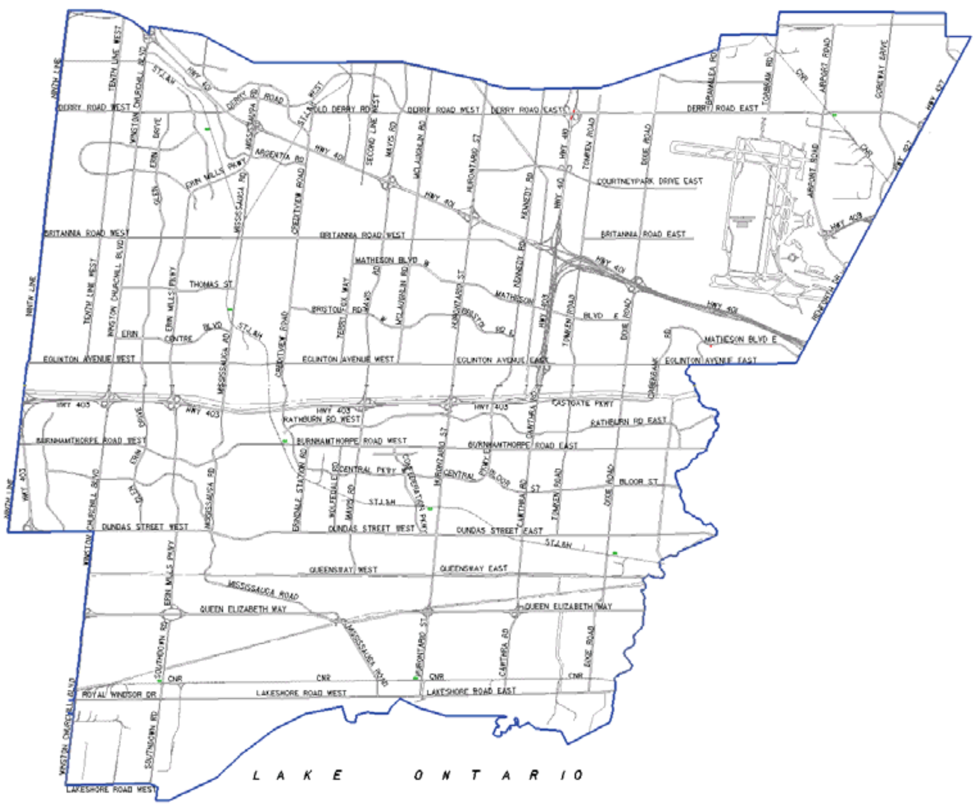


Figure 3.2 – Map of Enersource Territory

ELECTRICAL SYSTEM DESCRIPTION

4. Historical System Description

4.1 System Description

Enersource owns and operates the electrical power system in Mississauga. The system can be divided into two main categories: subtransmission and distribution.

4.1.1 Subtransmission System

Enersource's subtransmission system operates at a voltage of 44kV. The system receives electricity from Hydro One's Transformer Stations ("TS's" plural or "TS" singular) where voltage is transformed from 230kV to 44kV.

The Hydro One TS sites are: Meadowvale TS, Churchill Meadows TS, Erindale TS, Tomken TS, Bramalea TS, and Woodbridge TS. Enersource's subtransmission system is comprised of two areas: West 44kV and East 44kV, as illustrated in Figure 4.1 below.

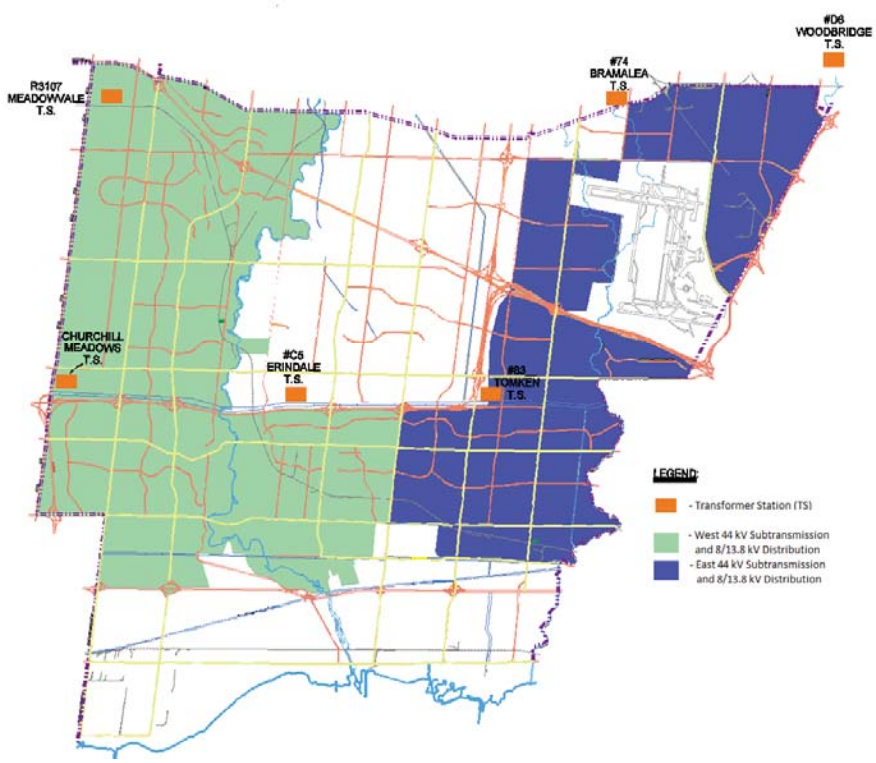


Figure 4.1 – Map of Enersource 44kV Subtransmission System

4.1.2 Distribution System

Enersource's distribution system operates at the voltages of 16/27.6kV, 8/13.8kV, and 2.4/4.16kV.

The system receives electricity from two sources: Hydro One's TS's where voltage is transformed from 230kV to 16/27.6kV, or Enersource's Municipal Stations ("MS's" plural or "MS" singular) sites where the voltage is transformed from 44kV to 8/13.8kV or from 16/27.6kV to 2.4/4.16kV

The Hydro One TS sites are: Oakville TS, Lorne Park TS, Cooksville TS, Richview TS, Erindale TS, Cardiff TS, and Bramalea TS.

Enersource supply points consist of 65 MS locations utilizing 103 power transformers that vary in capacity from 3 MVA to 20 MVA. The distribution system utilizes 58 distribution feeders.

Enersource has divided its distribution system into four areas: North 16/27.6kV, South 16/27.6kV and 2.4/4.16kV, West 8/13.8kV and East 8/13.8kV as illustrated in Figure 4.2 below.

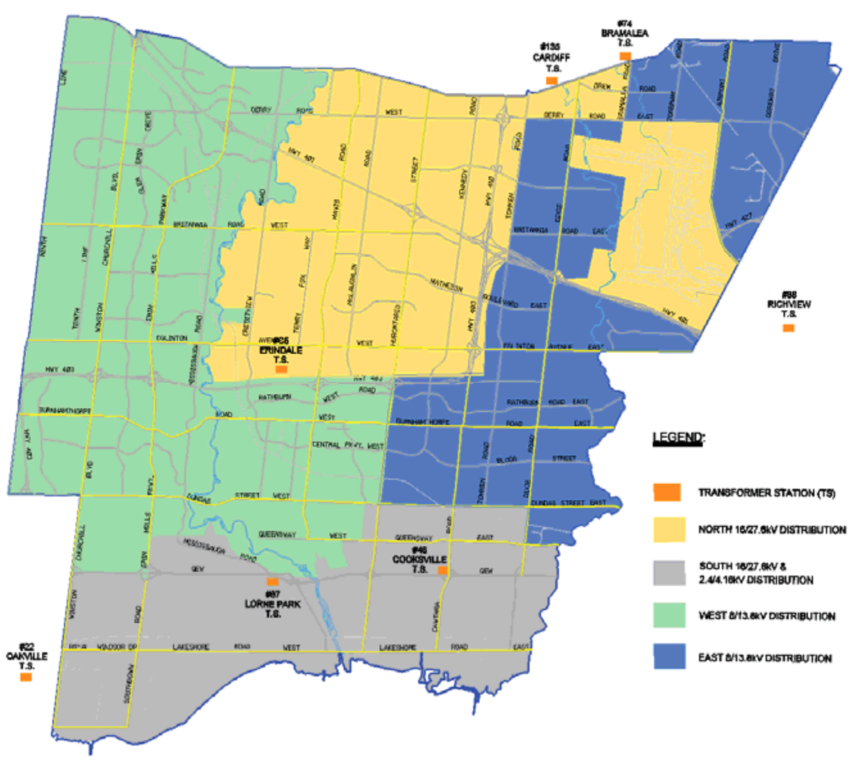


Figure 4.2 – Map of Enersource Distribution System

4.1.2.1 North 16/27.6kV Distribution System

The North 16/27.6kV System consists mainly of distribution equipment which is connected directly to Hydro One TS feeders.

Hydro One TS sites are: Erindale TS, Bramalea TS, Cardiff TS, and Richview TS.

This area contains one Enersource MS site comprised of two step-down transformers rated 44/27.6kV. The overall North 16/27.6kV distribution system utilizes 32 distribution feeders; four of which are supplied by the MS and 28 are supplied by Hydro One TS sites.

The area serviced by this system is illustrated in Figure 4.3 below.

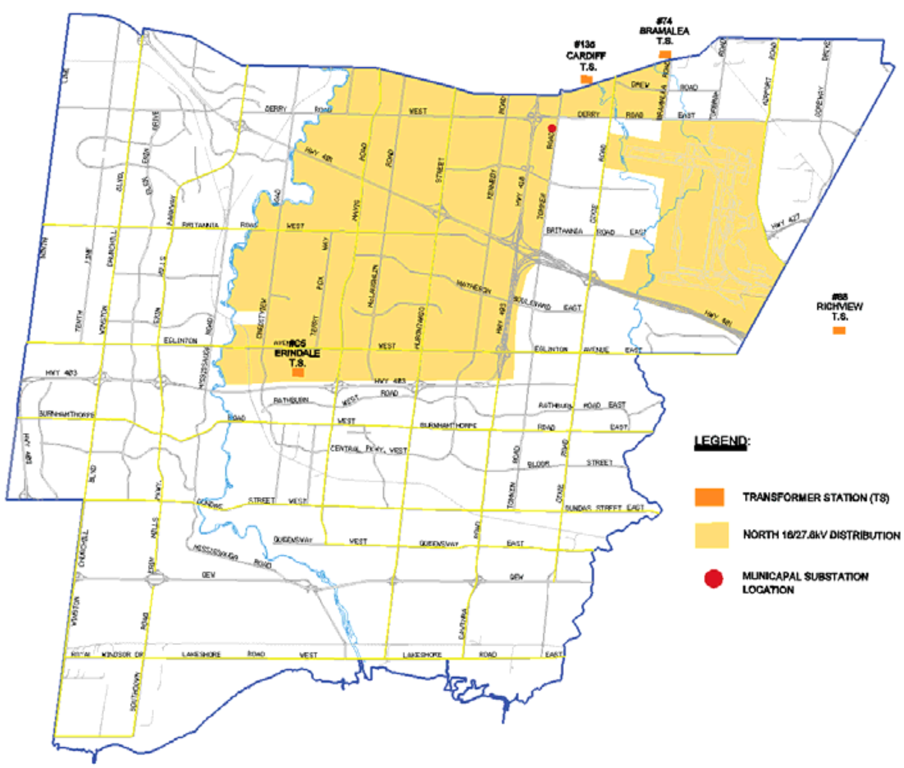


Figure 4.3 – Map of Enersource North 16/27.6kV Distribution System

4.1.2.2 South 16/27.6kV and 2.4/4.16kV Distribution System

The South 16/27.6kV System is composed of several large and small customers connected directly to Hydro One TS supply. Enersource's MS's further step down the voltage to the 2.4/4.16kV distribution system.

Hydro One TS sites are: Oakville TS, Lorne Park TS, and Cooksville TS.

This area contains 25 MS sites comprised of 38 step-down transformers rated 27.6/4.16kV. This distribution system utilizes 96 distribution feeders.

The area serviced by this system is illustrated in Figure 4.4 below.

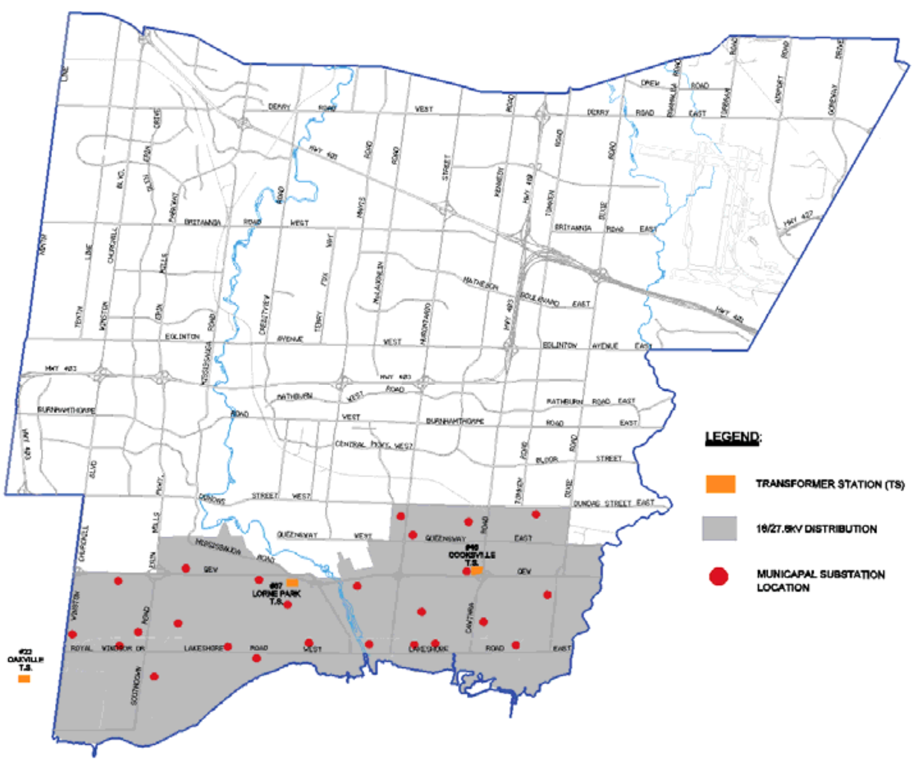


Figure 4.4 – Map of Enersource South 16/27.6 and 2.4/4.16kV Distribution Systems

4.1.2.3 West 8/13.8kV Distribution System

The West 8/13.8kV Distribution System covers the same geographical area as the 44kV subtransmission system, as shown in Figure 4.1. However, due to the large area and number of customers, the 8/13.8kV distribution system has been divided into west and east distribution systems, which is consistent with the division between the west and east 44kV subtransmission systems. All customers on this West 8/13.8kV system are connected directly to the distribution feeders supplied by Enersource MS's.

This area contains 22 MS sites comprised of 36 step-down transformers rated 44/13.8kV. This distribution system utilizes 129 distribution feeders.

The area serviced by this system is illustrated in Figure 4.5 below:

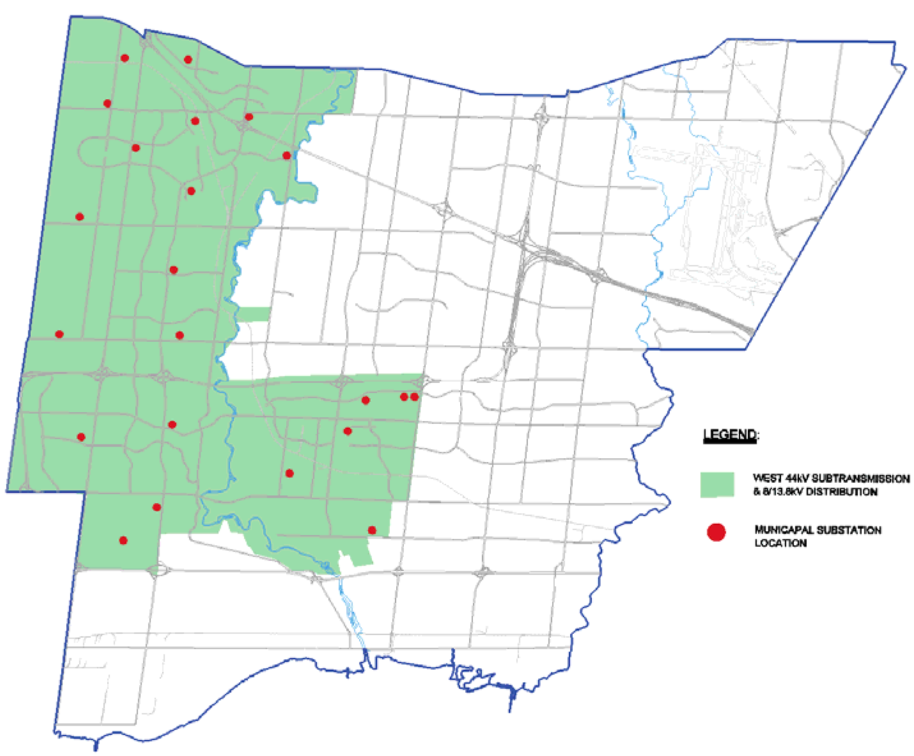


Figure 4.5 – Map of Enersource West 8/13.8kV Distribution System

4.1.2.4 East 8/13.8kV Distribution System

All customers on this system are connected directly to the distribution feeders supplied by Enersource MS's.

This area contains 17 MS sites comprised of 27 step-down transformers rated 44/13.8kV. This distribution system utilizes 86 distribution feeders.

The area serviced by this system is illustrated in Figure 4.6 below:

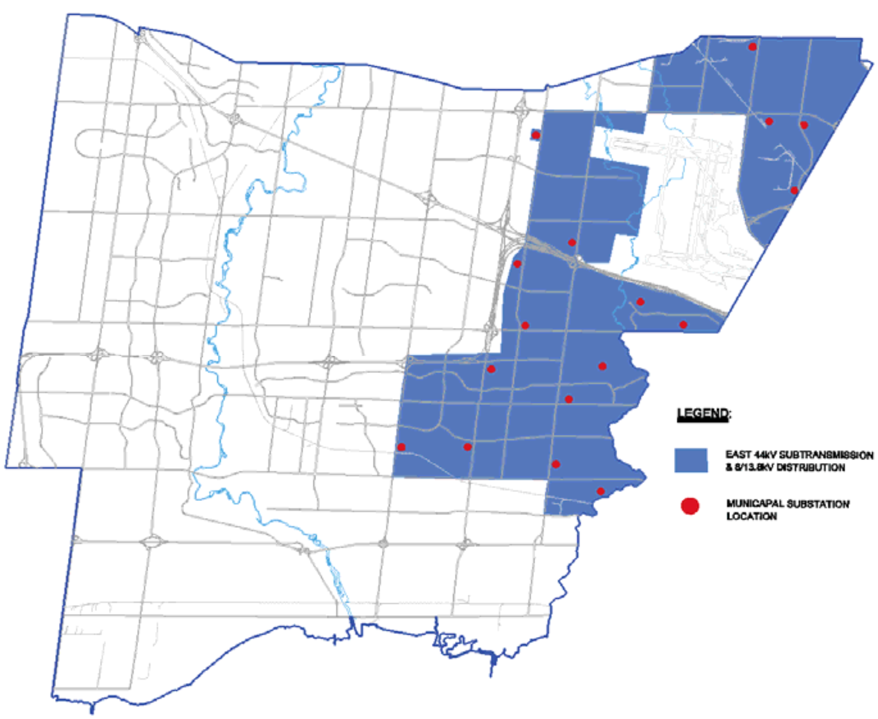


Figure 4.6 – Map of Enersource East 8/13.8kV Distribution System

5. Historical System Demand

Ontario's electricity demand is influenced by weather, calendar, economic activity and demographic drivers. Economic activity includes elements such as employment, industrial output, manufacturing and development. Peak system demands are short term durations in which Enersource's distribution system is stressed and depended upon by a large number of loads. Peak demand periods are heavily influenced by extreme weather conditions in addition to the economic and demographic elements described.

With the reduction of electrical heating and increasing demand for cooling, Enersource has shifted from a winter peaking to a summer peaking system. Since the demand on the system is at its peak in the hot summer months, the summer period heavily constrains the operation of Enersource's distribution system. In July, 2011, Enersource's system demand peak was 1,609 MW which was slightly below the all-time peak demand of 1,610 MW registered on August 1, 2006, which also coincided with Ontario's all-time peak.

Figure 5.1 below graphically illustrates Enersource's system peak demand from 1996-2011.

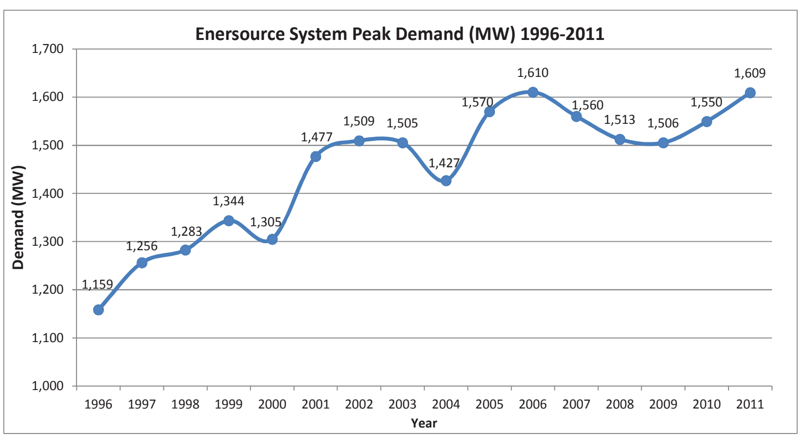


Figure 5.1 –Enersource System Peak Demand (1996-2011)

A decrease in system peak demand from 2007 to 2010 is attributed to reduced economic activity resulting from the 2008 recession, which especially impacted the commercial and large industrial customers in Mississauga and was compounded by mild summer weather. Another attribute to the decreased peak demand experienced includes energy efficiency driven by conservation and demand side management ("CDM") programs delivered by Enersource.

HISTORICAL RELIABILITY

6. Reliability History

System reliability is a key performance measure and is an OEB requirement for every electricity distributor to maintain reliability performance within its own three year range. In order to meet this requirement, Enersource has implemented several system reliability programs.

Enersource uses industry standards to measure and benchmark System Reliability Performance. The System Reliability Performance definitions are set by the Service Continuity Committee (SCC), which are a subgroup to the Canadian Electricity Association (CEA). Enersource follows the guidelines set out by CEA's Electric Power System Reliability Assessment program (EPSRA) which governs system continuity statistics for the entire electrical industry. Enersource implemented an Outage Management System (OMS) in 2009 which enhanced the ability to track reliability statistics.

The key measures of reliability are System Average Interruption Frequency Index (SAIFI) and System Average Interruption Duration Index (SAIDI). Frequency relates to the system performance whereas duration relates to the outage time.

For 2011, Enersource experienced 1.97 interruptions and 53.3 minutes of interruptions per customer. For 2010 these measures were 1.32 and 35.0 and for 2009 these measures were 1.18 and 36.7 respectively. The time period from 2010 to 2011, Enersource experienced an increase in outage minutes from 6,673,600 minutes to 10,277,717 minutes of total outages. These reliability measures are included in Table 6.1.

The main contributors toward the negative reliability trend include Loss of Supply, several severe weather storms as well as a high number of equipment failures.

Additional information and details regarding reliability results, incident cause classification and equipment statistics of outages from 2007 up to 2011 are listed in Tables 6.1, 6.2, 6.3 and Charts 6.1 and 6.2.

Reliability Statistics					
	2007	2008	2009	2010	2011
INTERRUPTIONS	377	384	852	2,083	1,027
CUSTOMERS AFFECTED	142,035	135,413	221,578	251,366	380,772
CUSTOMER MINUTES	7,075,965	3,626,325	6,893,927	6,673,600	10,277,717
SAIDI (Minutes)	38.7	19.6	36.7	35.0	53.3
SAIFI	0.78	0.73	1.18	1.32	1.97
SAIFI (MI)	4.0	3.9	5.3	3.2	5.0
CAIDI (Minutes)	49.8	26.8	31.1	26.5	27.0

Table 6.1 –Enersource Reliability Statistics (2007 - 2011)

Cause Codes Statistics (Customer Minutes)					
Cause Codes	2007	2008	2009	2010	2011
Unknown/Other	87,808	113,143	306,007	100,669	180,650
Foreign Interference	301,821	453,127	1,134,820	466,580	882,668
Scheduled	58,203	172,424	547,965	1,939,026	682,740
Loss of Supply (Hydro One)	371,944	513,037	402,209	362,222	1,893,664
Tree Contacts	209,448	166,761	469,506	257,916	893,379
Lightning	43,686	35,958	201,274	62,454	38,475
Defective Equipment	2,914,798	2,046,500	2,794,332	3,051,586	5,219,938
Weather	3,046,285	101,115	971,640	422,209	49,927
Adverse Environment	40,746	4,376	4	0	19,492
Human Element	1,226	19,884	66,170	10,938	416,784
Grand Total	7,075,965	3,626,325	6,893,927	6,673,600	10,277,717

Table 6.2 –Enersource Cause Code Reliability Statistics (2007 – 2011)

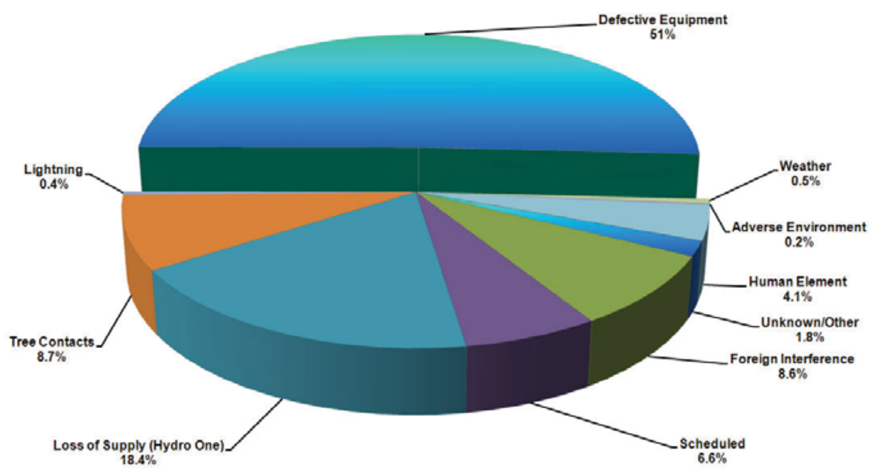


Chart 6.1 – Chart of Enersource Customer Minutes by Cause (2011)

Equipment Statistics (Customer Minutes)					
Cause Codes	2007	2008	2009	2010	2011
Underground Cable	1,808,340	1,023,062	1,917,155	2,120,732	3,143,850
Fuse	15,635	1,867	54,615	39,211	38,392
Insulators	27,293	240,811	70,412	2,687	42,884
Loadcenters	84,328	63,446	25,374	68,884	421,281
Overhead Equipment	150,379	341,622	215,713	230,471	1,098,335
Others/Unknown	0	5,320	122,939	62,183	133,394
Splices	650,821	38,780	239,933	277,098	0
Switches	28,732	79,333	32,581	24,938	86,549
Elbows/Terminations	35,500	130,912	26,505	55,984	62,340
Transformers	113,770	121,347	89,105	169,398	192,913
Total CM due to Equipment	2,914,798	2,046,500	2,794,332	3,051,586	5,219,938

Table 6.3 –Enersource Equipment Failure Statistics (2007 - 2011)

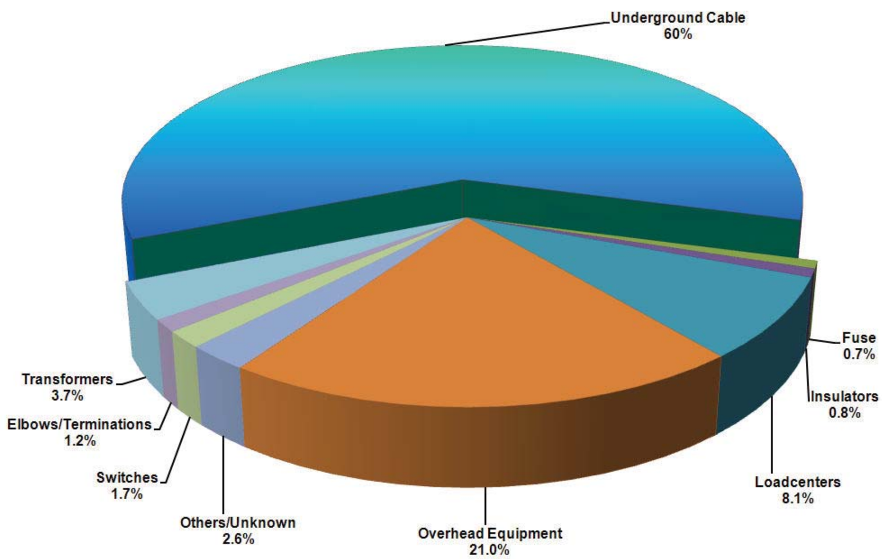


Chart 6.2 – Chart of Enersource Equipment Failure for 2011

AMP OVERVIEW

7. Overview

The objective of the Enersource's AMP is to outline the asset management practices which are part of an optimized lifecycle strategy for Enersource's electricity system assets. The scope of the AMP encompasses major projects and programs that are needed to sustain Enersource's electrical system.

The objectives of the AMP are to:

1) report on the performance of the power system and
2) identify risks and challenges that would adversely affect the ability to deliver economical and reliable power to Mississauga

Fundamental requirements of effective development and management of a power system is prudent planning, strategy, mission and values. The AMP provides planning direction for power system development, sustainment, reliability, asset inspections, maintenance and replacement programs, as well as increases to the overall system capacity.

The AMP details how Enersource manages, maintains and reinforces the electrical distribution system in a cost effective manner. In addition, it reviews the capital, operating and reliability trends over the past five years. The AMP covers a period of five years beginning January 1, 2012. Beyond 2012, general forecasts are provided which will be reviewed annually as part of the AMP yearly update.

Managing aging infrastructure and system capacity requirements will continue to present challenges. Enersource's power system assets range in age from new to over 50 years' old. The management of these assets is critical to providing the safe, reliable and efficient electricity distribution services to its customers.

Continued focus will be on managing the aging infrastructure, particularly in the management of poles, underground cables, distribution transformers, substation transformers and substation switchgear. Given the large expansion of the system in the 1980's and 1990's, a considerable amount of replacement is expected before the next twenty years. This must be prudently managed, to achieve the lowest long-term owning cost of the power equipment while conforming to standards, requirements, and meeting the needs and expectations of Enersource's customers in terms of performance and reliability.

AMP INVESTMENT STRATEGY AND INITIATIVES

8. Asset Management Strategy

The objective of the AMP is to evaluate physical assets associated with power delivery, and to make recommendations for the replacement and maintenance of the assets in order to achieve the lowest long term owning cost. The goal of Enersource's AMP is to effectively manage its assets on a life-cycle basis, with spending policies that align with corporate strategy and performance objectives.

Enersource uses several sources of data such as asset condition, criticality, reliability information, as well as, environmental and customer impacts. The data is computed and tools are used to produce a priority list of projects by asset classes. Several other requirements and risks are considered as shown in Sections 8.1 and 8.2.

Once each class of asset is evaluated, a list of projects is created. Each investment is described by a driver and scope of the project. A driver could be safety, reliability improvement, load growth, new customers or others. The main focus is on the next five years; however, long term outlook is also produced using the available information.

Finally, the overall list of projects is evaluated against corporate objectives, and each project is examined according to its cost and benefit analysis.

The objective of this process is to select the projects that deliver and support the required functions at the desired level of performance, that are sustainable for the foreseeable future, and that also stay within the targeted levels of risk and budget

8.1 Requirements Based Identification

The asset management planning process is built around the management strategy with regards to these key factors: planning, prioritization, and execution of capital and sustainment projects. The projects and programs are identified based on the following requirement categories:

<u>Capacity Requirements</u> - maintain and expand the power system in an efficient way to fully utilize all assets and supply power to all customers

<u>Service Quality Requirements</u> - maintain the performance of the power system with regard to reliability, power quality, staying within defined targets, and supporting customer value

<u>Customer Requirements</u> - meet all compliance standards, including new service connections, responding to customers enquiries, and scheduling appointments within a specified timeframe

<u>Strategic Initiatives</u> - pursue and increase the effectiveness of the operations, maintenance programs, and development of the power system while minimizing the environmental impacts in support of good corporate citizenship

8.2 Risk Based Evaluation

Risks need to be controlled and mitigated to support Enersource's corporate governance needs and the due diligence responsibilities of management. The main focus of risk assessment is to identify and prioritise risks associated with managing and expanding the power system assets. The objective would be to avoid catastrophe, reduce uncertainty, and improve predictability.

At Enersource, the risks associated with the AMP are composed of six main categories:

Economic Risks - is the condition of the existing assets evaluated to ensure they are repaired or replaced effectively to achieve the lowest long term owning costs? Do the new projects bring a maximum return on capital while delivering reliable power to customers?

Service Quality Risks - what is the impact of asset failure to customers? Are critical assets maintained properly and replaced prior to their expected end of useful life?

Regulatory/Legal Risks - does Enersource remain fully compliant in all legal and regulatory aspects of its operations?

Environmental Risks - are all assets and work procedures compliant with the current environmental standards and laws?

Reputational Risks - what could cause Enersource's status to deteriorate from a highly respected utility known for an efficient and effective operation while delivering quality performance and product at fair cost?

Employee/Public Safety - is the entire Enersource power system built, designed, and maintained with safety in mind, for both Enersource employees and the community?

As a part of the planning process, risk evaluations are completed for each asset class. The risk evaluations involve identifying the risk significance of each asset and how would it affect the six main risk categories, as well as evaluating the consequences of not proceeding with the capital or sustainment investment.

The process to evaluate assets was completed through an internal multi-disciplinary working group consisting of expert representatives from internal divisions and was lead by Internal Audit & Enterprise Risk group. Using risk evaluation software application which permits voting on each risk attribute for each asset class in an anonymous manner to ensure influence was not a factor in the risk assessment. Once the group completed voting for each asset class, the risks factors were compiled and were used to rank the asset classes from highest risk profile to lowest.

8.3 Asset Management Matrix

As a final step of the investment evaluation, all requirements and risks are considered as shown in Figure 8.3 below. Risk levels are on a scale of 1 to 5 with the higher numbers reflecting the highest risk.

	Risk						
Asset Class	**Economic**	**Service Quality**	**Regulatory/ Legal Compliance**	**Environmental**	**Reputational**	**Employee/ Public Safety**	**Average Risk Level**
Substation Power Transformers	3.8	4.5	2.5	4.0	3.7	3.0	3.6
Rolling Stock/Fleet	3.5	3.0	3.3	2.8	4.0	3.3	3.3
IT Systems	4.2	3.8	4.0	1.5	3.3	1.5	3.1
Wholesale and Smart Meters	3.3	2.5	4.8	1.7	3.8	1.8	3.0
Engineering Assets/IOM/Mapping	3.5	3.7	2.7	1.5	3.0	2.8	2.9
Green Energy Act	2.2	1.8	4.2	2.2	3.5	3.2	2.9
Land Acquisition/Building Renovation	4.2	2.8	2.2	1.3	3.7	2.8	2.8
Grounds and Buildings	3.8	2.8	1.7	3.0	2.3	2.5	2.7
Substation Circuit Breakers	3.5	3.7	2.3	2.3	1.8	2.2	2.6
Road Projects	3.0	1.7	4.2	1.5	2.8	1.7	2.5
Underground Cables - primary	3.5	3.5	1.7	1.8	2.3	1.8	2.4
Vault Transformers	2.7	3.0	1.7	2.5	3.0	1.5	2.4
Pad Mounted Transformers	2.5	2.2	1.3	2.5	2.5	2.2	2.2
Wood Poles	2.0	2.3	2.8	1.5	2.0	1.8	2.1
Pad Mounted Switchgear	3.0	2.3	1.5	1.3	1.8	2.0	2.0
Underground Cables - local	1.3	2.0	1.2	1.3	2.7	2.7	1.9
Switches	2.5	2.7	1.5	1.2	1.2	1.8	1.8
Pole Mounted Transformers	1.5	2.0	1.5	2.0	1.3	2.0	1.7
Concrete Poles	1.8	1.5	1.2	1.2	2.2	1.7	1.6

Table 8.3: Asset Investments and Risk Factors

AMP INPUT DATA SOURCES

9. Analytical Data Sources

- Asset Condition Assessment
- Load Forecast – System Capacity
- Testing and Inspection Program
- Integrated Operating Model
- Automated Mapping / Facilities Management / Geographical Information System

9.1 Asset Condition Assessment

Conducting an Asset Condition Assessment (an "ACA") is a process whereby the condition of all key asset categories owned by Enersource is assessed. The 2011 undertaking of an ACA resulted in the development of a health index (the "Health Index") for each asset class. The ACA determined the Health Index distribution for the entire population of assets in each class, and develop a forty-year condition-based replacement plan. The report that resulted from the ACA is used as one of the inputs for the AMP which evaluates the existing programs (sustainment, expansion and regulatory) and develop new ones in order to address the required replacement rates for all asset groups considered in the ACA.

9.2 Load Forecast – System Capacity

The long term system load forecast is utilized to identify the projected peak load demands in Mississauga. System capacity load forecasting is long term peak demand projection developed for each of the four areas of power system outlined in section 4 of this report. Load forecasting methodology utilized is similar to the short term peak demand forecasting methodology applied to revenue forecasting. Multivariate regression models are developed for each of the four areas using Itron MetrixND statistical application. Model inputs include sixteen years of actual energy purchases (1996-2011) from the Independent Electricity System Operator (IESO), actual weather data from Environment Canada weather station at the Lester B. Pearson International Airport, calendar data and demographic outlooks provided by the City of Mississuaga`s Building and Planning department including employment and population for each area.

Since forecasting weather over a long term with confidence is not possible, the load forecasting methodology does not predict weather but rather utilizes an extreme weather scenario to project system capacity requirements under extreme weather conditions. This process is similar to that adapted by the IESO in developing the assessment of the reliability and operability of the Ontario electricity system. Although extreme weather is inappropriate to use as the scenario for energy consumption as the likelihood of observing sustained extreme weather, the use of extreme weather scenario based on historical 31 years of actual weather is appropriate in projecting short term peak demand system capacity.

The city has gone through a very aggressive expansion period spanning the mid 1980's to the mid 2000's. Currently Enersource's expansion has slowed relative to the past peak periods, and available green space for further development has been significantly reduced.

9.3 Testing and Inspection Program

Enersource has several inspection programs for various distribution and subtransmission equipment. The inspection programs include monthly substation inspections, switchgear inspections and a yearly infrared overhead system inspection program. In addition, Enersource performs several tasks where informal inspections are performed. For example, during switching, responding to customer calls, insulator washing, fire prevention vault inspections or switchgear dry ice cleaning, the crews report on the condition of the equipment.
From the above inspection programs, the information pertaining to the condition of the equipment is recorded and considered for spot equipment replacements and rebuild projects.

9.4 Integrated Operating Model

The Integrated Operating Model (the "IOM") is a computer-based system that provides a single user interface for monitoring the grid, allowing for faster, more informed decision-making. The IOM consolidates information on location and attributes of distribution equipment, real-time crew location, and active outages including the number of customers affected. The IOM also performs the requirements of an Outage Management System (an "OMS"), which uses outage probability modeling to assist the Control Room Operators in determining the most likely source of an outage and allowing them to prioritize restoration efforts.

At Enersource, the type, duration, and cause of each outage is recorded by the Control Room Operators in the IOM and this information is the source of the reliability statistics. If equipment fails in the field, a follow-up report is created in the IOM, which is used for tracking and prioritizing follow-up activities.

In addition to being used as the basis for reliability statistics, the outage information stored in the IOM is used to investigate the worst-performing feeders and to identify low reliability areas.

9.5 Automated Mapping /Facilities Management/Geographical Information System

The Automated Mapping/Facilities Management/Geographical Information System (the "AM/FM/GIS") captures both graphical and database information pertaining to Enersource's field equipment. The AM/FM/GIS consists of a map of Mississauga including all streets and lots, with the location of Enersource equipment and civil structures overlaid on the map in the appropriate locations. For each item, several characteristics or attributes, including connectivity information, is captured in the database. Since the deployment of the AM/FM/GIS, the number of attributes maintained for each equipment item has grown to accommodate a diverse set of user requirements, and the system is one of the primary sources of asset information for Enersource. The equipment attributes along with equipment counts are used as data inputs to the ACA. In addition, in the future, the AM/FM/GIS system will record all maintenance activities.

INPUT DATA FINDINGS

10. Asset Management Data Findings

10.1 Asset Condition Assessment Report

To assist with the development of the AMP, Enersource performed a condition assessment of existing assets in order to assist in prioritizing and allocating sustainment resources. Enersource commissioned an independent third party to perform an ACA of Enersource's assets.

In early 2011, Enersource selected and engaged Kinectrics Inc. to complete the ACA. Kinectrics has a wide range of experience in assessing the condition of utility assets. Enersource utilized the Kinectrics' ACA in developing the 2012 AMP.

The ACA focused on the following asset classes:

Check list:

- municipal substation power transformers;
- substation circuit breakers
- pole mounted transformers
- single phase pad mounted transformers
- three phase pad mounted transformers
- vault transformers
- pad mounted switchgears
- switches
- underground cables
- wood poles and
- concrete poles

Data used in the study was obtained from Enersource's AM/FM/GIS and included the following asset information:

- age
- size
- voltage
- type
- sustainment records
- inspection records and
- testing evaluations

Based on Kinectrics' formulations and industry-accepted methodologies, equipment replacement rates for all of the above asset classes were developed.

10.2 ACA Asset Class Findings

10.2.1 Municipal Substation Transformer

As an asset class, substation power transformers constitute one of the largest investments in a utility's system. They are installed in municipal substations. The design life of a substation power transformer is approximately 40 years and with proper maintenance the life can be achieved.

The substation power transformers are used to step down the voltages from 44 kV to 13.8 kV or 27.6 kV and from 27.6 kV to 4.16 kV. The transformer sizes are 3 MVA, 5 MVA, 10 MVA and 20 MVA. Special consideration is given to these assets since a transformer failure may affect up to 5,000 customers.

It is Enersource's practice to collect oil samples at least once per year from every power transformer and to test them in order to determine the level of dissolved gases and the oil quality. Dissolved Gas Analysis is the most sensitive and reliable technique used for evaluating the health of oil-filled electrical equipment.

There are also monthly substation inspections and preventive maintenance programs in order to detect incipient weaknesses or impending failures.

The monthly inspections consist of visual inspections of the units in order to ensure that the transformer fans are working properly, as well as to check the oil level and ensure temperature gauges are indicating correctly. The transformers are checked for leaks as well.

The preventive maintenance program is based on elapsed time (usually every five years) and the main activities are:

- testing of all controls (relays gauges)
- in-depth inspection of the cooling system
- transformer bushing inspections
- insulation power factor testing and
- transformer turn ratio testing

At the end of 2010 there were 102 transformers installed in Enersource municipal substations. The average age of the population is 22 years. The demographic breakdown of the power transformers is shown in Figure 10.2.1.1.

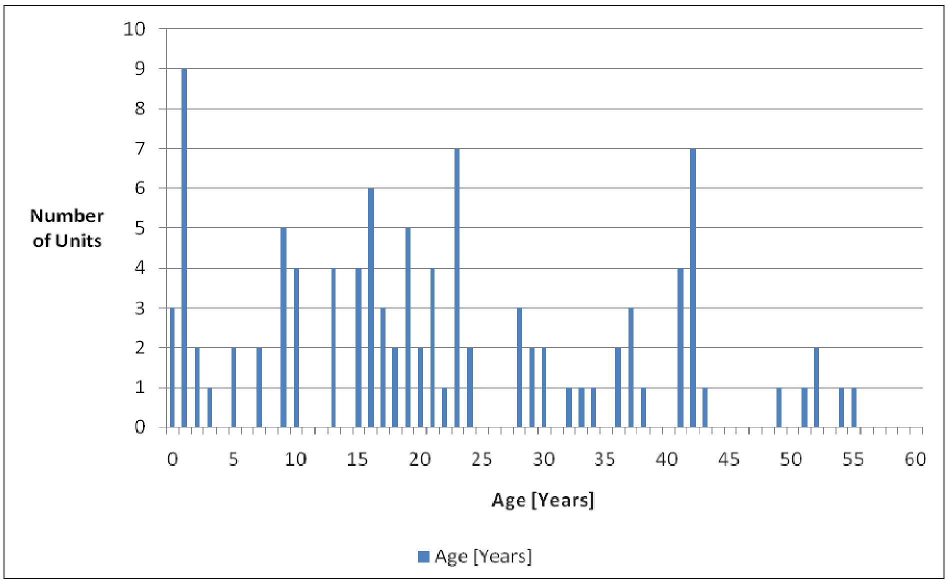


Figure 10.2.1.1: Substation Power Transformers - Age Distribution

According to the ACA, the present condition of Enersource's power transformers is as follows:

- 25 units in fair condition;
- 38 units in good condition; and
- 39 units in very good condition.

The suggested replacement rate (Figure 10.2.1.2) is seven transformers over the next ten years with an increasing number (averaging approximately three transformers per year) for the following10 years. The ACA assumes that 20% of the power transformer population will fail by 40 years and 99% of the population will fail by 60 years.

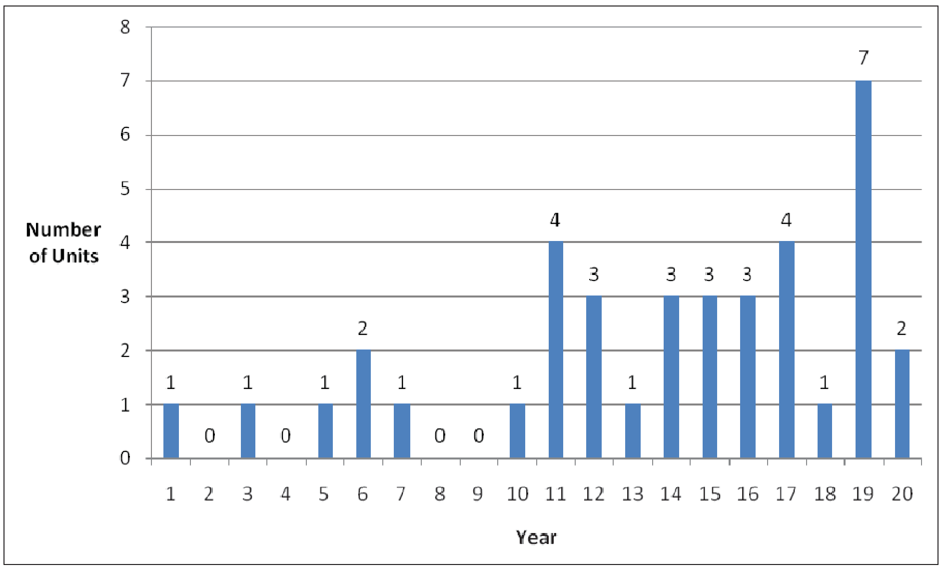


Figure 10.2.1.2: Substation Transformers - Recommended Replacement Rates

Enersource replacement program strategy considers replacing a unit based on the health index, location / number of customers served, transformer protection enhancement (implementation of the transformer differential protection) and also takes into account the other substation assets including the building and grounds.

There are situations when, in order to promote standardization and to better serve Enersource customers, the substation layout configuration is modified and the transformers needed to be replaced not because they approached the end of life but because they do not fit in the new configuration. The replaced transformers become spare inventory units or are used to replace other units that were in worse conditions and prone to failure.

In order to maintain a healthy power transformer fleet, we plan to continue to replace the power transformers on the same pace as in the most recent previous years.

10.2.2 Substation Circuit Breakers

The basic function of circuit breakers is to detect a fault condition and, by interrupting continuity, to immediately discontinue electrical flow. They are housed in metal clad switchgear cubicles with the associated controls. The circuit breaker voltage ratings are 4.16 kV, 13.8 kV, 27.6 kV and 44 kV. They can be classified by the medium used to extinguish the arc:

- vacuum circuit breakers
- air circuit breakers; and
- SF6 circuit breakers

In accordance with accepted engineering and utility practice Enersource has maintenance programs in place for the circuit breakers and switchgear units. Every switchgear unit is visually inspected monthly and every five years the substation is isolated and the circuit breakers maintained and tested together with the associated controls.

At the end of 2010 there were 464 circuit breakers installed in Enersource's municipal substations. The average age of the population is 22 years old. The demographic breakdown of the population is shown in Figure 10.2.2.1.

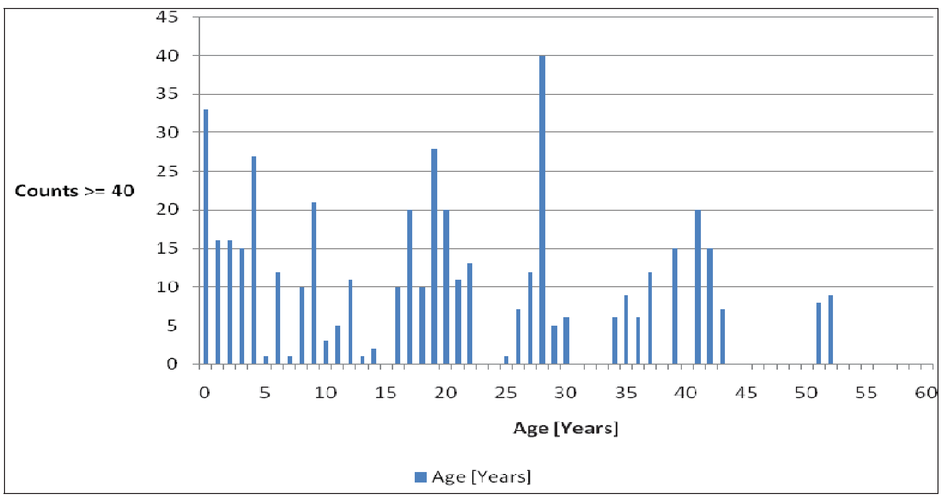


Figure 10.2.2.1: Circuit Breakers - Age Distribution

The ACA assumes that 20% of the population of circuit breakers will fail by 40 years and 99% of the population will fail by 60 years.

According to ACA the condition of the circuit breakers is as follows:

- 55 units (12% of the population) – very poor
- 40 units (9% of the population) – poor
- 60 units (13% of the population) – fair
- 96 units (21% of the population) – good and
- 213 units (46% of the population) – very good

The ACA suggested replacement chart is shown in Figure 10.2.2.2.

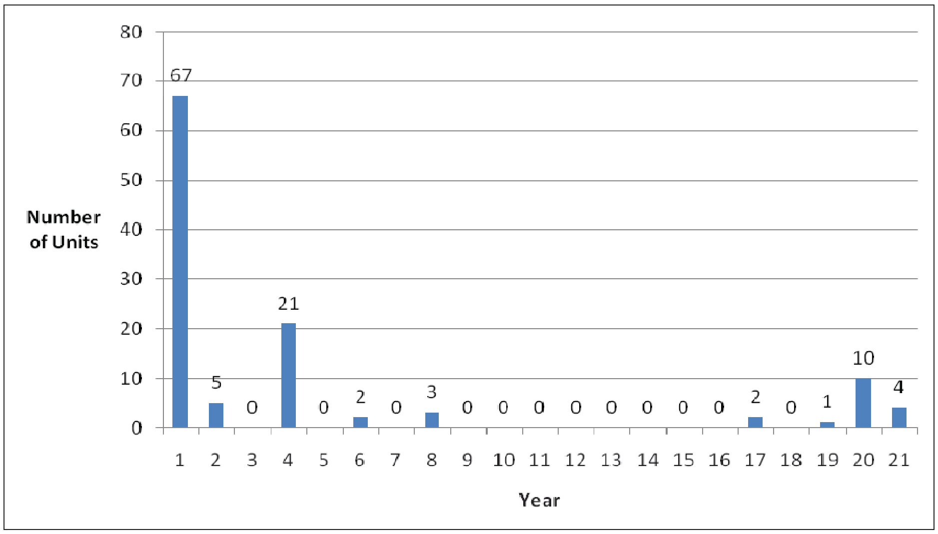


Figure 10.2.2.2: Circuit Breakers - Recommended Replacement Rates

Based on Enersource's operating experience and the findings during switchgear maintenance, certain circuit breakers have been found to be prone to failure and also pose a safety risk to substation technicians.

A replacement program has been implemented over the last four years to replace not only the breakers but the entire English Electric and PCG switchgear units due to their deficiencies.

All English Electric and PCG switchgear units will be replaced by the end of 2014 with new arc resistant units equipped with modern vacuum breakers using magnetic actuator technology.

Approximately 15 circuit breakers have been replaced each year over the past four years as part of the substations upgrade projects and Enersource plans to continue at the same replacement pace in the future. It is estimated that in the next three to four years all circuit breakers that are in very poor condition will be replaced.

Enersource has a program to replace the magnetic air circuit breakers with vacuum circuit breakers over the next 10 to 15 years. Also, Enersource is conducting an evaluation regarding the feasibility of replacing individual circuit breakers compared against the switchgear assembly.

The maintenance program and a pro-active approach regarding circuit breaker replacement are essential in avoiding major power disruptions due to substation equipment failure.

10.2.3 Pole Mounted Transformers

Distribution pole mounted transformers convert power from primary distribution voltages to 120/240V, 120/208V, 347/600V, or 600V secondary voltages. In the past, pole mounted transformers were installed in various sizes; however, to minimize inventory the sizes were standardized to 25kVA, 50kVA, 100kVA and 167kVA. Pole mounted transformers are smaller and supply up to 25 customers, and if they fail, the environmental, reliability, and customer impact is minimal. Utility practice is to run pole mounted transformers to failure. If the entire area is scheduled for a rebuild, then the transformers are replaced along with the poles, conductors, insulators and other pole line hardware.

At the end of 2010, there were 5,248 pole mounted transformers installed at Enersource. The average age of the population is 21 years. The ACA assumes that 20% of the population will fail by 45 years and 99% of the population will fail by 60 years. Five percent of the pole mounted transformer population is 45 years or older.

The rate of installation of pole mounted transformers has varied widely over the past 60 years. The installation rate was fairly low up to the early 1980's, after which point the city started to develop faster in the 1980's and 1990's. The installation rate more than doubled during the mid-1980's, and gradually started to stabilize. Finally, in 2009 and 2010, the rate of installation increased again due to the PCB transformer replacement program. Now, since many of the PCB transformers have been replaced, the rate is expected to stabilize. The demographic breakdown of pole mounted transformers is shown in Figure 10.2.3.1.

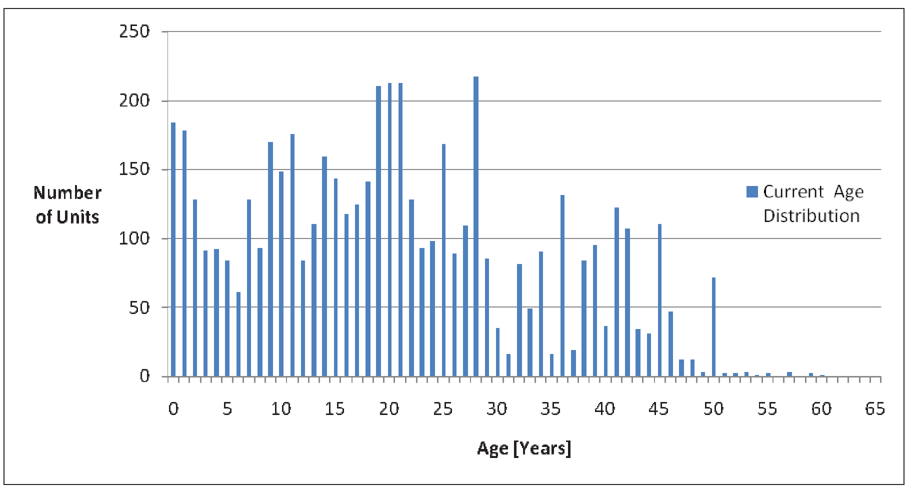


Figure 10.2.3.1: Pole Mounted Transformers - Age Distribution

According to the ACA, over 95% of the pole mounted transformers are in good or very good condition. Since several hundreds of transformers are near the end of their expected life, the ACA suggests that Enersource start replacing between 77 and 123 transformers each year.

According to the suggested replacement rates, after 40 years, 4,184 transformers will be replaced. In contrast to the historical rate of installation, on average, each year for the next 40 years Enersource should be replacing 105 transformers. The replacement quantities are shown in Figure 10.2.3.2.

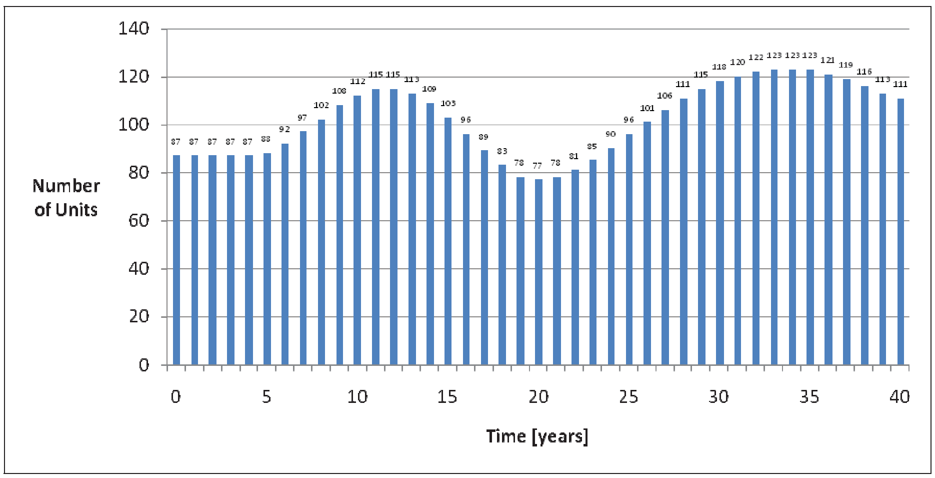


Figure 10.2.3.2: Pole Mounted Transformers - Recommended Replacement Rates

In 2010, through overhead rebuilds, failures and spot replacements, Enersource replaced approximately 130 pole mounted transformers. In 2011, approximately 100 transformers were replaced. The budget and labour resources will allow for replacement of a similar number of pole mounted transformers in 2012.

The current replacement rate for the pole mounted transformers is in line with the recommended replacement rate. The rate will be monitored in the future and further studies of transformer failures will be examined to ensure that the rate of replacement is appropriate.

10.2.4 Single Phase Pad Mounted Transformers

Single phase pad mounted transformers are used in the underground residential distribution system to step down the primary distribution voltages to a 120/240V secondary voltage. The secondary winding is usually divided into two equal parts each part is having a voltage of 120V between terminals. Two parts are connected in parallel for 120V and in series for 240V. Single phase pad mounted transformers are typically used to supply power to residential customers in subdivisions. They are typically installed on a concrete foundation on the city owned boulevard in front of houses.

In the past, several different sizes of single phase pad mounted transformers were installed in the city. In 1992, the residential sizes were standardized to 100kVA. This was done to reduce inventory levels. In addition, for special applications, such as traffic lights, cellular towers or bulk metered customers; 25 and 167kVA single phase pad mounted transformers are also available. A typical single phase pad mounted residential transformer has a provision for up to 14 secondary service connections.

At the end of 2010, there were 14,141 single phase pad mounted transformers in service. The average age of the population is 20 years. The ACA study assumes that 20% of the population will fail by 35 years and 99% of the population will fail by 45 years. Approximately nine percent of the population is 35 years or older.

The rate of installation of pad mounted transformers has varied widely over the past 50 years. The installation rate was fairly constant up to the early 1980's. However, when the city started to intensify development in the mid 1980's and 1990's, the installation rate increased. The installation rate more than doubled during the mid 1980's and has now gradually started to stabilize. In the mid 1990's the number of the transformers installed appears to decline slightly. This decline in the population demographics is likely caused by replacement of several hundreds of faulty transformers that were purchased in mid 1990's. Some of the transformers purchased at that time would fail prematurely within a first few years from the installation. In the late 2000's, the population demographics increased again due to the PCB transformer replacement program. Now, since many of the PCB transformers have been replaced, the rate of installation is expected to be driven predominately by future growth and underground rebuilds. The demographic breakdown of pad mounted transformers is shown in Figure 10.2.4.1.

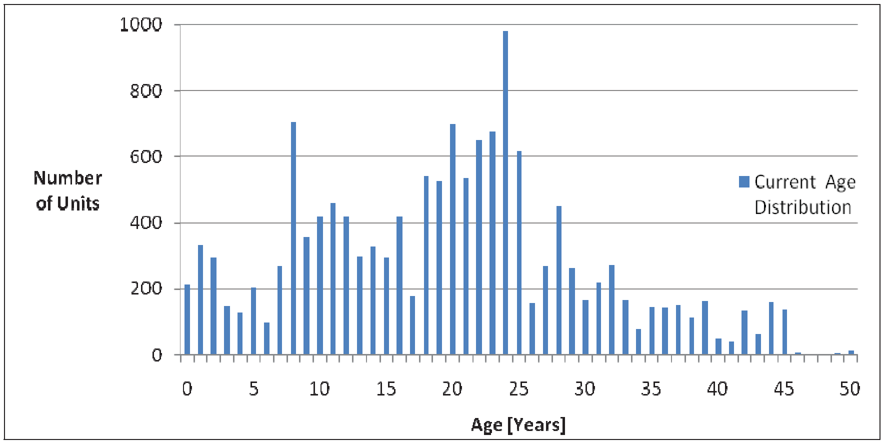


Figure 10.2.4.1: Single Phase Pad Mounted Transformer Age Distribution

According to the ACA, over 90% of the single phase pad mounted transformers are in good or very good condition. However, since several thousand of the transformers are near the end of their expected life, the ACA suggests an initial replacement of 751 transformers. This initial surge in the replacement rate is caused by a backlog of transformers that are overdue for replacement. After the first year, the ACA suggests replacing approximately 400 transformers per year and then, because of the spike in the population distribution, increase the rate to over 730 transformers per year.

According to the suggested replacement rates, after 40 years, 14,931 transformers will be replaced. In contrast to the historical rate of installations, each year for the next 40 years Enersource should be replacing an average of 373 transformers per year. The replacement quantities are illustrated in Figure 10.2.4.2.

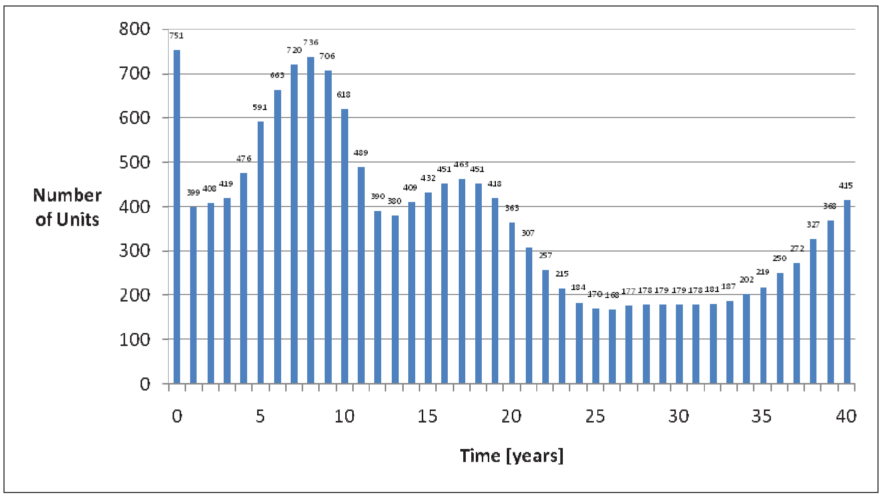


Figure 10.2.4.2: Single Phase Pad Mounted Transformers - Recommended Replacement Rate

In 2010, through underground rebuilds, failures, and spot replacements, Enersource replaced approximately 230 single phase pad mounted transformers. These numbers were slightly higher than the typical historical replacement rate due to the PCB transformer replacement program. In 2011, approximately 200 transformers were replaced. The 2012 budget and labour resources allow for replacement of a similar number of single pad mounted transformers.

It is evident that the current replacement rate of single phase pad mounted transformers is significantly lower than the rate suggested by the ACA. Current financial constraints, limited labour resources, and the low impact of failures by this equipment category, the suggested current rate is acceptable for a short term. However, in the long term, the replacement rate will have to be increased to match the rate suggested in the ACA in order to avoid aging assets past their expected life. Currently, reliability is not affected greatly by single phase pad mounted transformer failures, since over 90% of the population has a good or very good health index and only a moderate number of transformers fail each year. However, if Enersource does not increase the replacement rate, the population of single phase pad mounted transformers will start aging, resulting in an increase in number of transformer failures affecting reliability more significantly than today.

10.2.5 Three Phase Pad Mounted Transformers

Three phase pad mounted transformers are used in the underground distribution system to step down the primary distribution voltages to 120/208V, 347/600V, or 240/416V. Three phase pad mounted transformers are typically used to service industrial or commercial customers and occasionally they supply apartment buildings. These transformers are typically installed on a concrete foundation on private property.

Three phase pad mounted transformers come in different sizes typically from 75 to 3000kVA. The most common sizes are 150kVA, 300kVA, 500kVA, 750kVA, and 1000kVA. The size of the transformer depends on the customer's service size and secondary voltage. In most industrial/commercial installations, only one customer is connected to a three phase transformer. However, in the case of individually metered condominium/apartment buildings, several hundred customers are connected to the same unit.

As of the end of 2010, there were 1,735 three phase pad mounted transformers in service. The average age of the population is 15 years. For the ACA study, the assumption was taken that 20% of the population will fail by 35 years and 99% of the population will fail by 45 years. Approximately seven percent of the three phase pad mounted transformer population is 35 years or older.

The rate of installation of the three phase pad mounted transformers has varied widely over the past 50 years. As in the case of the single phase pad mounted and overhead transformers, the installation rate for three phase pad mounted transformers was very low up to the mid 1980's. Prior to that time, the majority of the industrial/commercial and apartment building services were supplied by vault transformers. Most of the three phase pad mounted transformers were installed in the early 2000's and the rate of installation has stabilized since then. In 2009 and 2010, some additional transformers were replaced under the PCB transformer replacement program. The number of replacements was not as large as in the case of the overhead or single phase pad mounted transformers. The demographic breakdown of three phase pad mounted transformers is shown in Figure 10.2.5.1.

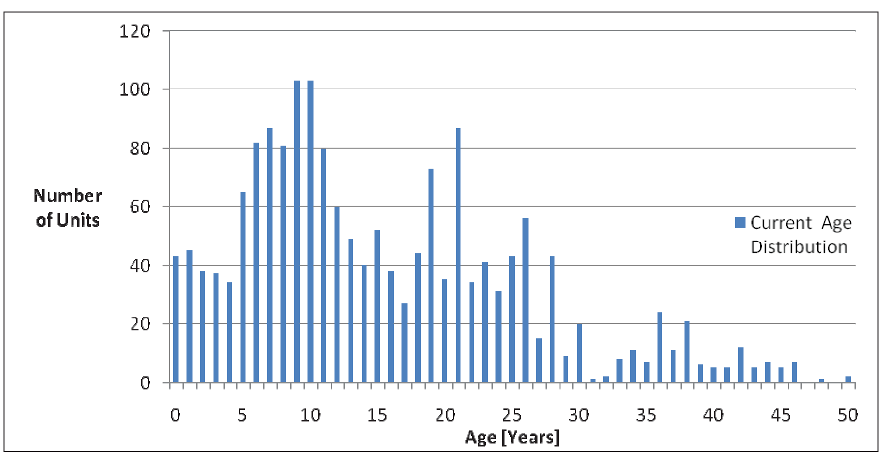


Figure 10.2.5.1: Three Phase Pad Mounted Transformer Age Distribution

According to the ACA, currently over 70% of the three phase pad mounted transformers are in good or very good condition. However, several hundred transformers presently have a poor or very poor health index. As a result, the ACA suggests an initial replacement of 42 transformers. As in the case of the single phase pad mounted transformers, this initial surge in the replacement rate is caused by a backlog of transformers that are overdue for replacement. After the first year, the ACA suggests replacing from fourteen to nineteen transformers per year for the next eight years. After that the rate should gradually increase to 80 transformers per year to accommodate for the wave increase in the population distribution.

According to the suggested replacement rates, after 40 years, 1,708 transformers will be replaced. In contrast with the historical rate of installations, each year for the next 40 years Enersource should be replacing an average of 43 transformers. The replacement quantities are shown in Figure 10.2.5.2.

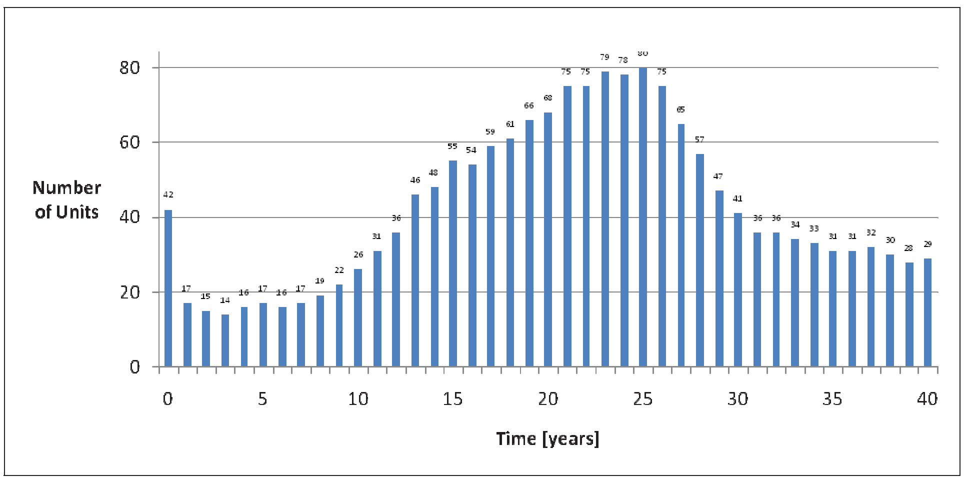


Figure 10.2.5.2: Three Phase Pad Mounted Transformers - Recommended Replacement Rates

In 2010 and 2011, through underground rebuilds, failures and spot replacements, Enersource replaced fewer than fifteen three phase pad mounted transformers annually. The 2012 budget and labour resources allow for the replacement of a similar number of pad mounted transformers.

It is evident that the current replacement rate of the three phase pad mounted transformer is significantly lower than the rate suggested by the ACA. Current financial constraints, limited labour resources, and the low impact of failures by this equipment category, the current rate is acceptable for the short term. Currently, Enersource has no dedicated programs that targets the replacement of the three phase pad mounted transformers. On average, ten transformers per year are replaced under cable replacement projects, and the transformers in the area that are past their expected useful life are replaced at the same time. Currently, Enersource's reliability and performance is not greatly impacted by three phase pad mounted transformer failures since typical installations supply only one customer, and the majority of the three phase pad mounted transformers population still has a good or very good health index. In the future, the plan is to increase main feeder and local distribution feeder cable rebuild projects, and replace aging three phase transformers under these projects.

10.2.6 Vault Transformers

Vault transformers are used in the underground distribution system to step down the primary distribution voltages to 120/208V, 347/600V, 240/416 or 600V secondary voltages. Vault transformers are predominantly used to supply power to industrial or commercial customers. Sometimes the transformers are also used to supply apartment buildings or townhouse complexes.

Vault transformer banks are made up of three single phase units that are interconnected with each other to supply three phase loads. As a comparison customers who are supplied from pole mounted transformers, are limited in terms of the size to 3-167kVA transformers, whereas vault transformation up to 3-750kVA is available. An additional benefit of the three single phase units is that if one of the units fails, the whole bank does not require to be replaced. The vault transformers are typically installed in a transformer vault room above grade. As a result, water drainage is not an issue as in the case of submersible transformer chambers.

In the past, several different sizes of the vault transformers were installed in the city. To reduce inventory levels, sizes of the vault transformers were standardized. Currently only 167 to 750kVA vault transformers are installed. In most industrial/commercial installations, only one customer is connected to a vault transformer bank, but in the case of individually metered townhouses or apartment buildings, hundreds of customers are connected to the same vault.

At the end of 2010, there were 3,885 vault transformers in service. The average age of the population is 26 years. The ACA assumes that 20% of the population will fail by 35 years and 99% of the population will fail by 45 years. According to ACA, approximately 21% of the vault transformer population is 35 years or older.

The rate of installation of the vault transformers has varied widely over the past 50 years. The rate of installation of the vault transformers was gradually increasing until the late 1980`s. At that time, due to issues with access, maintenance and the costly building space required for vault rooms, a design change was made from the installation of vault transformers to pad mounted transformers. Since then, each year only a small number of new vaults are built, in comparison with the number of three phase pad mounted transformer installations. The demographic breakdown of vault transformers is shown in Figure 10.2.6.1.

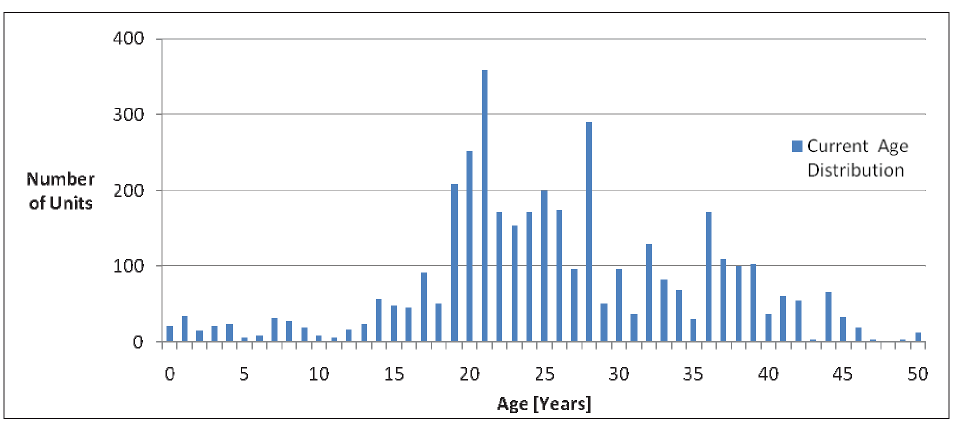


Figure 10.2.6.1: Vault Transformer Age Distribution

According to the ACA, although approximately 90% of the vault transformers are in good or very good condition, Enersource has several hundred transformers with a poor or very poor health index. As a result, the ACA suggests an initial replacement of 196 transformers. This initial surge in the replacement rate is caused by a large number of transformers that are overdue for replacement. After the first year, the ACA suggests gradually increasing the replacement rate from 119 to 180 units in fifteen years. After 15 years, the rate should be reduced.

According to the suggested replacement rates, after 40 years, 4,089 transformers will be replaced, which translates to an average replacement of 102 units per year. The replacement quantities are shown in Figure 10.2.6.2.

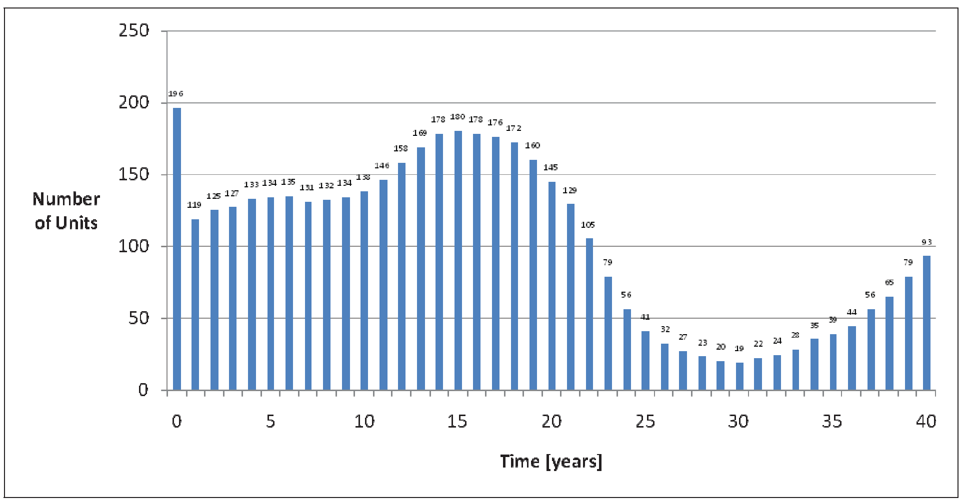


Figure 10.2.6.2: Vault Transformers - Recommended Replacement Rates

In 2010, through underground rebuilds, failures and spot replacements, Enersource replaced approximately twenty vault transformers, some of which were done under the PCB transformer replacement program. In 2011, approximately fifteen transformers were replaced. The 2012 budget and labour resources will allow for replacement of a similar number of vault transformers.

The current replacement rate of vault transformers is lower than the rate suggested by the ACA. After reviewing the ACA results, a secondary evaluation of the distribution data and the number of failures in the past was performed. It was observed that due to Enersource's practices and installation location on the transformers, the expected useful life of the vault transformers may be assumed longer than initially assumed. This is most likely because the units are sheltered from external elements that degrade other outdoor transformers and cause them to fail earlier. Further evaluation of the results is required. It is reasonable that the future useful life of vault transformers, based on more field and asset data, may require to be updated.

However, Enersource recognizes that the current replacement rate is too low and will have to be increased. A future study will determine the new replacement rate. Currently, Enersource's reliability is not greatly affected by the vault transformer failures since typical installations supply only one customer and the majority of the population still has a good or very good health index. In the future, the plan is to increase main feeder and local distribution feeder cable rebuild projects and replace aging vault transformers under these projects.

10.2.7 Pad Mounted Switchgear

Air insulated pad mounted switchgear units are one of the types of underground distribution switches used on the system. The main purpose of the underground switches is to control the flow of the current and protect cables, transformers and other components from over current under fault conditions.

Internal switches or fuses are air insulated and are installed inside a self-supporting metal enclosure. Switchgear units are typically installed above grade on a concrete foundation, typically on park property, a school, or sometimes on the city boulevard.

The switchgear unit consists of a low profile pad mounted enclosure with various internal compartments housing cable terminations, switches, and protection equipment. Depending on the internal configuration, the pad mounted switchgear can contain various amounts of 600A three pole loadbreak switches, or hook-stick operated single phase power fuses rated up to 200A.

In the past, switchgear units with two different voltage ratings were installed: 15kV and 25kV. In 1992, to reduce inventory levels, all new switchgear installations were standardized to 27.6kV.

Typically, a single switchgear unit in a residential area can supply power up to 400 customers; therefore, if the unit fails, the effect on reliability is significant with respect to the number of customers. Additionally, some failures are intermittent, making it extremely difficult and time consuming to find the faulty unit. In such cases, the customers are exposed to several short outages, negatively affecting the frequency, that is, the SAIFI, portion of reliability.

As of December, 2010, there were 784 pad mounted switchgear units installed. The average age of the population is 19 years. The ACA study assumes that 20% of the population will fail by 25 years and 99% of the population will fail by 45 years. According to ACA, approximately 26% of the switchgear population is 25 years or older.

The trend rate of installation for pad mounted switchgear units is similar to the trend of the single phase pad mounted transformers. The installation rate was fairly low up to the mid 1980's. After that, the installation rate kept increasing until the early 1990`s. Following that, the rate has returned to a typical installation rate. The demographic breakdown of the pad mounted switchgear is illustrated in Figure 10.2.7.1.

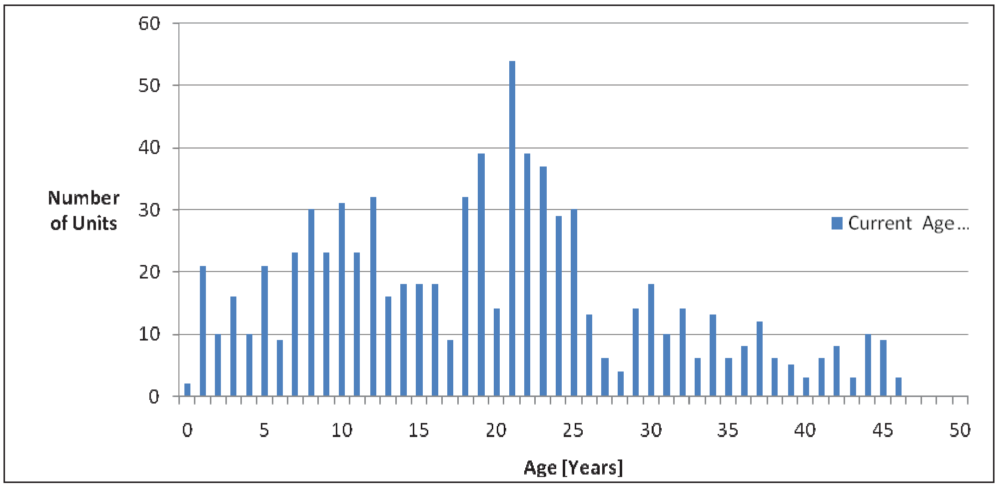


Figure 10.2.7.1: Pad Mounted Switchgear Age Distribution

According to the ACA, although 76% of the pad mounted switchgear units are in good or very good condition, Enersource has over 13% of the population has a poor or very poor health index. As a result, the report suggests an initial replacement of 31 units. After the first year, the report suggests replacing between 14 and 30 pad mounted switchgear units.

According to the suggested replacement rates, after 40 years, 888 switchgears will be replaced. In contrast to historical rates of installation, for the next 40 years Enersource will be replacing an average of 22 units each year. The replacement quantities are shown in Figure 10.2.7.2.

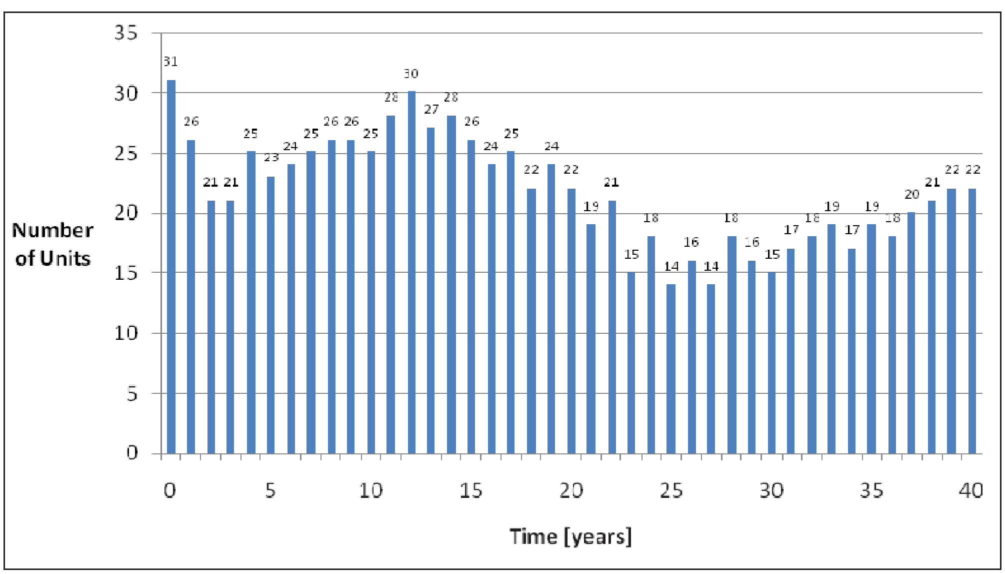


Figure 10.2.7.2: Pad Mounted Switchgear - Recommended Replacement Rates

In 2010 and 2011, through underground rebuilds, failures and spot replacements, Enersource replaced approximately 25 pad mounted switchgear units each year. The 2012 budget and labour resources will allow for replacement of a similar number of switchgear units

The 2012 replacement rate of the pad mounted switchgear is lower than the rate suggested by the ACA. Further adjustment to the replacement rate is needed to match the suggested ACA replacement levels. Additionally, when undertaking underground cable rebuilds in the area, effort is being made to reconfigure the distribution system to remove the switchgear altogether.

10.2.8 Overhead Switches

The primary function of these switches is to allow the isolation of line sections or equipment for maintenance, safety or other operating requirements. In general, switches consist of mechanically movable copper blades, supported on insulators, and mounted on metal bases. Their operating mechanism can be either a simple hook stick or a manually driven mechanism to move the ganged contacts. Air serves as the insulating medium between contacts when these switches are in the open position.

All of the overhead loadbreak switches used are rated for 600A continuous current and are capable of interrupting full current when opened under load. In addition to the loadbreak switches, Enersource also uses 900A in-line solid blade disconnect switches. These devices are not loadbreak and require to be manually operated from a bucket truck.

The majority of the switches installed are manually operated; however, a project is in place to install motor operators on switches at key locations to aid in the prompt restoration of power in case of an outage.

For the purpose of the ACA, the overhead switches were divided into three main categories: 44kV loadbreak switches, 27.6kV loadbreak switches, and in-line disconnect switches. Depending on the location, some units are located in critical points in the system. Their failure could result in a power interruption for several thousand customers; thus, the reliability impact from an overhead switch failure is very significant.

At the end of 2010 there were 295 - 44kV loadbreak switches, 221 - 27.6 loadbreak switches and 2,123 in-line disconnect switches. The average age of the population is eighteen, fifteen and eighteen years, respectively. The ACA assumes that 20% of the population will fail by 40 years and 99% of the population will fail by 55 years. In line with this assumption, according to ACA, between 4% and 8% of the overhead switch population is 40 years or older.

The rate of installation of 44kV switches was increasing until the late 1980`s. After that, the rate started to stabilize and is now fewer than five switches per year as the system matures. The installation rate of the 27.6kV loadbreak switches and in-line disconnect switches has been gradually increasing. The demographic breakdown of 44kV switches, 27.6kV switches, and in-line disconnect switches is shown in Figures 10.2.8.1, 10.2.8.2, and 10.2.8.3 respectively.

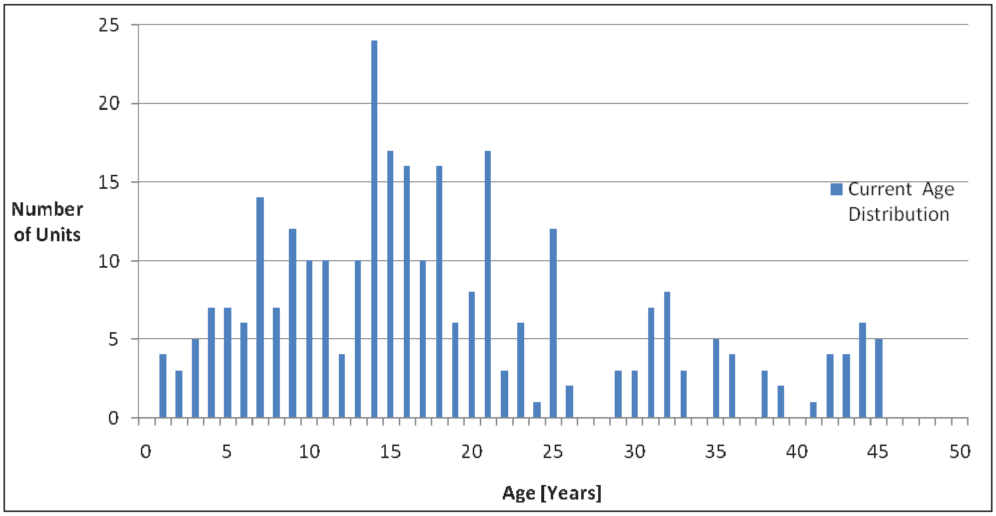


Figure 10.2.8.1: 44kV Loadbreak Switch Age Distribution

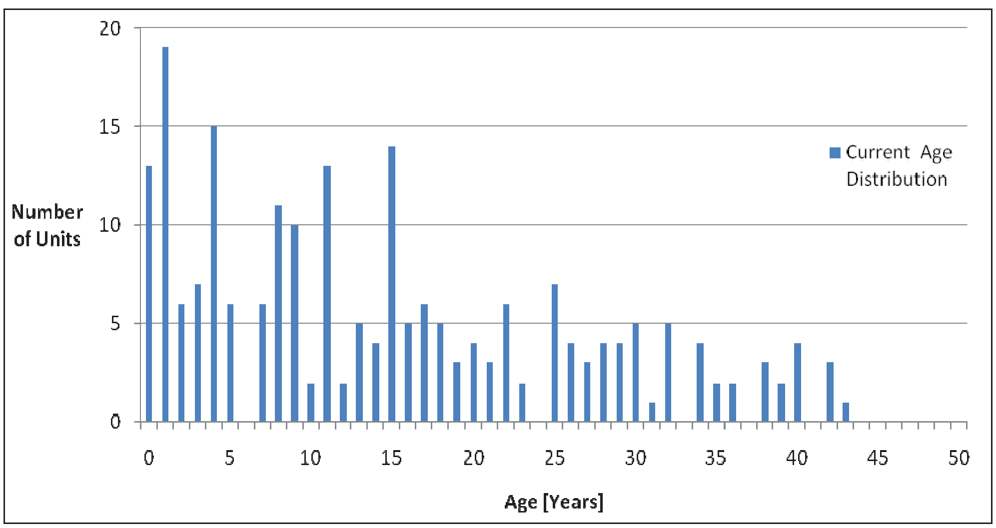


Figure 10.2.8.2: 27.6kV Loadbreak Switch Age Distribution

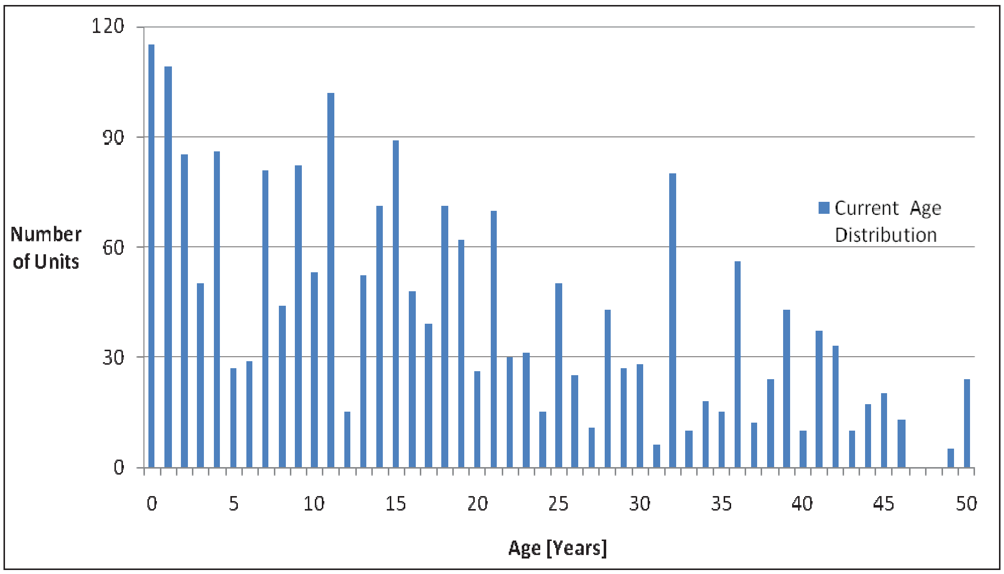


Figure 10.2.8.3: In-line Disconnect Switch Age Distribution

According to the ACA, 95% or more of the overhead switches are in good or very good condition. In addition, only 2% of the in-line switches have a health index below fair.

The ACA suggests an initial replacement rate on the 44kV system of four units, then increasing the rate to 22 switches. After that, the suggested replacement rate drops to one switch per year. The suggested replacement rate on the 27.6kV system is similar in pattern, except the number of switches to be replaced is lower in the earlier stage and higher after 21 years. The ACA also suggests replacing an initial seventeen in-line switches and increasing the rate to 64 units in 35 years.

According to the suggested replacement rates, after 40 years, 262 - 44kV loadbreak switches, 139 - 27.6kV loadbreak switches and 1,572 in-line disconnect switches will be replaced. In contrast with the historical rate of installations, for the next 40 years Enersource will be replacing an average of seven 44kV switches, three 27.6kV switches, and 39 in-line Disconnect Switches each year. The replacement quantities are shown in Figures 10.2.8.4, 10.2.8.5, and 10.2.8.6, respectively.

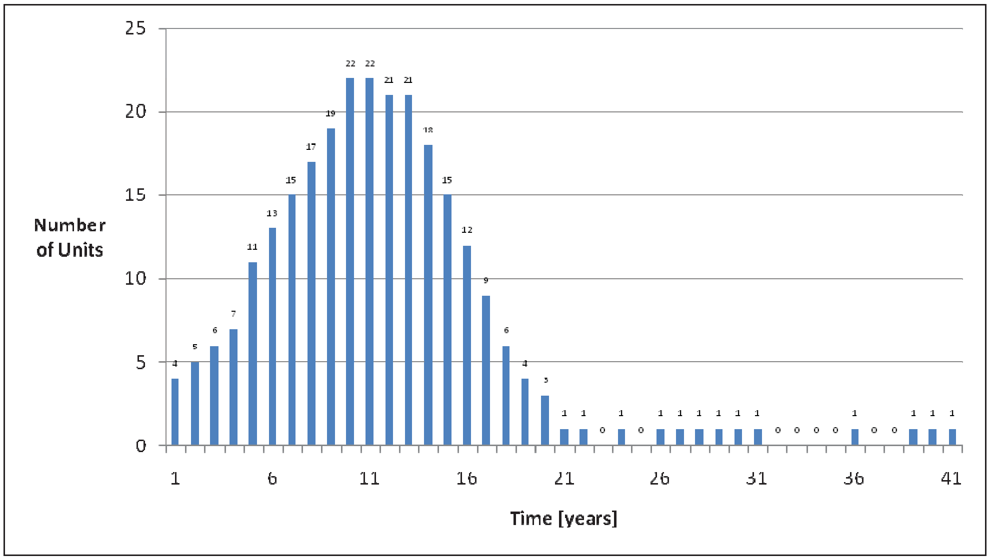


Figure 10.2.8.4: 44kV Loadbreak Switches - Recommended Replacement Rates

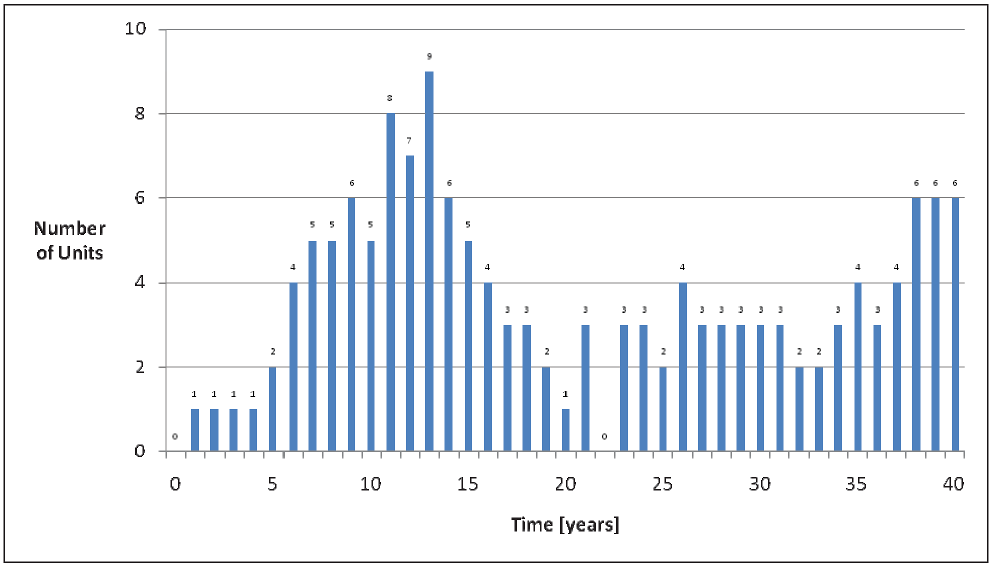


Figure 10.2.8.5: 27.6kV Loadbreak Switches - Recommended Replacement Rates

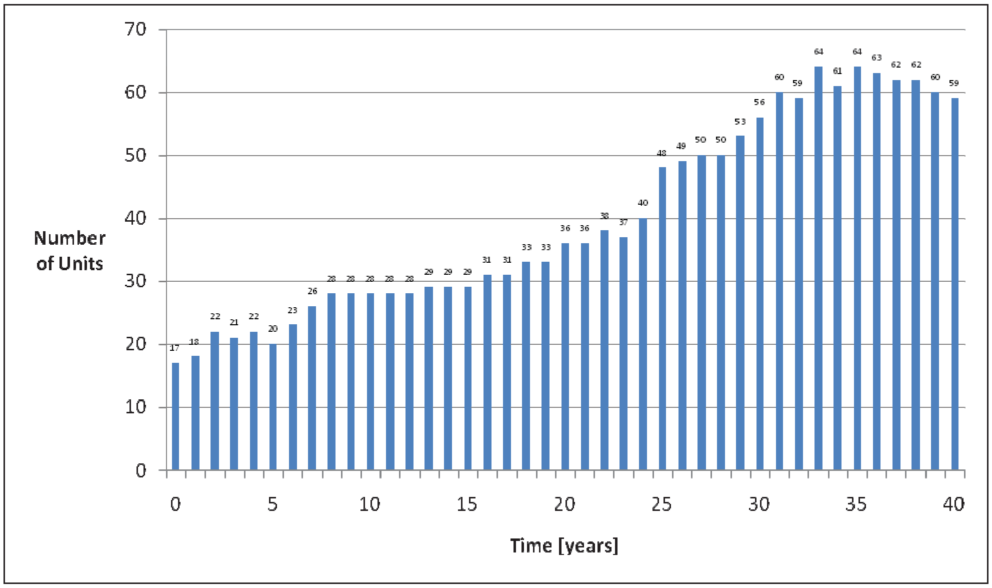


Figure 10.2.8.6: In-line Disconnect Switches - Recommended Replacements

On average, through overhead rebuilds, failures and spot replacements, Enersource replaces approximately 2 of the 27.6kV loadbreak switches and between 70 and 120 in-line disconnect switches annually. In 2010 or 2011 no 44kV loadbreak switches were replaced.

The current replacement rate of the overhead 27.6kV loadbreak switches is slightly higher than the recommended replacement rate. This is due to field inspections that identified defective switches or because of an overhead rebuild in the area, which covered replacement of the entire overhead system in the area.

In 2011, Enersource replaced 68 in-line disconnect switches. That number is higher than the number recommended by the ACA. Most of the in-line switches were replaced because of field inspections or from infra red scans. If a single switch is identified as defective, as a part of work bundling, the maintenance crew will replace all three switches of the same circuit; therefore, the total number of switches replaced is higher than the recommended replacement quantity.

The current replacement rate for the overhead loadbreak switches is consistent with the recommended replacement rate. The replacement rate for the overhead in-line switches will be monitored in the future and further studies of equipment failures will be examined to ensure that the rate is adequate.

10.2.9 Underground Primary Cables

Primary underground conductors are used to transport power from either 44kV or 16/27.6kV TS to an MS and then to the distribution transformers at 8/13.8 or 2.4/4.16 kV, depending on the location in the city. The primary cables are installed within the city boulevard, either directly buried or installed in a separate 100mm direct-buried PVC duct.

Distribution underground feeder cables are one of the more challenging assets for electricity systems, from a condition assessment and asset management viewpoint. Most often, they are considered to be the most expensive components, due to the high cost of materials and very high cost of installation and maintenance.

It is very difficult, and therefore very expensive, to obtain meaningful condition information for buried cables. Underground cable systems, unlike overhead lines, do not suffer from weather induced faults and have better reliability records.

For the purpose of the AMP, the primary underground cables are separated into two categories:

- Main Feeder Cables (all 350 to 1,000 kcmil Main Feeder Distribution and Subtransmission cables) and
- Local Distribution Feeder Cables (all 250 kcmil or smaller distribution cables)

In the past, different sizes and ratings of the cables were installed. In 1993, to reduce inventory levels, all distribution main feeder cables were standardized to 1000kcmil, 28kV and all local distribution cables were standardized to 1/0, 28kV.

The subtransmission main feeder cables typically supply an MS. As a result, a failure of a cable supplying a single station may result in disruption of power for up to 5,000 customers. In addition, the failed cable will cause a temporary interruption to the TS station that supplies tens of thousands of customers. Main feeder cables are typically supplying several switchgear units and can deliver power to up to 700 customers each. The local distribution feeder cable is connected to the pad mounted switchgear units or the overhead distribution system and typically will supply up to 400 customers. Cable failures will result in a power outage to all customers connected and typically will momentarily trip the MS breaker as the fuse typically isolates the fault.

As of the end of 2010, there were 1,283km of main feeder cables and 5,081km of local distribution feeder cables. The average age of the population is approximately 19 and 17 years, respectively. The ACA assumes that 20% of the population will fail by 40 years and 99% of the population will fail by 55 years.

As shown in Figures 10.2.9.1 and 10.2.9.2, the rates of installation of underground cables have varied widely over the past 50 years. The installation rates were gradually increasing until the early 1990`s. After that, installation rates stabilized in the mid 1990`s. Finally, in late 1990`s and early 2000`s cable installation rates started to increase again and reached the highest level in early 2000`s. Since then, the installation rates have been gradually declining.

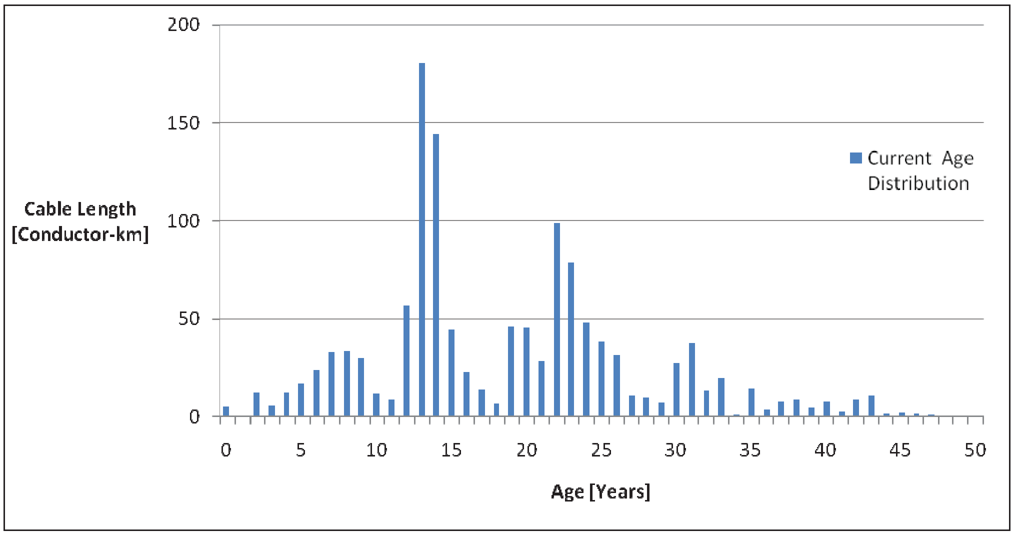


Figure 10.2.9.1: Main Feeder Cable - Age Distribution

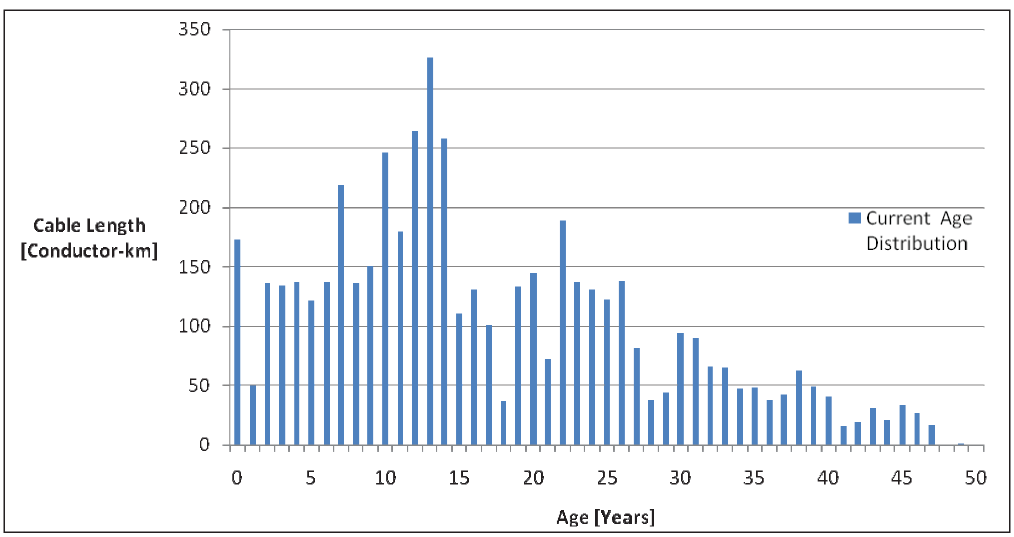


Figure 10.2.9.2: Local Distribution Feeder Cable - Age Distribution

According to the ACA, more than 95% of the underground cables are in good or very good condition. In addition, the ACA pointed out that almost 3km of main feeder cables and 50km of local distribution feeder cables, are in very poor or poor condition. The suggested replacement rate for the main feeder cables is starting at 5km per year and it will gradually increase to 48km in 25 years. For the local distribution feeder cable, the suggested rate starts at 33km per year and it increases to 167km in 35 years.

According to the suggested replacement rates, after 40 years, 1,186km of main feeder cables and 4,187km of local distribution feeder cables will be replaced. In contrast with the historical rate of installations, for the next 40 years Enersource will be replacing an average of 30km of main feeder cables and 105km of local distribution feeder cables each year. The replacement rates are shown in Figures 10.2.9.3 and 10.2.9.4.

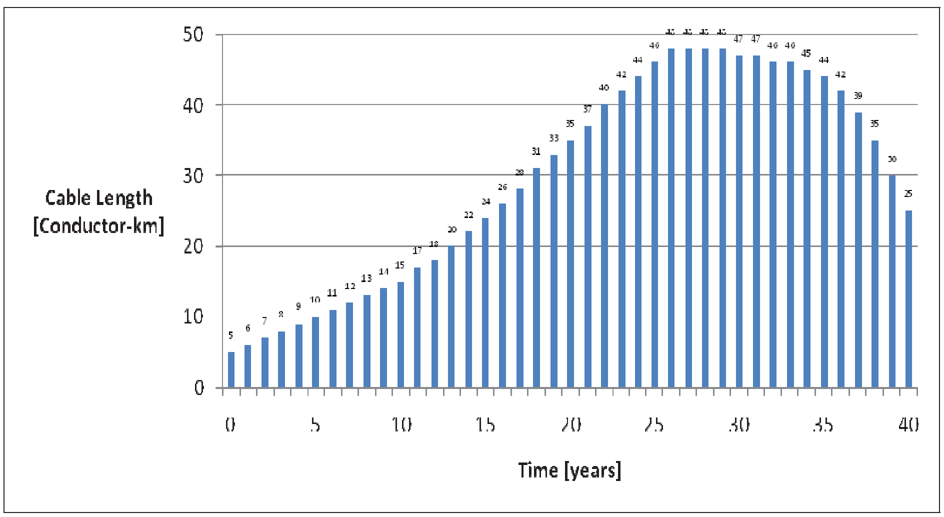


Figure 10.2.9.3: Main Feeder Cable - Recommended Replacement Rates

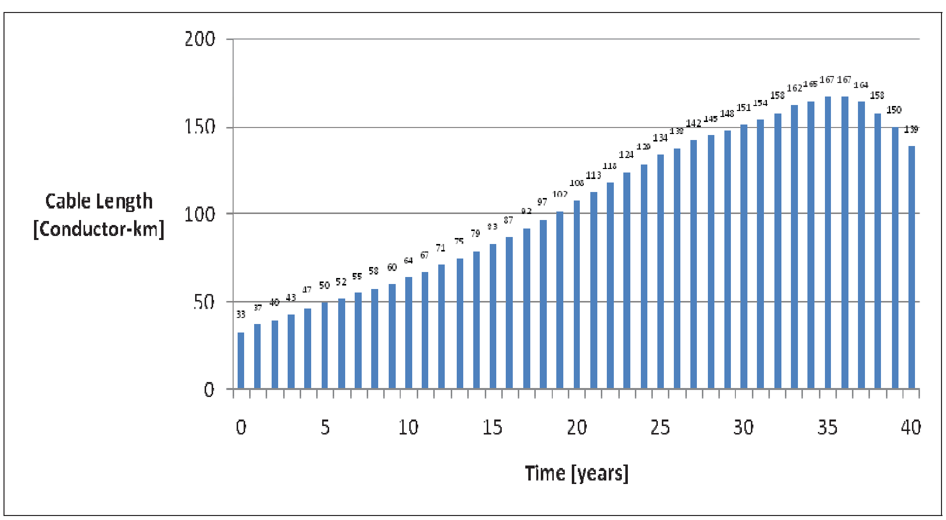


Figure 10.2.9.4: Local Distribution Feeder Cable - Recommended Replacement Rates

In 2010 and 2011, through underground rebuilds, failures and spot replacements, Enersource replaced approximately 5km of main feeder cables and 30km of local distribution feeder cables annually. The 2012 budget and labour resources allow for the replacement of approximately the same quantity of the cables.

In the past few years, the number of cable failures has increased significantly, which contributes to a decline in reliability. In 2011, 51% of the power outages that occurred were caused by equipment failures. Furthermore, failures of the underground power cables accounted for 60% of equipment failures.

Based on an additional evaluation of the number of failures and associated ages of the equipment, it was concluded that the expected useful life of the underground cables installed prior to 1987 is shorter than 40 years. After 1987, several changes were done to the materials used in cables as well as installation practices, which enhanced performance of the cable and prolonged its useful life to 40 years or more. For the purpose of the first iteration of the ACA, the average useful life for all cables was assumed to be 40 years. In the future revisions of the ACA, more accurate ages for cables installed prior to and past 1987 will be assigned.

The current replacement rate of the main feeder cables is consistent with the rate suggested by the ACA. In the near future, the replacement rate will have to be increased to match the rate suggested in the ACA in order to avoid aging assets past their expected life.

Currently, Enersource's reliability is not affected greatly by main feeder cable failures, since only a moderate number of main feeder cables fail each year. However, as noted previously, failures of local distribution feeder cables affect the reliability significantly. The ACA will have to be reviewed in the future to account for poor quality of cables manufactured before 1987, and recommended replacement rates for local distribution cables will probably be increased. The replacement rates for these cables will have to be increased every year to match the suggested ACA replacement rates.

10.2.10 Wood Poles

Poles serve as support structures for overhead conductors, switches, transformers and other devices. In addition to Enersource`s equipment, the poles often support streetlights and third party attachments such as telephone, cable TV and fiber communication cables. Poles are made of wood, concrete, metal or fiberglass. The vast majority of the poles on Enersource's system are wood or concrete. All poles are partially buried in the ground, and as a result they are self-supporting structures; nevertheless, there are locations where poles may need additional support, such as at dead ends or at corners.

Wood poles are one of the two main types of poles used. The poles installed in the past in Mississauga vary in sizes from 25 feet to 75 feet; however, to reduce the number of stocking sizes Enersource has standardized pole heights and classes. The height of a pole is determined by a number of factors, such as the number of conductors it must support, equipment-mounting requirements, clearances, and the presence of telecommunications facilities. The current preferred species for wood poles is Western Red Cedar.

Poles support bare overhead wires and other equipment. Failure of the pole is very serious, especially since the general public may come in contact with live conductors. In addition, depending on the number of circuits supported by the pole and the voltage, failure may disturb power to thousands of customers. Since the consequence of asset failure is significant, poles are proactively replaced prior to failure. As a result, failures of poles and pole line hardware are tracked closely and there are several programs in place to assess the condition of the poles. Typically, poles don't fail unless they are exposed to extreme storms, they become old and deteriorated, or they are damaged in vehicle accidents, from animals such as woodpeckers or termites, or from fallen trees.

At the end of 2010, there were 12,812 wood poles installed. The average age of the population is 23 years. The ACA assumes that 20% of the population will fail by 45 years and 99% of the population will fail by 75 years. According to the ACA, 11% of the wood pole population is 45 years or older.

The trend rate of installation of wood poles is fairly constant throughout the past. The rate of installation used to be slightly higher in the 1970`s and 1980`s, and has started to stabilize since then. The demographic breakdown of the wood pole population is shown in Figure 10.2.10.1.

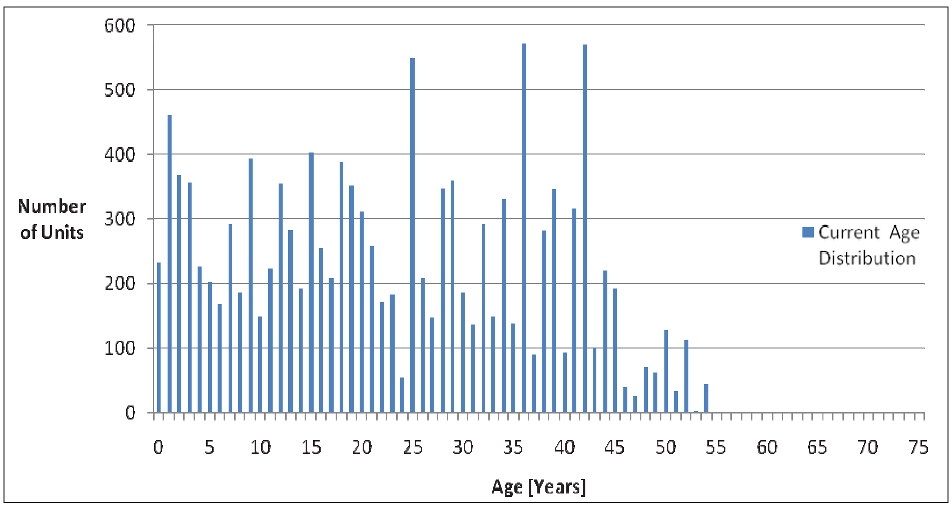


Figure 10.2.10.1: Wood Poles - Age Distribution

According to the ACA, over 95% of wood poles are in good or very good condition. The suggested replacement rate for the wood poles is starting at 58 units per year and it gradually increases to 262 units in 25 years.

According to the suggested replacement rates, after 40 years, 7,884 wood poles will be replaced. In contrast with the historical rate of installations, on average, for the next 40 years Enersource will be replacing 197 poles each year. The detailed replacement quantities are shown in Figure 10.2.10.2.

Historically, through overhead rebuilds, failures and spot replacements, Enersource, on average has replaced between 80 to130 wood poles per year. Many of the old wood poles on main roads are replaced with concrete ones since they offer better performance over time and have a longer useful life. In 2011, a large portion of the overhead maintenance resources had to be diverted to road project initiatives and other customer driven jobs, therefore approximately 40 wood poles were replaced. The 2012 budget and labour resources allow for the replacement of approximately the same number of wood poles.

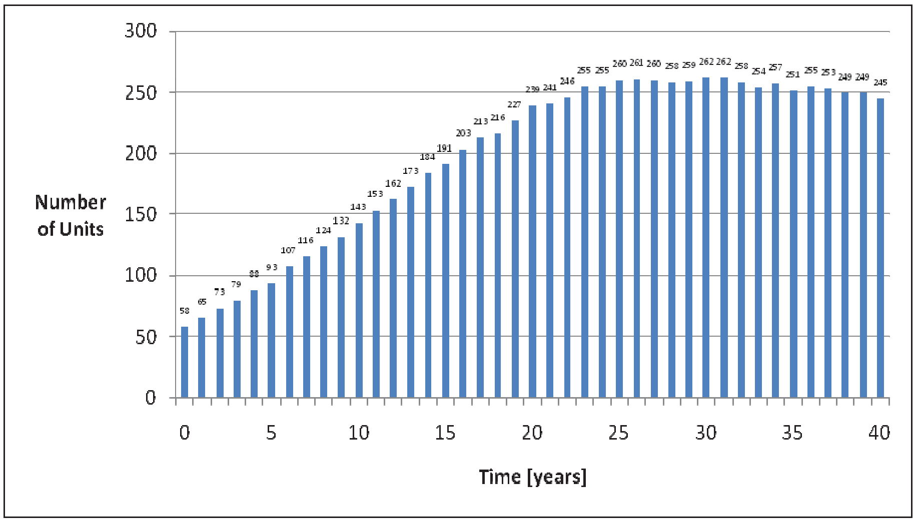


Figure 10.2.10.2: Wood Poles - Recommended Replacement Rates

The average current replacement rate is slightly higher than the rate suggested by the ACA; however it is lower than the 40 year average replacement rate. Future rates will have to be adjusted to maintain the replacement rate suggested by the ACA.

10.2.11 Concrete Poles

Concrete poles are the second main type of distribution support structures used. The smallest pole, 35 feet, is used to support a secondary service or span guy and the larger poles are used to support up to four primary circuits, overhead transformer banks, or loadbreak switches.

Concrete poles are typically installed in the city boulevard for all main feeder circuits along the major roadways. In addition, the concrete poles are used for distribution feed and secondary circuits in the central and northern part of the city.

As in the case of wood poles, concrete poles support bare overhead wires and other equipment. Failure of any pole is very serious, especially since the general public may come in contact with live conductors. In addition, since the majority of concrete poles support four circuits, the failure of a pole may disturb power to thousands of customers. Since the consequence of asset failure is significant, distribution and subtransmission poles are proactively replaced prior to failure. Typically, poles don't fail unless they are exposed to extreme storms, are old and deteriorated, or they are damaged in vehicle accidents.

At the end of 2010, there were 7,537 concrete distribution poles in service. The average age of the population is 18 years. The ACA assumes that 20% of the population will fail by 55 years and 99% of the population will fail by 80 years.

The trend rate of the installation of concrete poles has increased gradually, with an exception of the early 1990`s where the rate stabilized for approximately 10 years. The demographic breakdown of the concrete pole population is shown in Figure 10.2.11.1.

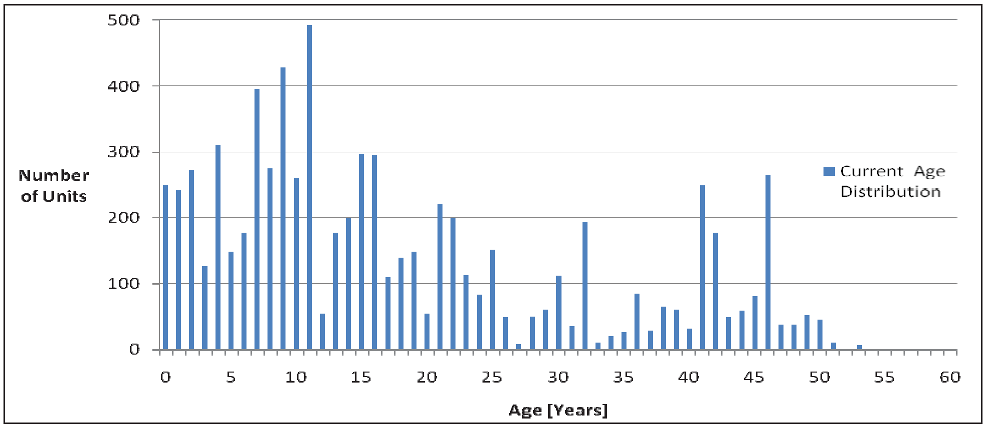


Figure 10.2.11.1: Concrete Poles - Age Distribution

According to the ACA, the majority of the population of concrete poles are in good or very good condition. The suggested replacement rate for the concrete poles is starting at four units per year and it gradually increases to 140 units in 40 years.

According to the suggested replacement rates, after 40 years, 2,605 concrete poles will be replaced. In contrast with the historical rate of installations, on average, for the next 40 years Enersource will be replacing 65 poles each year. The replacement quantities are shown in Figure 10.2.11.2.

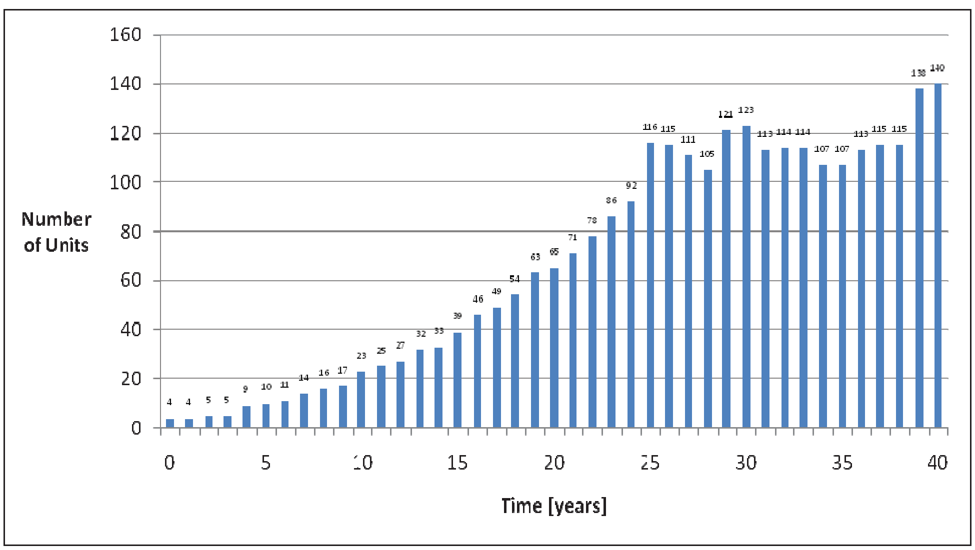


Figure 10.2.11.2: Concrete Poles - Recommended Replacement Rates

The current replacement rate for the concrete poles approximates the recommended replacement rate. The rate will be monitored in the future and further studies of equipment failures will be examined to ensure that the rate of replacement is appropriate.

10.3 Load Forecast

10.3.1 North 16/27.6kV System

In the North 16/27.6kV system, residential, industrial, and commercial development is still occurring and this trend is expected to continue over the next three to five years. This portion of the system is nearing TS capacity to adequately serve its customers. In the near future Enersource will require the addition of another Hydro One TS to service the area and to provide operational flexibility. Historical actual and forecasted peak demand for this area is shown below in Figure 10.3.1 North 16/27.6kV Distribution.

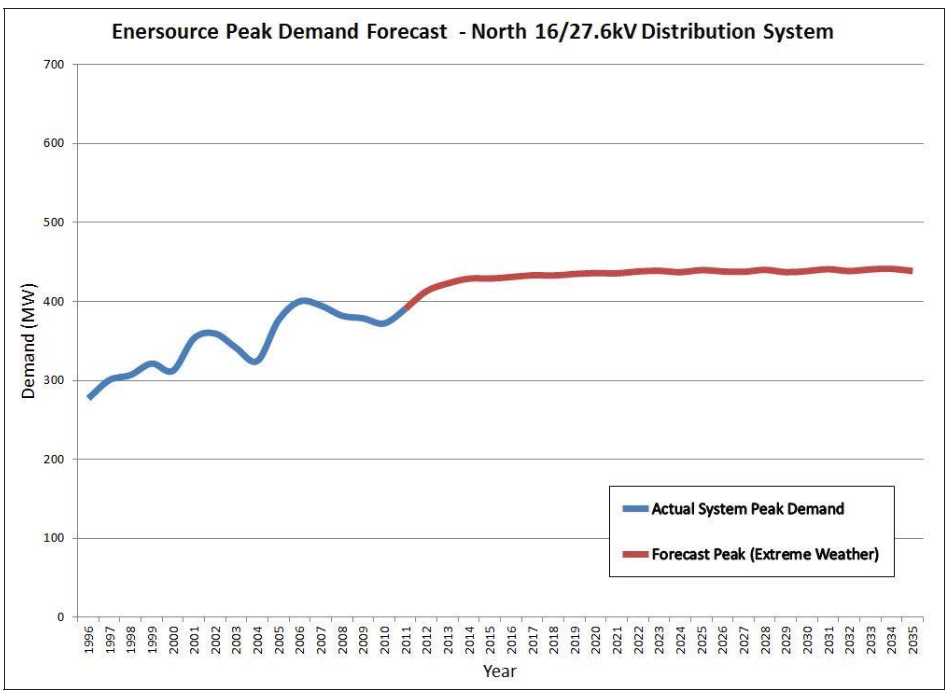


Figure 10.3.1 – Enersource Peak Demand Forecast - North 16/27.6kV Distribution System – Extreme Weather Scenario (1996-2035)

Year	2000	2005	2010	2015	2020	2025	2030	2035
Peak (MW)	312	376	372	429	435	439	439	439
Growth (%)		20.5%	-1.1%	15%	1.4%	0.9%	0%	0%

Table 10.3.1 – Enersource Peak Demand Forecast - North 16/27.6kV Distribution System – Extreme Weather Scenario (2000-2035)

10.3.2 South 16/27.6kV and 2.4/4.16kV Distribution

In the South 16/27.6kV region, redevelopment growth is projected through a number of new condominiums, industrial/commercial developments and at the water and wastewater pumping stations. The Lakeview, Clarkson, Herridge and Lorne Park pumping stations continue to expand and increase their load as more pumps and water mains are added. Historical actual and forecasted peak demand for this area is shown below in Figure 10.3.2 South 16/27.6kV Distribution.

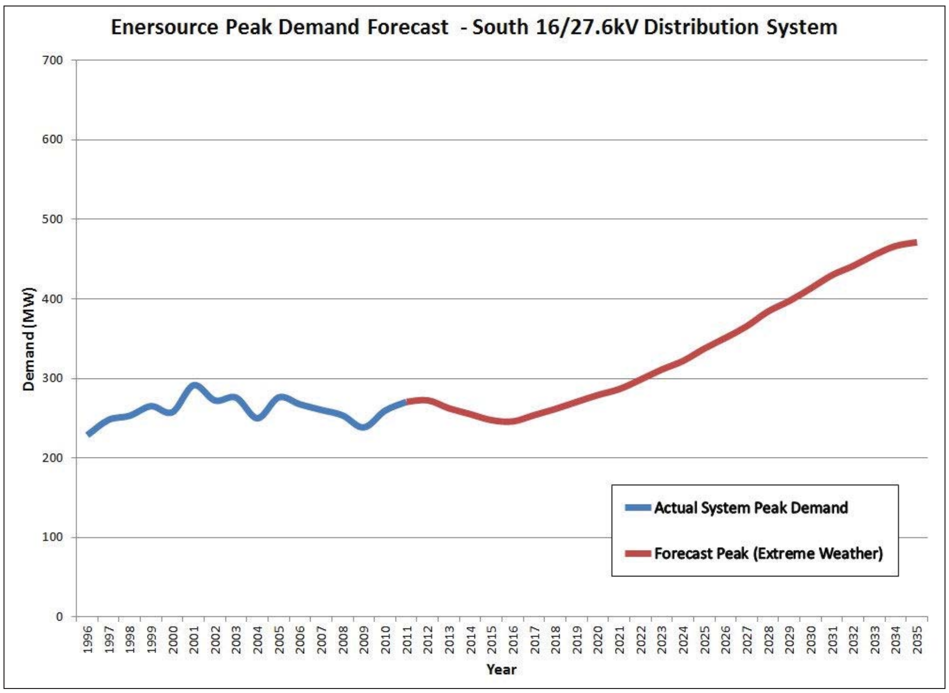


Figure 10.3.2 –Enersource Peak Demand Forecast - South 16/27.6kV Distribution System – Extreme Weather Scenario (1996-2035)

Year	2000	2005	2010	2015	2020	2025	2030	2035
Peak (MW)	258	276	260	248	279	338	413	471
Growth (%)		7%	-5.8%	-4.6%	12.5%	21%	22%	14%

Table 10.3.2 – Enersource Peak Demand Forecast – South 16/27.6kV Distribution System – Extreme Weather Scenario (2000-2035)

10.3.3 West 44kV Subtransmission and 8/13.8kV Distribution

The West 44kV system continues to serve predominantly condominium, residential and industrial/commercial loads. This part of the system will be further loaded by significant new condominium loads that are planned and under construction in the City Centre, along Eglinton Avenue in the west end of the city, and in new industrial/commercial loads in the Meadowvale area. Historical actual and forecasted peak demand for this area is shown below in Figure 10.3.3 West 44kV Subtransmission and 8/13.8kV Distribution Load Growth.

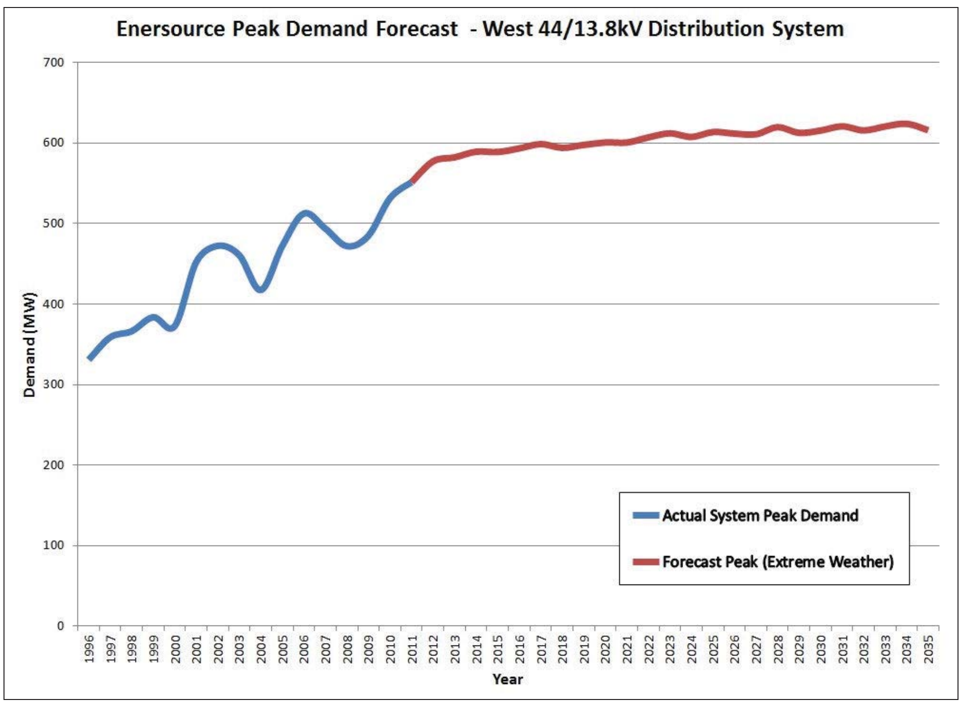


Figure 10.3.3 – Enersource Peak Demand Forecast - West 44/13.8kV Distribution System – Extreme Temperature Scenario (1996-2035)

Year	2000	2005	2010	2015	2020	2025	2030	2035
Peak (MW)	373	473	531	589	601	614	615	615
Growth (%)		27%	12%	11%	2%	2%	0%	0%

Table 10.3.3 – Enersource Peak Demand Forecast – West 44/13.8kV Distribution System – Extreme Weather Scenario (2000-2035)

10.3.4 East 44kV Subtransmission and 8/13.8kV Distribution

The East 44kV system continues to serve predominantly industrial/commercial loads. This part of the system is projected to experience moderate near term growth through additional new commercial and industrial loads from existing service upgrades and new customers. Historical actual and forecasted peak demand for this area is shown below in Figure 10.3.4 East 44kV Subtransmission and 8/13.8kV Distribution Load Growth.

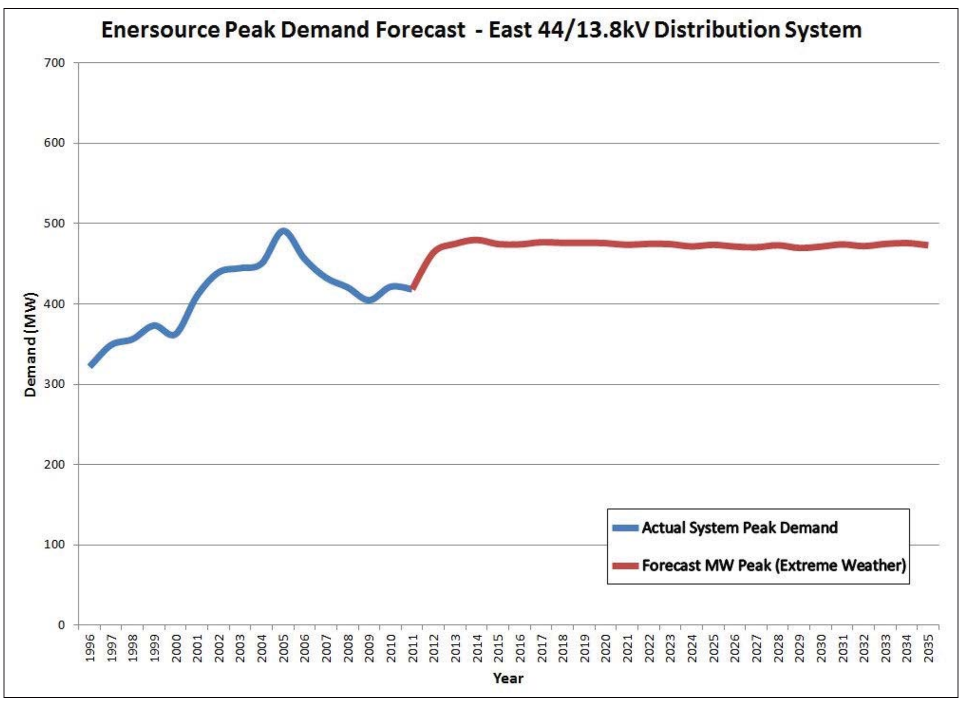


Figure 10.3.4 – Enersource Peak Demand Forecast - East 44/13.8kV Distribution System – Extreme Weather Scenario (1996-2035)

Year	2000	2005	2010	2015	2020	2025	2030	2035
Peak (MW)	362	491	421	475	475	473	471	473
Growth (%)		36%	-14%	13%	0%	0%	0%	0%

Table 10.3.4 – Enersource Peak Demand Forecast – East 44/13.8kV Distribution System – Extreme Weather Scenario (2000-2035)

10.4 Testing and Inspection Programs

10.4.1 Switchgear Dry Ice Cleaning

The distribution system consists of several important components to deliver electrical service to our customers. The distribution system has different types of switches to facilitate distribution of electrical load safely under normal and abnormal conditions. Enersource uses pad mounted switchgear on our underground primary distribution system. These switchgear units are one of the most important components of the distribution system. There are approximately 800 switchgear units in the distribution system.

These switchgear units are air insulated. The majority are installed near roadways to provide easy access for Enersource crews for switching operations. These units are exposed to road salt and other contaminants, which combined are a major cause of tracking leading to intermittent faults. These types of faults expose customers to multiple momentary power interruptions.

Enersource has a dry-ice maintenance program to clean the pad mounted switchgear units to mitigate tracking thus reducing equipment faults. Dry ice blast cleaning, which utilizes frozen carbon dioxide, offers a safe, effective and fast way to clean live electrical equipment. Dry Ice changes directly from a solid to a gas in normal atmospheric conditions without going through a wet liquid stage thereby offering a non-conductive, environmentally friendly method to clean switchgear. Since this technology can be utilized on live equipment it has a further benefit of not requiring customer outages.

In 2011 Enersource cleaned approximately 60 switchgear units using this method. At the same time these switchgear units were also inspected. All inspection findings are recorded and necessary actions are taken by the underground maintenance crew. This corrective maintenance reduces tracking thereby improving system reliability.

Figure 10.4.1.1: 27.6 kV Switchgear Dry Ice Cleaning

10.4.2 Overhead Infrared Inspection

Enersource has an annual overhead infrared inspection program which helps to detect defects in the electrical distribution system before they cause a major failure. The intent of the Infrared thermographic inspection program is to survey the electrical equipment, for hot spots, thus identifying potential electrical connection problems or defective equipment.

The infrared scanner converts heat radiation into a visible image. During the survey, digital infrared images and normal pictures are taken to depict the extent of the defect as well as the device location. The amount of heat emitted from the failing electrical component depends on both the ambient conditions and the actual current flow through that point. High electrical currents will stress most components and are easily detected.

Last year infrared inspection was performed on the entire overhead electrical distribution system; 20 hot spots were identified, a service order was generated for each hot spot, and all hot spots were reported to Enersource overhead maintenance crews for corrective action. An historical record of each hot spot is kept. A sample infrared inspection report is shown in Figure 10.4.2.1

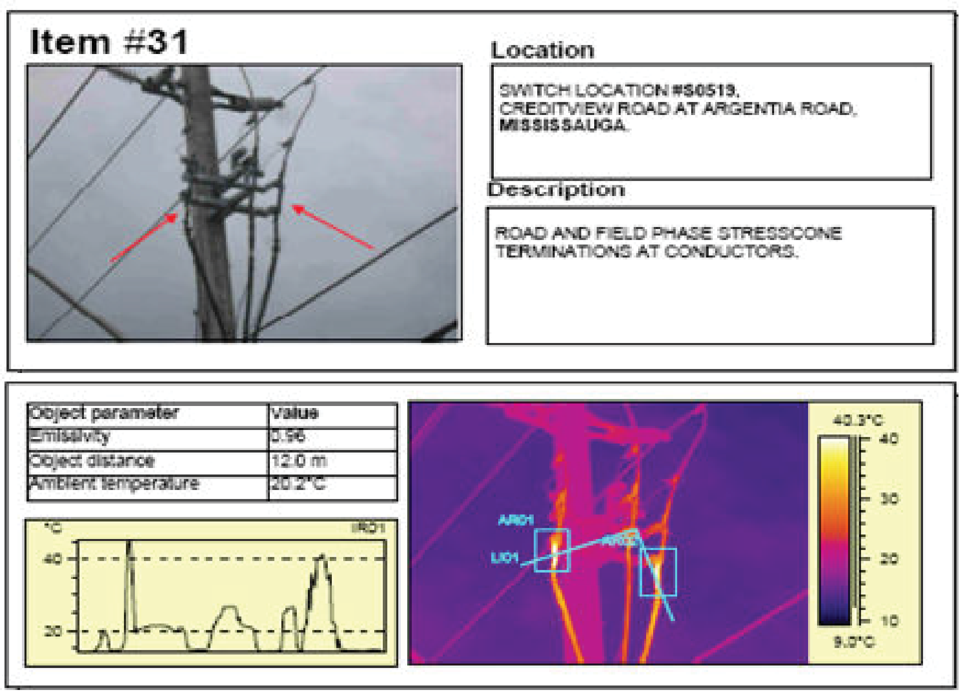


Figure 10.4.2.1: Sample Infrared Location Report

10.4.3 Overhead Loadbreak Switch Maintenance Program

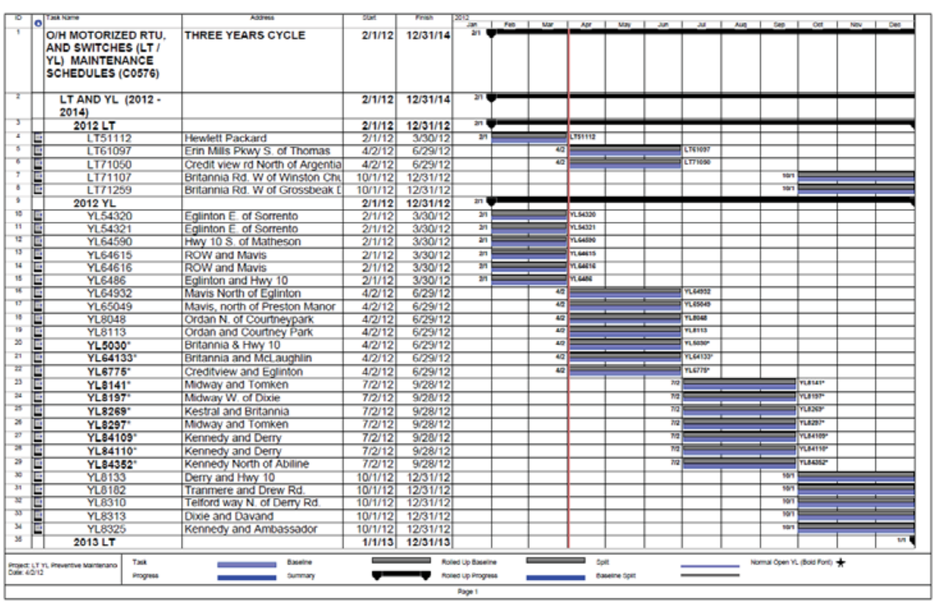
The power system has different types of switches to facilitate distribution of electrical energy. Load interrupters are one type of switch utilized in the overhead electrical power system. These switches are one of the most important components of our distribution system. Enersource has 92 motorized switches that we maintain in a three year cycle.

Enersource has a regular preventative maintenance program for the motorized load interrupter switches. The objective of this program is to perform preventive maintenance to preserve the switches' performance over its expected life.

During the maintenance of 44kV & 27.6kV loadbreak switches the following tasks are performed:

- inspection of the switch
- all necessary maintenance is performed
- grounding check
- check the minimum clearance between shut contact and interrupting unit
- check all contacts , clean contacts if necessary
- check handle location
- check pipe for couplings and adjustments
- check location and connection of ground strap
- check SCADA operation
- record of the maintenance is stored

In 2011, Enersource maintained 30 motorized switches, all necessary maintenance was done, and we will continue to inspect and maintain 1/3 of the motorized switches annually.



ID	Task Name	Address	Start	Finish
1	**O/H MOTORIZED RTU, AND SWITCHES (LT / YL) MAINTENANCE SCHEDULES (C0576)**	**THREE YEARS CYCLE**	**2/1/12**	**12/31/14**
2	**LT AND YL (2012 - 2014)**		**2/1/12**	**12/31/14**
3	**2012 LT**		**2/1/12**	**12/31/12**
4	LT51112	Hewlett Packard	2/1/12	3/30/12
5	LT61097	Erin Mills Pkwy S. of Thomas	4/2/12	6/29/12
6	LT71050	Credit view rd North of Argentia	4/2/12	6/29/12
7	LT71107	Britannia Rd. W of Winston Chu	10/1/12	12/31/12
8	LT71259	Britannia Rd. W of Grossbeak [	10/1/12	12/31/12
9	**2012 YL**		**2/1/12**	**12/31/12**
10	YL54320	Eglinton E. of Sorrento	2/1/12	3/30/12
11	YL54321	Eglinton E. of Sorrento	2/1/12	3/30/12
12	YL64590	Hwy 10 S. of Matheson	2/1/12	3/30/12
13	YL64615	ROW and Mavis	2/1/12	3/30/12
14	YL64616	ROW and Mavis	2/1/12	3/30/12
15	YL6486	Eglinton and Hwy 10	2/1/12	3/30/12
16	YL64932	Mavis North of Eglinton	4/2/12	6/29/12
17	YL65049	Mavis, north of Preston Manor	4/2/12	6/29/12
18	YL8048	Ordan N. of Courtneypark	4/2/12	6/29/12
19	YL8113	Ordan and Courtney Park	4/2/12	6/29/12
20	**YL5030***	Britannia & Hwy 10	4/2/12	6/29/12
21	**YL64133***	Britannia and McLaughlin	4/2/12	6/29/12
22	**YL6775***	Creditview and Eglinton	4/2/12	6/29/12
23	**YL8141***	Midway and Tomken	7/2/12	9/28/12
24	**YL8197***	Midway W. of Dixie	7/2/12	9/28/12
25	**YL8269***	Kestral and Britannia	7/2/12	9/28/12
26	**YL8297***	Midway and Tomken	7/2/12	9/28/12
27	**YL84109***	Kennedy and Derry	7/2/12	9/28/12
28	**YL84110***	Kennedy and Derry	7/2/12	9/28/12
29	**YL84352***	Kennedy North of Abiline	7/2/12	9/28/12
30	YL8133	Derry and Hwy 10	10/1/12	12/31/12
31	YL8182	Tranmere and Drew Rd.	10/1/12	12/31/12
32	YL8310	Telford way N. of Derry Rd.	10/1/12	12/31/12
33	YL8313	Dixie and Davand	10/1/12	12/31/12
34	YL8325	Kennedy and Ambassador	10/1/12	12/31/12
35	**2013 LT**		**1/1/13**	**12/31/13**

Figure 10.4.3.1: Sample of Motorized LT, YL and RTU 3 Year Maintenance Schedule

10.4.4 Station Maintenance Program

The maintenance programs of our municipal substations consist of the following:

- monthly inspections
- power transformer insulating oil testing and
- preventive maintenance

10.4.4.1 Monthly Inspections

The monthly inspections consist of visual inspections of the building and grounds as well as the electrical equipment inside the substations.

The building and grounds are checked for fence and gate / door integrity, vandalism, vegetation and environmental hazards such as transformer oil leaks or SF6 gas leaks.

The electrical equipment checks include inspection of the power transformer fans, battery and battery charger readings and protection relay flags.

All monthly inspection findings are recorded and actions taken as required.

10.4.4.2 Power Transformer Insulating Oil Testing

As part of the asset management of power transformers, Enersource collects oil samples at least once a year from every power transformer and tests them in accordance with the applicable standards. Regular sampling and testing of insulating oil is a valuable technique in a preventative maintenance program. Power transformer oil insulating tests results are maintained in a database and a report regarding the health of the power transformers is prepared annually.

Also observation of dissolved gases in the oil, and other oil properties, provides valuable information about transformer health.

Using proactive testing the life of the transformer can be maximized.

10.4.4.3 Preventive Maintenance

Substations electrical equipment is maintained on a regular schedule. The objective is to perform preventive maintenance approximately once every five years on each municipal power substation. This time interval can be reduced or increased based on operating conditions, equipment type and operating experience with the equipment.

Types of Substation Maintenance Activities include:

- transformer maintenance activities
- switchgear maintenance activities
- protection relays maintenance
- batteries & battery charger maintenance

10.4.4.3.1 Transformer Maintenance Activities

Transformer maintenance activities are based on the following documents and standards:

- manufacturer's instruction book
- IEEE 62-1995 IEEE Guide for Diagnostic Field Testing of Electric Power Apparatus Part 1: Oil Filled Power Transformers, Regulators, and Reactors
- doble transformer maintenance and test guide

The following maintenance tasks are performed on every oil-filled substation transformer:

- inspect and test all controls, wiring, fans, alarms and gauges;
- in-depth inspection of transformer cooling system (check for leaks and proper operation)
- in-depth inspection of transformer bushings, cleaning, waxing if needed
- doble test transformer and bushings
- inspect pressure controls;
- inspect and test the tap changer

10.4.4.3.2 Switchgear Maintenance Activities

The substation switchgear maintenance is based on the manufacturer's recommendation and as a minimum shall consist of the following:

Busbar, enclosure and insulators maintenance;

- external visual inspection
- check and tighten connections
- check and clean enclosure

Circuit breaker maintenance

- lube, clean, adjust, align control mechanism
- contact resistance measurement
- test tripping and closing circuits

10.4.4.3.3 Protection Relays Maintenance

Three types of relays are used to clear the faults that occur in the distribution grid.

For electromechanical (GE IAC type) relays; the maintenance tasks shall include:

- visual Inspection
- mechanical adjustment and inspection
- electrical tests and adjustments

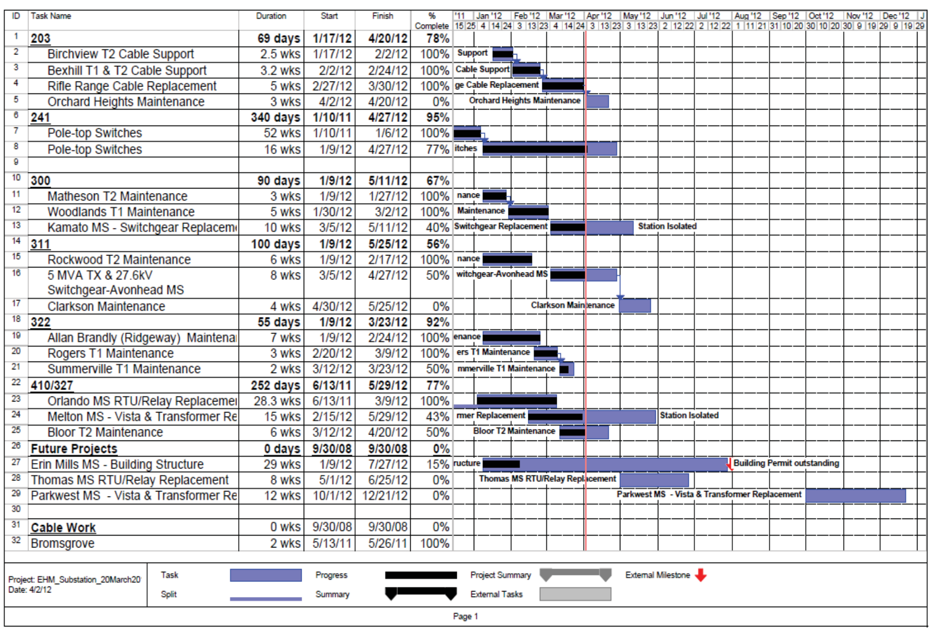
Electronic Relays (MCGG type) relays – since there are no moving parts in the electronic relays, there is no physical wear due to usage; the maintenance consists in secondary injection tests to verify the tripping time accuracy of the relays. Microprocessor based (UR type) relays – only injection tests are performed as maintenance tasks.

10.4.4.3.4 Battery & Battery Charger Maintenance

The battery and battery charger maintenance consists of the following activities:

- record the room temperature
- measure and record the battery voltage
- measure and record each battery voltage
- record the charge current

Sample of Substations maintenance activities schedule can be found in Figure 10.4.4.1 below:



ID	Task Name	Duration	Start	Finish	% Complete
1	**203**	**69 days**	**1/17/12**	**4/20/12**	**78%**
2	Birchview T2 Cable Support	2.5 wks	1/17/12	2/2/12	100%
3	Bexhill T1 & T2 Cable Support	3.2 wks	2/2/12	2/24/12	100%
4	Rifle Range Cable Replacement	5 wks	2/27/12	3/30/12	100%
5	Orchard Heights Maintenance	3 wks	4/2/12	4/20/12	0%
6	**241**	**340 days**	**1/10/11**	**4/27/12**	**95%**
7	Pole-top Switches	52 wks	1/10/11	1/6/12	100%
8	Pole-top Switches	16 wks	1/9/12	4/27/12	77%
9					
10	**300**	**90 days**	**1/9/12**	**5/11/12**	**67%**
11	Matheson T2 Maintenance	3 wks	1/9/12	1/27/12	100%
12	Woodlands T1 Maintenance	5 wks	1/30/12	3/2/12	100%
13	Kamato MS - Switchgear Replacem	10 wks	3/5/12	5/11/12	40%
14	**311**	**100 days**	**1/9/12**	**5/25/12**	**56%**
15	Rockwood T2 Maintenance	6 wks	1/9/12	2/17/12	100%
16	5 MVA TX & 27.6kV Switchgear-Avonhead MS	8 wks	3/5/12	4/27/12	50%
17	Clarkson Maintenance	4 wks	4/30/12	5/25/12	0%
18	**322**	**55 days**	**1/9/12**	**3/23/12**	**92%**
19	Allan Brandly (Ridgeway) Maintena	7 wks	1/9/12	2/24/12	100%
20	Rogers T1 Maintenance	3 wks	2/20/12	3/9/12	100%
21	Summerville T1 Maintenance	2 wks	3/12/12	3/23/12	50%
22	**410/327**	**252 days**	**6/13/11**	**5/29/12**	**77%**
23	Orlando MS RTU/Relay Replaceme	28.3 wks	6/13/11	3/9/12	100%
24	Melton MS - Vista & Transformer Re	15 wks	2/15/12	5/29/12	43%
25	Bloor T2 Maintenance	6 wks	3/12/12	4/20/12	50%
26	**Future Projects**	**0 days**	**9/30/08**	**9/30/08**	**0%**
27	Erin Mills MS - Building Structure	29 wks	1/9/12	7/27/12	15%
28	Thomas MS RTU/Relay Replacement	8 wks	5/1/12	6/25/12	0%
29	Parkwest MS - Vista & Transformer Re	12 wks	10/1/12	12/21/12	0%
30					
31	**Cable Work**	0 wks	9/30/08	9/30/08	0%
32	Bromsgrove	2 wks	5/13/11	5/26/11	100%

Figure 10.4.4.1: Sample of Substations 2012 Maintenance Schedule

10.5 Integrated Operating Model

The IOM contains an Outage Management System (OMS), which records all activities, outages and problems associated with the power system, including information on equipment failures. Each record includes information on the type of equipment that has failed, its location in the field, the duration, and cause of the outage, as well as, the number of customers affected. The equipment failure information is analyzed by the Reliability department. Different programs, such as the cable and wood pole rebuilds, are selected and prioritized based on the reliability data from the IOM. Sometimes different queries and maps are created to help better understand and visualize affected areas. Figure 10.5 shows a sample map illustrating cable failures and their effect on reliability over the past 10 years. In future, the plan is to use the reliability statistics from the equipment failures as one of the inputs into the updated ACA.

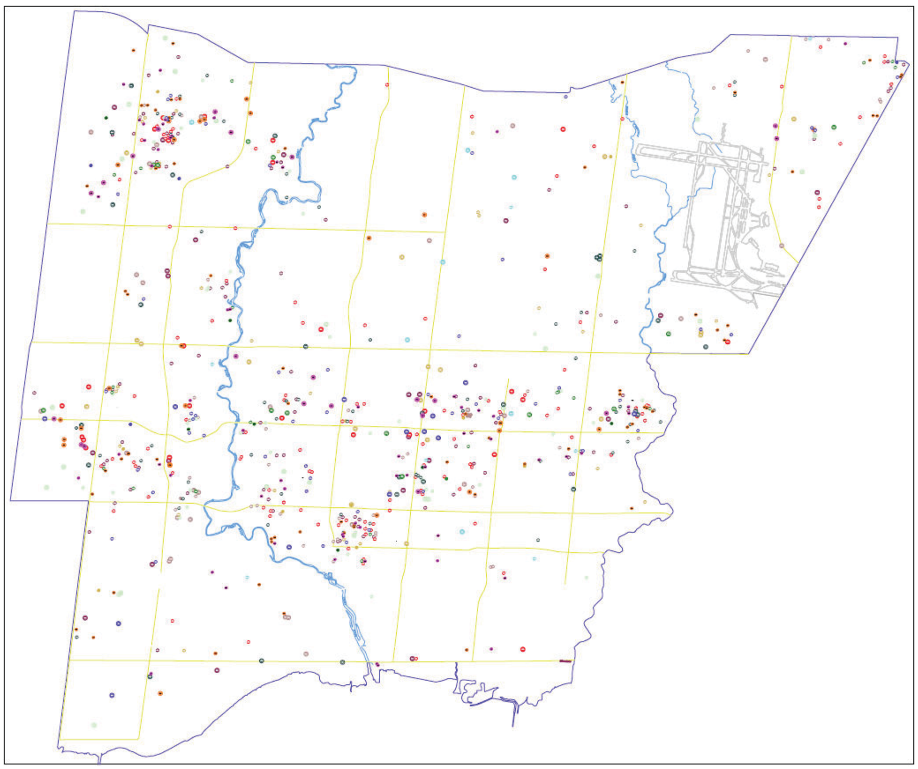


Figure 10.5: Cable Failure Map - IOM Data Source

10.6 Automated Mapping/Facilities Management/Geographical Information System

The AM/FM/GIS system is used to store attributes pertaining to Enersource's field equipment. Figure 10.6 shows a typical graphical user interface displaying a portion of the power system, along with all the attributes associated with the selected pad mounted transformer. Occasionally, a spatial map with a specific type or age of equipment is created from the AM/FM/GIS system. Such maps are used to aid the equipment inspections on the system. The information, such as equipment type, rating, voltage, age, manufacturer, and other technical data is used as an input to other studies. For the ACA, several databases were created containing the equipment attributes for all of the distribution and subtransmission hardware. The database is continually reviewed for further attributes for capture. The system is robust and flexible to accommodate evolving needs.

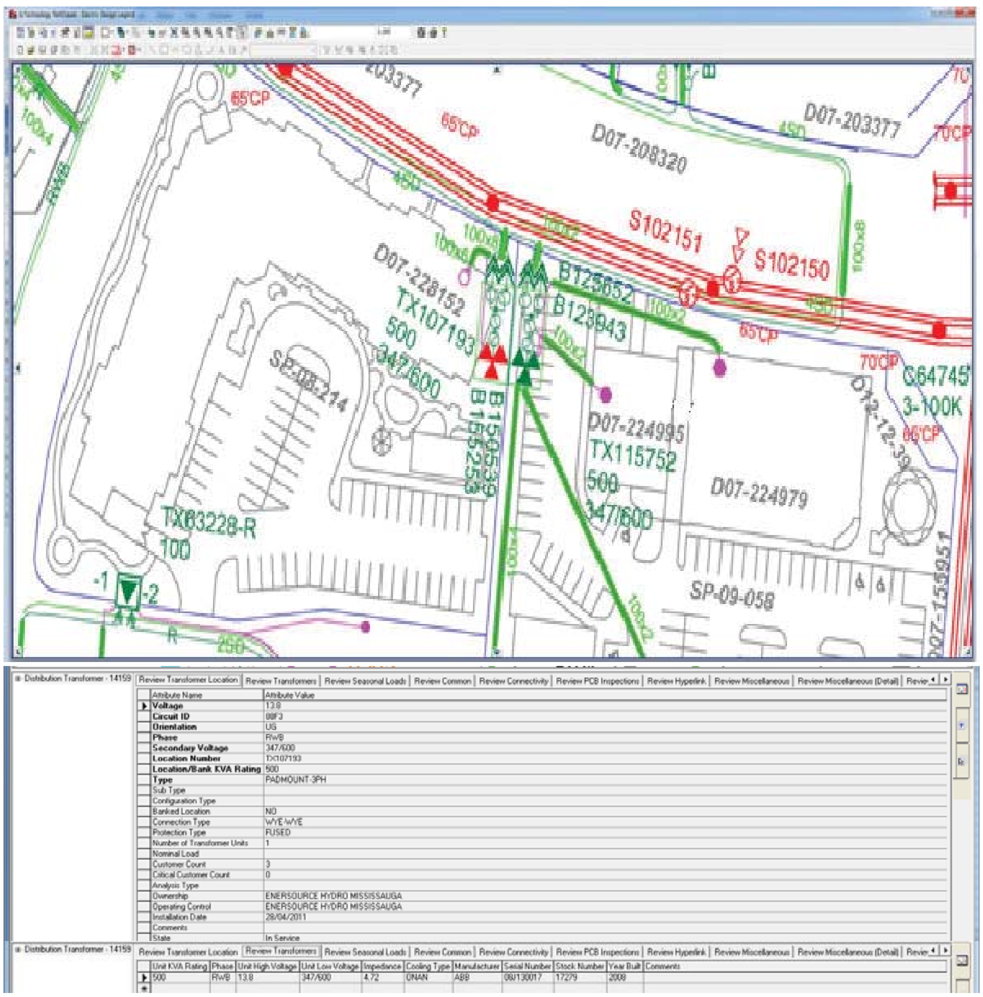


Figure 10.6: Sample Screenshot - G-Electric AM/FM

FUTURE PLANNING INITIATIVES

11. Planning Initiatives

11.1 System Planning Software - CYMDIST

Enersource is planning to utilize a program from CYME International Inc. called CYMDIST which performs power system analysis. This program is designed for system planning and simulating the behaviour of the system under different operating conditions and scenarios. The software, can perform power flow analysis, voltage drop and short circuit study, suggested switching optimization that will balance load for minimum losses or equalize feeder loading, displays effects of future load growth, perform contingency analysis, and do an arc flash hazard assessment and protective device coordination. Enersource plans to use CYMDIST to review the current system configuration, study it under different conditions, plan for system expansion and review proposed projects and changes to the power system.

11.2 Transformer Loading Tool

Enersource generates a transformer loading report based on a software application that provides aggregated power demand values for distribution transformers. The power demand information is collected from each individual account from our meter reading system. The connectivity information from the Automated Mapping/Facilities Management/Geographical Information System (AM/FM/GIS) is then used to associate each customer usage with the distribution transformer supplying the customer. The program can display either the maximum transformer load in any given day or it can provide an hourly breakdown of the power demand on a specific transformer. For the majority of the customer accounts, the consumption data is being captured on an hourly basis, but the program can display the transformer load by hour, day, month, quarter or annually. Enersource plans to utilize this report to monitor the loading of the distribution transformers to ensure they are utilized within acceptable limits. The loading data will be used as one of the inputs into the Asset Condition Assessment and will be a factor in calculating the health indexes of distribution transformers in future assessments.

11.3 Pole Testing Pilot Program

Pole testing and inspection program is a safe and economical pole management program that extends the life cycle of the wood pole system and allows for future planning of which poles to replace through the collection of data.

The objective of pole testing is to ensure our power system operates safely; to identify remaining life of the pole and collect useful data of the infrastructure.

We are in a process of establishing a pole testing and inspection program and we have selected three vendors to do a pilot project. The purpose of this pilot project is to test approximately 300 poles using two different pole testing methods.

- visual, sound and drill
- non destructive (using a resistograph)

The results of the pilot project will be reviewed by Enersource personnel, and based on the accuracy of the test results we will select the vendor with a high accuracy rate to run our pole testing and inspection program.

Work to be carried out:

- strength test and collect information required
- determine remaining life from the information gathered, including below-ground-line decay
- based on the field data determine the poles for remedial treatment

Equipment to be used:

- hammer to sound the pole on at least 3 sides in order to detect weaknesses
- drill 12.5 mm (1/2") holes to determine the internal weaknesses and such as advanced internal decay
- pole test to assess individual pole strength at ground line and at other weak locations, which are reachable from the ground
- resistograph to detect internal decay below and at ground line

End products:

- a set of information for each pole tested
- a list of poles to be replaced on the basis of their structural condition
- a digital database with all the relevant information
- a set of tables listing poles with potentially damaging defects such as extensive surface rot, mechanical damage, feathering, woodpecker damage and carpenter ant damage
- remaining pole life

Our ultimate goal is to start a pole testing and treatment program in 2012. We have approximately 13,000 wood poles in our system. We will test and treat 1/3 of these poles annually to help us prioritize our rebuild programs.

11.4 Ten Worst Feeder Study

The IOM outage reports are used to identify the worst performing feeders by analyzing historical outage data. Some of the measures typically looked at are: number of outages, total customer outage minutes, number of customers affected and number of auto reclosures. Feeders are ranked based on the outage types by weighting factors. The highest scores indicate feeders which are identified as needing additional review to determine action plans. This analysis assists in determining future overhead and underground maintenance programs. The studies will be continually updated in order to capture the reliability improvements in the areas that are being addressed and to find out what new areas should be considered in the future.

The historical worst feeders are shown in Figure 11.1 below.

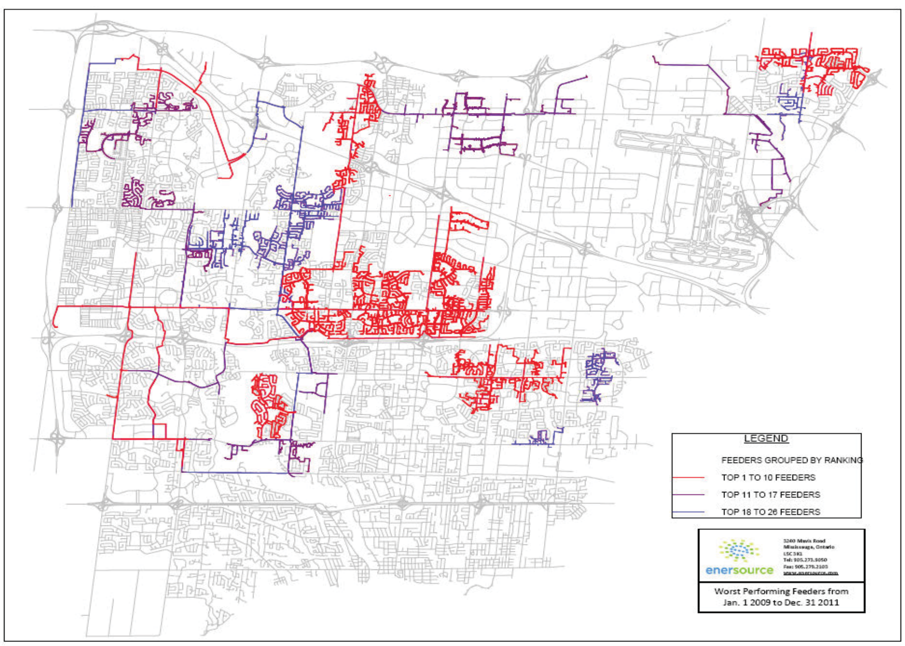


Figure 11.1 – Enersource Worst Feeder Map (2009-2011)

11.5 Major Outage Cause Study

Using the worst feeder study data the feeders are further analyzed to determine the cause or driving factor which caused the outage.

Examples of three (3) significant outage causes are:

- cable failure
- animal contact and
- weather related

Feeder failures due to cable failure are candidates for future underground subdivision rebuild programs are shown in Figure 11.2 below.

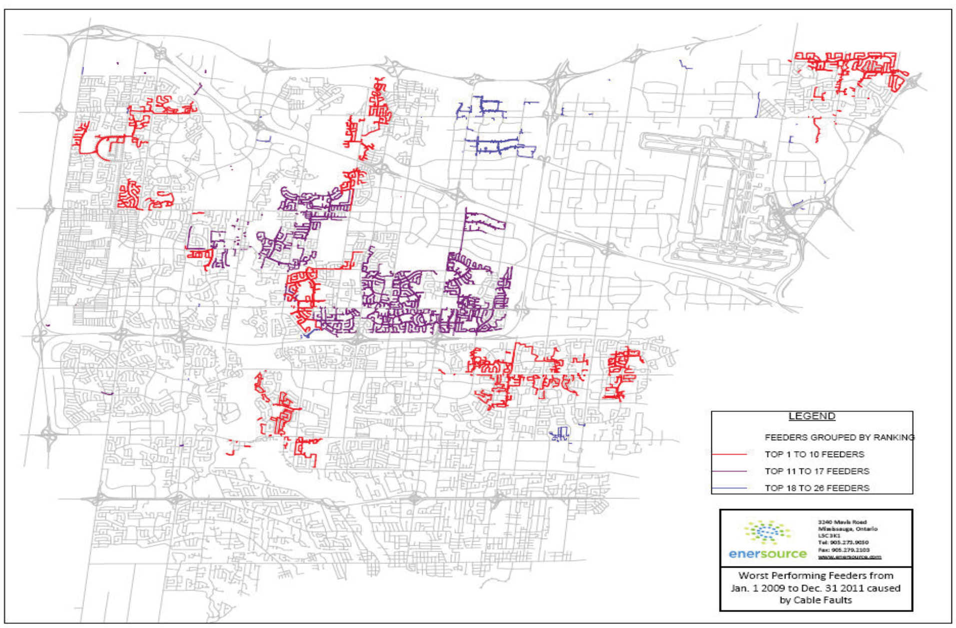


Figure 11.2 – Enersource Worst Feeder Due to Cable Faults (2009-2011)

Feeder failures due to animal contact are candidates for future maintenance programs such as vegetation management and animal protection programs are shown in Figure 11.3 below.

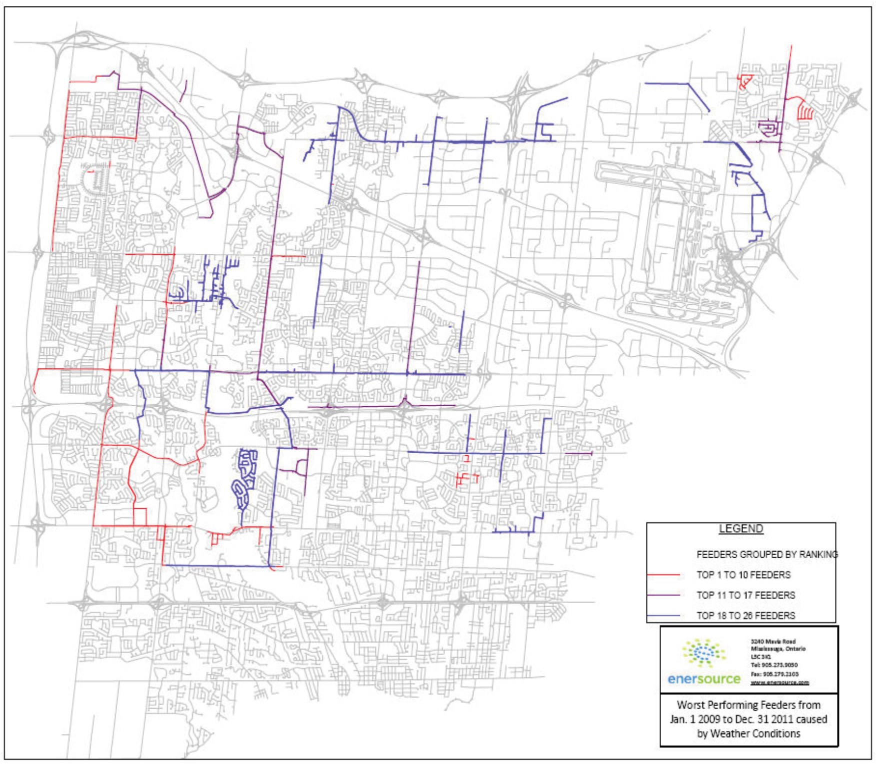


Figure 11.3 – Enersource Worst Feeder Due to Animal Contact (2009-2011)

Feeder failures which are weather related are candidates for future vegetation management and overhead rebuild programs are shown in Figure 11.4 below.

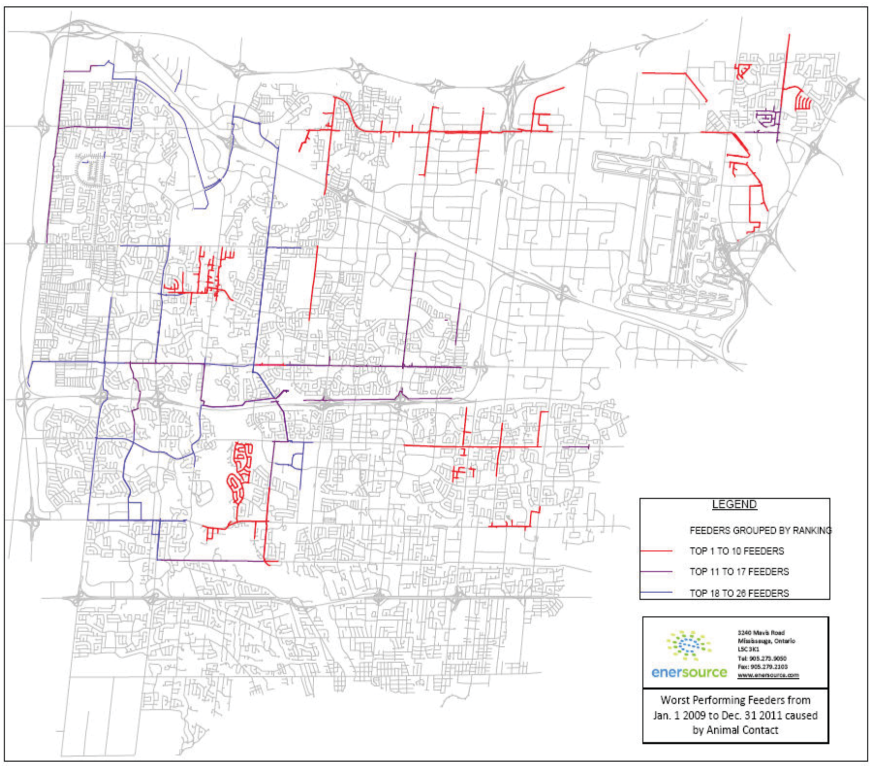


Figure 11.4 – Enersource Worst Feeder Due to Inclement Weather (2009-2011)

INVESTMENT PROGRAM

12. System Capacity – Growth Driven Investment

Growth-driven capital projects ensure the continuation of Enersource's capability to provide a secure and reliable supply of electricity to its customers. Growth is predicted through the combined use of 1) growth projections, 2) historical growth patterns and 3) load forecast models.

This section has two components:

- Subtransmission and Distribution Program
- Municipal Substation Construction and Upgrades Program

For major programs and projects, further details can be found in the appendix of this report.

12.1 Subtransmission and Distribution Program

Projects are designed to increase the capacity of the power system by installing new feeders in response to system load growth forecasts.

In 2010, Enersource delivered almost 8,000 GWh to its customers. Approximately 37% of the power was delivered to large industrial and commercial customers, who account for only 0.2% of the total number of Enersource customers. Individual large customers can add significant load to the system and provide unique challenges to connect and supply. Some customers may need to be connected in areas where there is insufficient capacity, necessitating construction of new feeders or substations to meet their specific needs

12.1.1 Subtransmission and Distribution Program Projects

The following list identifies the major projects that are scheduled for construction in 2012:

44/13.8kV Dundas Street – Glengarry Rd to Mississauga Road

The rebuild of the existing section of the pole line on Dundas Street between Glengarry Road and Mississauga Road is urgent, as the pole line is near the end of its life. In addition to the replacement of the existing circuits, a new 44kV feeder tie will be constructed to add capacity and help with operational requirements, enhance load balancing on the feeders in the area, as well as, improve reliability and system losses. This project requires the replacement of the existing pole line with the installation of new overhead plant with two 8/13.8kV and two 44kV circuits along Dundas Street from Glengarry Road to Mississauga Road.

McNiece MS Feeders – CN Railway Relocations

Completion of this project is necessary to avoid substantial costs associated with rent or purchase of the property along the railroad tracks from CN Railway. This project will allow year round access to the equipment, provide additional backup in the surrounding area and replace near end of life assets. Access has become severely limited due to railway build out. This project will allow

Enersource to fully utilize McNiece MS's assets. This project requires the removal of the existing 16/27.6kV and 2.4/4.16kV overhead lines along railway corridor and installation of underground main feeder circuits on Queen Street West from McNiece MS to Ibar Way.

Revus MS Feeders – CN Railway Relocations

Completion of this project is necessary to avoid substantial costs associated with rent or purchase of the property along the railroad tracks from CN Railway. This project will also allow improved access to the equipment by Enersource personnel, provide additional backup in the surrounding area and replace near end of life assets. Access has become severely limited due to railway build out. Also, this project will provide the necessary connections for the new modular type of 27.6/4.16kV Revus MS. This project requires the removal of the existing 16/27.6kV and 2.4/4.16kV overhead lines installed along the CN Railway tracks. A new pole line on Revus Avenue and Enola Avenue from Revus MS to Lakeshore Road E. will be installed.

The Queensway – Hurontario Street to Camilla Road

This project is necessary to facilitate the rebuild of Melton MS. Also, currently, there are two parallel pole lines along The Queensway between Camilla Road and Hurontario Street that will be converted to a single pole line and connected to the MS. This project will enable future construction of the 2.4/4.16kV ties between Melton MS and Cawthra Road. This enables better utilization of Melton MS, adds capacity to support operational requirements, enhance load balancing on the 2.4/4.16kV feeders in the area, and improves reliability. This project's requires the transfer of the existing 2.4/4.16kV circuits from a difficult to access right-of-way (ROW) to a more accessible 16/27.6kV pole line on The Queensway East. In addition, several termination poles at Melton MS will have to be relocated to facilitate the new connection points at the MS.

Hurontario Street and QEW Overpass

This project is needed to restore the North and South 2.4/4.16kV and 16/27.6kV feeder ties that were removed during the QEW interchange construction. Currently, there are two pole lines on Hurontario Street, one on the north side and one on the south side of QEW. This project will create ties, enable better utilization of Melton MS, enhance load balancing on the 2.4/4.16kV and 16/27.6kV feeders in the area, and improve reliability. This project requires construction of a new pole line link with two 2.4/4.16kV and two 16/27.6kV circuits along Hurontario Street from Premium Way to South Service Road.

Clarkson Rd – Lakeshore Road to Hydro One ROW

This project is required to allow full utilization of Clarkson MS, reduce outages in the area caused by animal and tree contacts and improve operational flexibility, feeder loading and contingency restoration. In addition, the pole line is near the end of its expected life and needs to be rebuilt to prevent any safety hazards that may arise from failure. This project's requires replacement of the existing wood pole line with undersized, #6 copper wire, with a new pole line that will carry two full capacity 2.4/4.16kV circuits constructed from 556 ASC Tree Wire.

Dundas Street – Jaguar Valley to Cawthra Road

The rebuild of the existing pole line on Dundas Street from Jaguar Valley to Cawthra Road is urgent, as the pole line is near the end of life. In addition to the replacement of the existing circuits, two new 44kV feeders will be constructed on the new pole line to add capacity and help with operational requirements, enhance load balancing on the feeders in the area, as well as, improve reliability and system losses. The new pole line will support two new 44kV circuits and two existing circuits, one 8/13.8kV and one 2.4/4.16kV.

The following list shows some of the projects that are proposed for construction in 2013:

44kV Churchill Meadows TS Feeder Egress – along Hydro One Right of Way

This project requires construction of a new pole line on Hydro One ROW, just north of Hwy 403, between Churchill Meadows TS and Winston Churchill Boulevard with four egress 44kV feeders.

Royal Windsor – Winston Churchill to Avonhead Road

This project is a rebuild of the existing overhead pole line on Royal Windsor Drive between Winston Churchill Boulevard and Avonhead Road with the addition of a second 2.4/4.16kV circuit.

Lakeshore Road – Hurontario Street to Cawthra Road

This project is a rebuild of the existing overhead pole line on Lakeshore Road between Hurontario Street and Cawthra Road with the addition of a new 16/27.6kV circuit. The new pole line will have two 2.4/4.16kV and two 16/27.6kV circuits.

Lakeshore Road – Hurontario Street to Kane Road

This project is a rebuild of the existing pole line on Park Street between Hurontario Street and Kane Road with the addition of a new 16/27.6kV circuit. The new pole line will have two 2.4/4.16kV and two 16/27.6kV circuits.

The Queensway – Cawthra Street to Dixie Road

This project requires installation of two new 2.4/4.16kV circuits on the existing concrete pole line on The Queensway East, between Cawthra Road and Stanfield Road. A new pole line between Stanfield Road and Dixie Road will also be built with two 16/27.6kV and two 2.4/4.16kV circuits, which will be tied to the existing circuits on Dixie Road.

Burnhamthorpe Road West – Winston Churchill Boulevard to Ridgeway Drive

This project requires construction of a new pole line with two 8/13.8kV circuits on Burnhamthorpe Road West between Winston Churchill Boulevard and Ridgeway Drive. The new pole line will have two 8/13.8kV circuits.

Subtransmission and Distribution historical and proposed funding from 2006 through 2016 is shown in Table 12.1 below.

Description	Actual					Forecast				
	2007 CGAAP	2008 CGAAP	2009 CGAAP	2010 CGAAP	2011 IFRS	2012 IFRS	2013 IFRS	2014 IFRS	2015 IFRS	2016 IFRS
Subtransmission and Distribution	5,358	4,584	8,290	3,515	4,735	4,010	5,832	4,545	4,723	4,901

Table 12.1 – Table of Enersource System Capacity – Subtransmission and Distribution Investment ($'000)

12.2 Municipal Station Construction and Upgrades Program

Substation construction program projects are designed to increase the capacity of the power system by installing new substations and feeders in response to system load growth forecasts.

MS's transform power from 44kV to 8/13.8kV or from 16/27.6kV to 2.4/4.16kV. MS's are capital intensive and make up a major component in the electricity system. Impact from a failure of a major MS can be very significant due to the large number of customers affected. The outage length duration to an MS failure is usually relatively long due to the amount of switching required to supply customers from other nearby stations.

To ensure adequate reliability, all major substation equipment such as power transformers, high and low voltage switchgear is closely monitored by the SCADA system. Yearly oil sample tests are completed to analyze the condition of the MS transformers. This information is one of several factors used to determine if transformers require replacement, service, or additional monitoring.

12.2.1 Municipal Station Construction and Upgrades Program Projects

Every five years Municipal Stations are taken out of service to complete preventative maintenance to sustain and maximize life expectancy of the substation and its vital components. The component replacement program addresses individual assets such as breakers, protection relays, transformers, enclosures, tap changers, switchgear and battery chargers that have reached the end of their service lives and are no longer capable of fulfilling their intended function.
List of major 2012 proposed projects:

<u>Melton MS rebuild</u>

The existing substation is comprised of two transformers and 4 switchgear units with the oldest component being 56 years old. All components have reached end of life with the exception of the 3T2 transformer. The switchgear has deteriorated to the point that operating restrictions have been implemented to ensure safety for our field personnel. The project includes the addition of an oil containment system, fence upgrade, battery charger system and upgrade to remote terminal equipment. The existing 3T2 transformer is 24 years old and will be inventoried as a system spare.

Erin Mills Town Centre MS

A new substation is being constructed to meet emerging system growth. This new substation is in the Erin Mills area of Mississauga. This new substation will include a new building, one 20 MVA power transformer, one 44kV switchgear and one line up of 8/13.8kV switchgear. The design will have 8 egress feeders into the distribution system servicing the neighborhood. The design will allow for future addition of a second 20 MVA transformer when required.

Kamato MS 8/13.8kV Switchgear Replacement

The 8/13.8kV switchgear at Kamato MS is 24 years old and has deteriorated to the point that safety barriers for field staff needed to be installed in order to operate successfully. Temporary operating instructions have been implemented, however, due to the safety and reliability concern with this particular switchgear. A complete replacement is required to bring the switchgear to a level of safe standard operating procedures. The replacement will include new protection relays and remote terminal equipment.

Avonhead MS Rebuild

The power transformer is 50 years old and from the oil analysis it has reached end of life and needs to be replaced. As part of this rebuild, transformer protection devices will be upgraded to standard circuit breakers.

List of major 2013 proposed projects:

Parkwest MS Rebuild

The existing substation is comprised of a 37 year old transformer and 4 reclosers that have reached end of life. The project will include the addition of an oil containment system, fence upgrade, battery charger system and upgrade of remote terminal equipment.

Revus MS Rebuild

The existing substation is comprised of a 43 year old transformer and 4 reclosers that have reached end of life. The project will include the addition of an oil containment system, fence upgrade, battery charger system and upgrade of remote terminal equipment.

Cawthra MS 2.4/4.16kV Switchgear Replacement

The 2.4/4.16kV English Electric switchgear at Cawthra MS is 55 years old and has reached end of life. The switchgear has deteriorated to the point that safety for field staff is a concern. Temporary operating Instructions have been implemented, however, due to the safety and reliability concern with this particular switchgear, a complete replacement is required to bring the switchgear to a level of safe standard operating procedures. The replacement will include new protection relays and remote terminal equipment.

Woods MS 8/13.8kV Switchgear Replacement

The 8/13.8kV switchgear at Woods MS is 22 years old and has deteriorated to the point that safety barriers for field staff are needed to be removed in order to operate the equipment successfully. Temporary operating instructions have been implemented, however, due to the safety and reliability concern with this particular equipment, a complete replacement is required to bring the switchgear to a level of safe standard operating procedures. The replacement will include new protection relays and remote terminal equipment.

Matheson MS 8/13.8kV Switchgear Replacement

The 8/13.8kV switchgear at Matheson MS is 22 years old and has deteriorated to the point that safety barriers for field staff are needed to be removed in order to operate successfully. Temporary operating instructions have been implemented, however, due to the safety and reliability concern with this particular equipment, a complete replacement is required to bring the switchgear to a level of safe standard operating procedures. The replacement will include new protection relays and remote terminal equipment.

Substation Construction program historical and proposed funding from 2007 through 2016 is shown in Table 12.2 below.

Description	Actual					Forecast				
	2007 CGAAP	2008 CGAAP	2009 CGAAP	2010 CGAAP	2011 IFRS	2012 IFRS	2013 IFRS	2014 IFRS	2015 IFRS	2016 IFRS
Municipal Substation Construction & Upgrades	3,962	5,714	7,500	6,692	5,650	5,302	5,302	5,784	5,784	5,784

Table 12.2 – Table of Enersource System Capacity – Substation Construction Investment ($'000)

Total Growth Driven Investment program historical and proposed funding from 2007 through 2016 is shown in Table 12.3 below.

Description	Actual					Forecast				
	2007 CGAAP	2008 CGAAP	2009 CGAAP	2010 CGAAP	2011 IFRS	2012 IFRS	2013 IFRS	2014 IFRS	2015 IFRS	2016 IFRS
Subtransmission and Distribution	5,358	4,584	8,290	3,515	4,735	4,010	5,832	4,545	4,723	4,901
Municipal Substation Construction & Upgrades	3,962	5,714	7,500	6,692	5,650	5,302	5,302	5,784	5,784	5,784
Total	**9,320**	**10,299**	**15,791**	**10,207**	**10,385**	**9,312**	**11,134**	**10,329**	**10,507**	**10,686**

Table 12.3 – Table of Enersource System Capacity – Growth Driven Investment ($'000)

13. System Sustainment – Reliability Driven Investment

Maintaining reliability is one of the key success factors of Enersource. To maintain reliability Enersource actively tracks outage cause and effects. Based on this information Enersource has ongoing rebuild, upgrade and replacement programs. For major programs and projects, further details can be found in the appendix of this report.

This section has five components:

- Subdivision Rebuilds Program
- Overhead Distribution Sustainment
- Underground Distribution Sustainment
- Transformer Replacement
- Automated Switches / SCADA Program

13.1 Subdivision Rebuild Program

Underground cable failures are the leading cause of equipment failures in the distribution system. To address this risk Enersource plans and executes a cable replacement program. On an annual basis, the worst performing areas of the underground cable system are identified.

Some of the criteria used to identify the worst performing areas include: number of cable failures, age of the cable and cable type installed. Cables older than 35 years are not jacketed and are therefore more susceptible to failure. Typical life expectancy for new replacement underground cable is approximately 40 years.

The actual locations of the yearly rebuild projects are prioritized after the hot summer months when the underground cable system is placed under its most stressful conditions due to high loading. Once the rebuild locations are selected, the projects are included in the following year's capital rebuild plans, budgeted for and designed. To optimize work efficiencies, rebuild projects typically involve the replacement of the complete underground system including cables, transformers, switchgear and other system components that are also near the end of their useful life.

The following criteria are used to identify underground cable replacement projects:

- number of cable failures in the present year
- number of cable failures in the last 2 - 5 years
- number of cable failures in the last 6 - 10 years
- age of the plant
- cable size (main feeder / local distribution) higher priority given to main feeder cables
- system reliability (number of customer's effected and customer minutes)
- existing design (rear lot, no backup, undersized cables)

Figure 13.1 below shows a ten year history of underground cable failures. Each point represents a cable failure. This gives an indication of worst performing distribution areas. Main feeder and distribution cable failures are tracked separately to assist with prioritizing rebuild areas.

Cable failures are then grouped according to distribution feeder layout and street configurations. Typically main feeder cables must be replaced from switchgear to switchgear location in a single rebuild project, whereas local distribution feeders can be installed in project phases. The "oval" rings in Figure 13.1 below represent areas which have been identified as possible rebuild areas.

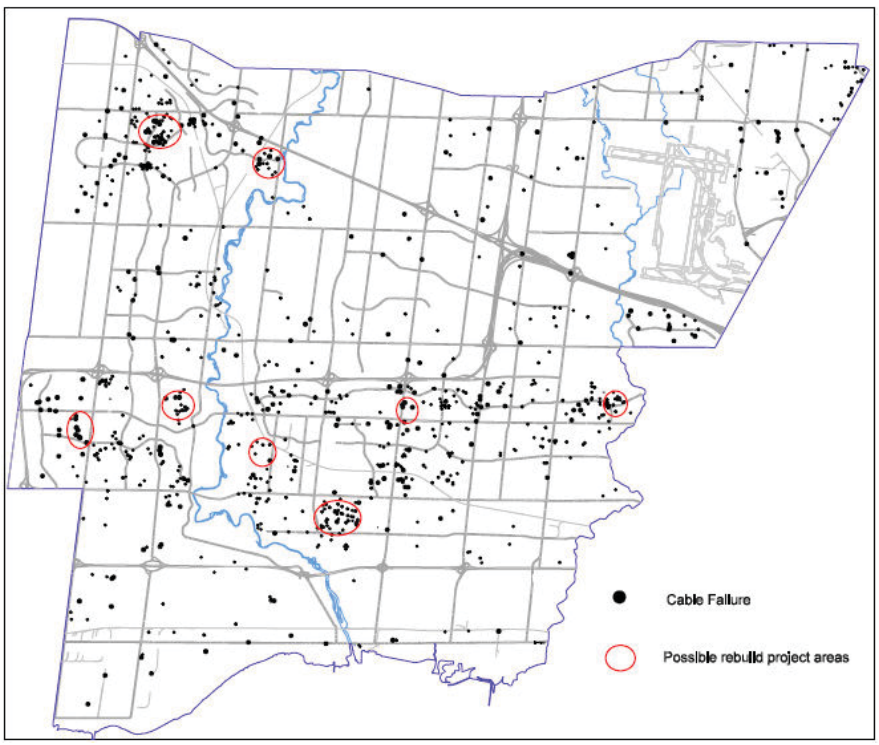


Figure 13.1: Ten year history of underground cable failures

Figure 13.2 below shows a close up pictorial of a segment of Mississauga showing 3 potential rebuild areas. The cable rebuild projects identified by the "oval" ring in this map are:

- Aquitaine and Montevideo Phase 1
- Campobello and Falconer
- Aquitaine and Montevideo Phase 2

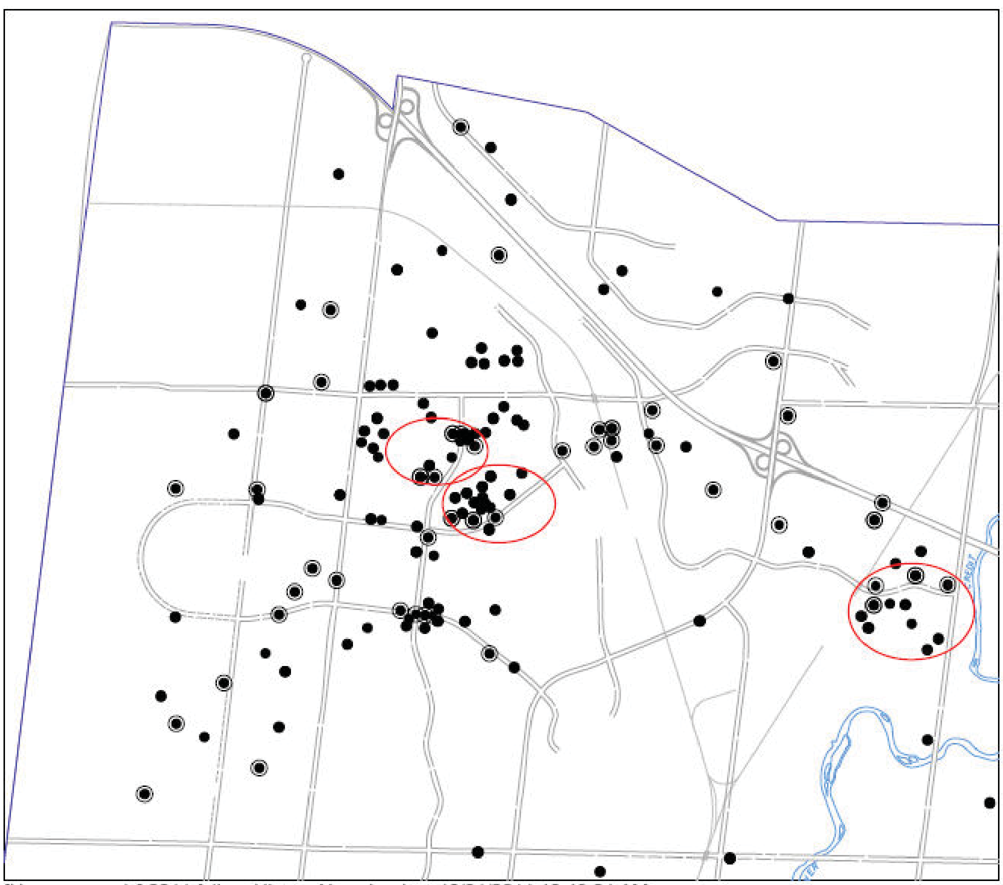


Figure 13.2: History of U/G cable failures in NW District

Table 13.1 below shows a list of underground rebuild projects proposed to be implemented in 2012. These projects have been prioritized based on the selection criteria shown.

Rebuild Areas	LOYALIST	AQUITAINE & MONTEVIDEO PH 1	CAMPOBELLO & FALCONER	ROBERT SPECK	PAISLEY BLVD W & WHALEY DR	AQUITAINE & MONTEVIDEO PH 2	PONYTRAIL & RATHBURN	CULLEN AVE	FARMACOTTAG E	ELENGALE DR
Main feeder Cable	X	X	X	X						
# of faults 2011	3	2	1	1		1			1	
# of faults last 2-5 years	4	2	2	3	1	2	1		3	
# of faults last 6-10 years	1	1		3			2	2		1
Distribution Cable					X	X	X	X	X	X
# of faults 2011		1			6	5	6	1	1	
# of faults last 2-5 years		5	5		4	5	3	9	2	3
# of faults last 6-10 years	1		2		6	3	1	3	5	2
Age of a cable (years)	30	38	33	30	35	35	32	35	32	45
Customers Effected	3700	1100	525	800	650	523	800	1700	1200	725
Customer Minutes	300K	260K	300K	60K	250K	193K	100K	125K	149K	38K
Existing Design	Front Lot	Front Lot	Front Lot	Front lot	Rear Lot	Front Lot	Front Lot	Front Lot	Front Lot	Radial

Table 13.1: Selection Criteria for selecting 2012 UG Rebuild Project

13.1.1 *Subdivision* Rebuild Program Projects

List of identified 2012 projects:

Loyalist Drive Main Feeder Rebuild

The underground cable system along Loyalist Drive is over 30 years old and has had 11 cable failures in the last 6 years, affecting approximately 3,700 customers multiple times for a total of 300,000 customer minutes outage. In addition this area has a natural occurring sulfur material in the ground which is causing the concentric neutral strands of the cable to fail prematurely. The project involves the replacement of 9,000m of 750kcmil cable and 5 switchgears improving the reliability to 3,700 customers.

Aquitaine Avenue and Montevideo Road Phase 1 Rebuild

The underground cable system along Aquitaine Avenue and Montevideo Road is over 38 years old and has had 10 cable failures in the last 4 years, affecting approximately 1,100 customers multiple times for a total of 260,000 customer minutes outage. The project involves the replacement of 2,300m of 750kcmil main feeder, 2,000m of local distribution feeder cables, 3 switchgears and 22 transformers. This project will improve the reliability to 1,100 customers.

Campobello Road and Falconer Drive Main Feeder Rebuild

The underground cable system along Campobello Road and Falconer Drive is over 33 years old and has had 10 cable failures in the last 4 years, affecting approximately 525 customers multiple times for a total of 300,000 customer minutes outage. This project involves the replacement of 4,000m of 350kcmil main feeder cables, 2 switchgears and 25 transformers. This project will improve the system reliability to 525 customers.

Robert Speck Parkway Main Feeder Rebuild

This underground cable system on Robert Speck Parkway is over 30 years old and has had 7 cable failures in the last 7 years, affecting approximately 800 customers multiple times for a total of 60,000 customer minutes outage. The project involves the replacement of 7,500m of 750kcmil cables, improving the reliability to 800 customers.

Paisley Boulevard and Whaley Drive Rebuild

The underground cable system along Paisley Boulevard and Whaley Drive is over 35 years old and has had 11 cable failures in the last 4 years, affecting approximately 650 customers multiple times for a total of 250,000 customer minutes outage. The project involves the replacement of approximately 4,000m existing local distribution feeder cables, 40 transformers and 516 secondary services. This project will improve the reliability to 650 customers.

Aquitaine Avenue and Montevideo Road Phase 2 Rebuild

The underground cable system along Aquitaine Avenue and Montevideo Road is over 35 years old and has had 16 cable failures in the last 6 years, affecting approximately 523 customers multiple times for a total of 193,000 customer minutes outage. The project involves the replacement of approximately 5,000m of existing local distribution feeder cables, 35 transformers and 523 services. This project will improve the reliability to 1,650 customers.

Ponytrail Drive and Rathburn Road Rebuild

The underground cable system along Ponytrail Drive and Rathburn Road is over 32 years old and has had 10 local distribution feeder cables failures in the last 6 years, affecting approximately 800 customers multiple times for a total of 100,000 customer minutes outage. The project involves the replacement of 4,300m of 1/0 cables, 25 transformers and 276 services. This Project will improve the reliability to 800 customers.

Cullen Avenue Rebuild

The underground cable system along Cullen Avenue area is over 35 years old and has had 10 cable failures in the last 6 years, affecting approximately 1,700 customers multiple times for a total of 125,000 customer minutes outage. The project involves the replacement of 2,000m of local distribution feeder cables, 25 transformers and 260 secondary services. This project will improve the reliability to 1,700 Customers.

Farmcottage Court Rebuild

This underground cable system in Farmcottage Court area is over 32 years old and has had 10 local distribution feeder cables failures in the last 6 years, affecting approximately 1,200 customers multiple times for a total of 149,000 customer minutes. The project involves the replacement of 3,000m of 1/0 cables and 40 transformers. This project will improve the reliability of 1,200 customers.

Ellengale Drive Rebuild

This underground cable system along Ellengale Drive is over 45 years old and has had 7 local distribution feeder cables failures in the last 10 years, affecting approximately 725 customers multiple times for a total of 38,000 customer minutes. The project involves the replacement of 1,100m of 1/0 cables, 8 transformers and 92 secondary services. This project will improve the reliability to 725 customers.

Figure 13.3 below identifies the location of proposed 2012 underground cable rebuild projects.

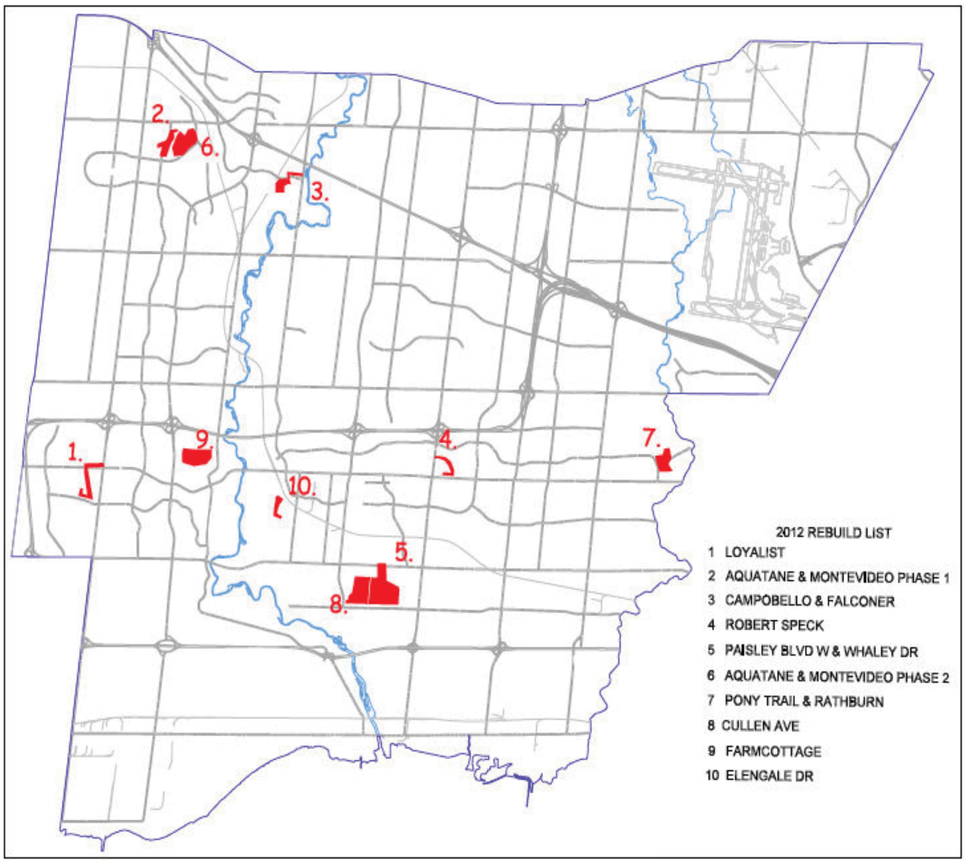


Figure 13.3: Underground Rebuild Project 2012

Sherobee Road Rebuild

In addition to the above projects this rebuild is also required. This project involves replacement of 4 non-standard power transformers, along with the associated accessories and cables. These installations are more than 35 years old. The replacement is also necessary since a recent dissolved gas-in oil analysis of the transformers is well below the acceptable limit. In addition, the units are not a stock item, hence Enersource does not have backup equipment for these installations. If one of the transformers fail, the customers may be subjected to lengthy unscheduled outage, inconvenience and Enersource will likely be required to install temporary generators for an extended period of time until new transformers are purchased and installed.

List of identified 2013 projects:

Mississauga Valley & Bloor St Rebuild

This underground cable system along Mississauga Valley Boulevard and Bloor St is over 38 years old and has had 6 cable failures in the last 5 years, affecting approximately 2250 customers multiple times for a total of 170,000 customer minutes outage. This project involves the replacement of 1,300m of main feeder cable and 3.8km of local distribution cables, 2 switchgears and 40 single phase transformers and 420 secondary services.

Abana Road Rebuild

This underground cable system along Abana Road, Boismere Court, Asta Drive and Pashak Court is over 41 years old. This area has several leaking transformers and few PCB transformers. The project involves the replacement of approximately 2,000m of local distribution feeder cables, 25 single phase transformers and 150 secondary services.

Middlebrook Street Rebuild

This underground cable system along Middlebrook Street, Darcel Avenue and Longo Circle is over 35 years old and has had 11 cable failures in the last 5 years, affecting approximately 8330 customers multiple times for a total of 122,000 customer minutes outage. The project involves the replacement of approximately 4,200m of local distribution feeder cables, 50 single phase transformers and 400 secondary services.

Isabella & Kenbarb Road Rebuild

This underground cable system along Kenbarb Ave, Isabella Street , Mervette Court and Medhat Drive is over 36 years old and has had 7 cable failures in the last 5 years, affecting approximately 500 customers multiple times for a total of 60,000 customer minutes outage. The project involves the replacement of approximately 3,000m of local distribution feeder cables, 20 single phase transformers and 200 secondary services.

Remea Court Rebuild

This underground cable system along Remea Court, Taffy Crescent and Gayline Gardens is over 35 years old and has had 9 cable failures in the last 5 years, affecting approximately 900 customers multiple times for a total of 113,000 customer minutes outage. The project encompasses the replacement of 2,100m of local distribution feeder cables, 20 single phase transformers and 200 secondary services.

Forestwood & Lindenle Rebuild

This underground cable system along Forestwood Drive , Lindenle Drive and Lenester Drive is over 45 years old and has had 7 cable failures in the last 5 years, affecting approximately 780 customers multiple times for a total of 105,000 customer minutes outage. The project involves the replacement of 5,000m of local distribution feeder cables, 50 single phase transformers and 350 secondary services.

Copenhagen & Fayet Circle Rebuild

This underground cable system along Copenhagen Road and Fayet Circle is over 35 years old and has had 7 cable failures in the last 5 years, affecting approximately 950 customers multiple times for a total of 104,000 customer minutes outage. The project involves the replacement of 3,500m of local distribution feeder cables, 20 pad mounted residential transformers and 350 services.

Subdivision Rebuilds program historical and proposed funding from 2007 through 2016 is shown in Table 13.2 below.

Description	Actual					Forecast				
	2007 CGAAP	2008 CGAAP	2009 CGAAP	2010 CGAAP	2011 IFRS	2012 IFRS	2013 IFRS	2014 IFRS	2015 IFRS	2016 IFRS
Subdivision Rebuilds	5,972	7,669	8,354	7,349	6,279	7,356	7,847	8,828	9,808	10,789

Table 13.2 – Table of Enersource System Sustainment – Subdivision Rebuilds Investment ($'000)

13.2 Overhead Distribution Sustainment

Projects under this program deal with the replacement of overhead pole lines that have reached their expected end of life.

13.2.1 Overhead Rebuild Program

The Overhead Rebuild Program is required for maintaining the existing overhead distribution infrastructure and ensuring it is kept at a safe and acceptable performance level.

Pole lines deteriorate over time and their strength may be reduced which introduces a risk of failure, especially under adverse weather conditions. Projects under this program deal with the replacement of overhead pole lines that have reached their expected end of life.

The main components of the overhead system are poles, pole top transformers, switches, conductors and associated overhead hardware such as insulators, fuses and arresters. According to the "Asset Condition Assessment" summarized in Section 8 of this report, the average expected life for wood poles is 45 years and 55 years for concrete poles. The same report also shows the average expected life for overhead transformers to be 45 years. In addition field assessments are carried out by operational personnel while doing work in the area, such as switching and responding to trouble calls in the area. This information along with other data such as system loading, customer outage impact, non-compliance with the current standards, reliability performance and an assessment of the future risks to public safety, allow Enersource to identify locations to be considered for overhead rebuild projects. Overhead rebuild projects include the replacement of poles, primary and secondary conductors, down guys, brackets, cross arms, insulators and transformers, as required.

13.2.2 Overhead Rebuild Program Projects

List of identified 2012 projects:

Old Meadowvale Village Overhead Conversion

Old Meadowvale Village is located in one of the older parts of Mississauga and the only area with a 4.8/8.3kV system in the northern part of the city. This area of 4.8/8.3kV system is a small pocket that is surrounded by 16/27.6kV system. Also this area has long runs of secondary services creating power quality issues to the customers. The existing pole line on Second Line West, Barberry Lane, Old Mill Lane and Pond Street will be rebuilt. The voltage in this area will be converted from 4.8/8.3kV to 16/27.6kV. This project includes the replacement of 56 wood poles, 6 transformers and 200m of primary wires, 2,500m of secondary conductors, 3 in-line switches and transfer approximately 40 existing services. This project is contingent on getting a Herritage Permit from the city.

Lorne Park Estate Rebuild

The existing pole line on Tennyson Avenue, Roper Avenue, Henderson Avenue, Long Fellow Avenue, Sangster Avenue, Chaucer Avenue, McConnell Avenue and Burns Avenue will be rebuilt. This project includes the replacement of 52 wood poles, 9 transformers, 1,200m of primary wires, 3,500m of secondary conductors, 2-in-line switches and transfer approximately 54 existing services. This project is contingent on getting ratepayer co-operation.

Martley Drive Rebuild

The existing pole line on Martley Drive will be rebuilt. This project includes the replacement of 15 wood poles, 2 transformers, 260m of primary wires, 400m of secondary wires and transfer of approximately 25 existing services.

Orchard Road Rebuild

The existing pole line on Orchard Road will be rebuilt. This project includes the replacement of 8 wood poles, 2 transformers, 250m of primary wires, 500m of secondary conductors and transfer of approximately 35 existing services.

Birchwood Drive Rebuild

The existing pole line on Birchwood Drive, Sayers Road and Ravine Drive will be rebuilt. This project includes the replacement of 16 wood poles with concrete poles, 2 transformers, 1,800m of primary wires, 750m of secondary wires and transfer of approximately 20 existing services.

Bremen Lane Rebuild

Bremen Lane is an area with an overhead and underground combination, which is a radial system. This area is selected to provide a backup supply to the area by adding 2 extra phases to the existing 1 phase primary wire. The existing pole line on Bremen Drive, Hammond Road and Morgan Avenue will be rebuilt. This project includes the replacement of 14 wood poles, 2 transformers, 300m of primary wires, 600m of secondary wires and transfer approximately 37 existing services.

A map of overhead rebuild projects proposed for 2012 is provided in Figure 13.4 below:

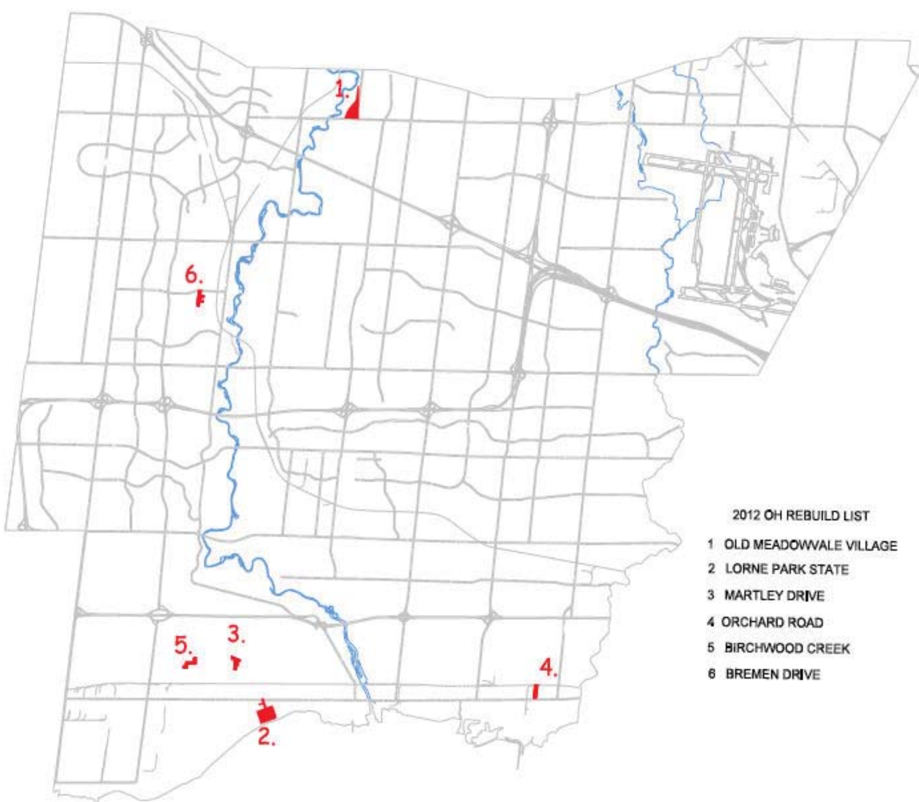


Figure 13.4: Overhead Rebuild Projects 2012

List of identified 2013 projects:

Cortland Crescent

The existing pole line on Courtland Crescent, Harvest Drive, Primate Road and Wealthy Place will be rebuilt. This project includes the replacement of 40 wood poles, 9 single phase transformers 2400m of local distribution wires, 2500m secondary wires and 227 secondary services.

Edenhurst Drive

The existing pole line on Edenhurst Drive, Randi Road and McGill Street will be rebuilt. This project involves the replacement of 36 wood poles, 7 single phase transformers 2800m of local distribution wires, 3000m secondary wires and 132 secondary services.

Birchview Drive

The existing pole line on Birchview Drive and South Aldo Drive will be rebuilt. This project involves the replacement of 32 wood poles, 9 single phase transformers 3350m of mainfeeder wires, 1600m secondary wires and 48 secondary services.

Clarkson Road South

The existing pole line on Clarkson Road South and Sunningdale Bend will be rebuilt. This project involves the replacement of 43 wood poles, 13 single phase transformers 3000m of local distribution wires, 2800m secondary wires and 64 secondary services.

Munden Road

The existing pole line on Munden Road and Pear Tree Road will be rebuilt. This project involves the replacement of 29 wood poles, 5 single phase transformers 800m of local distribution wires, 2200m secondary wires and 85 secondary services.

The Greenway

The existing pole line on The Greenway will be rebuilt. This project involves the replacement of 21 wood poles, 5 single phase transformers 900m of local distribution wires, 2000m secondary wires and 31 secondary services.

13.2.3 Overhead Switch Sustainment Program

Switches are one of the key components of the power system. They are used to reconfigure an electrical circuit by interrupting the current flow, or to isolate conductors. In addition, fused switches are used to protect transformers and underground conductors under fault conditions.

Enersource utilizes four types of overhead switches:

- loadbreak switches (load interrupter)
- remotely controlled switches
- in-line switches
- fused cutouts

In most cases when a failure of an overhead switch occurs, it is caused by contamination of the insulator, which will lead to a flashover and possibly degradation of the insulating medium. Sometimes contamination will cause leakage current to develop across the insulator, or other parts of the switch that are not meant to carry current. As a result, these parts may overheat and cause the switch to fail. Also, the loadbreak switches have mechanisms that suppress the arc when the switch contacts are opening, which sometimes fail, causing arcing and damage to the switch contacts.

In addition, when overhead switches are not operated over a long period of time, the switch contacts seize, preventing the crew from operating the switch.

System impact from a failure of an overhead switch is very significant, as typically they would be installed on the overhead main feeders that may supply multiple municipal stations or subtransmission feeders. Failure of an overhead switch installed near a TS may directly disturb power to several thousand customers, including large commercial and industrial customers.

13.2.4 Overhead Switch Sustainment Program Projects

To ensure that switches on the system are in proper working condition, all switching equipment is inspected with an infrared camera each year for arcing and overheating. If any switches are found faulty, a maintenance crew is dispatched to investigate. Depending on the severity of the defect, they scheduled to either refurbish or replace the switch.

Moreover, every manual loadbreak switch on the 44kV system is proposed to be taken out of service and maintained every five years. Since remotely controlled switches are installed at the critical points on the system where quick isolation of the fault is essential, their maintenance schedule is every three years.

Also under this program, defective cutouts, insulators and porcelain mid-span openers are replaced with polymer insulators or solid blade switches

13.2.5 Pole Replacement Program

Distribution poles serve as support structures for overhead conductors, switches, transformers and other devices. Poles can be wood, concrete, metal or fiberglass. The majority of the poles on the system are wood or concrete.

Wood poles are naturally grown material; therefore all of the poles differ in internal structure and consequently in mechanical strength. Natural degradation of the pole's strength involves naturally occurring fungi that attack and degrade the wood, which results in decay. The severity of the degradation depends on several factors, such as location, treatment, type of wood and installation practices.

Typically, poles do not fail unless they are exposed to extreme storms, are aged, deteriorated or are damaged in vehicle accidents. Wood poles can also be damaged by woodpeckers, termites or pole fires, which are caused by leakage current from insulator tracking. In addition, to improve appeal, in the past, many wood poles were painted grey. As a result, the paint trapped moisture inside the pole accelerating decay.

Failures of concrete poles may be caused by deterioration of the steel re-bars inside the pole due to an exposure to corrosive chemicals in the soil, or salts used in the winter on the roads. The severity of the degradation depends on several factors such as location, rusting of the exposed re-bars and whether a protective coating was used on the below ground section of the pole.

Since distribution and subtransmission poles support bare overhead wires and other equipment, failure of a pole is very serious, especially since the general public may come in contact with live conductors. In addition, depending on the number of circuits supported by the pole and the voltage, failure may disturb power to thousands of customers.

13.2.6 Pole Replacement Program Projects

In contrast to the overhead rebuild program, this pole replacement program does not target any specific area, but rather poles are replaced individually throughout the city.

Under this program, rather than replacing poles based on their age, location or system improvements, they are replaced based on their condition.

Pole condition is routinely assessed by operational personnel performing work on a pole such as switching or other asset replacement (transformers, insulators, lightning arrestors, etc.). If a deteriorated pole is found, the crew notifies the Control Room of the issue. After further assessment, if necessary, the pole is replaced.

From past experience, it is projected that approximately 50 poles will need to be replaced each year under this program. To support work integration, in addition to the pole itself, the equipment attached to the structure, such as brackets, insulators, transformers, switches, etc. are also reviewed and replaced at the same time if needed.

Overhead Distribution Upgrades program historical and proposed funding from 2007 through 2016 is shown in Table 13.3 below.

Description	Actual					Forecast				
	2007 CGAAP	2008 CGAAP	2009 CGAAP	2010 CGAAP	2011 IFRS	2012 IFRS	2013 IFRS	2014 IFRS	2015 IFRS	2016 IFRS
Overhead Distribution Sustainment	3,332	3,531	4,704	3,799	1,676	2,249	2,727	3,058	2,609	2,789

Table 13.3 – Table of Enersource System Sustainment – Overhead Distribution Upgrade Sustainment (in $'000)

13.3 Underground Distribution Sustainment

13.3.1 Pad Mounted Switchgear Replacement Program

The electrical distribution system consists of several important components to deliver electrical service to our customers. Enersource uses padmounted switchgear as an integral component on the underground primary distribution system. These switchgear units serve as an electrical distribution location as well as a switching point. There are approximately 800 switchgear units in the distribution system of which 8% are motorized and monitored via SCADA. The average installed age of these units is 19 years and 22% of the units are older than 25 years.

Air insulated switchgear have increasingly been experiencing failures due to age, design configurations and application voltage levels. This results in power quality, reliability and maintenance issues. These types of faults may expose customers to multiple power interruptions and may take days to troubleshoot and locate the problem. As Enersource's system ages, this type of failure has become even more prevalent.

Several different options were explored to mitigate the deteriorating performance of air insulated switching units. Enersource has selected solid dielectric technology for the padmounted switchgear replacement program. These units have a projected life span of 50 years and will enhance reliability performance as compared to air insulated switchgear.

13.3.2 Pad Mounted Switchgear Replacement Program Projects

Switchgear units which are in the poorest condition and are situated in critical distribution locations are considered for replacement. Enersource installed 7 solid dielectric units in 2011 and will continue to replace approximately 15 units annually starting in year 2012.

13.3.3 Primary Distribution Equipment Replacement Program

In addition to the main system components such as transformers, switchgears, cables, etc. the underground distribution system also consists of smaller, auxiliary components such as elbows, inserts, lightning arresters, fault indicators, etc. Without these auxiliary accessories, the main components of the system become inoperable; therefore, replacement of this equipment before failure is necessary.

Some of the auxiliary system components, such as elbows and inserts, are used by Enersource personnel to perform switching operations, isolations and restoration. Therefore their condition directly influences system reliability as well as the safe operation of equipment.

The useful life for elbows and inserts, which are used in the operation of transformers, varies significantly. Based on past experience, elbows are found to be in poor shape after 20 to 25 years, and need changing along with their inserts.

Other auxiliary devices, such as fault indicators, are used when troubleshooting an outage on the system. Their proper operation influences restoration time and, in turn, overall reliability of the system. Enersource has found through past experience that 20 years for transformer fault indicators is a typical useful life.

In addition, equipment condition is routinely assessed by operations personnel performing work on a transformer or switchgear, such as switching or other asset replacement. If a defective component is found, the crew notifies the Control Room and a maintenance crew is dispatched to perform necessary repairs when required.

13.3.4 Primary Distribution Equipment Replacement Program Projects

Enersource identifies areas that are to be considered for replacement of elbows, inserts, fault indicators and other minor primary distribution equipment. On an annual basis, approximately 40 fault indicators and 100 sets of elbows and inserts are replaced under this project.

13.3.5 Underground Cable and Splice Replacement Program

Underground primary cables are another key component of the distribution power system. They are one of the most expensive components to replace, due to the high costs of materials and high cost of installation.

Typically, underground cable failures are caused by degradation of the insulation, the dielectric medium that insulates the central conductor from the grounded concentric neutral wires. Insulation failure can be caused by several factors, for example:

- contaminated materials during the manufacturing stage
- poor adhesion of the extruded insulation shield
- imperfections at the conductor shield-insulation interface
- water inside the conductor strands or at the concentric neutral wires
- fault currents
- voltage surges from lightning and switching

Failures of underground cables can be as severe as failures of a pad mounted switchgear. The impact on customers depends on whether the cable is a subtransmission cable, main feeder distribution cable or local distribution feeder cable. The subtransmission cables typically supply a Municipal Substation, therefore a failure of a cable supplying a single station may result in a disruption of power for up to 5,000 customers.

The local distribution feeder cable is connected to a pad mounted switchgear or the overhead distribution system and typically will supply up to 500 customers. Cable failure will result in a power outage to all customers connected and typically will momentarily trip the Municipal Station breaker as the fuse isolates the fault.

In addition to cable spot replacement, this project also incorporates heat shrink splice replacement. In the past, several thousands of heat shrink cable splices were installed on the system. Later, it was discovered that a vast majority of them failed prematurely. As a result, Enersource took a proactive approach and decided to replace all known heat shrink splices with new cold shrink splices that perform considerably better. Cable and splice failures remain the largest contributor to customer outage time.

13.3.6 Underground Cable and Splice Replacement Program Projects

This program was developed on the basis of reliability improvements rather than age demographics. Potential projects are identified based on the total number of customer-hours of interruption due to cable or splice failures. These are typically older sections of underground primary cable that have deteriorated over time and where the underground rebuild needs to be delayed. If the same section of cable has had insulation failures three times in a short period of time and no other cables have failed in the same general area then the practice is to replace that section of cable immediately.

13.3.7 Secondary Cable Replacement Program

The distribution system has approximately 193,000 services in the city, the majority of which are connected to a distribution transformer via underground secondary service cable. Based on past experience, secondary cables are less prone to failure compared to primary cables of the same age, which is mainly due to less electrical stress and fewer fault current spikes. However, when secondary cables fail, they need to be immediately repaired, as they are needed to supply customers with power. Every year a number of underground residential and industrial/ commercial services fail beyond reasonable repair and require complete replacement. These failures typically result in outages to single residential or industrial/commercial businesses.

This cable replacement program does not target any specific area, but rather underground secondary cables, over various parts of the city, that have been determined to be at the end of their useful life. They are replaced individually. Under this program, rather than replacing secondary cables based on their age or size, they are replaced based on their condition and number of failures. This program funds the spot replacement of secondary services, over various parts of the city that are at the end of life and are beyond reasonable repair.

13.3.8 Secondary Cable Replacement Program Projects

This project typically covers replacement of approximately 35 secondary services on an annual basis. Aside from this program, secondary service cables are also replaced under the underground cable replacement program.

Underground Distribution Maintenance program historical and proposed funding from 2007 through 2016 is shown in Table 13.4 below.

Description	Actual					Forecast				
	2007 CGAAP	2008 CGAAP	2009 CGAAP	2010 CGAAP	2011 IFRS	2012 IFRS	2013 IFRS	2014 IFRS	2015 IFRS	2016 IFRS
Underground Distribution Sustainment	2,280	2,320	2,441	2,133	2,332	2,583	2,998	3,228	3,136	3,228

Table 13.4 – Table of Enersource System Sustainment – Underground Distribution Maintenance Investment (in $'000)

13.4 Transformer Replacement

13.4.1 Pad Mounted Transformer Replacement Program

Distribution transformers are one of the key components of the power system. Their purpose is to lower the primary voltage to secondary voltage levels acceptable to residential, industrial or commercial customers.

Typically transformer failures are random events that occur for various reasons. The most common cause of transformer failure is insulation breakdown. Lightning induced failures are typically manifested by turn-to-turn winding failures at or near the end turns of the windings. Lightning surges are random and may be decreased by the installation of lightning arrestors on the distribution system. Deterioration of insulation is also a function of time and temperature. Transformer temperature, in turn, is related to loading. The thermal stress leads to the ageing and decomposition of both the oil and cellulose used as an insulating material inside the transformer. Once the insulation fails, the transformer windings are short circuited. It is uneconomical to try to repair or refurbish a distribution transformer. Therefore all transformers that fail in the field are automatically replaced by a new unit.

Some of the older single phase pad mount transformers are rusted, especially if they were installed near roads or sidewalks due to salt application in winter time. This will have a negative impact on the transformer and affect performance and operation of the equipment. The transformer will either rust at the back near the tank, eventually causing the cooling oil to leak out or they will rust at the cable compartment. The rusted cable compartment may pose a potential hazard to the general public since it may leave exposed energized parts. As a result, these transformers are replaced immediately.

Every year a number of transformers fail which result in outages to customers. Sometimes transformers are found to be damaged by vehicle accidents or are leaking oil and require changing before they fail. A transformer failure in a residential area may only affect 10 to 12 customers so outage time is minimal. However a transformer failure in an industrial/commercial area could prove costly to the businesses.

Transformers are essential elements of the electrical distribution system and when they fail or if they are unsafe, they must be immediately replaced. To support work integration, in addition to the transformer itself, the equipment attached to it, such as elbows, inserts, fault indicators or arrestors are also replaced at the same time.

13.4.2 Pad Mounted Transformer Replacement Program Projects

The program is needed to allow for the planned and unplanned replacement of underground transformers that are in poor condition or fail in various parts of the city. Transformers are replaced under this program when a failure occurs, or through inspection are identified as damaged, or rusting beyond safe limits.

13.4.3 Pole Mounted Transformer Replacement Program

Similarly to the pad mounted transformers, the main purpose of the overhead transformers is to lower the primary voltage to secondary voltage levels acceptable to residential, industrial or commercial customers. Overhead transformers are not as affected by rust or vehicle accidents since they are not installed as close to traffic as pad mounted transformers.

The overhead transformers are very similar in construction to single phase pad mounted transformers, therefore they mostly fail due to insulation breakdown. When they fail they must be immediately replaced. A transformer failure in a residential area may only affect 10 to 20 customers so outage time is minimal. However a transformer failure for an industrial/commercial customer could prove costly to their business.

Transformer condition is routinely assessed by operational personnel performing work such as switching, responding to trouble calls or outages. The outside crews advise the Control Room of transformers that are in poor condition. When the Control Room gets the information they generate a report and send it to the Overhead Maintenance Department for follow-up. In addition to replacements of transformers that have failed, this program also provides for replacements of transformers that are rusted or leaking.

13.4.4 Pole Mounted Transformer Replacement Program Projects

The program is needed to allow for the planned and unplanned replacement of overhead transformers that are in poor condition in various parts of the city.

Transformer Replacement program historical and proposed funding from 2007 through 2016 is shown in Table 13.5 below.

Description	Actual					Forecast				
	2007 CGAAP	2008 CGAAP	2009 CGAAP	2010 CGAAP	2011 IFRS	2012 IFRS	2013 IFRS	2014 IFRS	2015 IFRS	2016 IFRS
Transformer Replacement	686	832	2,464	1,375	947	913	1,004	1,096	1,278	1,461

Table 13.5 – Table of Enersource System Maintenance – Transformer Replacement Investment (in $'000)

13.5 Automated Switches / SCADA Program

The Automated Switches/SCADA needs are identified two ways:

- As a result of inspection programs and tracking the age of Automated Switches and Substation auxiliary components
- As a result of system planning studies and by the monitoring of the worst performing supply points on the electrical grid. New automated switch locations are identified that will increase system performance

The electrical power grid is designed to automatically react to external events to ensure public safety. This could be to instantly shut off power for sustained events (such as a contractor digging into underground cables) or to have a sub-second momentary outage for tree contact to ensure homes, elevators in buildings and traffic lights are not unnecessarily exposed to long outages.

The Enersource SCADA system (Supervisory Control and Data Acquisition) is a real-time operating system used by the System Control Operator to monitor and control the electrical power grid. The SCADA system has over 15,500 points connected to it that comprises 65 Municipal Substations and over 250 field automated switches.

13.5.1 Automated Switches / SCADA Program Projects

To ensure the continued safe, efficient operation of the electrical grid, remotely controlled overhead and underground switches are used, allowing the System Control Operator to restore power to a large number of customers during outages.

Automated Switches and SCADA program historical and proposed funding from 2007 through 2016 is shown in Table 13.6 below.

Description	Actual					Forecast				
	2007 CGAAP	2008 CGAAP	2009 CGAAP	2010 CGAAP	2011 IFRS	2012 IFRS	2013 IFRS	2014 IFRS	2015 IFRS	2016 IFRS
Automated Switches / SCADA Program	1,187	1,438	1,328	1,660	1,473	1,382	1,750	2,119	2,487	2,672

Table 13.6 – Table of Enersource System Maintenance – Auto Switches and SCADA Investment (in $'000)

Reliability Driven Investment program historical and proposed funding from 2007 through 2016 is shown in Table 13.7 below.

Description	Actual					Forecast				
	2007 CGAAP	2008 CGAAP	2009 CGAAP	2010 CGAAP	2011 IFRS	2012 IFRS	2013 IFRS	2014 IFRS	2015 IFRS	2016 IFRS
Subdivision Rebuilds	5,972	7,669	8,354	7,349	6,279	7,356	7,847	8,828	9,808	10,789
Overhead Distribution Sustainment	3,332	3,531	4,704	3,799	1,676	2,249	2,727	3,058	2,609	2,789
Underground Distribution Sustainment	2,280	2,320	2,441	2,133	2,332	2,583	2,998	3,228	3,136	3,228
Transformer Replacement	686	832	2,464	1,375	947	913	1,004	1,096	1,278	1,461
Automated Switches / SCADA Program	1,187	1,438	1,328	1,660	1,473	1,382	1,750	2,119	2,487	2,672
Total	**13,457**	**15,790**	**19,291**	**16,316**	**12,707**	**14,483**	**16,326**	**18,329**	**19,319**	**20,939**

Table 13.7 – Table of Enersource System Maintenance – Reliability-Driven Investment (in $'000)

14. System Expansion and Upgrades – Customer Driven Investment

Customer driven investment projects are required for the connection of new customers or to modify or upgrade a customer's present service. Projects of this nature are not discretionary but mandatory and include work such as new residential connections, industrial/commercial connections and metering equipment upgrades and installation. For major programs and projects, further details can be found in the appendix of this report.

This section has five components:

- Industrial and Commercial Services
- New Subdivisions
- Road Projects
- Metering Equipment
- Smart Metering in New Condos

14.1 Industrial and Commercial Services

New condominium, industrial, commercial and residential subdivision projects are initiated by developers and property owners.

Commercial development is largely influenced by the state of the local economy and commercial vacancy rates. The majority of the commercial development work is occurring in the north-west end. Commercial growth has been slow but steady over the past few years.

Table 14.1 below summarizes historical connection of industrial/commercial customers.

	2007	2008	2009	2010	2011	2012	2013	2014
	Actual					Estimate		
Number of Industrial/ Commercial Services Connected	537	355	397	162	336	250	250	250

Table 14.1 – Table of Enersource New Industrial/Commercial Customer Connections

14.2 New Subdivisions

New subdivision projects are initiated by developers. Enersource connects new subdivision projects to the system as a part of the obligation in Enersource's electricity distribution license and pursuant to the Distribution System Code. Enersource is required to make an "Offer to Connect" to customers on a non-discriminatory basis upon written request for connection. Residential subdivision contributions are determined through the use of the Ontario Energy Board's prescribed economic evaluation methodology. Inputs into the model include projected load characteristics of the subdivision, the value of contributed plant and Enersource's expenditures to service the subdivision.

For new subdivision projects that require expansion of the distribution system, an OEB-approved discounted cash-flow model is used to determine customer contributions. The capital contribution is based on any shortfall between future revenues and the cost of connection, expansion and reinforcement.

Enersource tracks proposed developments from information provided by the city's Planning and Building department and uses this information to estimate future loading requirements. The number of concept draft plans and rezoning applications are a good indication of capital expenditures required in future years. Subdivision development is primarily dependent on the local economy. Growth has been steady in this sector over the past few years with townhouses and condominiums dominating the new construction.

Table 14.2 below summarizes historical connection of residential customers.

	2007	2008	2009	2010	2011	2012	2013	2014
	Actual					Forecast		
Number of Residential Services Connected	1,900	3,144	2,900	1,129	2,481	2,450	1,950	3,050

Table 14.2 – Table of Enersource New Residential Customer Connections

14.3 Road Projects

Enersource installs its infrastructure along the right of way that is owned and managed by the city of Mississauga (the "city") and the Region of Peel (the "Region"). Enersource is required to relocate or reconstruct its facilities in order to accommodate the specific requirements of the road authorities in accordance with Public Service Works Highways Act. Road work programs are a significant part of plant relocation throughout the city, impacting both overhead and underground distribution plant.

The amount of relocation work is primarily dependent on the economy and on various levels of government funding. The city establishes a road work program for each year but frequent and sudden changes can occur which adds uncertainty to the forecast of spending for these types of projects. The degree of impact on Enersource is difficult to determine at budget time as road designs are not always available and the impact to Enersource's systems are not determined until detailed design by the road authority is complete. Enersource attempts to better anticipate these possible requests through participation in meetings with the city and the Region and through review of city site plans and zoning amendments. The expected financial impact on Enersource of plant relocation is also based on new approved work projects from the city, historical trends and spending levels, previous year activities and multi year projects.

14.4 Metering Equipment

New metering installations are a requirement to meet the growth of Enersource's customer base. Operation and maintenance of existing metering equipment and back office systems is necessary in order to collect and provide automated meter reading data as the first stage of Enersource's meter to cash process. The reliability and accuracy of the metering equipment and back office systems is paramount to the ongoing billing of all Enersource customers and directly impacts Enersource's revenue stream. New installations are governed by OEB regulation and must be completed within specified timeframes. Equipment must be available in sufficient quantities to allow timely completion of this work. Maintenance of existing metering installations remains a critical function to ensure consistent and complete data for billing on a daily basis and to provide data to the provincial MDM/R.

Incorrect installation or setup and/or lack of maintenance could result in a metering failure resulting in loss of revenue and possible damage to Enersource's reputation.
The Metering Department has several initiatives underway; including:

- the upgrading of existing metering due to customer electrical service upgrades,
- replacing obsolete or damaged meters and
- conversion from 2.5 element to 3 element metering

14.5 Smart Metering in New Condominiums

Enersource continues to expand its efforts in installing individually metered suites ("IMS") with 7,100 units currently being metered. This technology is mainly used in condominiums, but is also applicable for use in metered rental units and apartment buildings through retrofitting. Enersource utilizes Power Line Carrier technology to allow the individual meters to communicate to a transponder which collects the usage data for the suites. This effectively allows the system to utilize the existing electrical wiring in the building as a communication medium thereby saving space and cost. Enersource uses wired phone lines to contact the transponder/collector.

System Expansion and Upgrades – Customer Driven Investment program historical and proposed funding from 2007 through 2016 is shown in Table 14.3 below.

Description	Actual					Forecast				
	2007 CGAAP	2008 CGAAP	2009 CGAAP	2010 CGAAP	2011 IFRS	2012 IFRS	2013 IFRS	2014 IFRS	2015 IFRS	2016 IFRS
Industrial and Commercial Services	5,146	2,182	2,472	260	1,542	1,326	960	960	960	1,143
New Subdivisions	589	1,781	818	8,001	2,398	1,843	1,647	1,647	1,354	1,354
Road Projects	1,075	783	1,056	2,312	991	1,176	1,087	999	999	732
Metering Equipment	(274)	462	408	356	658	952	695	760	859	859
Smart Metering in New Condos	-	1,680	608	970	681	977	952	1,383	865	887
Total	**6,537**	**6,888**	**5,363**	**11,899**	**6,269**	**6,274**	**5,342**	**5,749**	**5,037**	**4,975**

Table 14.3 – Table of Enersource System Expansion and Upgrades – Customer-Driven Investment (in $'000)

15. Non-System Requirements – Regulatory Driven Investment

Regulatory driven investment projects are mandated by industry regulations. Projects of this nature include wholesale metering upgrades per IESO market rules and OEB-sponsored initiatives such as smart metering and time-of-use rates ("TOU") and the Green Energy and Green Economy Act (GEA). For major programs and projects, further details can be found in the appendix of this report.

This section has three components:

- Wholesale Metering
- Smart Metering
- Green Energy and Feed-in Tariffs

15.1 Wholesale Metering

All wholesale metering installations used for settlement in the Ontario electricity wholesale market must be registered with the Independent Electricity System Operator (IESO) and conform to the specifications outlined in the IESO Market Rules. Furthermore, each wholesale metering installation must also comply in accordance to Measurement Canada's (MC) Electricity & Gas Inspection Act. Specifically, all instrument transformers and meters must be approved by Measurement Canada for use. If any of the Instrument Transformers (IT) are not approved by MC, the non-compliant IT must be replaced or approved at the earliest seal expiry date.

Sixteen (16) wholesale metering projects are proposed for 2012 located at Tomken TS, Cooksville TS, Lorne Park TS, Erindale TS and Meadowvale TS. These metering upgrades are required in order to meet the IESO market rules and Measurement Canada regulations. Failure to comply with the IESO Market Rules exposes Enersource to market sanctions, potential fines and increased electrical losses applied against Enersource.

15.2 Smart Metering

Enersource completed its smart meter mass deployment program in 2010, installing approximately 192,000 smart meters in Mississauga. This initiative included the installation of a wireless backhaul comprising of 540 communication devices. The system is now operational, downloading meter data daily and in production with Time of Use Rate billing.

The smart meter deployment included the installation of approximately 174,000 residential and 16,000 small commercial (<50 kW) meters. These meters communicate with a local collector meter, forming individual local area networks ("LAN"), using a proprietary mesh network technology which operates on a 900 MHz wireless system. The mesh network uses 128-bit data encryption to ensure security of the data being transmitted. Enersource has built in operational flexibility with overlapping LAN networks. An advanced metering infrastructure, or AMI, collects data from the collector meters through the wireless backhaul IP network.

System outage reporting at the meter level is planned to be integrated into the outage management system providing more granular information for the control room staff to better determine the impact of an outage. The existing smart meter infrastructure is expected to provide more data that will enhance Enersource's ability to accurately determine transformer loading and to provide more definitive load forecasting.

Enersource is piloting a remote disconnect meter that eliminates the need for field visits for disconnect/limiter installations in cases of non-payment. The technology allows a meter to be programmed to either act as a limiter or to fully disconnect using a remote command. A reconnect can also be executed using the same communication technology. The existing smart meter infrastructure is expected to provide more data that will enhance Enersource's ability to accurately determine transformer loading and to provide more definitive load forecasting.

In 2012, Enersource received meters for 600V services which were not available in the market during the mass deployment. Approximately 1,500 of these meters will be installed.

15.3 Green Energy and Feed-in Tariffs

Enacted in May 2009, the Green Energy and Green Economy Act ("GEA") was introduced to encourage renewable generation, energy conservation and the creation of green jobs. A key GEA element to enable renewable generation is the Ontario Power Authority's ("OPA") Feed-in Tariff ("FIT").

The FIT program is divided into two streams: large projects above 10 kW follow the FIT process for connection; and smaller projects of 10 kW or less follow the microFIT process for connection. Typically, it is residential customers which apply for microFIT projects whereas business and large industrial customers apply for the FIT projects. The program rules, contracts and prices are developed and set by the OPA.

Enersource has the responsibility to connect renewable generators in accordance to the OPA FIT program rules, OEB codes, Electrical Safety Authority ("ESA") safety requirements and Enersource standards, as outlined in the company's Conditions of Service.

Non-System Requirements – Regulatory Driven Investment program historical and proposed funding from 2007 through 2016 is shown in Table 15.1 below.

Description	Actual					Forecast				
	2007 CGAAP	2008 CGAAP	2009 CGAAP	2010 CGAAP	2011 IFRS	2012 IFRS	2013 IFRS	2014 IFRS	2015 IFRS	2016 IFRS
Conservation & Demand Response	396	(22)	43	-	-	-	-	-	-	-
Wholesale Metering	509	75	974	518	700	2,779	-	-	-	-
Smart Metering	7,374	6,104	8,392	8,184	2,850	1,488	-	-	-	-
Green Energy – FIT/MicroFIT	-	-	-	61	197	133	183	219	256	293
Total	**8,279**	**6,157**	**9,410**	**8,763**	**3,747**	**4,401**	**183**	**219**	**256**	**293**

Table 15.1 – Table of Enersource Non-System Requirements - Regulatory Driven Investment (in $'000)

16. Non-System Requirements – Internally Driven Investment

This section has eight components:

- Engineering and Asset Systems
- Rolling Stock
- Information Technology
- JDE / ERP System
- Meter to Cash
- Grounds & Buildings
- Acquisition of Administration Building
- Major Tools

For major programs and projects, further details can be found in the appendix of this report.

16.1 Engineering and Asset Systems

The Engineering and Asset Systems (E&AS) capital budget provides information technology tools to Enersource personnel, primarily in the Engineering and Operations area, in order to assist them in the management of field assets. These tools include software and hardware for 160 people, including both office and field personnel. The budget assists Enersource in improving efficiency and reliability, reducing costs, and ensuring the safety of staff and the public.

To ensure that all computer hardware is kept current, it is replaced on a three or four year cycle, depending upon the life-span of the equipment. Workstations (high-end PCs used for running Engineering applications), monitors, servers and field computers are replaced on an appropriate schedule to ensure that the equipment complies with current standards. Plotters, or wide-format printers for the output of drawings and maps, have a five to eight year life cycle.

If additional licenses of engineering software applications are required so that information and analysis capability can be made available to more of our internal and field personnel, the E&AS budget is utilized. Software upgrades for any of the Engineering systems are funded through this budget.

The largest two software systems utilized by Engineering and Operations, include the Integrated Operating Model (IOM) and the Automated Mapping/Facilities Management/Geographical Information System (AM/FM/GIS). Any projects related to these two systems are funded through the E&AS capital budget.

Enersource was significantly under budget for 2009 and 2010 because of delays in the IOM implementation, but recovery is anticipated in 2011 and 2012.

16.1.1 Integrated Operating Model

The initial mandate for Enersource's Integrated Operating Model (IOM) project was to integrate AM/FM/GIS, SCADA, and other electronic and manual systems to streamline processes for Operations personnel. The elimination of duplicate record-keeping processes, reduction in manual paperwork and reporting in the field, and the provision of automatic reporting of reliability indices were planned. The ability to provide a detailed audit trail for improved network analysis and maintenance was a requirement. A greatly improved planning process, rapid response capabilities, and the delivery of greater overall system efficiency were expected results.

Phase 1 of the IOM project has been in use in the System Control Centre (SCC) since September 2008. The system receives regular map updates from AM/FM/GIS and real-time inputs from SCADA. With just a quick glance, operators can track active outages and assess the number of customers affected. Combined with outage probability modeling, this information allows them to determine the most likely source of outages and prioritize restoration efforts. The installation of GPS/mobile routers in company vehicles now allows the operators to determine which crews are able to respond the fastest. Automatic tracking of customer interruption reporting, including the availability of a detailed audit trail, has been in place since July 2010.

The IOM continues to evolve and transform Enersource operational practices and procedures. The IOM has provided the opportunity to formalize and streamline a number of processes while improving the accuracy of its plant and equipment information. Combined with other initiatives, improved capital planning and greater overall system efficiency has been achieved and continued enhancements of the IOM are anticipated.

A project to prioritize and manage SCADA alarms through the IOM is in progress. Eventually, the ability to control SCADA devices from this single IOM interface will also be available. Software for load flow analysis will be integrated into the IOM system so that switch planning can be done with greater ease and confidence. This will allow a large number of redundant paper maps that are currently used to track switch status, to be phased out and replaced over time. Equipment failure tracking will be implemented to more proactively identify grid issues. Integration with the Smart Metering, Interactive Voice Response (IVR), and Customer Care and Billing (CC&B) systems will provide even further ability to track and resolve problems, and communicate with our customers.

Mobile workforce management software (MWFM) is being considered for installation in Enersource trucks. This will allow for more efficient, real-time communication between the crews and the Control Room to take place through the software's computer-aided dispatch modules.

16.1.2 Automated Mapping / Facilities Management / Geographical Information System

The Automated Mapping/Facilities Management/Geographical Information System (AM/FM/GIS) captures both graphical and database information pertaining to Enersource's field equipment. The AM/FM/GIS consists of a map of the city of Mississauga including all streets and lots, with the location of Enersource equipment and civil structures overlaid on the map in the appropriate locations. Also included in the system are relevant non-equipment items such as municipal addresses and easements. In total, Enersource maintains information for 955,000 equipment and other related items.

Employees can quickly and easily locate an equipment item or a customer address on the map and ascertain the overall configuration in the area. Additionally, the maintenance of a database allows for the generation of reports, for example the total number and type of each transformer, pole or other equipment item.

The power source and the downstream devices for each piece of equipment are modeled in the system. This allows for more complex reporting such as the number of customers per feeder. This model can also be used as the basis for complex engineering analysis software applications such as the one used to calculate line losses.

Since the deployment of the AM/FM/GIS, the number of attributes or characteristics maintained for each equipment item has grown to accommodate a diverse set of user requirements and the system is becoming one of the primary sources of asset information for Enersource. It supplied the base information for the Kinectrics ACA study. Most recently, polychlorinated biphenyl (PCB), infrared, dry ice cleaning, and tree trimming inspection information have been imported into the system. The processes are in place to ensure that the system is updated based on planned rebuilds or new construction projects. Formal processes are being designed and implemented to ensure that emergency field changes and small maintenance jobs are also consistently included in the system.

16.2 Rolling Stock

Enersource requires a fleet of specialized and non-specialized vehicles to complete daily activities including the construction and maintenance of the electrical system. They also provide for quick restoration of power due to electrical system disturbances. Degradation of fleet assets could jeopardize worker safety and negatively affect electrical system performance and response to outages.

To effectively manage fleet assets Enersource has a fleet strategy whose goals are:

- provide safe, reliable and efficient vehicles / equipment to meet the operational needs
- compliance with legislation and regulations
- compliance with accepted industry norms and best practices
- cost effectiveness
- standardization of equipment specifications
- environmental considerations such as fuel economy, exhaust emissions and
- disposal through reputable commercial vehicle and equipment resellers

To achieve the goals outlined above, Enersource maintains a ten year capital plan. This plan is an essential tool for both short and long term budgeting and planning. This plan lists all the current vehicles and proposes the future replacement dates and costs, based on past experience and accepted industry standard vehicle life cycles. Another of the long term goals of the capital plan is to smooth the annual capital expenditures.

Contributing to the proposed replacement date of individual vehicles are factors such as vehicle age, mileage, engine hours, operational cost, maintenance costs and general mechanical condition of the vehicle. Individual assessment of the vehicle is done by Enersource's qualified mechanics when due to be replaced and sometimes adjustments may be made. Some vehicles may be retained because they are in better than average condition and some are replaced earlier due to being in poorer-than-average-condition.

Vehicles are not always replaced "like for like". Prior to replacement of a vehicle, an assessment of the current fleet needs is made with the Supervisors to determine if an alternate vehicle type or size would be beneficial.

The proposed replacement ages for each vehicle class are outlined below. Present replacement criteria are based on manufacturers' recommendations and repair history;

- light vehicles are replaced after 3 - 5 years, or 170,000 km
- service trucks are replaced after 5 - 7 years or 200,000 km
- heavy equipment trucks are replaced after 10 – 12 years, or after 230,000 km and
- work equipment is replaced on a condition based assessment

Additional capital is also required to meet any equipment requirements for staff growth, resulting from succession planning and work program increases.

16.3 Information Technology

The mandate of the Information Technology department is to maintain a highly effective and reliable computer infrastructure, providing services to the organization in areas such as;

- the support, maintenance and security of a corporate network (which includes data, email and web environments) and to provide a highly reliable and available environment
- ensure the availability of all servers supporting the many business critical applications used throughout the company and to provide service and support of these systems as required
- provide efficient, reliable and timely support to the end user community on all desktop and telephone related issues
- management of the corporate telecommunications infrastructure which includes telephones, wireless devices and the Call Center queuing system
- assist in the implementation of new capital and operating projects by providing consulting, planning and implementation expertise in the commissioning of new applications and processes
- administration of all hardware and software maintenance contracts to ensure legal compliance and timely renewals

16.4 JDE / ERP System

Originally implemented in 2003, Oracle J.D. Edwards (JDE) is in the Enterprise Resource Planning (ERP) family of software packages. It is a modular, scalable and integrated information management software system that facilitates the flow of information across the different divisions of Enersource.

The main areas of Enersource that JDE and its auxiliary applications, such as DcLink for processing inventory warehouse transactions wirelessly, assist in processing daily transactions, automate business processes and reporting are:

- Finance – General Ledger, Accounts Payable, Accounts Receivable, Fixed Assets
- Operations – Service Orders, Street-lighting and Supporting Guarantee Calls
- Supply Chain – Inventory/Warehouse Management, Procurement
- Human Resources – Employee Management

JDE also interfaces with other major applications within Enersource such as the Automated Mapping/Facilities Management/Geographical Information System (AM/FM/GIS) and the Customer Care and Billing (CC&B) system to ensure data integrity and simplification of business processes. The capital expenditures required are to leverage our investment to get the most out of the system so that additional business processes, such project estimating and time entry, can be automated.

In addition, capital funds are required for upgrades so that Enersource remains current on its level and version of software. This will ensure that vendor support and compatibility with other software, such as newer versions Microsoft Office, Internet Explorer and hardware devices such tablets are available. This will aid Enersource to efficiently and promptly adapt as the industry and technology evolves.

16.5 Meter to Cash

The mandate of the Meter to Cash group is to maintain and operate Metering and Customer Information System solutions, in order to provide efficient and accurate meter readings and bills for the residents of Mississauga. The main systems that are used for these processes include Elster AMI, and Oracle's Customer Care and Billing, and Microsoft Biztalk. All systems are modular and scalable for maintainability.

Customer Care and Billing (CC&B) is a fully integrated solution. The main business areas/modules in CC&B are the following:

- customer account management/premise management
- cash and collections
- customer contact tracking and management
- metering / meter management
- meter reading / estimating
- mobile field activity management
- rates engine
- billing / bill creation
- analyses and reporting

CC&B, also interfaces with other major applications within Enersource such as: JD Edwards for general ledger and accounts payable, Field Worker for mobile field activities, and the Metering Application Server (MAS) database, for Time of Use billing, to ensure data integrity and simplification of business processes.

The future capital expenditures are required to leverage Enersource's investment in the various meter to cash systems, and to efficiently comply with the Ontario regulatory changes in the areas of customer service, cash and collection, Meter reading and billing. This will aid Enersource to efficiently and promptly adapt as the industry and technology evolves.

16.6 Grounds and Buildings

Capital expenditures are required to acquire and maintain Enersource workspaces and service facilities to acceptable standards. The existing facility at 3240 Mavis Road presently has approximately 400 employees and this number continues to grow. The Mavis Road facility is comprised of three building sections aging from 20 to 48 years old. To allow for a flexible work area and a safe work environment, it is imperative that Enersource continues its capital expenditures.

Some key projects will see major upgrades in the following areas: HVAC, Electrical panels, Environmental stormceptor installation, roof structures, parking lot paving, windows, health and safety issues as they arise, workstation upgrades and continuing to add infrastructure security systems.

Enersource has a Business Continuity Management site located at 30 Stavebank Road. This building has reached its end of life. A building assessment indicated that over $700K must be invested to bring the facility to acceptable condition. Even with this investment, the facility would still not meet current seismic Ontario Building Code requirements usually attributed to Disaster Recovery Sites. As part of the new Erin Mills Town Centre Municipal Substation construction project, the building will be expanded to accommodate the requirements of the Enersource Business Continuity Management Plan.

16.7 Acquisition of Administration Building

Enersource presently has all of its business functions located at 3240 Mavis Road in Mississauga. This includes all Operations and Administration. Over the past two years, Enersource recognized the need to address the problems created from the lack of office space, lack of meeting room locations, lack of large equipment storage and lack of fleet parking area. To partially address these issues, we have converted trades training areas to meeting rooms, have two employees per office, built workstations wherever space allows. A property has been leased for some of the trucks and materials to reduce fleet parking to accommodate new employee parking.

In 2010, a comprehensive Facility study was completed that identified two conceptual alternatives to the status quo of the 3240 Mavis Road facility. The status quo was not a viable option for the following reasons: inadequate meeting rooms, lack of fleet parking areas, not enough employee parking, cramped quarters, no room for pole storage and lack of space for growth. The proposed alternatives were as follows: construct a building addition to our 3240 Mavis Road facility or acquire/construct a new facility in the North-West area of Mississauga and transfer all Administration function to it.

16.8 Major Tools

In order to maintain and operate an electrical system as well as the operation of a fleet of over 200 vehicles, investment in quality tools is paramount. Each truck is furnished with basic hand tools and equipment while specialized items are limited to specific trucks, (examples include: chainsaws on Forestry vehicles, cable cutters and crimpers on underground vehicles,). Funding for tool expenditures of $5,000 or more per item is classified as a "major tool" and requires additional internal approvals. This category of funds covers the purchase of such items as:

- mud tracks – to allow vehicles to traverse over wet ground and/or over buried pipelines
- ground leads - to allow for the safe operation of personnel and equipment on isolated electrical equipment
- battery operated devices – to allow for repair of underground cable in splice pits and provide better ergonomics for staff
- cable locating equipment – to find buried operational cables so that other utilities can perform their construction work without causing cable damage
- fault finding equipment – to aid in locating underground cable faults requiring repair

Non-System Requirements – Internally Driven Investment program historical and proposed funding from 2007 through 2016 is shown in Table 16.1 below.

Description	Actual					Forecast				
	2007 CGAAP	2008 CGAAP	2009 CGAAP	2010 CGAAP	2011 IFRS	2012 IFRS	2013 IFRS	2014 IFRS	2015 IFRS	2016 IFRS
Engineering & Asset Systems	1,860	1,587	689	349	996	1,145	921	911	687	591
Rolling Stock	1,786	1,542	1,993	1,453	1,900	1,834	1,975	1,975	2,200	2,300
Information Technology	461	952	1,123	2,703	1,199	1,406	886	698	844	750
JDE/ERP System	-	-	-		2,017	1,350	1,547	1,172	1,312	1,312
Meter to Cash (CC&B)	3,276	6,001	2,894	79	891	1,134	726	1,312	1,125	984
Grounds & Buildings	1,033	1,282	1,537	905	1,805	2,476	6,933	4,457	3,268	3,169
Acquisition of Administration Building	-	-	-	-	-	19,952	-	-	-	-
Major Tools	172	240	219	40	243	175	200	200	210	210
Total	**8,588**	**11,603**	**8,456**	**5,530**	**9,052**	**29,472**	**13,187**	**10,725**	**9,646**	**9,317**

Table 16.1 – Table of Enersource Non-System Requirements – Internally Driven Investment (in $'000)

BUDGET SUMMARY

17. Budgets

17.1 System Capacity – Growth Driven Investment

The Growth Driven Investment program historical and proposed funding from 2007 through 2016 is shown in Table 17.1 below.

Description	Actual					Forecast				
	2007 CGAAP	2008 CGAAP	2009 CGAAP	2010 CGAAP	2011 IFRS	2012 IFRS	2013 IFRS	2014 IFRS	2015 IFRS	2016 IFRS
Subtransmission and Distribution	5,358	4,584	8,290	3,515	4,735	4,010	5,832	4,545	4,723	4,901
Municipal Substation Construction & Upgrades	3,962	5,714	7,500	6,692	5,650	5,302	5,302	5,784	5,784	5,784
Total	**9,320**	**10,299**	**15,791**	**10,207**	**10,385**	**9,312**	**11,134**	**10,329**	**10,507**	**10,686**

Table 17.1 – Table of Enersource System Capacity – Growth Driven Investment (in $'000)

Major Variance Factors 2013 Test Year Forecast vs 2012 Bridge Year Forecast

1) Approximate $1.8M increase in growth related investment mainly due to purchase of $2M easement for Churchill Meadows TS egress feeder project. This is the net result of increases in "subtransmission and distribution plus no increase in municipal substation construction and upgrades".

Specifically this funding is for the following item:

- buying the property required to build the egress from the Ontario Realty Corporation (ORC) in the Hydro Right of Way (ROW)

Major Variance Factors 2014 Forecast vs 2013 Test Year Forecast

1) Approximate $0.8M decrease in growth driven investments due to one time easement purchase of $2M in the prior year. This is the net result of decrease in "subtransmission and distribution plus and increase in municipal substation construction and upgrades".

17.2 System Sustainment and Reliability – Reliability Driven Investment

The Reliability Driven Investment program historical and proposed funding from 2007 through 2016 is shown in Table 17.2 below.

Description	Actual					Forecast				
	2007 CGAAP	2008 CGAAP	2009 CGAAP	2010 CGAAP	2011 IFRS	2012 IFRS	2013 IFRS	2014 IFRS	2015 IFRS	2016 IFRS
Subdivision Rebuilds	5,972	7,669	8,354	7,349	6,279	7,356	7,847	8,828	9,808	10,789
Overhead Distribution Sustainment	3,332	3,531	4,704	3,799	1,676	2,249	2,727	3,058	2,609	2,789
Underground Distribution Sustainment	2,280	2,320	2,441	2,133	2,332	2,583	2,998	3,228	3,136	3,228
Transformer Replacement	686	832	2,464	1,375	947	913	1,004	1,096	1,278	1,461
Automated Switches / SCADA Program	1,187	1,438	1,328	1,660	1,473	1,382	1,750	2,119	2,487	2,672
Total	**13,457**	**15,790**	**19,291**	**16,316**	**12,707**	**14,483**	**16,326**	**18,329**	**19,319**	**20,939**

Table 17.2 – Table of Enersource System Maintenance – Reliability Driven Investment (in $'000)

Major Variance Factors 2012 Bridge Year Forecast vs 2011 Actual

1) Approximate $0.7M increase in reliability and growth driven investments. This is the net result of increases in "subdivision rebuilds, overhead distribution sustainment, underground distribution sustainment" less decreases in "transformer replacement, automated switches / SCADA program, subtransmission and distribution and municipal substation construction and upgrades".

Specifically this funding is for the following items:

- to improve reliability by replacing underground equipment
- to ensure that substandard overhead lines, that have reached their end of life are replaced
- to ensure that the replacement of inoperable and end of life equipment
- the spot replacement of overhead switching equipment
- to ensure that substandard wood poles, cross arms and concrete poles are replaced

Major Variance Factors 2013 Test Year Forecast vs 2012 Bridge Year Forecast

1) Approximate $1.8M increase in reliability driven investment mainly due to the higher forecast replacement of distribution system assets. This is the net result of increases in "subdivision rebuilds, overhead distribution sustainment, underground distribution sustainment, transformer replacement, automated switches / SCADA program".

Specifically this funding is for the following items:

- to improve reliability by replacing underground equipment
- to ensure that substandard overhead lines, that have reached their end of life are replaced
- to ensure that the replacement of inoperable and end of life equipment
- the spot replacement of overhead switching equipment
- to ensure that substandard wood poles, cross arms and concrete poles are replaced
- three phase feeders, as well as single phase residential cable replacement

- replacement of sections of the overhead system that have been determined to be at the end of life
- specific projects locations have been identified in the Asset Management Plan

Major Variance Factors 2014 Forecast vs 2013 Test Year Forecast

1) Approximate $2M increase in reliability driven investments due to continued higher forecast replacement of distribution system assets. This is the net result of increases in "subdivision rebuilds, overhead distribution sustainment, underground distribution sustainment, transformer replacement, automated switches / SCADA program".

Specifically this funding is for the following items:

- to improve reliability by replacing underground equipment
- to ensure that substandard overhead lines, that have reached their end of life are replaced
- to ensure that the replacement of inoperable and end of life equipment
- the spot replacement of overhead switching equipment
- to ensure that substandard wood poles, cross arms and concrete poles are replaced
- three phase feeders, as well as single phase residential cable replacement
- replacement of sections of the overhead system that have been determined to be at the end of life

17.3 System Expansion and Upgrades – Customer Driven Investment

The Customer Driven Investment program historical and proposed funding from 2007 through 2016 is shown in Table 17.3 below.

Description	Actual					Forecast				
	2007 CGAAP	2008 CGAAP	2009 CGAAP	2010 CGAAP	2011 IFRS	2012 IFRS	2013 IFRS	2014 IFRS	2015 IFRS	2016 IFRS
Industrial and Commercial Services	5,146	2,182	2,472	260	1,542	1,326	960	960	960	1,143
New Subdivisions	589	1,781	818	8,001	2,398	1,843	1,647	1,647	1,354	1,354
Road Projects	1,075	783	1,056	2,312	991	1,176	1,087	999	999	732
Metering Equipment	(274)	462	408	356	658	952	695	760	859	859
Smart Metering in New Condos	-	1,680	608	970	681	977	952	1,383	865	887
Total	**6,537**	**6,888**	**5,363**	**11,899**	**6,269**	**6,274**	**5,342**	**5,749**	**5,037**	**4,975**

Table 17.3 – Table of Enersource System Expansion and Upgrades – Customer Driven Investment (in $'000)

Major Variance Factors 2013 Test Year Forecast vs 2012 Bridge Year Forecast

1) Approximate $0.9M decrease in customer driven investments due to expected decrease in new customer connection demand. This is the net result of decreases in "industrial commercial services, new subdivisions, road projects, metering equipment, smart metering in new condos".

Specifically this funding is for the following items:

- to meet the demand to connect new industrial/commercial customers
- for existing customer service upgrades

17.4 Non-System Requirements – Regulatory Driven Investment

The Regulatory Driven Investment program historical and proposed funding from 2007 through 2016 is shown in Table 17.4 below.

Description	Actual					Forecast				
	2007 CGAAP	2008 CGAAP	2009 CGAAP	2010 CGAAP	2011 IFRS	2012 IFRS	2013 IFRS	2014 IFRS	2015 IFRS	2016 IFRS
Conservation & Demand Response	396	(22)	43	-	-	-	-	-	-	-
Wholesale Metering	509	75	974	518	700	2,779	-	-	-	-
Smart Metering	7,374	6,104	8,392	8,184	2,850	1,488	-	-	-	-
Green Energy – FIT/MicroFIT	-	-	-	61	197	133	183	219	256	293
Total	**8,279**	**6,157**	**9,410**	**8,763**	**3,747**	**4,401**	**183**	**219**	**256**	**293**

Table 17.4 – Table of Enersource Non-System Requirements - Regulatory Driven Investment (in $'000)

Major Variance Factors 2012 Bridge Year Forecast vs 2011 Actual

1) Approximate $2.1M increase in wholesale meter upgrade related to the timing of Hydro One investment.

Specifically this funding is for the following items:

- metering installations must be registered with the IESO and inline with the IESO
- metering installation shall comply in accordance to Measurement Canada's Electricity & Gas Inspection Act
- all instrument transformers and meters must be approved by Measurement Canada

2) Approximate $1.4M decrease in smart metering due to program winding down

Specifically this funding is for the following item:

- for the completion of the Smart Metering deployment for 600 Volt metering installations

Major Variance Factors 2013 Test Year Forecast vs 2012 Bridge Year Forecast

1) Approximate $2.7M decrease in wholesale metering due to expected completion of this program in the prior year.

2) Approximate $1.5M decrease in smart metering due to expected completion of this program in the prior year.

17.5 Non-System Requirements – Internally Driven Investment

The Internally Driven Investment program historical and proposed funding from 2007 through 2016 is shown in Table 17.5 below.

Description	Actual					Forecast				
	2007 CGAAP	2008 CGAAP	2009 CGAAP	2010 CGAAP	2011 IFRS	2012 IFRS	2013 IFRS	2014 IFRS	2015 IFRS	2016 IFRS
Engineering & Asset Systems	1,860	1,587	689	349	996	1,145	921	911	687	591
Rolling Stock	1,786	1,542	1,993	1,453	1,900	1,834	1,975	1,975	2,200	2,300
Information Technology	461	952	1,123	2,703	1,199	1,406	886	698	844	750
JDE/ERP System	-	-	-		2,017	1,350	1,547	1,172	1,312	1,312
Meter to Cash (CC&B)	3,276	6,001	2,894	79	891	1,134	726	1,312	1,125	984
Grounds & Buildings	1,033	1,282	1,537	905	1,805	2,476	6,933	4,457	3,268	3,169
Acquisition of Administration Building	-	-	-	-	-	19,952	-	-	-	-
Major Tools	172	240	219	40	243	175	200	200	210	210
Total	**8,588**	**11,603**	**8,456**	**5,530**	**9,052**	**29,472**	**13,187**	**10,725**	**9,646**	**9,317**

Table 17.5 – Table of Enersource Non-System Requirements – Internally Driven Investment (in $'000)

Major Variance Factors 2012 Bridge Year Forecast vs 2011 Actual

1) Approximate $20.4M increase in land, buildings and grounds primarily due to purchase and retrofit of a new building. This is the net result of increases in "engineering & asset systems, information technology, meter to cash, grounds & buildings, new administration building" less decreases in "rolling stock, JDE/ERP system and major tools".

Specifically this funding is for the following items:

- capital expenditures are required to maintain EHM's workspace and service facilities
- building enhancements are required
- professional services was acquired in 2011 to perform planning studies
- a new site was purchased in December 2011 to meet Enersource needs
- expenditures are for the purchase includes existing building, land and interior works
- provide facility improvements by replacement on a priority basis of major building components, such as: windows, doors, fencing, plumbing, security gates, paving, security camera, heating, ventilation and air conditioning (HVAC), garage doors, external wall stucco resurfacing, washroom efficiency programs

Major Variance Factors 2013 Test Year Forecast vs 2012 Bridge Year Forecast

1) Approximate $20M decrease due to new building purchase and retrofit completion in the prior year.

2) Approximate $4.6M increase for improvements to the operations facility and other general equipment.

Specifically this funding is for the following items:

- capital expenditures are required to maintain EHM's workspace and service facilities
- building enhancements are required
- provide facility improvements by replacement on a priority basis of major building components, such as: windows, doors, fencing, plumbing, security gates, paving, security camera, heating, ventilation and air conditioning (HVAC), garage doors, external wall stucco resurfacing, washroom efficiency programs

3) Approximate $0.9M decrease in information systems due to expected completion of major initiatives. This is the net result of increases in "JDE/ERP system" less decreases in "engineering & asset systems, information technology and meter to cash".

Major Variance Factors 2014 Forecast vs 2013 Test Year Forecast

1) Approximate $2M decrease in grounds and buildings investments due to significant completion in the prior year.

17.6 Business Plan: 2012 - 2016

Table 17.6 below summarizes the historical and proposed funding that is required for the next five years to ensure that Enersource has the capability to provide a safe, secure and reliable supply of electricity, meet system load growth demands and successfully complete all regulatory driven initiatives.

Description	Actual					Forecast				
	2007 CGAAP	2008 CGAAP	2009 CGAAP	2010 CGAAP	2011 IFRS	2012 IFRS	2013 IFRS	2014 IFRS	2015 IFRS	2016 IFRS
System Capacity – Growth Driven Investment	9,320	10,299	15,791	10,207	10,385	9,312	11,134	10,329	10,507	10,686
System Systainment – Reliability Driven Investment	13,457	15,790	19,291	16,316	12,707	14,483	16,326	18,329	19,319	20,939
System Expansion & Upgrades – Customer Driven Investment	6,537	6,888	5,363	11,899	6,269	6,274	5,342	5,749	5,037	4,975
Non-System Requirements - Regulatory Driven Investment	8,279	6,157	9,410	8,763	3,747	4,401	183	219	256	293
Non-System Requirements – Internally-Driven Investment	8,588	11,603	8,456	5,530	9,052	29,472	13,187	10,725	9,646	9,317
TOTAL CAPITAL EXPEDITURES	**46,180**	**50,737**	**58,310**	**52,714**	**42,159**	**63,942**	**46,173**	**45,351**	**44,766**	**46,209**

Table 17.6–Table of Enersource Total Capital Budget Expenditures (in $'000)

17.7 Treatment of Early De-recognition of Assets

Due to International Financial Reporting Standards ("IFRS"), each asset is to be re-recognized when it is disposed or when not future economic benefits are expected from its use. Hence, when an item is de-recognized any gain or loss upon early de-recognition is to be included as a profit of roll. To ensure Enersource complies with IFRS requirements, Enersource has implemented business processes to enable tracking of assets removed from the distribution system.

Tracking of such assets is completed presently with the utilization of automated mapping / facilities management (AM/FM) system which records and stores asset attributes. Alignment of geographic datasets with asset attribute data reflecting Enersource field equipment is completed in the AM/FM system by overlaying a map of Enersource's service territory with locations of Enersource's equipment and civil structures. It is important to note that equipment attributes including asset population are utilized and inputs into the Integrated Operating Model ("IOM") system, the annual asset condition assessment ("ACA") and annual asset management plan activities.

In order to establish the value of the assets removed prematurely from the system, linkages were established between the fixed asset financial system ("JDE") and geographical information system ("GIS") component of the AM/FM system. Reporting tools were developed and implemented to provide frequent status reports which identify changes of plant presently in place in the field for that specific period. Additional future development of systems will enable the capability to record maintenance activities, comprehensive equipment failure data and other relevant transaction history as it applies to each asset class.

In 2011, Enersource incurred a write off of $1.859M which has been coded to depreciation expense and forecasts write offs of $1.924M for 2012, write off of $1.981M for 2013 and write off of $2.041M in 2014.