Attachment 2-VECC-9b

Change Orders

Algoma Power Inc.
EB-2024-0007

TULLOCH
ENGINEERING

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CHANGE ORDER NO. 001

Design-Builder: S.&T. Electrical Contractors Limited
Job No.: 19101

Owner: Algoma Power Inc.
Project: Algoma Power New Facility

Change Order Issue Date: December 11, 2020
Name of Contract: Algoma Power New Work Operations Facility

Contract Date: December 11, 2020
Description of Change Order: Scope Amendments and Contract Price Reduction

Adjustment to the Contract Time is N/A day(s).
The Completion Date, as amended by this and all preceding Change Orders, is: N/A.

Timely completion is of the essence. The costs and effect on the Contract Price, the Contract Time and the Completion Date of each Change Order shall be dealt with separately and shall be deemed to include all direct, indirect, and consequential costs associated with that Change Order, including without limitation all impact costs, overhead, and profits. No other claim shall be considered or paid by the Owner.

CHANGE ORDER DETAILS

Recitals

A. Owner and Design-Builder entered into the CCDC-14 Design-Build Stipulated Price Contract, as amended by the Supplementary Conditions, dated as of December 11, 2020 (the "Contract").

B. Owner and Design-Builder have agreed to effect a change in Design-Services and/or Work, change in Contract Price and/or change in Contract Time, pursuant to the terms of the Contract.

C. For value received, the Parties agree as follows.

Interpretation. Any defined term used in this Change Order that is not defined in this Change Order has the meaning given to that term in the Contract.

Contract Remains in Full Force. Except for the change in Design-Services and/or Work, change in Contract Price and/or Contract Time set out in this Change Order and any previous Change Order(s), the Contract remains in full force, not otherwise amended.

Change Order Description. The Owner and the Design-Builder have agreed to the following change in Design-Service and/or Work, change in Contract Price, and/or change in Contract Time, as set out below:

Approval for a decrease in the Contract Price in the amount of (-$2,326,112.00).

This change constitutes a decrease in the Contract Price.

Item 1 (Proposed design and cost reduction)

During the design process and in the provision of the Design Services, the Owner and the Design-Builder shall collaborate on proposed design changes or modifications that may reduce the Contract Price. The Design-Builder shall use reasonable efforts to propose to the Owner, or the Owner may propose, certain design changes or modifications and the associated reduction to the Contract Price, which shall include without limitation, reduction in the size of the building, orientation of the building on the site, and modifications to the electrical systems and generator capacity.

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Item 2 (Decrease in overall building size and arrangement)
(-$1,023,462.00)

Change Description is based on modification from Baseline proposed design:

- Reduced building square footage to 38,927.
- East wall moves West one bay and still contains the windows as in the proposed design. All associated roof structural and the North / South walls are eliminated.
- Far West wall moves East one bay and w/ 8 OHD's & (1) man door. All associated roof structural and the North / South walls are eliminated. North and South OHD's creating the current drive-through are eliminated and exchanged for (2) related man doors.
- The Wash bay on the North side is relocated to fleet garage.
- Remove existing court yards and reconfigure layout to suite.
- Removal of (1) roof top unit.
- Appropriate Electrical and Mechanical reduction based on new square footage.

Item 3 (Reducing Lighting Scope 75,000hrs to 50,000hrs life cycle)
(-$120,000.00)

Substitute current 70,000hr life expectancy lighting package and controls with 50,000hr lighting package and controls. Number of fixtures and locations stay the same.

Item 4 (Remove Supply and Install of 3 & 5 Ton OH Cranes)
(-$125,000.00)

Remove supply and install of 3- & 5-Ton cranes from scope of work. Eliminate crane rails from scope of work. Eliminate feeders from scope of work.

Building is still built to accept crane later – feed for crane can be added later without issues as it is in shop area and the ceiling space is opened to accept conduits and feeder cables as required.

Item 5 (Remove Supply and Install of Cold Storage Building)
(-$200,000.00)

Remove from scope the following:

- Supply and Install of Building
- Concrete slab
- Distribution Feed
- Supply and install of Lights and Power
- Supply and install of Card access.

*Will leave in conduit to from electrical room to identified location for future installation

Item 6 (Reduce Generator Size 350kW (Diesel only) and Minor Variations in Electrical distribution)
(-$200,000.00)

- 350KW Generator – Diesel Only – Approx. 60% of building load

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CHANGE ORDER NO. 001

- 2000A Switch board – set for 1200A – sized for future growth
- Emergency Lighting fed from Generator
- Remove approximately 2 distribution feeds and associated transformer, wire and hardware.
- Remove distribution feed and associated transformer, wire and hardware. Leave in place conduit for future installation.

Item 7 (Reduce Sites works based on new building orientation)
($110,650.00)

Based on the updated orientation, location, and reduced building size there are a few areas of reduced scope as the building is also closer to some site services (sanitary, water).

- Update to cost of Excavation of road, parking lots and compound area
- Reduced Gravel for Backfill
- Granular "A" under foundations, floor, sanitary sewer, watermain, etc.
- Reduced material for sanitary system and connection

No changes to sidewalks, curbs, green areas, erosion blanket or storm pond.

Item 8 (Owner Supply of WIFI Access Point Equipment)
(-$12,000.00)

Owner to supply WIFI equipment for Design-Builder to install through building.

Item 9 (Remove API Contingency Allowance)
(-$500,000.00)

Item 10 (Remove Lunchroom Furniture and Kitchen Appliances)
(-$35,000.00)

CHANGE IN CONTRACT PRICE

The Owner hereby modifies the payments as follows: (Mark **NIL** in "Basis" not used)

Lump Sum Basis	Approval for reduced cost and decrease in Contract Price.	$ (-2,326,112.00)
Unit Price or Force Account Basis	Design-Services and/or Work authorized by this Change Order will be paid for at rates set out in the email quotation attached herein, or in the Contract, to a maximum amount of:	$ NIL

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CHANGE ORDER NO. 001

ACCEPTED BY:

Owner per:		**Design-Builder per:**	
Signature:	J. Scott Hawkes	Signature:	
Print Name:	Scott Hawkes	Print Name:	Dennis Tatasciore
Date:	December 11, 2020	Date:	December 11, 2020

Authorized by the Owner as an amendment to the Contract by:

TULLOCH Engineering

Signature:

Print Name: DAN WOODY

Date: DECEMBER 11, 2020

SUMMARY

Original Contract Price	$	14,694,849.00
Value of this Change Order	$	(-2,326,112.00
Net change to Date	$	(-2,326,112.00
Revised Contract Price	$	12,368,737.00

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CHANGE ORDER NO. 002

Design-Builder:	S.&T. Electrical Contractors Limited	**Job No.:**	191101
Owner:	Algoma Power Inc.	**Project:**	Algoma Power New Facility
Change Order Issue Date:	June 30, 2021	**Name of Contract:**	Algoma Power New Work Operations Facility
Contract Date:	December 11, 2020	**Description of Change Order:**	Scope Amendments and Contract Price Increase

Adjustment to the Contract Time is 5 day(s).
The Completion Date, as amended by this and all preceding Change Orders, is: N/A.

Timely completion is of the essence. The costs and effect on the Contract Price, the Contract Time and the Completion Date of each Change Order shall be dealt with separately and shall be deemed to include all direct, indirect, and consequential costs associated with that Change Order, including without limitation all impact costs, overhead, and profits. No other claim shall be considered or paid by the Owner.

CHANGE ORDER DETAILS

Recitals

A. Owner and Design-Builder entered into the CCDC-14 Design-Build Stipulated Price Contract, as amended by the Supplementary Conditions, dated as of December 11, 2020 (the "Contract").

B. Owner and Design-Builder have agreed to effect a change in Design-Services and/or Work, change in Contract Price and/or change in Contract Time, pursuant to the terms of the Contract.

C. For value received, the Parties agree as follows.

Interpretation. Any defined term used in this Change Order that is not defined in this Change Order has the meaning given to that term in the Contract.

Contract Remains in Full Force. Except for the change in Design-Services and/or Work, change in Contract Price and/or Contract Time set out in this Change Order and any previous Change Order(s), the Contract remains in full force, not otherwise amended.

Change Order Description. The Owner and the Design-Builder have agreed to the following change in Design-Service and/or Work, change in Contract Price, and/or change in Contract Time, as set out below:

Approval for an increase in the Contract Price in the amount of (+$139.131.50).

This change constitutes an increase in the Contract Price.

Supply and Installation of 5 Ton Top Running Single Girder Overhead Crane
(+139,131.50)

Scope of Work

5 Ton Top Running Single Girder Overhead Crane
Quantity: 1
Crane Technical Data:
Type: Top Running Single Girder - W21x122

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CHANGE ORDER NO. 002

CMAA Class: C Working Environment:
Indoor Ambient Temperature: 5 to 40*C
Power Supply: 575/3/60
Crane Structure Finish: Safety Yellow Paint
Electrical Inspection: ESA
Approved Crane Design Standards: CSA & CMAA Approved

Bridge: Stahl

Girder Construction: Profile
Bridge Capacity: 5 Ton (10,000 lbs.)
Span: 50’
Runway Rail Type: ASCE #30
Bridge End Trucks: Stahl Direct Drive Tube Style End Trucks
Number of Crane Wheels: 4
Static Wheel Load: TBD
Crane Wheel Gage 78.7" (2,000 mm)
Crane Wheel Diameter 4.33" (110 mm)
Bridge Drive: 2 Speed Bridge
Traveling Speed: 6.3/25.0 m/min
Primary Bridge Control: Flex-6 Radio Remote Control System
Secondary Bridge Control: Spare Radio Flex-6 c/w Selector Switch
Bridge Travel Limit Switch: Two Step - to slow and to stop
Safety Features: Warning Horn Beacon Light

Trolley: Stahl

Trolley Drive: 2 Speed
Trolley Speed: 82/20 ft/min Hoist(s): Main

Hoist: Stahl

Hoist Type: Stahl Electric Wire Rope
Hoist Capacity: 5 Ton (10,000 lbs.)
FEM Duty Cycle: 2m (ISO M5)
Available Lifting Height: 6m
Hoist Lift Speed: 6/1 m/min
Brake Type: DC Magnetic Disc
Safety Features: Overload Protection, Upper & Lower Limits.

Crane Rail System:

Type: ASCE #30 and End Stops
1.1.3 Runway Power Supply:

Type: Tandem Collector Shoes c/w 8-Bar 41 ft. long
1.1.4. Crane Support Structure:
Type of Runway System: W14x53 Runway Beams Included

Installation, Load Testing and Commissioning:
Includes installation of runway and overhead crane
Includes manpower and operator

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CHANGE ORDER NO. 002

Includes man lift rentals Includes mobile rental (Broderson or Telehandler)
Includes travel time and mileage
Includes accommodations and meals
Includes test weights Electrical 600V Breaker Disconnect switch.

Summary

Total Material 3,293.62
JOURNEYMAN (59.66 Hrs @ $95.00) 5,667.70
FOREMAN (2.88 Hrs @ $104.50) 300.96
CLEAN UP (1.74 Hrs @ $95.00) 165.30
SITE EXPENSES (per Day) (64.28 @ 0.00 @ $7.50 + 0.000 % + 0.000 % + 0.000 %) 482.10
Markup (@ 10.000 %) 990.97

Subtotal 10,900.65

S&I / Commission Crane ($114,150.00 + 0.000 % + 0.000 % + 10.000 %) 125,565.00
Subtotal 136,465.65
Insurances 272.93
Bonding 2,392.93
Final Amount $139,131.51

CHANGE IN CONTRACT PRICE

The Owner hereby modifies the payments as follows: (Mark **NIL** in "Basis" not used)

Lump Sum Basis	Approval for increase in Contract Price.	$ (+139,131.50)
Unit Price or Force Account Basis	Design-Services and/or Work authorized by this Change Order will be paid for at rates set out in the email quotation attached herein, or in the Contract, to a maximum amount of:	$ NIL

ACCEPTED BY:

Owner per:

Signature: APPROVED By Jie Han at 4:53 pm, Jun 30, 2021

Print Name: Jie Han

Date: June 30, 2021

Design-Builder per:

Signature: Dennis Tatasciore

Print Name: Dennis Tatasciore

Date: July 26, 2021

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CHANGE ORDER NO. 002

Authorized by the Owner as an amendment to the Contract by:

TULLOCH Engineering

Signature:

Print Name: Dan Moody

Date: June 30, 2021

SUMMARY

Original Contract Price	$	14,694,849.00
Value of this Change Order	$	(+139,131.50
Net change to Date	$	(-2,186,980.50
Revised Contract Price	$	12,507,868.50

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CHANGE ORDER NO. 003

Design-Builder:	S.&T. Electrical Contractors Limited	**Job No.:**	191101
Owner:	Algoma Power Inc.	**Project:**	Algoma Power New Facility
Change Order Issue Date:	November 15, 2021	**Name of Contract:**	Algoma Power New Work Operations Facility
Contract Date:	December 11, 2020	**Description of Change Order:**	Subsurface Conditions and Adjustments to the Contract Price and Contract Time

Adjustment to the Contract Time is 90 day(s).

The date for Substantial Performance of the Work, as amended by this and all preceding Change Orders, is: August 30, 2022

Timely completion is of the essence. The costs and effect on the Contract Price and the Contract Time of each Change Order shall be dealt with separately and shall be deemed to include all direct, indirect, and consequential costs associated with that Change Order, including without limitation all impact costs, overhead, and profits. No other claim shall be considered or paid by the Owner.

CHANGE ORDER DETAILS

Recitals

A. Owner and Design-Builder entered into a CCDC-14 Design-Build Stipulated Price Contract, as amended by Supplementary Conditions, dated as of December 11, 2020 (the "Contract").

B. Design-Builder issued a Request for Change Directive – Access Road Changes dated May 4 and 27, 2021 ("CD1").

C. Design-Builder issued a Request for Change Directive – Civil Development Change of Design Scope dated May 10, 2021 ("CD2").

D. Design-Builder issued a Notice of Dispute dated June 16, 2021 ("NOD").

E. Owner issued a Contemplated Change Notice No. 005 dated July 8, 2021 ("CCN005") in relation to the Design Services and Work described in CD1 and CD2.

F. Design-Builder issued a Change Quote dated August 11, 2021 ("Change Quote") in response to CCN005.

G. Owner and Design-Builder have agreed to effect a change in Design Services and/or Work, a change in Contract Price, and a change in Contract Time as provided and on the terms set out in this Change Order.

H. Design-Builder has agreed to abandon and withdraw the NOD.

I. For value received, the Owner and Design-Builder agree as follows.

Interpretation. Any capitalized term used in this Change Order that is not defined in this Change Order has the meaning given to that term in the Contract.

Contract Remains in Full Force. Except for the change in Design Services and/or Work, change in Contract Price, and the change in the Contract Time set out in this Change Order and any previous Change Order(s), the Contract remains in full force, not otherwise amended.

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CHANGE ORDER NO. 003

Change Order Description. This Change Order covers and includes for all impacts to the Contract Price and Contract Time related to the Design Services and Work required to be performed in relation to CD1, CD2, and CCN005. The Design-Builder has no further claims and releases the Owner in respect of all matters and claims described in CD1, CD2, the Change Quote and the NOD.

The Owner and the Design-Builder have agreed to the following changes in Design Services and/or Work, Contract Price, and Contract Time, as set out below:

Item No. 1 Resubmission Costs
(+$24,932.50)

Internal management related to the resolution of problems associated with the soil conditions and civil redesign of the site.

Item No. 2 Winter Conditions
(+$22,500)

Increase in labour costs during construction to account for a loss in labour productivity as a result of a 3-month delay in construction caused by the subsurface conditions.

Item No. 3 Additional Heating, Hoarding and Frost Protection
(+$75,000)

Additional costs associated with concrete placement during winter months.

Item No. 4 Design Consultant – Water Management
(+$10,893)

Cost to complete additional engineering associated with establishing a revised building elevation and re-design of the site due to soil conditions

Item No. 5 Design Consultant - Realignment
(+$5,400)

Additional engineering cost associated with reviewing alternatives and re-design so as not to disturb the existing electrical transformer and other electrical infrastructure along the site entrance road.

Item No. 6 Geotechnical Consultant – Additional Assessment
(+$10,000)

Additional cost for geotechnical consultant to attend meetings and complete multiple computer model simulations to determine long term settlement of the building for various site elevations.

Item No. 7 East and North Off-Site Ditching
(+$22,192.49)

Additional cost for ditching in addition to site Storm Water Management (SWM) measures to capture run-off from adjacent properties.

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CHANGE ORDER NO. 003

Item No. 8 Additional Sub-Drain
(+$59,626.35)

Additional cost for sub-drain associated with revised road cross section as required to remain on API's property.

Item No. 9 Additional Excavation
(+$54,956.34)

Additional cost for additional excavation associated with the lower site grade.

Item No. 10 Additional Sub-Drain (Transformer)
(+$1,640.60)

Additional cost for sub-drain to drain the transformer vault.

Item No. 11 Shallow Foundation Insulation
(+$28,894.40)

Additional cost for exterior insulation to provide frost protection to the foundations.
Additional costs for rebar in the foundation walls to reduce cracking due to settlement.

Item No. 12 Erosion Control Blanket
(+$18,066.89)

Additional cost for additional quantity of erosion control blanket on increased slope area.

Item No. 13 Reg 406 Soil Boring and Testing
(+$44,700.00)

Additional cost for an environmental consultant to test, monitor and document excess soil removal from the site.

CHANGE IN CONTRACT PRICE

The Owner hereby modifies the payments as follows: (Mark NIL in "Basis" not used)

Lump Sum Basis	Subtotal	$378,802.57
	10% Overhead and Profit	$37,880.26
	Total Approval for Increase in Contract Price	$416,682.83
Unit Price or Force Account Basis	Design-Services and/or Work authorized by this Change Order will be paid for at rates set out in the email quotation attached herein, or in the Contract, to a maximum amount of:	NIL

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CHANGE ORDER NO. 003

CHANGE IN CONTRACT TIME

The Owner and Design-Builder have agreed to a 90-day extension to the date for Substantial Performance of the Work. All costs related to or arising from such extension are included and incorporated in this Change Order and in the change in the Contract Price, and the Design-Builder has no other, and waives all other claims related to the extension in the Contract Time arising from CD1, CD2, CCN005 and the Change Quote.

ACCEPTED BY:

Owner per:		**Design-Builder per:**	
Signature:		Signature:	
Print Name:	Jie Han	Print Name:	Dennis Tatasciore
Date:	November 19, 2021	Date:	November 19, 2021

Authorized by the Owner as an amendment to the Contract by:

TULLOCH Engineering

Signature:	
Print Name:	Dan Moody
Date:	November 25, 2021

SUMMARY

Original Contract Price	$	14,694,849.00
Value of this Change Order	$	(+416,682.83)
Net change to Date	$	(-1,770,297.67)
Revised Contract Price	$	12,924,551.30

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CHANGE ORDER NO. 004

Design-Builder:	S.&T. Electrical Contractors Limited	**Job No.:**	191101
Owner:	Algoma Power Inc.	**Project:**	Algoma Power New Facility
Change Order Issue Date:	May 18, 2022	**Name of Contract:**	Algoma Power New Work Operations Facility
Contract Date:	December 11, 2020	**Description of Change Order:**	Scope Amendments and Contract Price Increase

Adjustment to the Contract Time is 0 day(s).
The Completion Date, as amended by this and all preceding Change Orders, is: _____.

Timely completion is of the essence. The costs and effect on the Contract Price, the Contract Time and the Completion Date of each Change Order shall be dealt with separately and shall be deemed to include all direct, indirect, and consequential costs associated with that Change Order, including without limitation all impact costs, overhead, and profits. No other claim shall be considered or paid by the Owner.

CHANGE ORDER DETAILS

Recitals

A. Owner and Design-Builder entered into the CCDC-14 Design-Build Stipulated Price Contract, as amended by the Supplementary Conditions, dated as of December 11, 2020 (the "Contract").

B. Owner and Design-Builder have agreed to effect a change in Design-Services and/or Work, change in Contract Price and/or change in Contract Time, pursuant to the terms of the Contract.

C. For value received, the Parties agree as follows.

Interpretation. Any defined term used in this Change Order that is not defined in this Change Order has the meaning given to that term in the Contract.

Contract Remains in Full Force. Except for the change in Design-Services and/or Work, change in Contract Price and/or Contract Time set out in this Change Order and any previous Change Order(s), the Contract remains in full force, not otherwise amended.

Change Order Description. The Owner and the Design-Builder have agreed to the following change in Design-Service and/or Work, change in Contract Price, and/or change in Contract Time, as set out below:

Approval for an increase in the Contract Price in the amount of (+$583,778.24).

This change constitutes an increase in the Contract Price.

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CHANGE ORDER NO. 004

Scope of Work

Item No. 1 Supply and Install New 20'x116' Transformer Storage Platform (CCN 002)

As instructed in CCN002-R3:

This pricing covers the cost to fabricate, supply and install transformer racks as detailed/described in the documents. Excavation Granular base Backfill Precast concrete foundations Installation of the steel racks and signage.

Subtotal 362,719.97

10% Overhead and Profit 36,272,00

Final Amount $398,991.97

Item No. 2 Supply and Install New Pole Storage Racks (CCN 003)

As instructed in CCN003-R3

This pricing covers the cost to supply and install pole bunks as detailed/described in the documents. Excavation Granular base Backfill Precast concrete foundations Installation of steel posts, bolted to the precast at each end to contain the stock and intermediate posts for separating stock.

Subtotal 141,417.40

10% Overhead and Profit 14,141,74

Final Amount $155,559.14

Item No.3 Supply and Installation of two (2) Dual EV charger units (free Standing Stations)

Evr-Green 4000
Supply and Install (2) Dual EV charger units (free Standing Station)
Supply and Install vinyl jacketed, concrete filled steel pipe bollards at each unit)
Supply and Install (2) feeds for units (independent circuits).
Supply and Install (2) 2-pole breakers of suitable ampacity.
ESA Permit

Subtotal 26,570.12

10% Overhead and Profit 2,657.01

Final Amount $29,227.13

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CHANGE ORDER NO. 004

CHANGE IN CONTRACT PRICE

The Owner hereby modifies the payments as follows: (Mark **NIL** in "Basis" not used)

Lump Sum Basis	Approval for increase in Contract Price.	$ (+583,778.24)
Unit Price or Force Account Basis	Design-Services and/or Work authorized by this Change Order will be paid for at rates set out in the email quotation attached herein, or in the Contract, to a maximum amount of:	$ NIL

ACCEPTED BY:

Owner per:

Signature:

Print Name: Jie Han

Date: May 18, 2022

Design-Builder per:

Signature:

Print Name: Dennis Tatasciore

Date: May 18, 2022

Authorized by the Owner as an amendment to the Contract by:

TULLOCH Engineering

Signature:

Print Name: Dan Moody

Date: August 8, 2024

SUMMARY

Original Contract Price	$	14,694,849.00
Value of this Change Order	$	(+583,778.24)
Net change to Date	$	(-1,186,519.45)
Revised Contract Price	$	13,508,329.60

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CHANGE ORDER NO. 005

Design-Builder:	S.&T. Electrical Contractors Limited	**Job No.:**	191101
Owner:	Algoma Power Inc.	**Project:**	Algoma Power New Facility
Change Order Issue Date:	May 18, 2022	**Name of Contract:**	Algoma Power New Work Operations Facility
Contract Date:	December 11, 2020	**Description of Change Order:**	Scope Amendments and Contract Price Increase

Adjustment to the Contract Time is 0 day(s).
The Completion Date, as amended by this and all preceding Change Orders, is: .

Timely completion is of the essence. The costs and effect on the Contract Price, the Contract Time and the Completion Date of each Change Order shall be dealt with separately and shall be deemed to include all direct, indirect, and consequential costs associated with that Change Order, including without limitation all impact costs, overhead, and profits. No other claim shall be considered or paid by the Owner.

CHANGE ORDER DETAILS

Recitals

A. Owner and Design-Builder entered into the CCDC-14 Design-Build Stipulated Price Contract, as amended by the Supplementary Conditions, dated as of December 11, 2020 (the "Contract").

B. Owner and Design-Builder have agreed to effect a change in Design-Services and/or Work, change in Contract Price and/or change in Contract Time, pursuant to the terms of the Contract.

C. For value received, the Parties agree as follows.

Interpretation. Any defined term used in this Change Order that is not defined in this Change Order has the meaning given to that term in the Contract.

Contract Remains in Full Force. Except for the change in Design-Services and/or Work, change in Contract Price and/or Contract Time set out in this Change Order and any previous Change Order(s), the Contract remains in full force, not otherwise amended.

Change Order Description. The Owner and the Design-Builder have agreed to the following change in Design-Service and/or Work, change in Contract Price, and/or change in Contract Time, as set out below:

Approval for an increase in the Contract Price in the amount of (+$49,827.02).

This change constitutes an increase in the Contract Price.

TULLOCH ENGINEERING

71 Black Road
Unit 8
Sault Ste Marie ON
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T 705 949 1457
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866 806 0602
saultstemarie@tulloch.ca
www.TULLOCH.ca

CHANGE ORDER NO. 005

50% of CCN# 8

Item No.1 Supply and Installation of one (1) Fire Rated Overhead Door and one (1) non-fire rated overhead door, as well as the preparation of a framed opening (drywalled over) for a future overhead door installation.

- Labour, material, and equipment to supply and install fire rated coiling overhead door 167-O1 between Shipping/Receiving (167) and Storage Garage (174)

CCN# 9

- Labour, material, and equipment to supply and install non fire rated coiling overhead door 166-O1 between Shipping/Receiving (167) and Stores Racking (166).

- Labour, material, and equipment to prepare a framed opening (drywalled over) for a future overhead door installation between the Fleet Repair Garage (153) and Fleet Storage Area (174).

Subtotal	45,297.29
10% Overhead and Profit	4,529.73
Final Amount $49,827.02	

CHANGE IN CONTRACT PRICE

The Owner hereby modifies the payments as follows: (Mark **NIL** in "Basis" not used)

Lump Sum Basis	Approval for increase in Contract Price.	$	(+49,827.02)
Unit Price or Force Account Basis	Design-Services and/or Work authorized by this Change Order will be paid for at rates set out in the email quotation attached herein, or in the Contract, to a maximum amount of:	$	NIL

ACCEPTED BY:

Owner per:		**Design-Builder per:**	
Signature:		Signature:	
Print Name:	Jie Han	Print Name:	Dennis Tatasciore
Date:	May 18, 2022	Date:	May 18, 2022

TULLOCH ENGINEERING

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www.TULLOCH.ca

CHANGE ORDER NO. 005

Authorized by the Owner as an amendment to the Contract by:

TULLOCH Engineering

Signature: Dan Moody

Print Name: Dan Moody

Date: August 8, 2024

SUMMARY

Original Contract Price	$	14,694,849.00
Value of this Change Order	$	(+49,827.02)
Net change to Date	$	(-1,136,692.43)
Revised Contract Price	$	13,558,165.60

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71 Black Road
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CHANGE ORDER NO. 006

Design-Builder:	S.&T. Electrical Contractors Limited	**Job No.:**	191101
Owner:	Algoma Power Inc.	**Project:**	Algoma Power New Facility
Change Order Issue Date:	October 2, 2022	**Name of Contract:**	Algoma Power New Work Operations Facility
Contract Date:	December 11, 2020	**Description of Change Order:**	Scope Amendments and Contract Price Increase

Adjustment to the Contract Time is 0 day(s).
The Completion Date, as amended by this and all preceding Change Orders, is: _____.

Timely completion is of the essence. The costs and effect on the Contract Price, the Contract Time and the Completion Date of each Change Order shall be dealt with separately and shall be deemed to include all direct, indirect, and consequential costs associated with that Change Order, including without limitation all impact costs, overhead, and profits. No other claim shall be considered or paid by the Owner.

CHANGE ORDER DETAILS

Recitals

A. Owner and Design-Builder entered into the CCDC-14 Design-Build Stipulated Price Contract, as amended by the Supplementary Conditions, dated as of December 11, 2020 (the "Contract").

B. Owner and Design-Builder have agreed to effect a change in Design-Services and/or Work, change in Contract Price and/or change in Contract Time, pursuant to the terms of the Contract.

C. For value received, the Parties agree as follows.

Interpretation. Any defined term used in this Change Order that is not defined in this Change Order has the meaning given to that term in the Contract.

Contract Remains in Full Force. Except for the change in Design-Services and/or Work, change in Contract Price and/or Contract Time set out in this Change Order and any previous Change Order(s), the Contract remains in full force, not otherwise amended.

Change Order Description. The Owner and the Design-Builder have agreed to the following change in Design-Service and/or Work, change in Contract Price, and/or change in Contract Time, as set out below:

Approval for an increase in the Contract Price in the amount of (+$56,634.33).

This change constitutes an increase in the Contract Price.

TULLOCH
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saultstemarie@tulloch.ca

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CHANGE ORDER NO. 006

Item No.1 Supply and Installation of one (1) man door gate adjacent to the East Motorized compound gate.

- Gate will be a single swing door 4' x 8' with associated hardware
- Installation of security access and power to man door
- Kantech KT400 Door Controller
- P225XSF Reader
- GateMag
- Lot Wire
- Underground Conduit from Building

Subtotal $9,880.42
10% Overhead and Profit $988.04

Final Amount $10,868.46

Item No. 2 Supply and Install of 1 rolling steel overhead door 6'-8" x 9'-0".

- 22 Gauge Slats
- Face wall mount
- Motorized, 3 button station
- Electrical requirements for power to door
- Installation of security access and power to man door
- Kantech KT400 Door Controller
- P225XSF Reader
- Reframing of existing opening to suit
- Supervision

Subtotal $24,489.41
10% Overhead and Profit $2,448.94

Final Amount $26,938.35

Item No. 3 Supply and Install of fourteen (14) work benches custom built to suit area (Lines and Forestry Rooms (Rooms 157 & 163).

- 14 work benches custom built to suit area
- 60"W x 36"H x 24"D
- 1 x 18"D x 60"W lower shelf
- Painted steel top reinforced with wood filler
- Adjustable foot pads
- Standard powder coat finish to be selected by owner
- Assembly and installation
- Supervision

Subtotal $17,115.93
10% Overhead and Profit $1,711.59

Final Amount $18,827.52

TULLOCH ENGINEERING

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CHANGE ORDER NO. 006

CHANGE IN CONTRACT PRICE

The Owner hereby modifies the payments as follows: (Mark **NIL** in "Basis" not used)

Lump Sum Basis	Approval for increase in Contract Price.	$	(+56,634.33)
Unit Price or Force Account Basis	Design-Services and/or Work authorized by this Change Order will be paid for at rates set out in the email quotation attached herein, or in the Contract, to a maximum amount of:	$	NIL

ACCEPTED BY:

Owner per:

Signature: [signature]

Print Name: Jie Han

Date: October 2, 2022

Design-Builder per:

Signature: [signature]

Print Name: ~~Dennis Tatasciore~~ Andrew Marshall

Date: Nov. 10, 2022

Authorized by the Owner as an amendment to the Contract by:

TULLOCH Engineering

Signature: [signature]

Print Name: Dan Moody

Date: August 8, 2024

SUMMARY

Original Contract Price	$	14,694,849.00
Value of this Change Order	$	(+56,634.33)
Net change to Date	$	(-1,080,058.10)
Revised Contract Price	$	13,614,790.90

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CHANGE ORDER NO. 007

Design-Builder:	S.&T. Electrical Contractors Limited	**Job No.:**	191101
Owner:	Algoma Power Inc.	**Project:**	Algoma Power New Facility
Change Order Issue Date:	February 1, 2023	**Name of Contract:**	Algoma Power New Work Operations Facility
Contract Date:	December 11, 2020	**Description of Change Order:**	Scope Amendments and Contract Price Increase

Adjustment to the Contract Time is 0 day(s).
The Completion Date, as amended by this and all preceding Change Orders, is: _____.

Timely completion is of the essence. The costs and effect on the Contract Price, the Contract Time and the Completion Date of each Change Order shall be dealt with separately and shall be deemed to include all direct, indirect, and consequential costs associated with that Change Order, including without limitation all impact costs, overhead, and profits. No other claim shall be considered or paid by the Owner.

CHANGE ORDER DETAILS

Recitals

A. Owner and Design-Builder entered into the CCDC-14 Design-Build Stipulated Price Contract, as amended by the Supplementary Conditions, dated as of December 11, 2020 (the "Contract").

B. Owner and Design-Builder have agreed to effect a change in Design-Services and/or Work, change in Contract Price and/or change in Contract Time, pursuant to the terms of the Contract.

C. For value received, the Parties agree as follows.

Interpretation. Any defined term used in this Change Order that is not defined in this Change Order has the meaning given to that term in the Contract.

Contract Remains in Full Force. Except for the change in Design-Services and/or Work, change in Contract Price and/or Contract Time set out in this Change Order and any previous Change Order(s), the Contract remains in full force, not otherwise amended.

Change Order Description. The Owner and the Design-Builder have agreed to the following change in Design-Service and/or Work, change in Contract Price, and/or change in Contract Time, as set out below:

Approval for an increase in the Contract Price in the amount of (+$20,130.25).

This change constitutes an increase in the Contract Price.

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CHANGE ORDER NO. 007

Item No.1 Supply and Installation of RFID Truck Gate Operations

Each Gate will have (2) Nedap Ultimate Long Range RFID readers. One for Entry and One for Exit.
These readers will be integrated into a Kantech KT Card Access Panel for connection to the main System.
(40) Nedap Heavy Duty ISO Vehicle Identification Tags. Client to secure to Vehicles.
Each Gate will have one Avigilon HD Video Intercom connected to the main Camera System.
Each Gate will have two Kantech Card Reader Mounted on the Gate Post for local Card Access by an individual.

Subtotal	$48,300.23
Unused AV Allowance	-($30,000.00)
Sub-total	$18,300.23
10% Overhead and Profit	$ 1,830.02
Final Amount	$20,130.25

CHANGE IN CONTRACT PRICE

The Owner hereby modifies the payments as follows: (Mark **NIL** in "Basis" not used)

Lump Sum Basis	Approval for increase in Contract Price.	$ (+20,130.25)
Unit Price or Force Account Basis	Design-Services and/or Work authorized by this Change Order will be paid for at rates set out in the email quotation attached herein, or in the Contract, to a maximum amount of:	$ NIL

ACCEPTED BY:

Owner per:	**Design-Builder per:**
Signature:	Signature:
Print Name: Jie Han	Print Name: ~~Dennis Tatasciore~~ Andrew Marshall
Date:	Date:

TULLOCH ENGINEERING

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CHANGE ORDER NO. 007

Authorized by the Owner as an amendment to the Contract by:

TULLOCH Engineering

Signature:

Print Name: Dan Moody

Date: April 12, 2023

SUMMARY

Original Contract Price	$	14,694,849.00
Value of this Change Order	$	(+20,130.25)
Net change to Date	$	(-1,059,927.85)
Revised Contract Price	$	13,634,921.20

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CHANGE ORDER NO. 008

Design-Builder:	S.&T. Electrical Contractors Limited	**Job No.:**	191101
Owner:	Algoma Power Inc.	**Project:**	Algoma Power New Facility
Change Order Issue Date:	August 4, 2023	**Name of Contract:**	Algoma Power New Work Operations Facility
Contract Date:	December 11, 2020	**Description of Change Order:**	Scope Amendments and Contract Price Increase

Adjustment to the Contract Time is 0 day(s).
The Completion Date, as amended by this and all preceding Change Orders, is: .

Timely completion is of the essence. The costs and effect on the Contract Price, the Contract Time and the Completion Date of each Change Order shall be dealt with separately and shall be deemed to include all direct, indirect, and consequential costs associated with that Change Order, including without limitation all impact costs, overhead, and profits. No other claim shall be considered or paid by the Owner.

CHANGE ORDER DETAILS

Recitals

A. Owner and Design-Builder entered into the CCDC-14 Design-Build Stipulated Price Contract, as amended by the Supplementary Conditions, dated as of December 11, 2020 (the "Contract").

B. Owner and Design-Builder have agreed to effect a change in Design-Services and/or Work, change in Contract Price and/or change in Contract Time, pursuant to the terms of the Contract.

C. For value received, the Parties agree as follows.

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Contract Remains in Full Force. Except for the change in Design-Services and/or Work, change in Contract Price and/or Contract Time set out in this Change Order and any previous Change Order(s), the Contract remains in full force, not otherwise amended.

Change Order Description. The Owner and the Design-Builder have agreed to the following change in Design-Service and/or Work, change in Contract Price, and/or change in Contract Time, as set out below:

Approval for an increase in the Contract Price in the amount of (+$235,000.00.

This change constitutes an increase in the Contract Price.

TULLOCH ENGINEERING

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CHANGE ORDER NO. 008

Item No.1 Owner Requested Modifications (Interior and Exterior)

Exterior Site Modifications

- Complete exterior site improvements as noted on the attached drawing SK3 (Tulloch), dated July 12, 2023 (please note this drawing was prepared to reflect the potential full paving of the ring road. The paving of the ring road was presented as a separate price to the base work shown on the drawings and has not been approved as part of this change order).
  - Drawing reflects Options 2 as described on the S&T Quote dated July 4, 2023 (attached).
  - Drawing reflect Separate Price No. 4 as described on the S&T Quoted dated July 11, 2023 (attached).

Interior Site Modifications

- Supply and Install additional horn strobes within the facility (quantity to be determined).
- Supply and Install additional smoke/heat detectors within the facility (quantity to be determined).

Subtotal	$235,000.00
Final Amount	$235,000.00

CHANGE IN CONTRACT PRICE

The Owner hereby modifies the payments as follows: (Mark **NIL** in "Basis" not used)

Lump Sum Basis	Approval for increase in Contract Price.	$	(+235,000.00)
Unit Price or Force Account Basis	Design-Services and/or Work authorized by this Change Order will be paid for at rates set out in the email quotation attached herein, or in the Contract, to a maximum amount of:	$	NIL

ACCEPTED BY:

Owner per:		**Design-Builder per:**	
Signature:		Signature:	
Print Name:	Jie Han	Print Name:	~~Dennis Tatasciore~~ Andrew Sabo
Date:	August 8, 2023	Date:	Aug 10/23

TULLOCH ENGINEERING

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saultstemarie@tulloch.ca

www.TULLOCH.ca

CHANGE ORDER NO. 008

Authorized by the Owner as an amendment to the Contract by:

TULLOCH Engineering

Signature: Don Moody

Print Name: DON MOODY

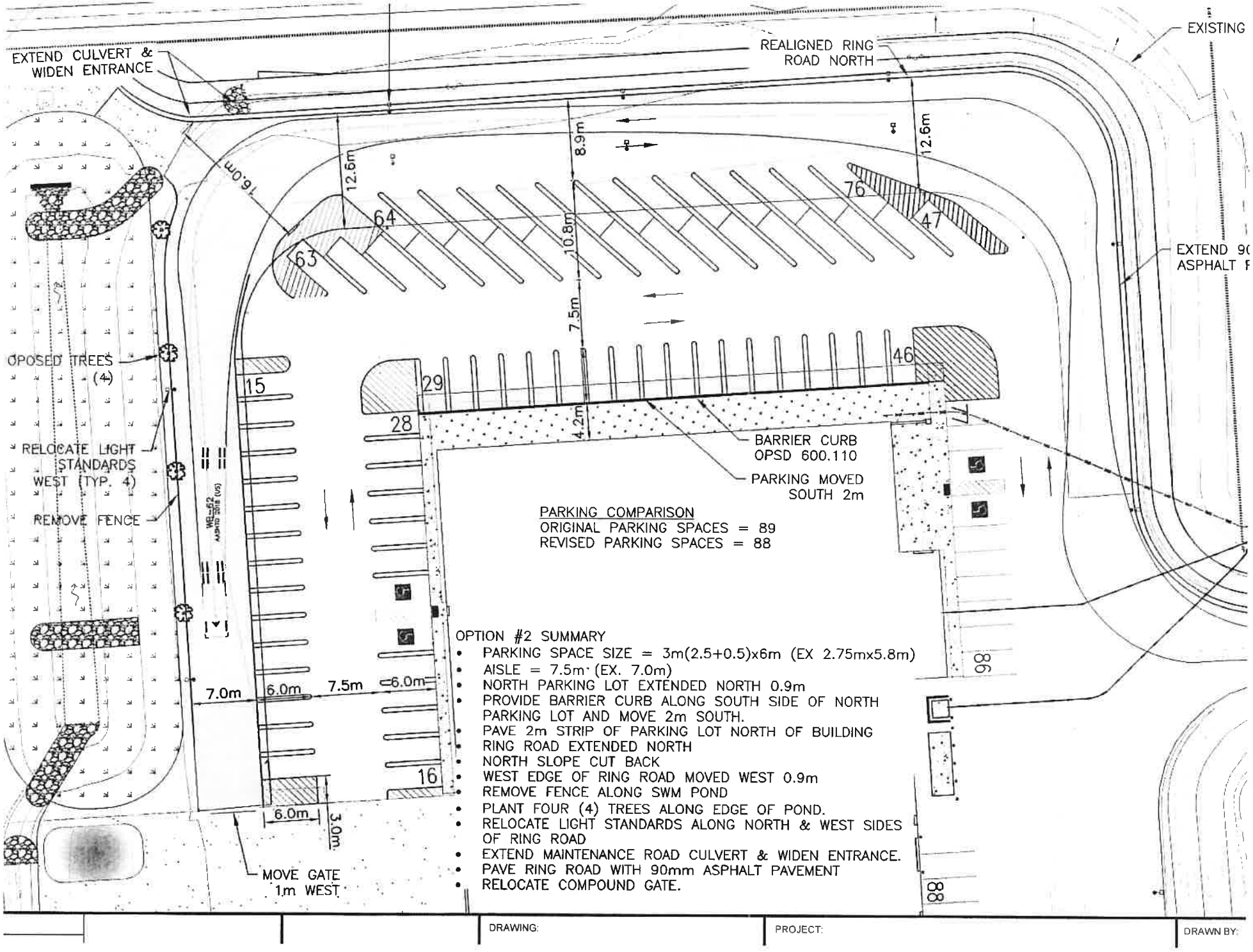
Date: AUGUST 20, 2024

SUMMARY

Original Contract Price	$	14,694,849.00
Value of this Change Order	$	(+235,000.00)
Net change to Date	$	(-824,927.85)
Revised Contract Price	$	13,869,921.20

Attachments:

20007 June 2023 Parking Alternatives OPT 2-SK3-OPT.2 WITH EXISTING.pdf
API - Site Modifications July 4 23 RS Option #2 Breakdown Jul 19, 23 RS.pdf
API - Ad Surf and Asp Modifications July 11 23 RS Breakdown Jul 19, 23 RS.pdf


EXTEND CULVERT & WIDEN ENTRANCE
REALIGNED RING ROAD NORTH
EXISTING
EXTEND 90 ASPHALT F
16.0m
12.6m
8.9m
12.6m
10.8m
7.5m
4.2m
64
63
76
47
46
29
28
15
16
OPOSED TREES (4)
RELOCATE LIGHT STANDARDS WEST (TYP. 4)
REMOVE FENCE
BARRIER CURB OPSD 600.110
PARKING MOVED SOUTH 2m
PARKING COMPARISON
ORIGINAL PARKING SPACES = 89
REVISED PARKING SPACES = 88
7.0m
6.0m
7.5m
6.0m
6.0m
3.0m
MOVE GATE 1m WEST
86
88
OPTION #2 SUMMARY
• PARKING SPACE SIZE = 3m(2.5+0.5)x6m (EX 2.75mx5.8m)
• AISLE = 7.5m (EX. 7.0m)
• NORTH PARKING LOT EXTENDED NORTH 0.9m
• PROVIDE BARRIER CURB ALONG SOUTH SIDE OF NORTH PARKING LOT AND MOVE 2m SOUTH.
• PAVE 2m STRIP OF PARKING LOT NORTH OF BUILDING
• RING ROAD EXTENDED NORTH
• NORTH SLOPE CUT BACK
• WEST EDGE OF RING ROAD MOVED WEST 0.9m
• REMOVE FENCE ALONG SWM POND
• PLANT FOUR (4) TREES ALONG EDGE OF POND.
• RELOCATE LIGHT STANDARDS ALONG NORTH & WEST SIDES OF RING ROAD
• EXTEND MAINTENANCE ROAD CULVERT & WIDEN ENTRANCE.
• PAVE RING ROAD WITH 90mm ASPHALT PAVEMENT
• RELOCATE COMPOUND GATE.
DRAWING:
PROJECT:
DRAWN BY:

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158 Sackville Road
Sault Ste Marie, ON P6B 4T6
Tel: 705-942-3043
Fax: 705-942-0614
Email: rsmith@stgroup.ca

Quotation

To:

Date: July 4, 2023
July 19, 2023 Updated

Algoma Power Inc.
251 Industrial Park Cres.
Sault Ste. Marie, ON

Re: Site Work Modifications Option #2 (BREAKDOWN)

Attention: Dan Moody A. Sc. T. – Project Manager

We are pleased to submit the following quotation:

Option #2 Work Includes:

- Extend North parking lot 0.9m
- Original parking 89 spaces – Revised parking 84 spaces
- Barrier curb at South edge of North parking lot
- Extend ring road North
- North slope cut back
- West edge of ring road moved West 0.9m
- Remove fence along SWM pond
- Plant 4 trees along edge of SWMpond
- Relocate light standards along North and West sides of ring road
- Extend maintenance road culvert and widen entrance
- Pave the first 23m of ring road with 90mm asphalt pavement
- Relocate compound gate

Option #2 Price: $212,057.00 + HST
Labour: $67,255.83
Equipment: $65,919.46
Material: $78,881.71
Option #2 Engineering Costs: $7,850.00 + HST

This quotation has been issued during the Global Coronavirus Pandemic. Given this and the highly unusual and unpredictable circumstances arising therefrom and notwithstanding what is otherwise provided in this Proposal and in addition to any other remedies provided hereunder, S.&T. Group shall be entitled to time extensions or other reasonable contractual adjustments including but not limited to increased cost of materials and equipment or the consequences of the delay in obtaining same, arising directly or indirectly out of or in connection with the Coronavirus Pandemic, which has or can lead to delays or other impacts in the delivery of goods or provision of services, or otherwise affect S.&T. Group's contractual obligations or duties hereunder.

"All Credit Card purchases may be subject to a service fee of 2.5%"

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Randy Smith
Construction Estimator / Project Coordinator

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158 Sackville Road
Sault Ste Marie, ON P6B 4T6
Tel: 705-942-3043
Fax: 705-942-0614
Email: rsmith@stgroup.ca

Quotation

To:

Date: July 11, 2023
July 19, 2023 Updated

Algoma Power Inc.
251 Industrial Park Cres.
Sault Ste. Marie, ON

Re: Additional Site Surface Modifications (BREAKDOWN)

Attention: Jennifer Rose

We are pleased to submit the following quotation:

Work Includes:

Separate Price No. 1
To supply and install asphalt on entire ring road: **$229,195.00 + HST**

Separate Price No. 2
To make green space on north side of building 4m wide and provide an additional 2.2m of asphalt on South edge of existing asphalt: **$24,469.00 + HST**

Labour: **$7,585.39**
Equipment: **$7,340.70**
Material: **$9,542.91**

Separate Price No. 3
To supply and install asphalt to pave "vehicle and trailer" parking area only: **$22,567.00 + HST**

Labour: **$6,995.77**
Equipment: **$6,770.11**
Material: **$8,801.12**

Separate Price No. 4
Combination of 2.2m on the South edge of existing asphalt plus the "vehicle and trailer" parking at the North edge of existing asphalt: **$47,036.00 + HST**

This quotation has been issued during the Global Coronavirus Pandemic. Given this and the highly unusual and unpredictable circumstances arising therefrom and notwithstanding what is otherwise provided in this Proposal and in addition to any other remedies provided hereunder, S.&T. Group shall be entitled to time extensions or other reasonable contractual adjustments including but not limited to increased cost of materials and equipment or the consequences of the delay in obtaining same, arising directly or indirectly out of or in connection with the Coronavirus Pandemic, which has or can lead to delays or other impacts in the delivery of goods or provision of services, or otherwise affect S.&T. Group's contractual obligations or duties hereunder.

"All Credit Card purchases may be subject to a service fee of 2.5%"

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Randy Smith
Construction Estimator / Project Coordinator

TULLOCH ENGINEERING

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CHANGE ORDER NO. 009

Design-Builder:	S.&T. Electrical Contractors Limited	**Job No.:**	191101
Owner:	Algoma Power Inc.	**Project:**	Algoma Power New Facility
Change Order Issue Date:	August 9, 2023	**Name of Contract:**	Algoma Power New Work Operations Facility
Contract Date:	December 11, 2020	**Description of Change Order:**	Scope Amendments and Contract Price Increase

Adjustment to the Contract Time is 0 day(s).
The Completion Date, as amended by this and all preceding Change Orders, is: _____.

Timely completion is of the essence. The costs and effect on the Contract Price, the Contract Time and the Completion Date of each Change Order shall be dealt with separately and shall be deemed to include all direct, indirect, and consequential costs associated with that Change Order, including without limitation all impact costs, overhead, and profits. No other claim shall be considered or paid by the Owner.

CHANGE ORDER DETAILS

Recitals

A. Owner and Design-Builder entered into the CCDC-14 Design-Build Stipulated Price Contract, as amended by the Supplementary Conditions, dated as of December 11, 2020 (the "Contract").

B. Owner and Design-Builder have agreed to effect a change in Design-Services and/or Work, change in Contract Price and/or change in Contract Time, pursuant to the terms of the Contract.

C. For value received, the Parties agree as follows.

Interpretation. Any defined term used in this Change Order that is not defined in this Change Order has the meaning given to that term in the Contract.

Contract Remains in Full Force. Except for the change in Design-Services and/or Work, change in Contract Price and/or Contract Time set out in this Change Order and any previous Change Order(s), the Contract remains in full force, not otherwise amended.

Change Order Description. The Owner and the Design-Builder have agreed to the following change in Design-Service and/or Work, change in Contract Price, and/or change in Contract Time, as set out below:

Approval for an increase in the Contract Price in the amount of (+$21,142.71).

This change constitutes an increase in the Contract Price.

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CHANGE ORDER NO. 009

Item No.1

Supply and install of Manitowoc Ice 520lb Indigo NXT Full Cube Ice Maker with 532lb Storage Bin, Air Cooled, 115v
- Reworking of plumbing at existing location
- Reworking of floor drain to suit ice maker drainage
- Supply and install potable water supply at ice maker location (cold water only). Includes filter
- Demo and repair of drywall to suit plumbing
- Remove half of VCT flooring and replace with new
- Supervision

Subtotal	$21,142.71
Final Amount	$21,142.71

CHANGE IN CONTRACT PRICE

The Owner hereby modifies the payments as follows: (Mark **NIL** in "Basis" not used)

Lump Sum Basis	Approval for increase in Contract Price.	$	(+21,142.71)
Unit Price or Force Account Basis	Design-Services and/or Work authorized by this Change Order will be paid for at rates set out in the email quotation attached herein, or in the Contract, to a maximum amount of:	$	NIL

ACCEPTED BY:

Owner per:		**Design-Builder per:**	
Signature:		Signature:	
Print Name:	Jie Han	Print Name:	~~Dennis Tatasciore~~ Andrew Sarlo
Date:	August 9, 2023	Date:	Aug 10/23

TULLOCH ENGINEERING

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www.TULLOCH.ca

CHANGE ORDER NO. 009

Authorized by the Owner as an amendment to the Contract by:

TULLOCH Engineering

Signature: Dan Moody

Print Name: Dan Moody

Date: August 13, 2023

SUMMARY

Original Contract Price	$	14,694,849.00
Value of this Change Order	$	(+21,142.71)
Net change to Date	$	(-803,785.14)
Revised Contract Price	$	13,891,063.90

Attachments:

STE5760 - Ice Maker r3 Option C.pdf

Attachment 2-VECC-9c

Project Reports

Algoma Power Inc.
EB-2024-0007

TULLOCH ENGINEERING

71 Black Road
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P6B 0A3

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saultstemarie@TULLOCH.ca

March 8, 2021
19-1101

Algoma Power Inc.
a FortisOntario Company
2 Sackville Road, Suite A
Sault Ste. Marie, Ontario
P6B 6J6

Attn: Dan Richards, C.E.T.
Project Manager

RE: Project Status Report
Algoma Power New Facility
March, 2021

Dear Dan:

Provided herein is our monthly project status report for the Algoma Power New Facility Design Build Project.

TULLOCH – Owner's Engineer Invoicing

- TULLOCH will endeavor to submit OE invoicing within the first calendar week of each month.
- Invoice forecasting has been submitted (valid until May, 2020)
- Invoicing for surveying services related to severance/easements will be issued separately.
- A tracking sheet for OE monthly invoices is available below.

S&T – Design Builder (EPC) Monthly Invoice

- January and February, 2021 Progress Invoices have been received from S&T and Certificates of Payment have been issued.
- The process for review of payments will be as follows:
  - TULLOCH receives invoice from S&T
  - TULLOCH reviews invoice for accuracy
  - TULLOCH reviews invoice against projected monthly invoicing and advises API if there is a substantial deviation
  - If no concerns or discrepancies, TULLOCH processes a Certificate of Payment
  - COP is issued to API for payment processing
  - Once the COP is accepted for processing, all parties should be notified via email.
- Progress payments will be tracked in the document below.
- All future COP submission from TULLOCH to S&T will include a summary of dates that are critical for compliance wit the Construction Act
  - Date Invoice received

- Date until which API may dispute the invoice
- Date on which payment must be received by S&T

- To date, S&T has invoiced $184,582.42 + HST.

Risk Registry

- The Project Risk Registry has been submitted for review by the API Team.
- The Risk Registry will be updated as required throughout the project.

Project Schedule

- Based on recent Team discussions, S&T has advised that the project is generally tracking in accordance with the Project Schedule. Currently, the Conceptual Design Phase is nearing completion, although the process has produced information that will expedite the forthcoming Detailed Design Phase.

- S&T will share the master Microsoft Project Schedule with API at intervals to be determined. This shared schedule will permit merging with the internal API schedule.

Request for Information (RFI) Log

- Four RFIs have been received to date. RFI numbering is not indicative of quantity issued.
- The below tracking sheet will be updated throughout the project.

Change Order Tracking

- As Change Orders are approved, the tracking sheet will be updated.
- One Change Order has been processed so far.

Distribution List: Dan Richards, Jennifer Rose, Dave Larochelle, Meagan Figures

TULLOCH ENGINEERING

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saultstemarie@TULLOCH.ca

November 16, 2021
19-1101

Algoma Power Inc.
a FortisOntario Company
2 Sackville Road, Suite A
Sault Ste. Marie, Ontario
P6B 6J6

Attn: Dan Richards, C.E.T.
Project Manager

RE: Project Status Report
Algoma Power New Facility
November 16, 2021

Dear Dan:

Provided herein is our monthly project status report for the Algoma Power New Facility Design Build Project.

General Project Update

- Interior concrete spread footings are complete. Foundation subcontractor has progressed to perimeter foundation walls. Industrial Park access road subbase and ditching are in place. Temporary ditching is in place at select locations on the site to manage ground water.
- 100% Design Drawings have been submitted for review. TULLOCH and API are currently in the process of reviewing.
- September 7th, 2021 – S&T requested that the Team revisit the notion of partial early release of their Holdback (10% for consulting services).
- Negotiations have continued regarding CCN 005. S&T presented their "best and final" offer to API. TULLOCH completed a review of S&T's revised submission and supporting documentation and subsequently made a revised recommendation for payment to API. TULLOCH has prepared a draft Change Order for these items, which is currently with API for review.
- S&T has made an email submission regarding Change Order 001, Item No. 1, TULLOCH, and API have completed an initial review; additional discussion is expected to take place once CCN 005 has been resolved.
- TULLOCH has prepared and submitted to API a report summarizing energy efficiency inclusions within the RFP, the detailed design, and as recommended in the Enbridge "Savings By Design" report. At the time of report submission, S&T had not provided budgetary pricing for several potential energy efficiency upgrades. Additional discussion is expected to take place, once CCN 005 has been resolved.
- Updated schedule submitted by S&T on September 22nd, 2021.
- TULLOCH and API have reviewed CCN 002, 003 and 004 responses. CCN 004 has received internal API approval. TULLOCH to discuss with S&T potential revised approached to CCN 002

and 003. Additional discussion with S&T is expected once CCN 005 has been resolved.
- Building structural steel has begun to arrive in Sault Ste. Marie and is scheduled for erection during the week of November 22nd, 2021.

TULLOCH – Owner's Engineer Invoicing

- TULLOCH will endeavor to submit OE invoicing within the first calendar week of each month.
- Invoice forecasting has been prepared (valid until December 2021)
- Invoice forecasting for the next five (5) months has been submitted.
- Invoicing for surveying services related to severance/easements will be issued separately.
- A tracking sheet for OE monthly invoices is available below.

S&T – Design Builder (EPC) Monthly Invoice

- S&T invoice for Progress Payment No. 9 was issued to the Team for review and approval on November 8th, 2021.
- Permission was granted to S&T to invoice for roofing materials as part of Progress Payment No. 9. There were conditions to this agreement, which S&T fulfilled, TULLOCH recommended to S&T that a meeting be requested to discuss the potential for invoicing for materials not delivered to the API project site.
- The process for review of payments will be as follows:
    - TULLOCH receives invoice from S&T
    - TULLOCH reviews invoice for accuracy
    - TULLOCH reviews invoice against projected monthly invoicing and advises API if there is a substantial deviation
    - If no concerns or discrepancies, TULLOCH processes a Certificate of Payment
    - COP is issued to API for payment processing
    - Once the COP is accepted for processing, all parties should be notified via email.
    - TULLOCH will maintain regular communication with API until such time that the Payment has been escalated for approval at the executive level.
- Progress payments will be tracked in the document below.
- All future COP submission from TULLOCH to S&T will include a summary of dates that are critical for compliance with the Construction Act
    - Date Invoice received
    - Date until which API may dispute the invoice
    - Date on which payment must be received by S&T
- To date, S&T has invoiced **$2,391,620.69 + HST**.
- An Update Schedule of expected invoicing was provided by S&T on July 29, 2021.
- With all future Payment Certificates, TULLOCH will provide (in the covering email) an indication as to whether the previous month's progress is generally in accordance with the proposed schedule. General conformance to projected monthly cashflow will also be reviewed.

Risk Registry

- The Risk Registry will be updated as required throughout the project.
- Recent additions to the Risk Registry include:
  - Potential for design changes pending the outcome of the Enbridge Session
  - Potential for CD001 and CD002 to escalate to adjudication
  - No buffer left in the schedule
  - Liability of API Staff attending the site

Project Schedule

- Updated Cash Flow Forecast and Project Schedule from S&T was issued to the Team on August 8, 2021.
- Concrete foundations are nearing completion.
- Building structural steel installation is scheduled to commence the week of November 22nd, 2021.
- A request for an updated schedule has been made to S&T.

Request for Information (RFI) Log

- Five RFIs have been received to date. RFI numbering is not indicative of quantity issued.
- The below tracking sheet will be updated throughout the project.

Contemplate Change Notice / Change Order Tracking

- As Change Orders are approved, the tracking sheet will be updated.
- Responses to CCN 002, 003, and 004 have been received from S&T. TULLOCH and API have reviewed and will in turn respond to S&T requesting clarifications and alternate pricing.
- After a lengthy negotiation, S&T submitted their “Best and Final” offer for CCN 005. TULLOCH has completed a review.
- A draft Change Order (CO 003) has been prepared and issued to API for review.

Change Directive Tracking

- As requests for Change Directives (CD) are received, the tracking sheet will be updated.

- Two requests for Change Directives have been received so far.
- A formal response to the Change Directives was issued to S&T on June 2, 2021

General Information Tracking

- An API internal document to track issued and received status of official project documentation as well as informal information requests made to S&T

Distribution List: Dan Richards, Jennifer Rose, Dave Larochelle, Meagan Figures

Photo 1 – Perimeter Pier Footing

Photo 2 – Perimeter Strip Footing (Looking Southwest)

Photo 3 – Interior Spread Footings

TULLOCH ENGINEERING

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saultstemarie@TULLOCH.ca

April 9, 2021
19-1101

Algoma Power Inc.
a FortisOntario Company
2 Sackville Road, Suite A
Sault Ste. Marie, Ontario
P6B 6J6

Attn: Dan Richards, C.E.T.
Project Manager

RE: Project Status Report
Algoma Power New Facility
April 9, 2021

Dear Dan:

Provided herein is our monthly project status report for the Algoma Power New Facility Design Build Project.

General Project Update

- Revised Certificates of Insurance have been received from S&T.
- Civil Schematic design drawings have been submitted for review.
- Architectural Design Development is approximately 95% complete.
- Structural Design development is proceeding and a design submittal will be forthcoming.
- Civil Design development is proceeding and a design submittal will be forthcoming.
- Mechanical and Electrical Design Development is under way. A design brief will be forthcoming.
- A letter regarding a change in contract price for the Canam building system was issued to API. Further discussion has determined that additional price increases are forthcoming.
- Further update regarding project budget is expected to be provided the week of April 12th.
- The DART meeting has been delayed until April 22/23.
- Green North Development has committed to relocating items currently on API property.
- The MNRF has verified that the den has been vacated. Work may proceed on site with no permit provided the den is not disturbed. Provided that removal of the den can be delayed until after April 30th, no permit will be required. Written confirmation of this will be provided.
- The relocation of the communication line is scheduled to commence on April 12th.

TULLOCH – Owner's Engineer Invoicing

- TULLOCH will endeavor to submit OE invoicing within the first calendar week of each month.
- Invoice forecasting has been submitted (valid until May, 2020)
- Invoicing for surveying services related to severance/easements will be issued separately.
- A tracking sheet for OE monthly invoices is available below.

- A new Purchase Order was provided for all future invoices related to Owner's Engineer Services.

S&T – Design Builder (EPC) Monthly Invoice

- March, 2021 Progress Invoice has been received from S&T and the Certificate of Payment have been issued.
- The process for review of payments will be as follows:
    - TULLOCH receives invoice from S&T
    - TULLOCH reviews invoice for accuracy
    - TULLOCH reviews invoice against projected monthly invoicing and advises API if there is a substantial deviation
    - If no concerns or discrepancies, TULLOCH processes a Certificate of Payment
    - COP is issued to API for payment processing
    - Once the COP is accepted for processing, all parties should be notified via email.
- Progress payments will be tracked in the document below.
- All future COP submission from TULLOCH to S&T will include a summary of dates that are critical for compliance wit the Construction Act
    - Date Invoice received
    - Date until which API may dispute the invoice
    - Date on which payment must be received by S&T
- To date, S&T has invoiced **$244,250.22 + HST**.

Risk Registry

- The Risk Registry will be updated as required throughout the project.
- Recent additions to the Risk Registry include:
    - Unexpected Increase to Project Costs
    - Delays with Communication Line Installation
    - Bear Den on site
    - DART process, severance application & impact on building permit process

Project Schedule

- The Schematic Design Process is complete and has been accepted by API.
- Design developments is underway.
- As provided by S&T, Material Items affecting project timeline:
    - Architectural - Schematic Design - User Group Interviews – Scheduled to be completed end of January, this was pushed into mid February.

- Civil – Schematic Design - Geotechnical – Results of Geotechnical Analysis of property limited design options and detailed analysis was required to resolve.
- The DART meeting has been post-pined to April 22/23.
- S&T has provided an update Microsoft Project Schedule with has been shared with Dave Larochelle.

Request for Information (RFI) Log

- Four RFIs have been received to date. RFI numbering is not indicative of quantity issued.
- The below tracking sheet will be updated throughout the project.

Change Order Tracking

- As Change Orders are approved, the tracking sheet will be updated.
- One Change Order has been processed so far.
- One Request for Change Order has been submitted by S&T.

Distribution List: Dan Richards, Jennifer Rose, Dave Larochelle, Meagan Figures

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saultstemarie@TULLOCH.ca

July 19, 2021
19-1101

Algoma Power Inc.
a FortisOntario Company
2 Sackville Road, Suite A
Sault Ste. Marie, Ontario
P6B 6J6

Attn: Dan Richards, C.E.T.
Project Manager

RE: Project Status Report
Algoma Power New Facility
July 19, 2021

Dear Dan:

Provided herein is our monthly project status report for the Algoma Power New Facility Design Build Project.

General Project Update

- The site has been stripped of vegetation and organics. Dan Moody and Meagan Figures attending the site on June 30 to review progress with Randy Smith of S&T. Site photos are provided at the end of this report.
- No further update has been provided by S&T regarding overall project schedule or scheduling risks to the project.
- A conditional permit (foundations only) has been received by S&T. A copy was requested from S&T on July 19, 2021.
- A request to provide an update as to the schedule to obtain all outstanding permits for the project was submitted to S&T on July 19, 2021.
- A Change Order (CO 002) was issued to S&T for the addition of the 5 ton capacity overhead crane.
- Contemplated Change Notices have been issued to S&T to obtain pricing for Pole Bunks, Transformer Storage Racks and EV Charging Stations.
- TULLOCH completed a detailed technical review of CD1, CD2 as well as the supplemental geotechnical information that was provided by S&T. After internal discussion it was determined that a Contemplated Change Notice (CCN) would be issued. CCN 005 was issued to S&T on July 8, 2021.
- The Enbridge review session took place on June 29th, 2021. Dave Larochelle, Taylor Wilson, Jim Tait and Dan Moody will attend. The session was mostly a presentation, with little information being requested from API or S&T.
- The Architectural design development submission was approved (with comments) and retuned to S&T on July 14, 2021.
- The Civil design development submission is under review and is expected to be returned to

S&T early in the week of July 19, 2021.

TULLOCH – Owner's Engineer Invoicing

- TULLOCH will endeavor to submit OE invoicing within the first calendar week of each month.
- Invoice forecasting has been prepared (valid until December, 2021)
- Invoice forecasting for the next five (5) months has been submitted.
- Invoicing for surveying services related to severance/easements will be issued separately.
- A tracking sheet for OE monthly invoices is available below.

S&T – Design Builder (EPC) Monthly Invoice

- No invoice was issued by S&T in June, 2021
- The process for review of payments will be as follows:
    - TULLOCH receives invoice from S&T
    - TULLOCH reviews invoice for accuracy
    - TULLOCH reviews invoice against projected monthly invoicing and advises API if there is a substantial deviation
    - If no concerns or discrepancies, TULLOCH processes a Certificate of Payment
    - COP is issued to API for payment processing
    - Once the COP is accepted for processing, all parties should be notified via email.
    - TULLOCH will maintain regular communication with API until such time that the Payment has been escalated for approval at the executive level.
- Progress payments will be tracked in the document below.
- All future COP submission from TULLOCH to S&T will include a summary of dates that are critical for compliance wit the Construction Act
    - Date Invoice received
    - Date until which API may dispute the invoice
    - Date on which payment must be received by S&T
- To date, S&T has invoiced **$857,440.95 + HST**.
- An Update Schedule of expected invoicing was requested from S&T on July 6, 2021.

Risk Registry

- The Risk Registry will be updated as required throughout the project.
- Recent additions to the Risk Registry include:
    - Potential for design changes pending the outcome of the Enbridge Session
    - Potential for CD001 and CD002 to escalate to adjudication
    - No buffer left in the schedule
    - Liability of API Staff attending the site

Project Schedule

- An updated Project Schedule was requested from S&T on July 6, 2021.
- A request to provide an update as to the schedule to obtain all outstanding permits for the project was submitted to S&T on July 19, 2021.
- The Architectural design development submission was approved (with comments) and returned to S&T on July 14, 2021.
- The Civil design development submission is under review and is expected to be returned to S&T early in the week of July 19, 2021.

Request for Information (RFI) Log

- Five RFIs have been received to date. RFI numbering is not indicative of quantity issued.
- The below tracking sheet will be updated throughout the project.

[redacted]

Contemplate Change Notice / Change Order Tracking

- As Change Orders are approved, the tracking sheet will be updated.
- Contemplated Change Notice CCN-001 to CCN-005 have been issued to S&T.
- Change Order C0-001 and CO-002 have been issued to S&T.
- One Request for Change Order has been submitted by S&T.

Change Directive Tracking

- As requests for Change Directives (CD) are received, the tracking sheet will be updated.
- Two requests for Change Directives have been received so far.
- A formal response to the Change Directives was issued to S&T on June 2, 2021

Distribution List: Dan Richards, Jennifer Rose, Dave Larochelle, Meagan Figures

Photo 1 – Looking North-East from the Sackville Road Entrance Area.

Photo 2 – Looking East from the Sackville Road Entrance Area.

Project Title

Meeting
Purpose: Bi-weekly AOC Meeting

Date:	August 9, 2021	Owner:	S&T Group
Location:	Team Meetings	Recorder:	Andrew Marshall
Time:	3:00PM	Facilitator:	Andrew Marshall

Attendees

	Name	Role		Name	Role
*	Jim Tait		*	Randy Beltramin	
*	Andrew Marshall		*	Jennifer Rose	
*	Randy Smith		*	Mike Tatasciore	
*	Andrew Sarlo		*		
*	Dave LaRochelle				
*	Dan Moody				
*	Dan Boulanger				

Denotes * Attendance; # Absent; + Substitute

Agenda

	Subject	Presenter	Time
	Construction Progress Update		
	Safety		
	Schedule		
	Submittals		
	New Items		
	Changes		
	Round Table		

Next Meeting

- August 23rd 2021

Discussion #1 – Progress Update

- Review of last meetings minutes
  - Actions taken,
  - Anything outstanding
- Superintendents daily log review
  - Daily Status of project
  - Any concerning issues
- Input from attending parties

Design

- 66% Design Package Complete – Andrew M. to send out for review
- Structural Package Review complete – Canam is anticipated to go into production this week
  - Structural design is at completion with Civil design nearing completion

Utilities

- Incoming Electrical service under review by PUC – Application has been submitted
- Incoming Sanitary and Water services under review by PUC – Application has been submitted
- Incoming natural gas services under review by Enbridge – Application has been submitted

Site Heavy Civil – In progess

- Avery on Site
- Current working on Access Rd. and control of stormwater on property
  - Bear Den has been removed.
  - Underside of footing excavation to follow

Discussion #2 – Safety/Environmental

- COVID-19
  - Changes in legislation
  - Changes in safety protocol
  - Proper documentation
- Site relation safety issues

Nothing to report at this time.

Discussion #3 – Schedule

- Major changes
  - Changes to critical path
  - Solutions
  - Productivity
- For seeable changes
  - Delays upcoming, etc.
- 2 weeks look ahead

Critical Path

- Access Road (Service trenching)– next 2 weeks – In progress
- Footing excavation – Starting ~August 23rd
- Footings (Forms and Concrete) – Expected to be completed by
- Application for final permitting towards end of month with anticipated IFP drawings – End of August of permit submission
  - 99% complete drawings ready for April 6th

- Canam Production of building to be completed late September\Early October which aligns with completion of
- Building Erection to start mid October.

Discussion #4 – Submittals

- Review Submittal Log
  - New submittals
  - Missing/outstanding submittals

Design Development – Submittals and responses 100% complete

- All other questions and comments should be address via 66% design package submission.

Review drawings and address for next meeting

Discussion #5 – New Items

- RFI Review
  - New RFI's
  - Existing/unanswered
- Input from attending parties

Nothing to report at this time.

Discussion #6 - Changes

- Change order review
  - Outstanding/unanswered change orders
  - New changes orders to be presented
- CCN002 – Transformer Storage Racks – In Progress.
- CCN003 – Pole Bunks – In Progress
- CCN004 – EV Charging Stations – Estimate complete, preparing for submission
- CCN005 EOD Tuesday August 10, 2021

Discussion #7 – Round Table

- Meeting review
- Closeout remarks from attending parties

Action No	Agenda Item	Subject	Action	Assigned To	Due Date

API New Facility

Meeting
Purpose: BI WeeklyAOC Meeting

Date:	June 28th, 2021	Owner:	S. & T. Group
Location:	Team Meetings	Recorder:	Andrew Marshall
Time:	3:30pm	Facilitator:	Andrew Marshall

Attendees

	Name	Role		Name	Role
*	Jim Tait		*	Randy Beltramin	
*	Andrew Marshall		*	Jennifer Rose	
*	Randy Smith				
*	Andrew Sarlo				
*	Dave LaRochelle				
*	Dan Moody				
*	Dan Boulanger				

Denotes * Attendance; # Absent; + Substitute

Agenda

	Subject	Presenter	Time
	Open Remarks		
	Civil Design Update		
	Structural Design Update		
	Architectural Design Update		
	Mechanical Design Update		
	Electrical Design Update		
	Security Design		
	New Items		

Next Meeting

July 12th, 2021 3:00pm

Discussion #1 – Open Remarks

- Current Status of project
- Strategy moving forward
- Time constraints

Discussion #2 – Civil Design Update

- Final elevations required
  - Site Grading – drawing complete
  - 90% completion
  - Surface grades will not change
  - Storm water management pond design is complete
  - Can move on with construction
  - Minor changes will be made along the way
  - Conditional Permits have been granted
- Ditching Details for East properties
  - Go ahead was approved
  - Ditches on adjacent properties – Enbridge needs to forward information to higher level
- Ditching Details for South and West city ditch
  - Price to give to city along with construction price (design + construction)
- Entrance Road Final Design
  - Virtually done
  - Apart of servicing drawing
- Sanitary and Storm access road base details for extension across Sackville Rd allowance
  - Same detail as city ditch
  - Sackville sanitary system is over capacity
  - Hydraulic grade line analysis – if below lowest basement elevation – will work – gravity down to Sackville
  - Failed analysis – Basement elevations required in critical areas
- Watermain Details – size increase
  - 200mm diameter needed

- New foundation details related to the Canam Load changes affecting column footings/consolidation/balance of foundation
  - Reg straightening out Canam final drawings
  - Still need engineer approval
- Impact of the Canam load changes – cost and schedule impact

Discussion #3 – Structural Design Update

- Anchor bolt designs – received
- Canam Coordination drawings
    - Final Design Outstanding

Discussion #4 – Architectural Design Update

- Canam package has been received by IDEA
    - Coordinating into drawings currently
    - 50% of perimeter has been reviewed
    - 95% of gridlines are correct
    - Windows along N W E elevations are lower than Architectural
    - IDEA will return in packages – doors and windows needed
    - Latest Monday for feed back to Canam
    - Canam comment on compliance – thickness of panels and insulation
- Level 1 Layout design in review by API
    - Moving forward with detailed design

Discussion #5 – Mechanical Design Update

- HVAC design in process – update?
- New quotations from Gagnon have been received to use a different roof top unit
    - Cut sheets will be sent out
    - Check opening of York units
    - Check compatibility
- Utilities layout

Discussion #6 – Electrical Design Update

- PUC coordination
    - Follow up required
- Utilities layout
    - Pole movement if necessary

- Existing feeds
  - Wont allow a new feed off the existing feed
  - Higher pole needed? Extend out to another pole
  - Under ground to dip pole? – idea to be presented
- Lighting redesign by Ralph – Status?
  - Exterior lighting – placement
    - Enough space to allow another pole along front of building
    - Shane to send plan to S&T, Ralph, and Randy B

Discussion #7 –Security Design Update

- Updated security layout – status?
- Specific card reader requested – integrate to reuse existing

Discussion #8 –New Items

- Crane progress – approval in process
  - Randy S to send crane details to IDEA for review

Action No	Agenda Item	Subject	Action	Assigned To	Due Date

Attachment 2-VECC-17

Past ACA

Algoma Power Inc.
EB-2024-0007

METSCO
MAKING IT POSSIBLE

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ASSET CONDITION ASSESSMENT REPORT 2018

Prepared by

P-18-201

December 2018

Disclaimer

This 2018 report has been prepared by METSCO Energy Solutions Inc. (“METSCO”) for Algoma Power Inc. (“API”). Neither API, nor METSCO, nor any other person acting on their behalf makes any warranty, expressed or implied, or assumes any legal responsibility for the accuracy of any information or for the completeness or usefulness of any process disclosed or results presented, or accepts liability for the use, or damages resulting from the use, thereof. Any reference in this report to any specific process or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement or recommendation by API or METSCO.

Asset Condition Assessment Report 2018

Final Report

December 2018

Experts:

Robert Otal, B.Eng., P.Eng.
Director, Asset Management & Analytics

Dawid Lizak, B.A.Sc., M.Eng
Associate, Asset Management & Strategy

Expert Support: **James Warburton, B.Sc., B.Eng. (in progress)**
Student Intern Associate, Asset Management Analytics

Approved By:

Thor Hjartarson, M.A.Sc., P.Eng
Chairman

Executive Summary

This Asset Condition Assessment report is prepared for Algoma Power Inc.'s (API's) distribution assets. The report provides estimates of assets' conditions based on data provided by Algoma Power Inc. in November 2018.

As Algoma Power Inc. continues utilizing a risk-based asset management strategy to determine the optimal timing and scope of investments into asset renewal, an Asset Condition Assessment is prepared to determine the condition of the asset. A brief outline of implementing a risk-based asset management is documented in Section 2. The first step towards implementation of a risk-based asset management approach is to develop a yard stick, such as a Health Index, that could be employed to measure and benchmark the health and condition of in-service assets. A comprehensive methodology has been developed and documented in Section 3 of the report for assets targeted within the scope of this analysis. The methodology in this report has been updated to METSCO Energy Solutions Inc.'s Health Index Formulation to better reflect the accuracy of an asset's condition for risk management. By applying the methodology, an asset's condition assessment is produced.

The Asset Condition Assessment is based on data compiled in November 2018 and covers the following classes of assets owned by Algoma Power Inc.:

- Distribution Wood Poles
- Distribution Transformers
- Overhead Primary Conductors
- Underground Primary Cables
- Overhead Switches
- Reclosers
- Capacitors
- Station Power Transformers
- Station Spares and Regulator Transformers
- Ratio Banks
- Protection Relays
- Ground Grids & Yards/Buildings

For each asset group the Health Index is calculated with utility provided data. Assets are classified in one of five conditions: Very Good, Good, Fair, Poor, or Very Poor. The results of the Asset Condition Assessment are summarized in Figure 0.1.

Figure 0.1: Health Index Results

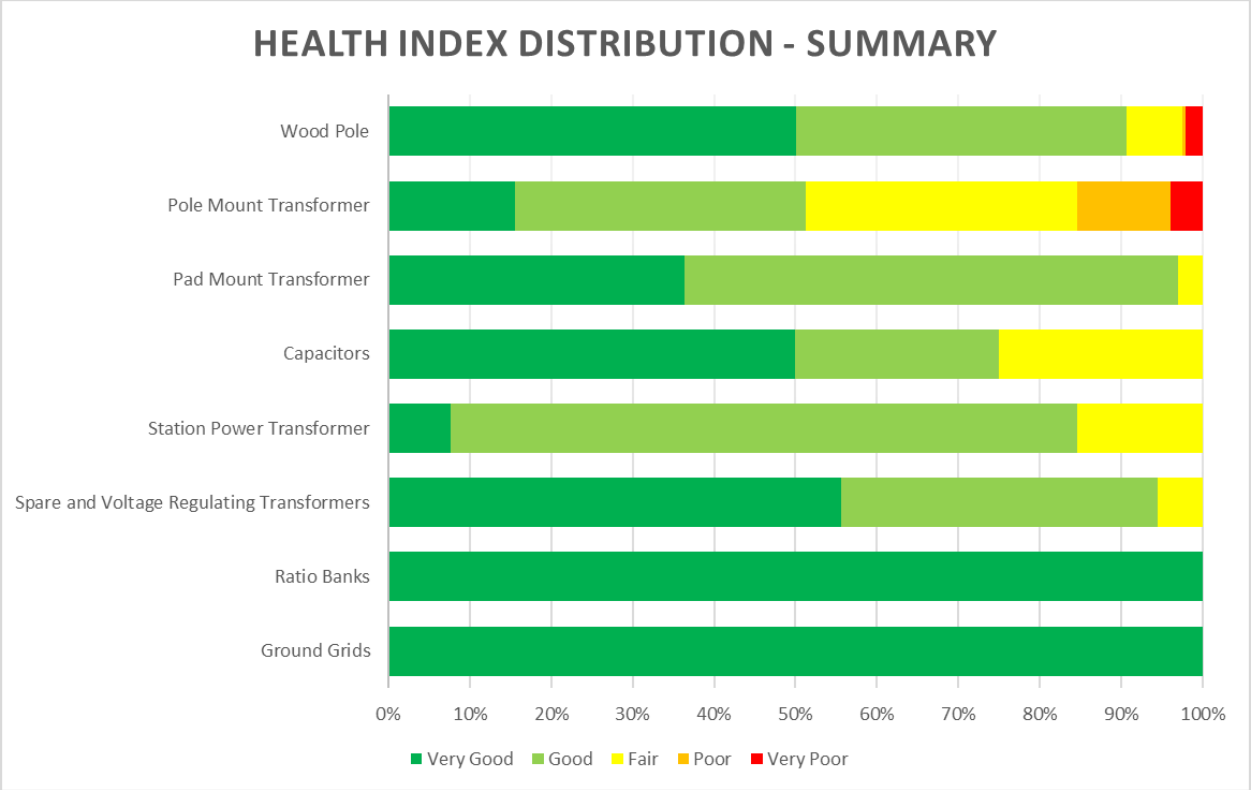

Table 0-1 presents the summary of the Health Index results. For each asset class the following details are given: the total population, average Health Index, average Data Availability Indicator (DAI), and the Health Index distribution. The Recommended Health Index Formulation is derived from METSCO's experience based on the Best Practice Health Index Formulations, the available data and the most important parameters that determine end of life for each asset. The Data Availability Indicator is a percentage of availability of condition parameter data for an asset or asset class, as measured against the condition parameters considered in the Recommended Health Index Formulation. A DAI of 100% for an asset indicates successful population of values for all condition parameters defined in the Recommended Health Index Formulation for the asset and is therefore a measure of the success in meeting its intentioned data collection. Though many asset health indices are currently dependent on age alone, it presents an opportunity for Algoma Power Inc. to structure their data collection process moving forward. Additional data parameters will further reinforce Algoma Power Inc.'s ACA.

The majority of Algoma Power Inc.'s system is in Good or better condition which suggests Algoma Power Inc.'s past renewal investments were effective in maintaining the system health. However, there are some assets that can benefit from an increase in asset renewal. This will reduce the risk of failure, decrease the cost of reactive failures, and reduce the amount of below Fair condition graded assets in the system.

METSCO's strongest recommendation is that Algoma Power Inc. begin collecting and keeping condition records consistent for all assets inspected rather than checking for a pass/fail criterion, which typically identifies assets in need of replacement. This will establish a stronger baseline of the asset health indices rather than being primarily dependent on age. Additionally, METSCO has provided a recommended asset replacement plan for asset renewal solely based on the current ACA results calculated. The asset replacement plan is a baseline that provides the projected quantities of assets that would likely require replacement for the next short-term planning period (2019 to 2024) to improve the asset category's Health Index and to maintain the overall system health.

Table 0-1: Asset Condition Assessment Overall results

Asset Category	Population	Health Index Distribution (%)					Average Health Index	Average DAI
		Very Good	Good	Fair	Poor	Very Poor		
Wood Pole	28104	50.0%	40.6%	6.9%	0.3%	2.1%	83%	55%
Pole-Mount Transformer	4800	15.6%	35.6%	33.4%	11.4%	4.0%	68%	Age only
Pad-Mount Transformer	132	36.4%	60.6%	3.0%	0%	0%	83%	Age only
Capacitor	4	50.0%	25.0%	25.0%	0%	0%	84%	100%
Station Power Transformer	13	7.7%	76.9%	15.4%	0%	0%	77%	84%
Spares and Voltage Regulating Transformers	18	55.5%	38.9%	5.6%	0%	0%	87%	75%
Ratio Banks	3	33.3%	66.6%	0%	0%	0%	100%	100%
Ground Grids	8	100%	0%	0%	0%	0%	100%	100%
Yards & Buildings	8	100%	0%	0%	0%	0%	100%	100%

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1 Introduction

This report summarizes the results of an Asset Condition Assessment (ACA) study carried out by METSCO Energy Solutions Inc. (METSCO) on behalf of Algoma Power Inc.. The main objectives are to generate Health Indices with current condition data of in-service assets employed in the electricity distribution plan and recommend replacement plans.

The ACA methodology is applied to different categories of assets that are deployed within Algoma Power Inc.'s distribution system. Adoption of the ACA methodology requires periodic asset inspections and recording of asset condition to identify those assets most at risk. Additionally, computing the Health Index for distribution assets requires identifying end-of-life criteria for various components associated with each asset type. Each criterion represents a factor that is influential in determining the component's condition relative to its potential failure. These components and tests shown in the tables are weighted based on their importance in determining the assets' end-of-life.

The assets covered in the report include the following assets:

- Distribution Wood Poles
- Distribution Transformers
- Overhead Primary Conductors
- Underground Primary Cables
- Overhead Switches
- Reclosers
- Capacitors
- Station Power Transformers
- Station Spares and Regulator Transformers
- Ratio Banks
- Protection Relays
- Ground Grids & Yards/Buildings

The information contained within this report is compiled based on data available in November 2018. The report is organized into four sections including this introductory section:

- Section 2 outlines the strategic asset management plan, summarizing standards ISO 55000/55001/55002, an overview of the METSCO methodology and the ACA process;
- Section 3 provides the Condition Assessment methodology framework and assessment for the asset's age, condition and overall data collection;
- Section 4 summarizes our recommendations for Algoma Power Inc. on data collection improvements for improving the Health Index results;
- Section 5 summarizes a recommended strategy for Algoma Power Inc. for future investment planning.

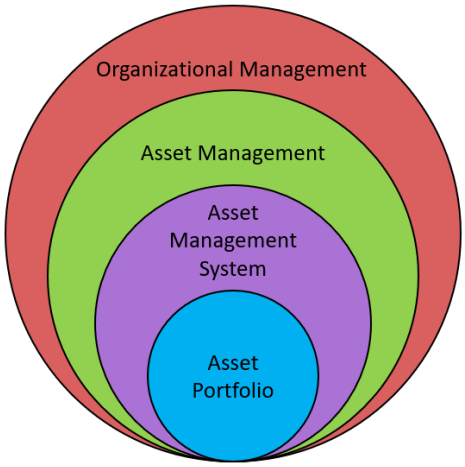
2 Strategic Asset Management Plan

2.1 Industry Standard for Asset Management Planning

The Industry Standard for Asset Management Planning is outlined in ISO 5500X. Asset Management (AM) is generally applied to one of three groups of entities: those looking to establish and set up an asset management system, those looking to realize more value from an asset base, and those looking to review an asset management system already in place for avenues of improvement. In this way, ISO 5500X should always be applied in the scope of the organization; relating to its purpose, operating context, and financial constraints. Stakeholders should be of primary concern when applying or analysing any new or updated AM framework.[1]

An asset is any item or entity that has a value to the organization. This can be actual or potential value, in a monetary or otherwise intangible sense (i.e. public safety). The hierarchy of an AM framework is as follows: an asset portfolio, containing all known information regarding the assets, sits as the fundamental core of an organization. Around the asset portfolio the AM system operates and is the set of interacting elements to establish policy, objectives, and the processes to achieve those objectives. The AM system is encompassed by the AM practices, which are executed as the coordinated activity of the organization to realize maximum value from its assets. Finally, the organizational management organizes and executes the underlying hierarchy.[1]

Figure 2.1 Relationship between key Asset Management terms[1]



Asset management is fundamentally grounded as a risk-based approach. The overarching goal of an AM process it to quantify all assets risk by their probability and impact (where possible) and then look to minimize these risks through asset management operations and procedures. The application of rigorous AM processes can produce multiple types of benefits for an organization including, but not limited to: realized financial profits, better classified and managed risk among

[1] ISO 55000 – Asset management – Overview, principles and terminology

assets, better informed investment decisions, demonstrated compliance among the asset base, increased public and worker safety, and corporate sustainability.[1]

Asset management processes are ideally integrated throughout an entire organization. This requires a well-documented AM framework that is shared between all relevant agents. In this way, the organization stands to benefit the most from its own on-hand resources, whether it be via technical experts, those operating and maintaining the assets, or those with an understanding of the financial operations and constraints on the organization as a whole. Usually the AM implementing principles are documented within a Strategic Asset Management Plan (SAMP). The SAMP should be used as a guide for the organization to apply its asset management principles and practices for its specific-use case. Distribution of the SAMP should be open within an organization and updated on regular basis in order to best quantify the most current and comprehensive asset management practices being implemented within the organization. Just as the asset base performance is subject to in-depth review, the asset management process and system should be reviewed with the same rigor.[1]

Well executed AM hinges on the ability for an organization to classify its asset via comprehensive and extensive data and data collection procedures. This includes but is not limited to: the collection and storage of technical specifications, historical asset performance, projected asset behaviour and degradation, configuration of an asset or asset-group within the system, the operational relation of one asset to another, etc.. In this way, AM systems should be focused on the techniques and procedures in which data can be most efficiently extracted and stored from its asset base to allow for further analysis and insights to be made. With more asset data on hand, better and more informed decisions can be made to realize greater benefits and reduce the risk across the asset portfolio managed by an organization.[2]

AM practices can help quantify and drive strategic decisions. A better understanding of the asset portfolio within an organization will allow for fluid reorganization or changes in management processes to realize tangible benefits to the organization. This is largely due to AM being a fundamentally risk-based approach, which lends it to be a sound framework for creating financial plans driven by evidence-based support. AM practices should also have goals in mind when framing asset investments, changes in asset configuration, or acquisition of new assets. This can include better technical compliance, increased safety, increased reliability, or increased financial performance of the asset base. ISO 5500X states explicitly that all asset portfolio improvements should be assessed via a risk-based approach prior to being implemented.[2]

Finally, asset management should be regarded to as a fluid process. Adopting a framework and idealized set of practices does not bind the organization or restrict its agency. With time, the goal of any asset management system is to continually improve and realize benefit within the organization through better management of its asset portfolio. Continually improved asset data and data collection procedures, updated SAMPs, and further integration of into all aspects of an

[2] ISO 55002 – Asset management – Management systems – Guidelines for the application of ISO 55001

organization's activities as it grows and changes over time should be the goal of any AM framework.[2]

An Asset Condition Assessment (ACA) represents the first step in fully integrating the AM framework outlined by ISO 55000. By evaluating the current set of available data related to the condition of in-service assets within an organization's asset portfolio, condition scores for each asset are determined. The level of degradation of an asset, knowledge of its configuration within the system, and its corresponding likelihood of failure feed directly into a risk-based assessment. Efforts of an ACA strive to collect, consolidate, and present the results framed by the current organizational AM framework for the purposes of properly quantifying and managing the risks of its asset portfolio. An ACA should provide insights into the current state of an organizations asset base, the risks associated with the degradation of portions of the assets in the system, how this degradation can be better managed within the current AM framework, and how to best make use of these results to extract maximum value from the asset portfolio going forward.

2.2 Overview of METSCO Methodology

2.2.1 Overall Asset Management Strategy

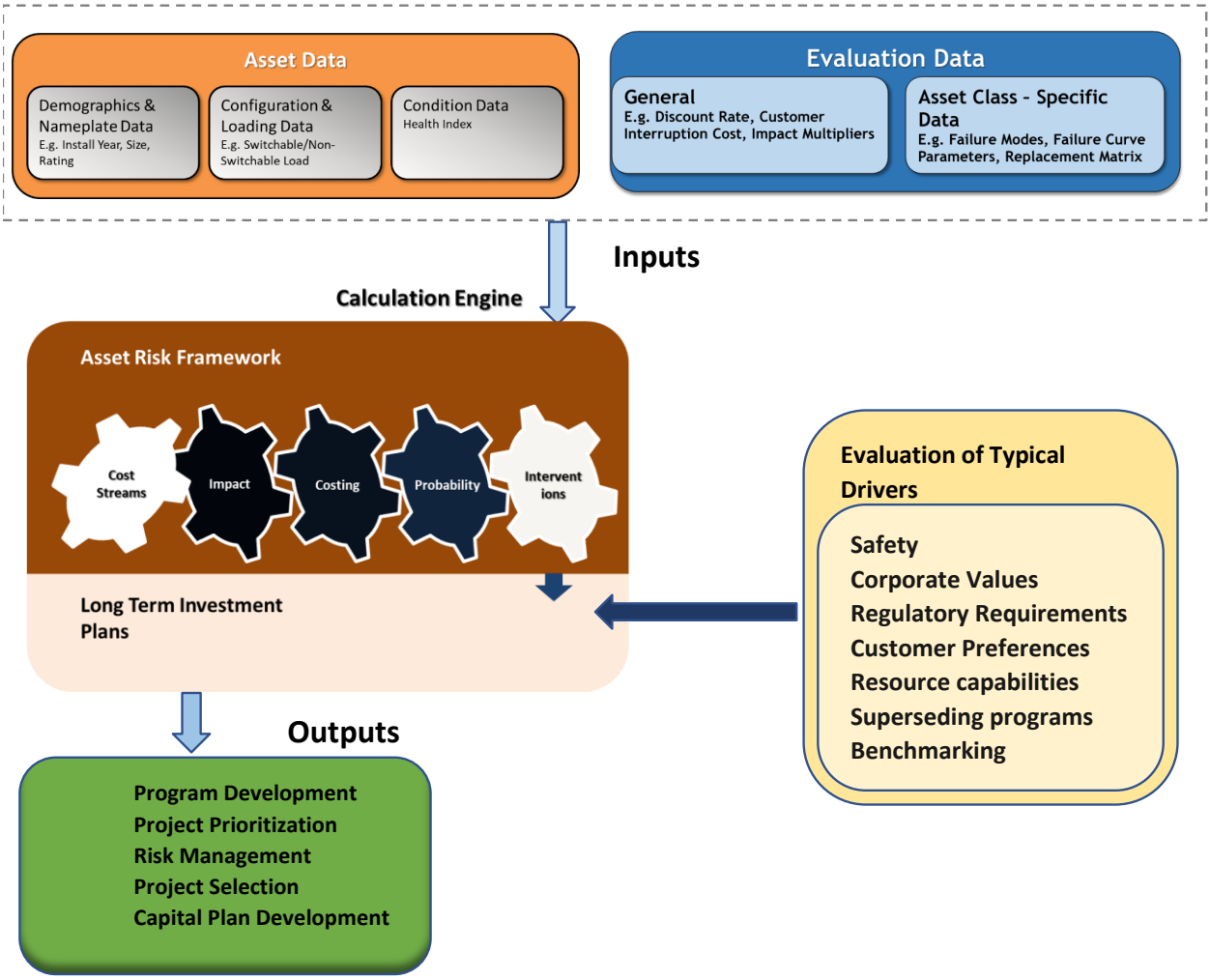
Decisions involving investment into fixed assets play a major role in determining the optimal performance of distribution systems. Most of the investments in fixed assets are triggered by either declining performance in the areas of supply system reliability, power quality or safety, increasing operating and maintenance costs associated with aging assets, or anticipated growth in demand requiring capacity upgrades. In any case, investments that are either oversized or made too far in advance of the actual system need may result in sub-optimal returns on investment. On the other hand, investments not made on time when warranted by the system needs raise the risk of missing performance targets and would fail to result in optimized investment. Optimal operation of the distribution system is achieved when "right sized" investments into renewal and replacement (capital investments) and into asset repair, rehabilitation, and preventative maintenance are planned and implemented based on a "just-in-time" approach. In summary, the overarching objective of the Asset Management Strategy is to find the right balance between capital investments in new infrastructure and operating and maintenance costs so that the combined total cost over the life of the asset is minimized.

METSCO is a proponent of a Risk-Based Asset Management Strategy, which determines the risk of asset failure based on the condition of the asset. Asset condition is commonly measured with "Asset Health Indices" and computes the valuation of the risk based on probabilities and consequences of asset failure and identifies the optimal risk mitigation alternative through an evaluation of all available options. Asset management covers the full life cycle of a fixed asset, from preparation of the asset specification and installation standards - to the scope and frequency of preventative maintenance during the asset's service life – and finally to the determination of the assets end-of-life and retirement from service. At each stage of an asset's life cycle, decisions are made to achieve the right balance between achieving maximum life expectancy, highest operating performance, lowest initial investment (capital costs), and lowest operating costs. The

best-in-class asset management strategies employ integrated processes that allow optimal levels of financial and operating performance to be achieved, using transparent and objective criteria that can easily be audited and inspected by regulators.

The overarching objective is to develop a prioritized capital and preventative maintenance investment plans, which are implemented over periods of ten to twenty-five years and optimize system performance. Corporate objectives and performance requirements are incorporated into the model by placing appropriate weights and costs on project drivers as shown in Figure 2.3.

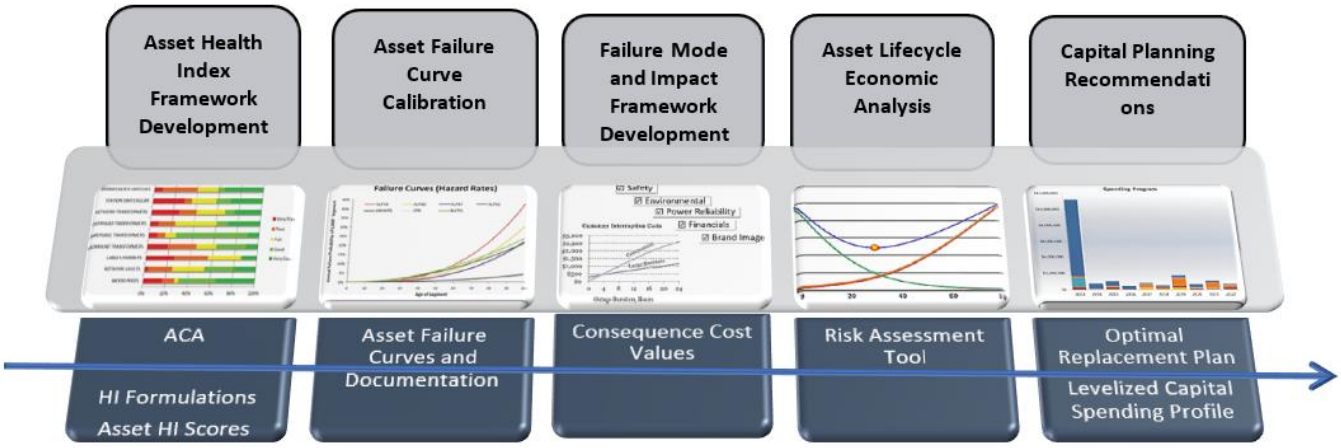
Figure 2.3: Model to Identify Assets with Highest Risks



METSCO's overall asset management approach includes executing and assessment within the 5 frameworks as presented in Figure 2.4. Under the asset Health Index (HI) framework development, an Asset Condition Assessment (ACA) is performed. An ACA is used to produce the HI, which is a quantified condition score of the asset. The HI score is ultimately calculated using asset age and inspection data. With this technique, condition-based failure probability can

be determined. Different assets have different failure curves that are calibrated using their failure data. In risk calculations, failure probability is used to determine the likelihood of failure of an asset of a given age in a given year. Failure mode and impact framework development calculates the consequence cost values for various failure modes considering customer impacts, collateral damage impact, environmental impact, etc. Once the probability and impact of asset failure have been determined, the risk cost can be calculated, along with the life-cycle costs of the asset. Assets will be recommended for optimal replacement when an optimal balance is achieved between capital spending and risk mitigated.

Figure 2.4: Overall AM approach



2.2.2 Asset Condition Assessment Process

The major steps in the ACA are briefly discussed below:

1. Identify Asset Classes: Identify asset classes to be considered in the asset condition assessment study

   Typical asset classes in the distribution system include:

   - Station Transformers
   - Station Circuit Breakers
   - Station Batteries
   - Capacitors
   - Controls and Protective Relays
   - Overhead Primary Conductors
   - Underground Primary Conductors
   - Distribution Transformers
   - Switches
   - Poles

2. Data Analysis:
   - Collection of asset related data such as GIS records, asset demographics, inspection/testing records, etc.
   - Validate the accuracy of data, e.g. check for data discrepancies between files
   - Develop a "Recommended Health Index Formulation" (RHIF) for each asset based on the available data, published best practice information and expert assessment of the data parameters which are reasonably obtained and are most indicative of asset end of life.
   - Identify additional asset data needed to determine and evaluate asset condition and assess the potential of collecting additional useful asset condition information to improve accuracy of the asset condition assessment results.
   - Make recommendation on collecting additional data that is reasonably available. This includes the methods to obtain additional data typically include inspection, testing, sampling, collection of paper records, field work to collect asset data, adopting advanced technology to record inspection/testing data, etc.
3. Collect additional condition information specific to each asset class.
4. Calculate Data Availability Indicator (DAI)

   DAI is a percentage of availability of condition parameter data for an asset, as measured against the condition parameters considered in the RHIF. DAI is calculated as a ratio of the sum of weighted condition parameters scores of available condition parameters to the sum of total weighted condition parameters scores from the recommended HI formulation.

$$DAI = \left(\frac{\sum_{i=1}^{N} Weight_i * CPAF_i}{\sum_{i=1}^{N} Weight_i}\right) x\ 100$$

   Where *i* corresponds to the condition number, *N* is the total number of condition parameters considered in the HI calculation, and *CPAF* is the Condition Parameter Availability Factor which is a "flagging variable" that is equal to 1 if the condition parameter data is available for the asset and equal to 0 otherwise.

   A DAI of 100% for an asset indicates successful population of values for all condition parameters defined in the Recommended Health Index Formulation for the asset and is therefore a measure of the success in meeting its intentioned data collection criterion. Typically, DAI are less than 100% for "sampled" assets such as cables and wood poles or where the costs to collect additional data are not warranted such as for low risk assets.

   In addition, there is a data set representing the "Best Practice Health Index Formulation", which an asset owner may be moving towards and in this case the recommendation for process improvements may include the effort to be taken to collect additional condition parameters defined in the Best Practice Health Index Formulation for the entire population of assets, which is expected to increase the accuracy of ACA results.

5. Asset Condition Assessment

A Health Index (HI) is an indicator of asset remaining life given as a percentage. A new asset should have a HI of 100% and an asset in very poor health should have a HI below 30%. Table 2-1 presents the HI ranges and the corresponding asset condition.

Table 2-1: Asset Condition based on Health Index

Health Index	Condition	Description	Requirements
[85–100]	Very Good	Some ageing or minor deterioration of a limited number of components	Normal maintenance
[70–85]	Good	Significant deterioration of some components	Normal maintenance
[50–70]	Fair	Widespread significant deterioration or serious deterioration of specific components	Increase diagnostic testing; possible remedial work or replacement needed depending on criticality
[30–50]	Poor	Widespread serious deterioration	Start planning process to replace or rehabilitate considering risk and consequences of failure
[0–30]	Very Poor	Extensive serious deterioration	Asset has reached its end-of-life; immediately assess risk; replace or refurbish based on assessment

To determine the HI for an asset, formulations are developed based on conditions that lead to asset end of life. A weight is assigned to each condition to indicate the amount of influence the condition has on the overall asset health. When presented with a HI formulation such as:

Table 2-2: Health Index Calculation Example

#	Condition Criteria	Weight	Condition Grade	Factors	Maximum Score
1	Condition example 1	4	A,B,C,D,E	4,3,2,1,0	16
2	Condition example 2	6	A,C,E	4,2,0	24
3	Condition example 3	6	A,B,C,D,E	4,3,2,1,0	24
				MAX SCORE	**64**

Each condition is ranked from A to E and each rank corresponds to a numerical grade:

A – 4 Best Condition
B – 3 Normal Wear
C – 2 Requires Remediation
D – 1 Rapidly Deteriorating
E – 0 Beyond Repair

The Health Index is then calculated as follows:

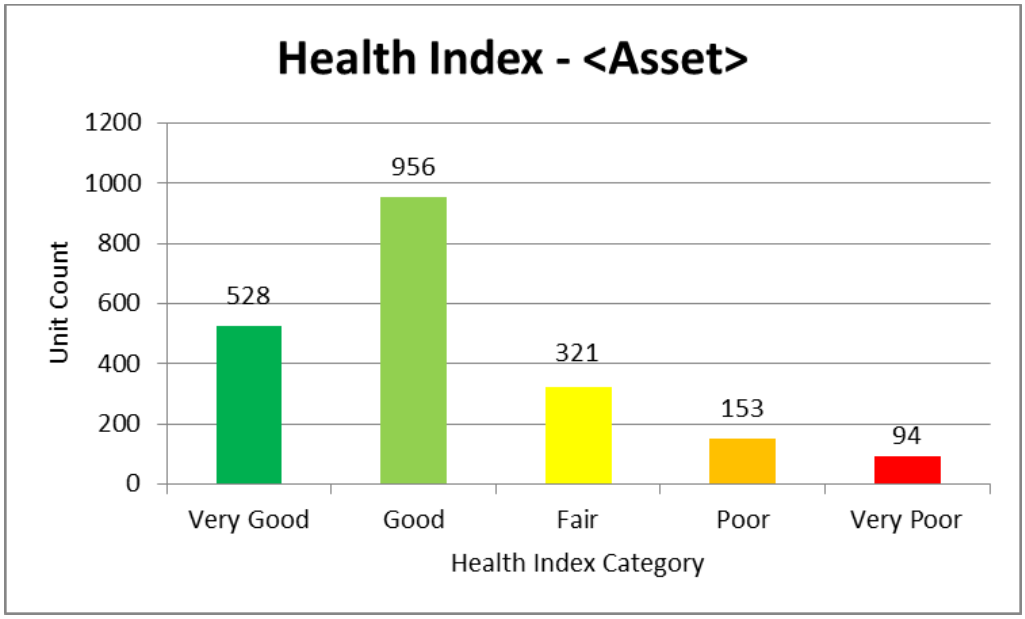
$$HI = \left(\frac{\sum_{i=1}^{N} Weight_i * Numerical\ Grade_i}{Total\ Score}\right) x\ 100 \qquad \text{(EQ 1)}$$

Where:

- *i* corresponds to the condition number,
- *N* is the total number of condition parameters considered in the HI calculation,
- *HI* is a percentage representing the remaining life of the asset.

Figure 2.5 shows the example graph representation of HI conditions for an asset class categorizing assets into Very Good to Very Poor condition.

Figure 2.5: Asset Health Index Graph-Example



6. Demographic Assessment

A useful cross-reference to an HI is a representation of asset demographics. Assets are charted based on age from installation date, and other pertinent demographics such as material or manufacturer/type etc. Since many institutions still consider age when making replacement plans, it is important to document any significant variations from the age-base results and the condition-based HI. As an example, cables are known to have different life expectancies based on the technology available at the time of installation or in other cases equipment of a certain manufacture may be known to be reaching end of life and failing at a higher than predicted rate. Figure 2.6 represents a typical demographic chart to represent the asset age data.

Figure 2.6: A Typical Demographic Chart

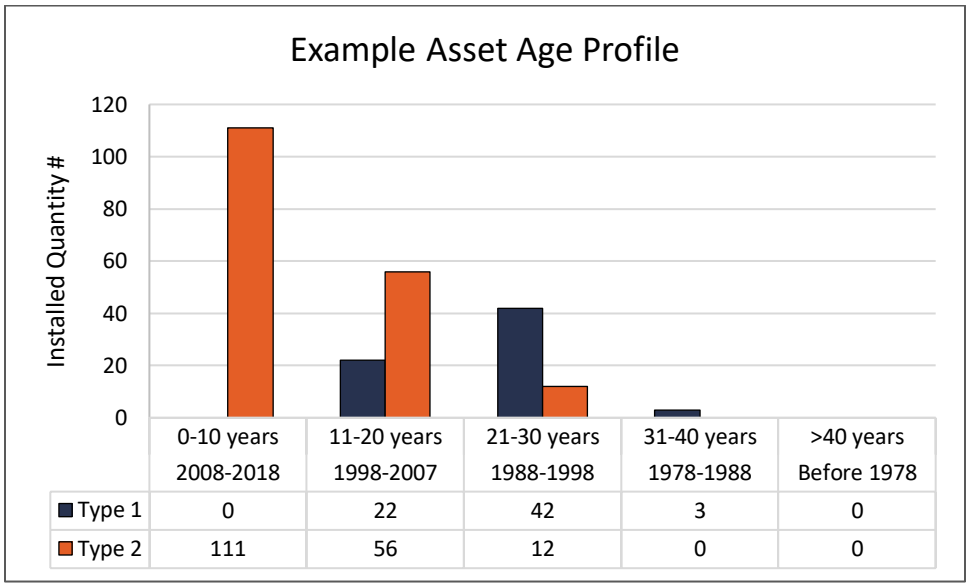
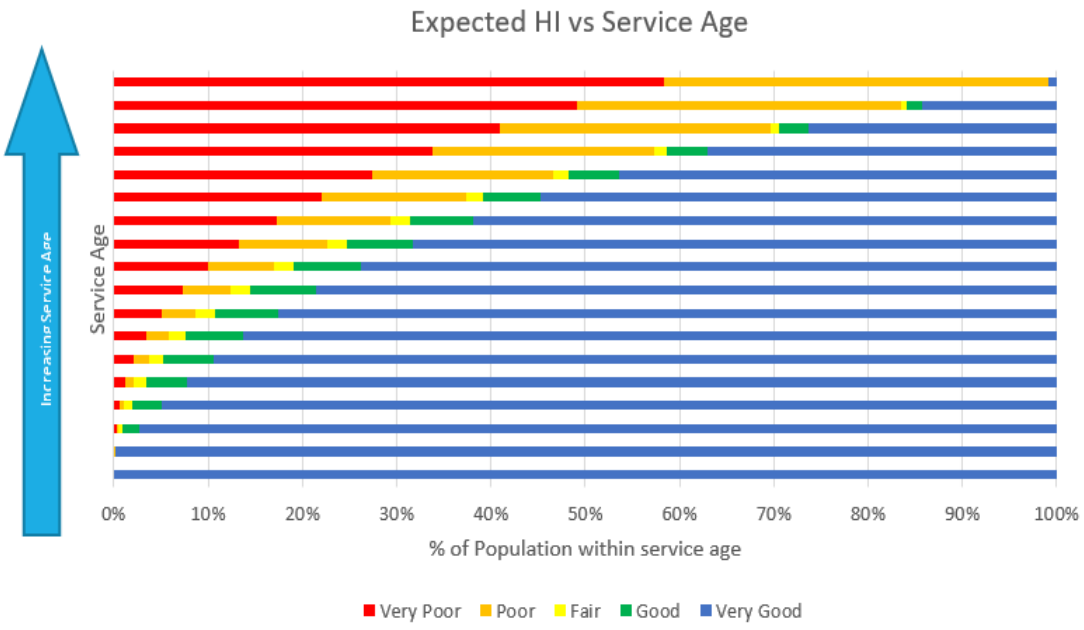


Figure 2.7 presents the example expected relation between the HI condition and the service age. It is expected that the HI conditions should gradually change from Very Good to Very Poor as the service age of an asset increases. Non-age-related HI factors are being compared against age in order to avoid double counting.

Figure 2.7: Expected HI Vs Service Age Trend-Example



7. Recommendations: The last stage of the ACA process provides recommendations to the organization on data collection process improvements that are expected to increase the validity of HI results.

3 Health Indices

3.1 Distribution Assets

3.1.1 Wood Pole

3.1.1.1 Condition Assessment Methodology

Wood being a natural material has degradation processes that are different from other assets on distribution systems. The most critical degradation process for wood poles involves biological and environmental mechanisms such as fungal decay, wildlife damage and effects of weather.

The Health Index for wood poles is calculated by considering a combination of end-of-life criteria. Each criterion represents a factor critical in determining the asset's condition relative to a potential failure to occur. Table 3-1 summarizes the methodology used to generate the Health Index for wood poles.

Table 3-1: Wood Pole Health Index Algorithm

#	Condition Criteria	Weight	Condition Score	Factors	Maximum Score
1	Remaining Strength	8	A,B,C,D,E	4,3,2,1,0	32
2	Wood Rot	6	A,B,C,D,E	4,3,2,1,0	24
3	Mechanical Defects	4	A,B,C,D,E	4,3,2,1,0	16
4	Service Age	3	A,B,C,D,E	4,3,2,1,0	12
				MAX SCORE	**84**

Remaining strength is one of the most important factors in determining a pole's health condition. Table 3-2 is used to translate remaining strength of the pole into a condition rating.

Table 3-2: Criteria for Remaining Strength

Condition Rating	Corresponding Condition
A	91% to 100%
B	81% to 90%
C	71% to 80%
D	61% to 70%
E	Less than 60%

A visual inspection record notes the degree of wood rot/decay developed on the pole's external surface, internal cross-section and cross-arm sections. Presence of wood rot signifies there is a high moisture content surrounding the pole and impacts the pole's strength. Table 3-3 is used to translate degree of wood rot developed into a condition rating.

Table 3-3: Criteria for wood rot

Condition Rating	Corresponding Condition
A	There is no wood rot or other damage to the pole and the pole is in like new condition
B	Minor wood rot and/or minor damage to pole, does not require corrective action. Minimal deterioration
C	There is significant wood rot and/or damage, requiring planned corrective action. Significant deterioration
D	There is major wood rot, and/or damage requiring immediate emergency repairs. Major deterioration
E	Wood rot or damage is beyond repair

Additionally, visual records are found for the following mechanical defects found on wood poles:

- Feathering: Fibre damage that may occur when wind hits a wood pole with force beyond the pole's bearing capacity
- Ants: Insect infestation
- Cracks: Wood cracks that may hold moisture and cause decay or weaken the structures through freeze/thaw forces during winter or exhibit partial damage that may result when objects come into contact with the wood pole
- Burn damage: Burning from conductor faults and insulator flashovers
- Woodpecker damage: Damage from the bird tapping into the wood pole

Table 3-4 is used to translate degree of mechanical defects developed into a condition rating.

Table 3-4: Criteria for mechanical defects

Condition Rating	Corresponding Condition
A	No signs of any defects on the wood pole due to cracking, insect infestation, vandalism, vehicular accidents, electrical burns, lightning, soil erosion.
B	Minor signs of defects on the wood pole due to cracking, insect infestation, vandalism, vehicular accidents, electrical burns, lightning, soil erosion
C	Significant signs of defects on the wood pole due to cracking, insect infestation, vandalism, vehicular accidents, electrical burns, lightning, soil erosion
D	Major signs of defects on the wood pole due to cracking, insect infestation, vandalism, vehicular accidents, electrical burns, lightning, soil erosion
E	Serious signs of defects on the wood pole due to cracking, insect infestation, vandalism, vehicular accidents, electrical burns, lightning, soil erosion

Since service age provides a reasonably good measure of the remaining life of the asset, it is employed as an assessment parameter. Table 3-5 is used to translate service age into a condition rating.

Table 3-5: Criteria for Service Age

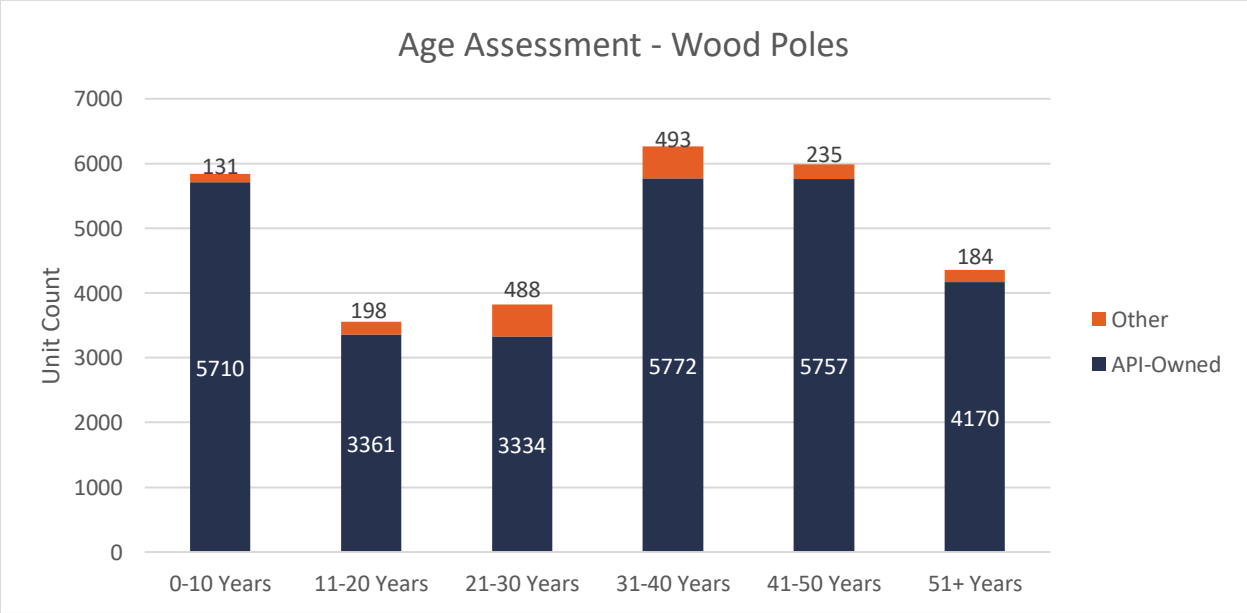
Condition Rating	Corresponding Condition
A	0 to 10 years
B	11 to 30 years
C	31 to 40 years
D	41 to 55 years
E	Over 55 years

3.1.1.2 Results of Analysis

Age Assessment

Algoma Power Inc. owns 28104 wood poles within its service territory. Figure 3.1 presents the age distribution for wood poles in-service. Age is unknown for ~1% of Algoma Power Inc.'s in-service wood poles. The unknown data set is extrapolated onto the known set and distributed by percentage weight. Additionally, there exists 1729 Wood Poles owned by Bell and Hydro One within the Algoma Power Inc. service territory that are configured for joint use. The total number of wood poles within the service territory is therefore 29833 units.

Figure 3.1: Wood Pole Age Demographic



Condition Assessment

Algoma Power Inc.'s pole test data and demographics were used to calculate the Health Index based on the criteria provided in Table 3-1. Algoma Power Inc. uses a resistograph testing method to determine the remaining strength of wood. The remaining strength is calculated using the resistograph measurements and examined by a third party and compared to the standard manufacturer strength values based on wood type. To date, Algoma Power has inspection

records for five years, which has resulted in 55% of the wood poles having an inspection record. On a 10-year inspection cycle, this translates very well to the amount of data collected and can be a fair representation of the overall wood pole population. To accommodate the remaining 45% of wood poles with no inspection record, the resulting output calculations from the known data set can be extrapolated onto the full wood pole population as a best estimate. The Health Index distribution for the inspected wood poles is presented in Figure 3.2. The Health Index distribution for the extrapolation onto the whole wood pole population is presented in Figure 3.3.

Figure 3.2: Wood Pole Health Index Demographic (Inspected data set)

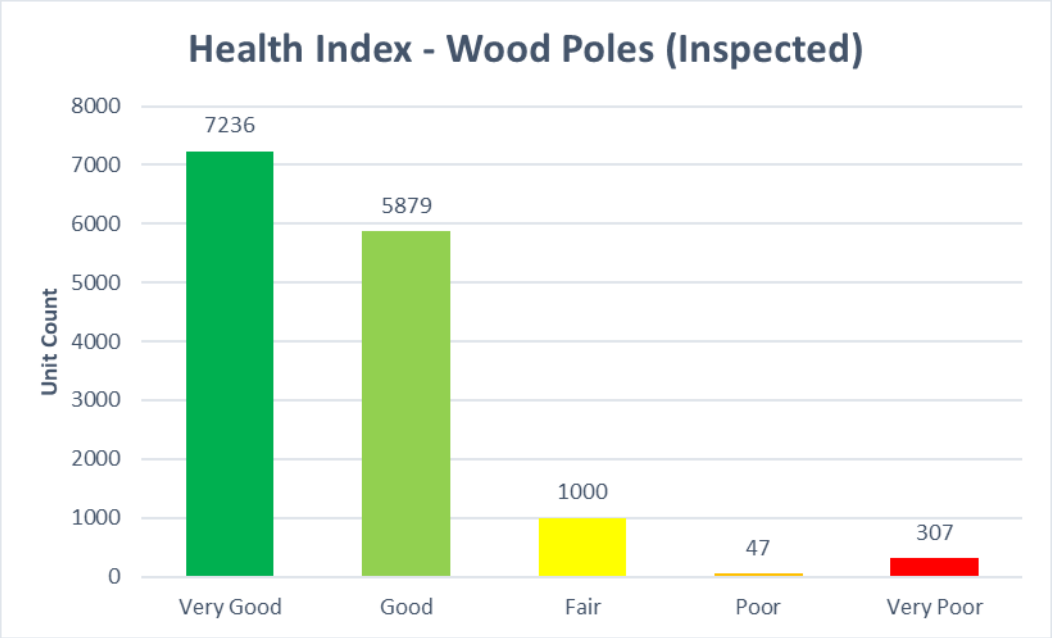
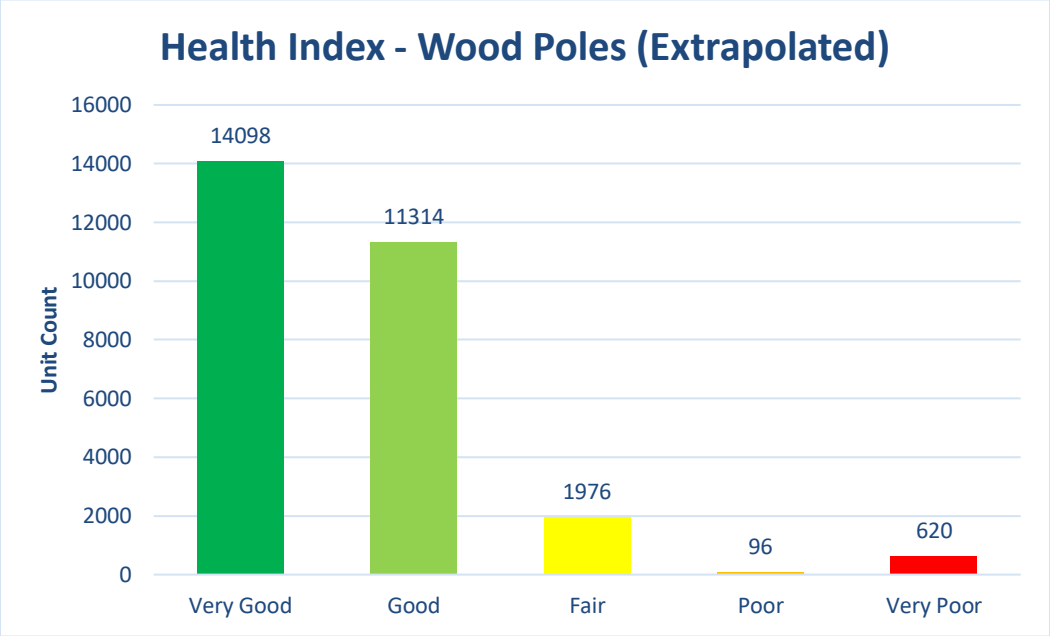


Figure 3.3: Wood Pole Health Index Demographic (Extrapolated data set)



Data Assessment

The Data Availability Indicator (DAI) is created to measure the reasonably collected data to date by the utility for completion regarding parameters used in the Health Index algorithm. The average DAI for the individual inspected wood pole data is 100%. For the extrapolated data set for wood poles, the asset class DAI is 55% since just over half (corresponding to 55%) of the wood poles have an inspection record. To be clear, 55% of the wood poles in the system have every reasonable condition parameter collected as part of an on-record inspection, with the remaining 45% awaiting inspection within the ongoing inspection cycle. As the inspection cycle continues to progress, this asset class DAI should increase as a larger portion of the wood pole population is inspected. Section 4.0 provides recommendations for data collection for Health Index Formulation improvement for Wood Poles.

3.1.2 Overhead Primary Conductor

3.1.2.1 Condition Assessment Methodology

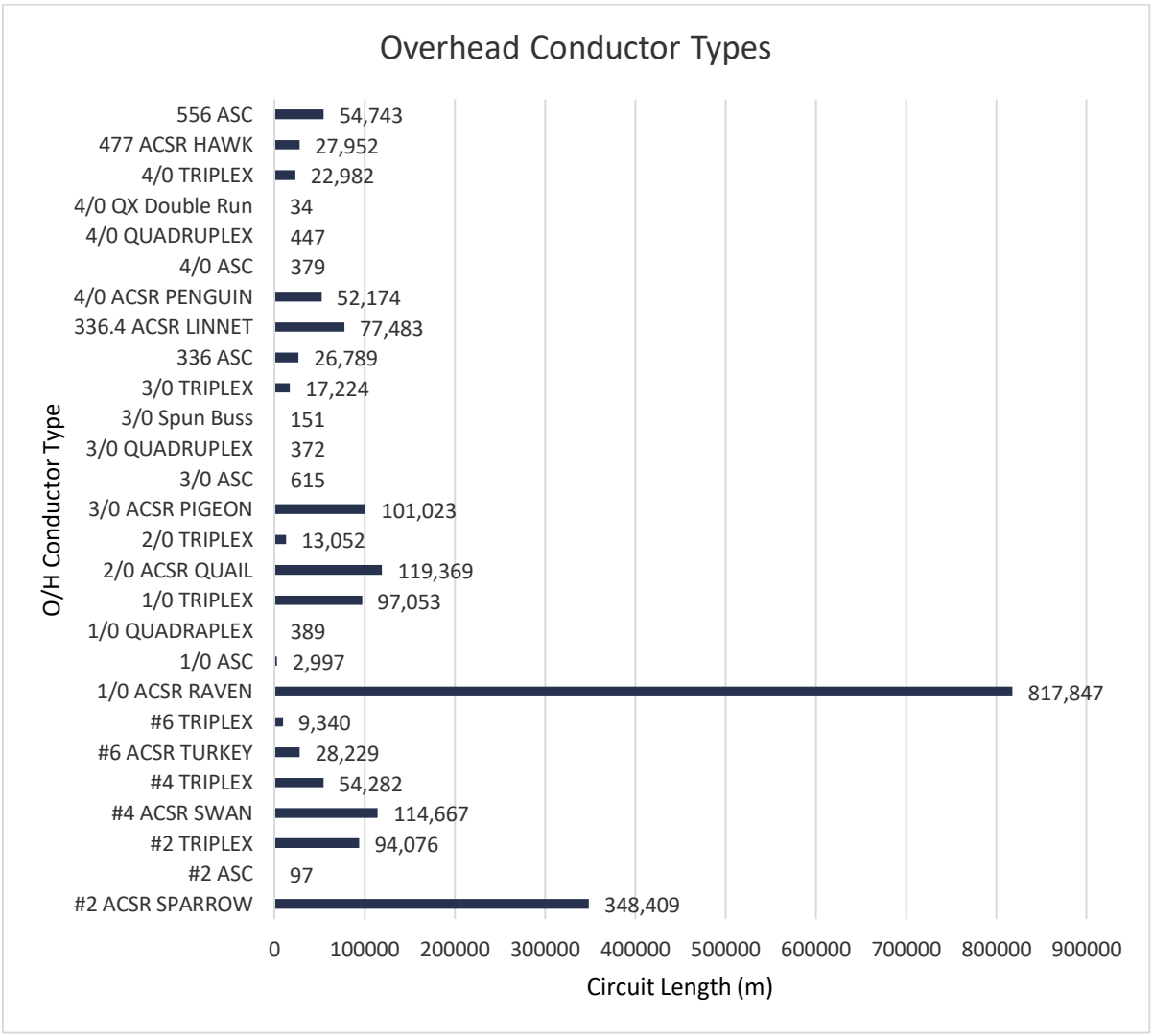
Although laboratory tests are available to determine the tensile strength and assess the remaining useful life of conductors, distribution line conductors rarely require testing. The service age provides a reasonably good measure of the remaining strength of overhead conductor with the lack of visual inspection for conductor defects. However, conductors on distribution lines typically often outlive the poles and are not usually on the critical path to determine end of life for a line section.

The only exception to the above rule might be where small gauge, solid strand copper conductors susceptible to frequent breakdowns are in use or where line conductors are too small for line loads resulting in sub-optimal system operation due to high line losses.

3.1.2.2 Results of Analysis

Algoma Power Inc. owns approximately 1,861km of overhead primary conductor within its service territory. Figure 3.4 presents overhead primary conductor type demographic. 40% of Algoma Power Inc.'s conductor is of type 1/0 ACSR RAVEN followed by 17% of type #2 ACSR. There is no age information available on overhead primary conductors, however, that is acceptable since conductors are replaced through project renewals. Furthermore, Algoma Power Inc. has no small gauge, solid strand copper conductor's in-service which eliminates the possibility of failure risk due to conductor breakdown.

Figure 3.4: Overhead Primary Conductor Type Demographic



3.1.3 Underground and Submarine Primary Cable

3.1.3.1 Condition Assessment Methodology

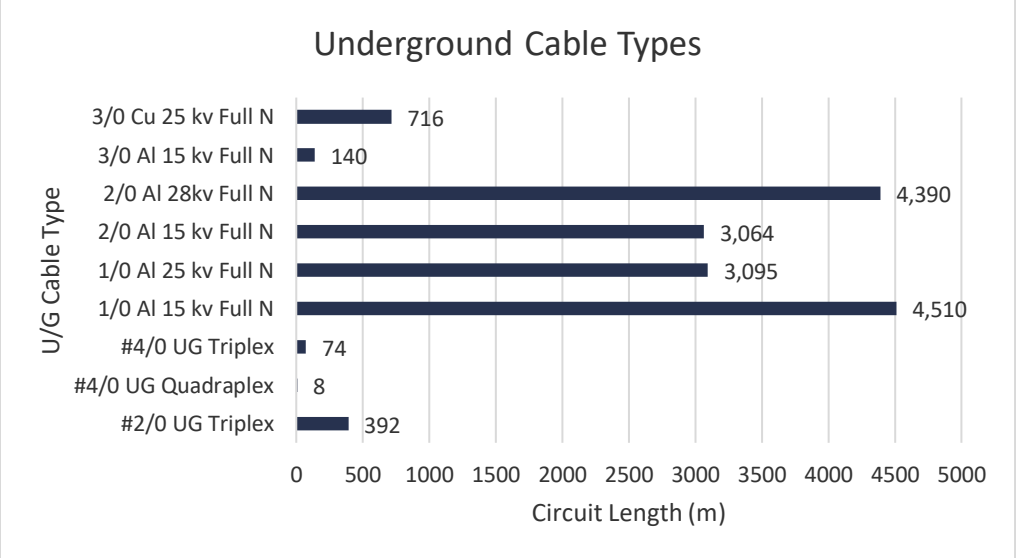
Distribution underground cables are one of the more challenging assets on electricity systems from a condition assessment and asset management viewpoint. Although several test techniques, such as partial discharge (PD) and water tree diagnostic testing have become available over the recent years, it is still very difficult and expensive to obtain accurate condition information for buried cables. However, a sampling methodology can be executed to determine a general condition of the asset. Managing underground and submarine cable renewals is commonly done through a cost performance analysis. A failed cable has a negative cost impact which is calculated by the loss of service to customers, emergency repair costs and the operating costs to restore service. When the costs associated with failures becomes higher than the annualized cost of underground or submarine cable replacement, the cable should be considered for replacement. Additionally, service age provides a reasonably good measure of the remaining strength of underground and submarine primary cables.

3.1.3.2 Results of Analysis

Age Assessment

Algoma Power Inc. owns approximately 16.4km of non-overhead primary cable within its service territory, of which approximately 7.2km is submarine type and the remaining 9.2km is underground type cable. Figure 3.5 presents the underground and submarine primary cable type demographic. Approximately, 28% of Algoma Power Inc.'s conductor is of type 1/0 Al 15kv Full N followed by approximately 27% of type 2/0 Al 28kv Full N. There is no age information available on underground and submarine primary cables. Section 4.0 provides recommendations for data collection improvement.

Figure 3.5: Underground and Submarine Primary Cable Type Demographic



3.1.4 Distribution Transformer

3.1.4.1 Condition Assessment Methodology

Two types of distribution transformers are assessed within this report: pole mount transformer and pad mount transformer. Typically, utilities replace distribution transformers as part of overhead or underground rebuild projects or when they are assessed as having a high risk of failure. Furthermore, pole-mount transformers are replaced when a pole requires replacement or has failed. Typically, these pole-mount transformers are older and are found on older poles that will require replacement within the short-term. Apart from painting the tanks, replacing a damaged bushing or repairing a leaky gasket, very little preventative maintenance or testing is carried out on distribution transformers. Algoma Power Inc. continues to perform regular visual inspections to manage the system risk and reliability of these assets. Table 3-6 summarizes the methodology to generate the Health Index for Distribution Transformers.

Table 3-6: Distribution Transformer Health Index Algorithm

#	Condition Criteria	Weight	Condition Score	Factors	Maximum Score
1	Service Age	1	A,B,C,D,E	4,3,2,1,0	4
				MAX SCORE	**4**

Since the service age provides a reasonably good measure of the remaining life of transformers, it is employed as an assessment parameter. Table 3-7 presents the service age condition rating.

Table 3-7: Criteria for Service Age

Condition Rating	Corresponding Condition
A	0 to 10 years
B	11 to 20 years
C	21 to 30 years
D	31 to 40 years
E	41 years or older

3.1.4.2 Results of Analysis

Age Assessment

Algoma Power Inc. owns 4800 pole mount transformers and 132 pad mount transformers. Figure 3.6 and Figure 3.7 presents the extrapolated age distribution for pole mount and pad mount transformers, respectively. Age is known for 51% of pole mount transformers and 84% of pad mount transformers. The unknown data set is extrapolated onto the known set and distributed by percentage weight.

Figure 3.6: Pole mount Age Demographics

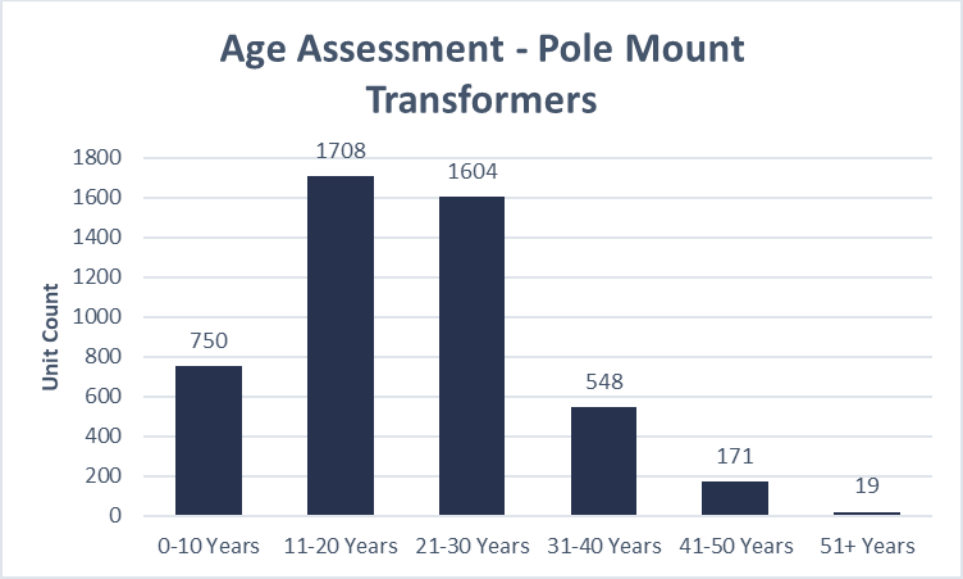
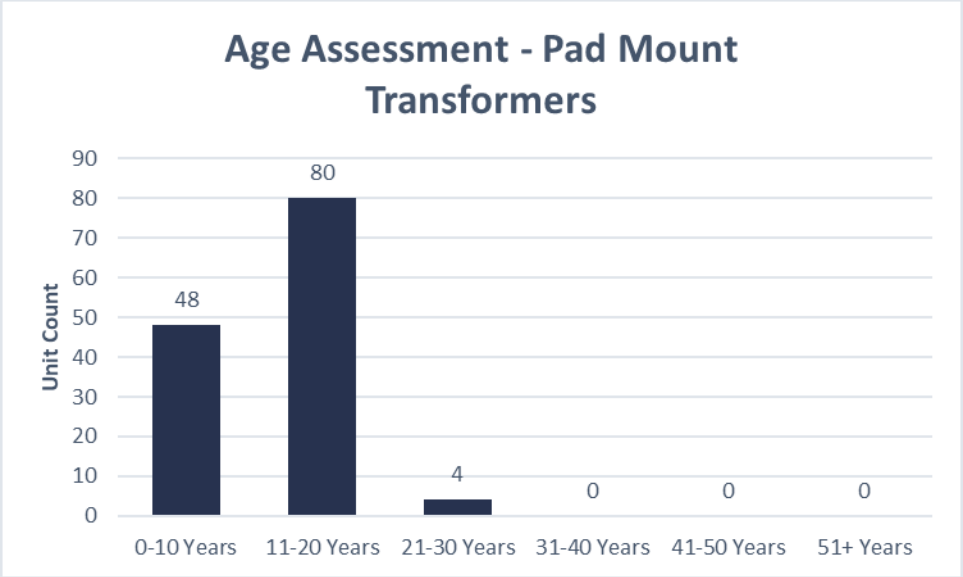


Figure 3.7: Pad Mount Age Demographics



Condition Assessment

Although the recommended Health Index Formulation for distribution transformers considers only service age, Algoma Power Inc. notes that the average number of customers connected to each transformer is between 2-3 residential or seasonal customers, where the predominant kVA rating of the transformer is 15 or 25 kVA. This yields a low failure risk due to transformer overloading. Additionally, historical failures for pole mount transformers have been as a result of lightning, wildlife or for an unknown reason, where for each unknown failure overloading was not a

contributing factor and the internal condition of the asset had not been significantly degraded. As previously mentioned, pole mount transformer age data is known for 51% of the population and pad mount transformer age data is known for 84% of the population. Figure 3.8 and Figure 3.10 show the Health Index distribution of the known data set, whereas Figure 3.9 and Figure 3.11 shows the extrapolated Health Index distribution.

Figure 3.8: Pole Mount Transformers Health Index Demographics (known data set)

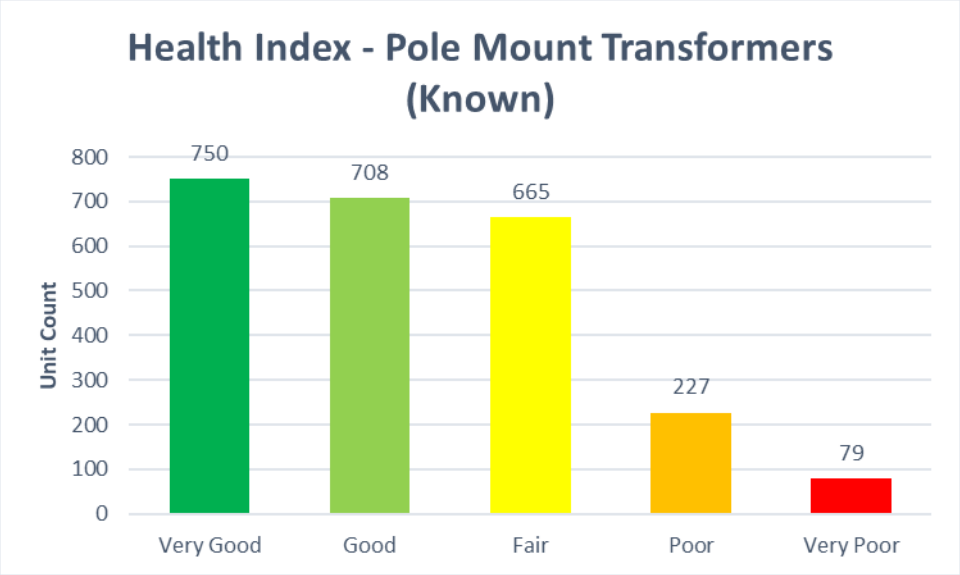


Figure 3.9: Pole Mount Transformer Health Index Demographic (extrapolated data set)

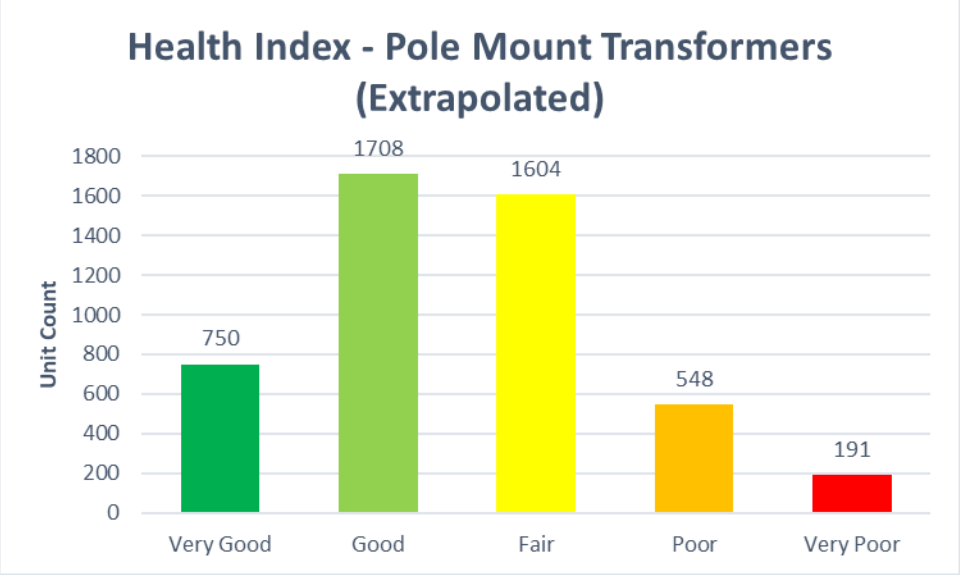


Figure 3.10: Pad Mount Transformer Health Index Demographic (known data set)

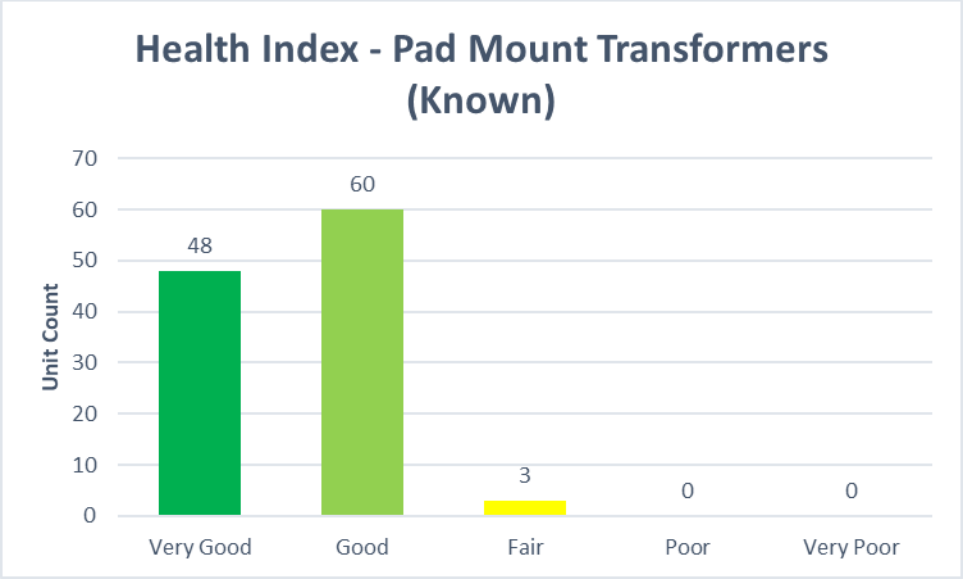
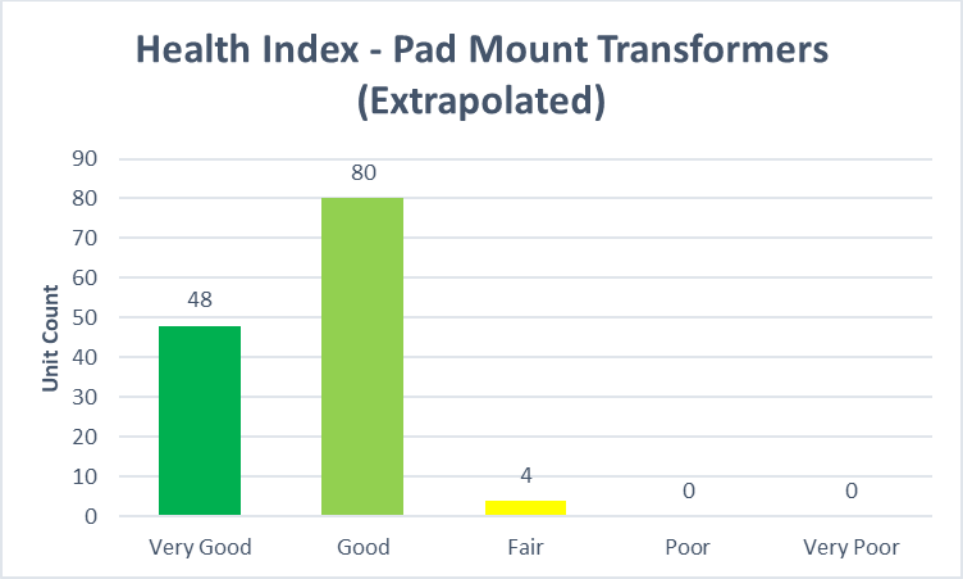


Figure 3.11: Pad Mount Transformer Health Index Demographic (extrapolated data set)



Data Assessment

The Data Availability Indicator (DAI) is created to measure the reasonably collected data to date by the utility for completion regarding parameters used in the Health Index algorithm. The DAI for distribution transformers cannot be calculated since the Health Index Formulation is dependent on only service age, which would result in an ostensibly low and uninformative asset class DAI. Section 4.0 provides recommendations for data collection for Health Index Formulation improvement.

It should be noted that extrapolated values for the age of pole and pad mounted transformers is not carried over to those in the 0-10 years of age grouping. This is because it is highly unlikely that the installation or manufacture age for an asset these young would be unknown. Since the entire health index score is based on an age-based scaling factor, a similar result is seen in the extrapolated health index results for these assets.

3.1.5 Overhead Switch

3.1.5.1 Condition Assessment Methodology

Algoma Power Inc.'s risk management continues to manage the asset's risk of failure through regular visual inspections and infrared (IR) scanning of station switches and switches located on critical lines. The outputs of the visual inspections and IR scanning assist Algoma Power Inc. in determining appropriate maintenance interventions, however, there is no condition data that can be utilized for an ACA currently. Should any switch exhibit high temperature readings from the IR scan, they are proactively replaced before the asset experiences a failure on its own. In the case where an IR scan is not available for a switch asset, the remaining switches are subject to visual inspections or are configured for run-to-failure management.

The Health Index for overhead switches is calculated by considering only service age. Table 3-8 summarizes the methodology to combine these criteria into an overall Health Index.

Table 3-8: Overhead Switch Health Index Algorithm

#	Condition Criteria	Weight	Condition Score	Factors	Maximum Score
1	Service Age	1	A,B,C,D,E	4,3,2,1,0	4
				MAX SCORE	**4**

Since the service age provides a reasonably good measure of the remaining life of overheard gang operated switches, it is employed as an assessment parameter. Table 3-9 presents the service age condition rating.

Table 3-9: Criteria for Service Age

Condition Rating	Corresponding Condition
A	0 to 10 years
B	11 to 20 years
C	21 to 30 years
D	31 to 40 years
E	Over 41 years

3.1.5.2 Results of Analysis

Algoma Power Inc. owns 800 overhead switches within its service territory. In-service switch types include polymeric fused cutout, open type cutouts, fused cutouts, in-line fused cutouts and porcelain. Of 800 in-service switches, 201 switches (25%) have a recorded installation year. All 201 switches with an installation record have an age between 0 and 5 years old.

Algoma Power Inc. manages the failure risk through its maintenance programs and remedies via appropriate actions to rectify the issue and to mitigate the failure risk. Section 4.0 provides recommendations for data collection for Health Index Formulation improvement.

Porcelain Fuse Cut-Outs

Fuse cut-outs are pole-mounted switching devices, used to disconnect or reconnect pole mounted equipment to the line, such as distribution transformers or underground laterals. Porcelain insulated cut-outs have been in use in the electrical industry for many decades. Porcelain was also the material of choice for most other electrical equipment that required insulation, i.e. line insulators, arrestors and bushings. In the early 1980's large numbers of porcelain insulators began failing, particularly in cold climate regions. "Cement growth" was causing insulators to crack. The expansion and contraction of the adhesive interface which joined the porcelain to the hardware (connector) causes stresses on the porcelain. These stresses cause small cracks to appear in the porcelain which eventually lead to an electrical and/or mechanical failure of the porcelain insulator. Cracked porcelain cut-outs can also result in pole fires resulting in more extensive asset replacements.

Transmission insulators and distribution insulators had been the focus of the industry's attention throughout most of the 1980's and 1990's, resulting in expenditure of millions of dollars to rectify the problem of defective porcelain. During the past several years many utilities throughout North America have seen increasing failures of their porcelain insulated cut-outs. The mode of failure is very similar to that of insulators. Small cracks in the porcelain initially appear near the interface between the porcelain and hardware. These fractures eventually lead to a mechanical failure of the cut-out. Cement growth is the likely cause of the initial cracks. The breakage of porcelain insulated cut-outs is a concern from a safety and reliability perspective. During cut-out operation the porcelain can break causing the cut-out to separate into two parts. This creates a hazard to line personnel operating the cut-out and can cause outages to customers. The common industry solution to this problem has been replacement of porcelain insulated cut-outs with polymer insulated cut-outs.

Some failures may result in electrical failure of the insulation, while in other cases the insulator has cracked and broken resulting, in pole fires. The failing cut-outs do present a high risk of injury to public or utility employees in these cases.

Algoma Power Inc. has adopted a program under which porcelain cut-outs are being systematically replaced with polymer cut-outs to mitigate safety risks. This program will continue until all high-risk porcelain cut-outs have been replaced. Algoma Power Inc. has 50 recorded known porcelain switches remaining in the system.

3.1.6 Reclosers

Algoma Power Inc. owns 189 reclosers, with 131 installed and 58 as spares for replacements. Figure 3.12 presents the distribution of installed recloser subtypes. The age distribution of both

installed and spare reclosers is presented in Figure 3.13. No condition data is available and therefore no Health Index Formulation can be recommended at this time.

Figure 3.12: Recloser Subtypes Demographic

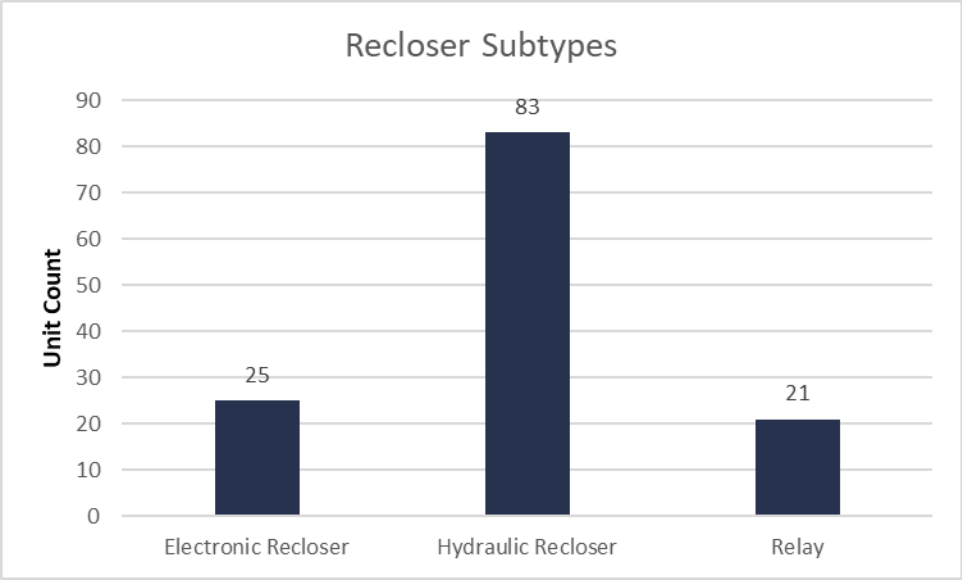
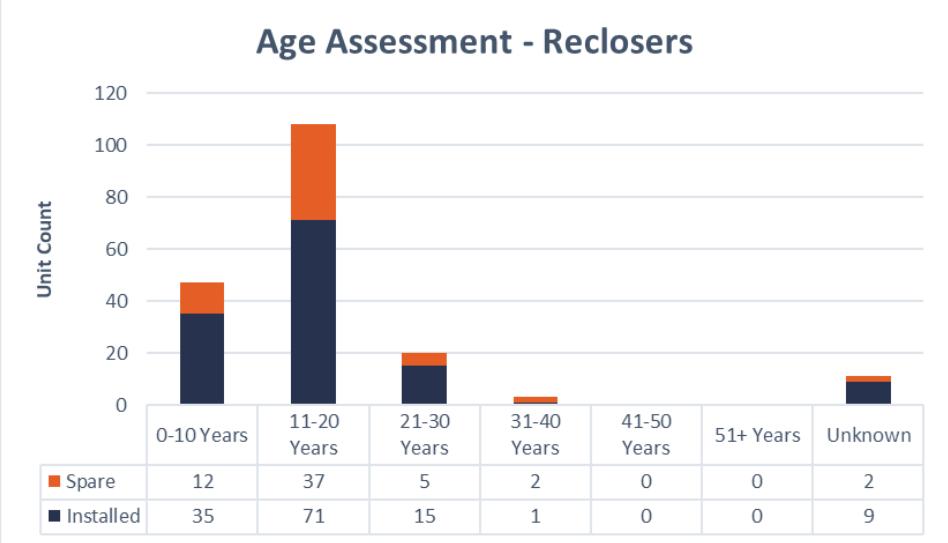


Figure 3.13: Recloser Age Demographic



3.1.7 Capacitor

3.1.7.1 Condition Assessment Methodology

Algoma Power Inc. owns four capacitors each having a shunt connection type. The Health Index for capacitors is calculated by considering a combination of end-of-life criteria. Each criterion represents a factor critical in determining the asset's condition relative to a potential failure to

occur. Table 3-10 summarizes the methodology to generate the Recommended Health Index. Table 3-11 to Table 3-13 provide the condition grading for the end-of-life criteria identified.

Table 3-10: Capacitor Health Index Algorithm

#	Condition Criteria	Weight	Condition Score	Factors	Maximum Score
1	Contamination	4	A,B,C,D,E	4,3,2,1,0	16
2	Connectors and Conductor Condition	1	A,B,C,D,E	4,3,2,1,0	4
3	Bank Condition	3	A,B,C,D,E	4,3,2,1,0	12
				MAX SCORE	**32**

Table 3-11: Criteria for Capacitor Units Condition

Condition Rating	Corresponding Condition
A	No indication of any capacitor failures though bulging of cans or oil leaks. No external sign of deterioration of gaskets/ weld seams on cans. No external corrosion or rust on cans
B	Less than 1% of capacitor cans indicate failure through bulged tanks or oil leaks. Minor external sign of deterioration of gaskets/ weld seams and minor rust on remaining healthy capacitor cans.
C	Fewer than 3% of capacitor cans indicate failure through bulged tanks or leaking oil. Significant external signs of deterioration of gaskets/ weld seams and/or rusting of remaining healthy capacitor cans. Minor signs of oil leaks or oil stains on capacitor cans. Requires corrective maintenance within the next several months.
D	Fewer than 5% of capacitor cans indicate failure through bulging of tanks or oil leaks. Major external sign of deterioration of gaskets/ weld seams on cans. Signs of significant oil leaks or oil stains on healthy cans. Extensive external corrosion or rust on cans. Requires corrective action within the next few weeks.
E	More 5% of capacitor cans indicate failure through bulged tanks and oil leaks. Capacitor bank unable to provide intended function and has degraded beyond repairs.

Table 3-12: Criteria for Connectors and Conductors Condition

Condition Rating	Corresponding Condition
A	All connectors are tight, free from corrosion and show no sign of overheating. Live conductors are adequately supported and impose no excessive loading during normal or fault current carrying duty.
B	Normal signs of wear with respect to the above characteristics.
C	One of the above characteristics is unacceptable.
D	Two of the above characteristics are unacceptable.
E	Connectors or conductors have failed or are damaged/degraded beyond repair.

Table 3-13: Criteria for Overall Shunt Capacitor Bank Condition

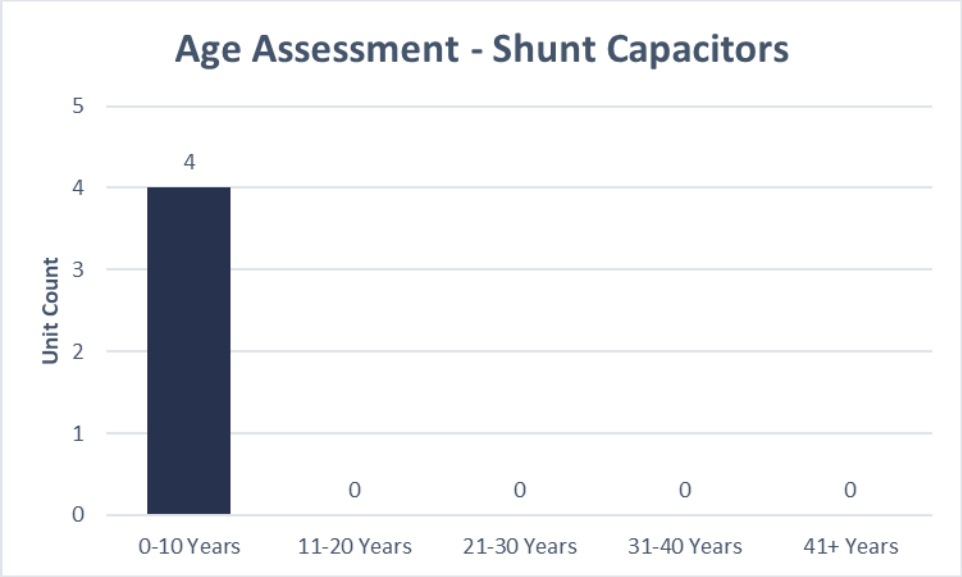
Condition Rating	Corresponding Condition
A	Capacitor Bank is externally clean, corrosion free. All primary and secondary connections are in good condition. No external evidence of overheating or any other abnormality. Appears to have been well maintained.
B	Normal signs of wear with respect to the above characteristics.
C	One or two of the above characteristics are unacceptable.
D	More than two of the above characteristics are unacceptable.
E	Capacitor is defective, damaged or degraded beyond repairs.

3.1.7.2 Results Analysis

Age Assessment

Ages are known for all four capacitors owned by Algoma Power Inc. and is presented in the figure below.

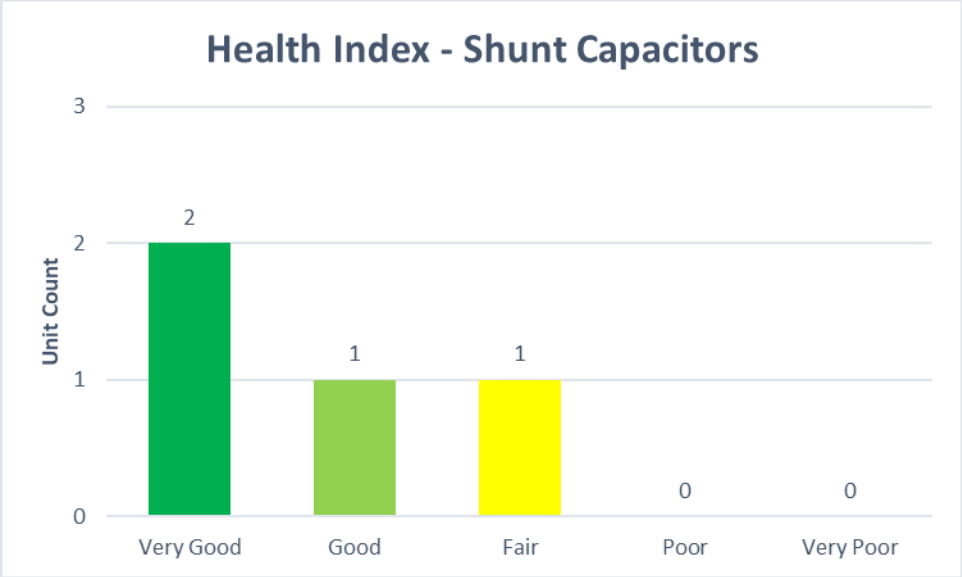
Figure 3.14: Capacitor Age Demographic



Condition Assessment

Four capacitors are inspected and maintained by Algoma Power Inc.. Figure 3.15 shows the Health Index demographic of the four capacitors. IR scans are also conducted on capacitors to identify deficiencies, however, Algoma Power Inc.'s asset risk management addresses the deficiencies through appropriate actions to mitigate the risk of failure and safety risk.

Figure 3.15: Capacitor Health Index Demographic



Data Assessment

The Data Availability Indicator (DAI) is created to measure the reasonably collected data to date by the utility for completion regarding parameters used in the Health Index algorithm. The DAI for capacitors is 100% for the inspected asset population, meaning every capacitor-type asset within the system has been inspected with sufficient condition parameters being graded. Section 4.0 provides additional recommendations for data collection for Health Index Formulation improvement.

3.2 Station Assets

3.2.1 Station Power Transformer

There are 10 in-service station power transformers within Algoma Power Inc. service territory. In addition, there are 9 spares, 12 voltage regulator transformers and 10 ratio banks.

3.2.1.1 Condition Assessment Methodology

The Health Index for station power transformers is calculated by considering a combination of condition criteria obtained from Algoma Power Inc.'s inspection records. Table 3-14 summarizes the methodology to generate the Health Index for power transformers, spare transformers and voltage regulators. Figure 3.19 summarizes the methodology to generate the Health Index for ratio banks.

Table 3-14: Station Power Transformer, Spare Transformer and Voltage Regulator Health Index Algorithm

#	Condition Criteria	Weight	Condition Score	Factors	Maximum Score
1	Dissolved Gas Analysis	10	A,B,C,D,E	4,3,2,1,0	40
2	Peak Load*	10	A,B,C,D,E	4,3,2,1,0	40
3	Insulation Power Factor	10	A,B,C,D,E	4,3,2,1,0	40
4	IR Scan	10	A,B,C,D,E	4,3,2,1,0	40
5	Oil Quality	8	A,B,C,D,E	4,3,2,1,0	32
6	Service Age	6	A,B,C,D,E	4,3,2,1,0	24
7	Overall Condition	6	A,B,D	4,3,1	24
8	Transformer Bushing Condition	5	A,B,D	4,3,1	20
9	Transformer Tank Condition	2	A,B,D	4,3,1	8
10	Transformer Grounds Condition	1	A,B,D	4,3,1	4
11	Oil Level	1	A,B,D	4,3,1	4
12	Radiators/Fans Condition	1	A,B,D	4,3,1	4
13	Connections Condition	1	A,B,D	4,3,1	4
14	Oil Leaks	1	A,B,D	4,3,1	4
15	Gauges/Arrestors/Valves Condition	1	A,B,D	4,3,1	4
				MAX SCORE	**292**

**Note: This criterion does not apply for spares or voltage regulators and would be omitted from the MAX SCORE total.*

Table 3-15: Station Ratio Bank Health Index Algorithm

#	Condition Criteria	Weight	Condition Score	Factors	Maximum Score
1	Peak Load	10	A,B,C,D,E	4,3,2,1,0	40
2	IR Scan	10	A,B,C,D,E	4,3,2,1,0	40
3	Service Age	6	A,B,C,D,E	4,3,2,1,0	24
				MAX SCORE	**104**

Table 3-16 to Table 3-21 provide the condition rating translation for the various condition criteria used within the Health Index algorithm. To determine the condition of the Dissolved Gas Analysis (DGA), DGA condition criteria requires data on gas concentrations (obtained from transformer inspections) and dissolved gas rate of change (obtained from the two most recent inspections). For both DGA and Oil Quality, the worst condition is taken as the dominant grade.

Table 3-16: Criteria for DGA Results

Gas Condition	Gas Generation Rate		
	Low	Low to High	High
Condition 1	A	A	B
Condition 2	B	B	C
Condition 3	C	C	D
Condition 4	D	D	E

Table 3-17: Criteria for Peak Load*

Condition Rating	Corresponding Condition
A	Typical peak load less than 50% of its rating
B	Typical peak load of 50% to 75% of its rating
C	Typical peak load of 75% to 100% of its rating
D	Typical peak load of 100% to 125% of its rating
E	Typical peak load of greater than 125% of its rating

**Note: This criterion does not apply for spares or voltage regulators.*

Table 3-18: Criteria for Insulation Power Factor

Condition Rating	Corresponding Condition
A	$PF_{MAX} < 0.5$
B	$0.5 \leq PF_{MAX} < 1$
C	$1 \leq PF_{MAX} < 1.5$
D	$1.5 \leq PF_{MAX} < 2$
E	$PF_{MAX} \geq 2$

Table 3-19: Criteria for IR Scan

Condition Rating	Corresponding Condition
A	No hot spots are noticeable; no temperature excess over reference point of transformer at normal temperature.
B	Small hotspots are identified but do not require further investigation; excess of 0-9 degrees over reference point.
C	Significant hot spots are identified, and further investigation is required; excess of 10-20 degrees over reference point.
D	Serious hot spots are identified that need further investigation/attention as soon as possible; excess of 21-49 degrees over reference point
E	Critical hotspots are identified that need immediate attention; excess of more than 50 degrees over reference point.

Table 3-20: Criteria for Oil Quality Tests

Test	Station Transformer Voltage Class	Grade
	U ≤ 69 kV	
Acid Number	≤0.05	A
	0.05-0.20	C
	≥0.20	E
IFT [mN/m]	≥30	A
	25-30	C
	≤25	E
Dielectric Strength [kV]	>23 (1mm gap) >40 (2 mm gap)	A
	≤40	E
Water Content [ppm]	<35	A
	≥35	E

Table 3-21: Criteria for Service Age

Condition Rating	Corresponding Condition
A	Less than 20 years
B	20 to 40 years
C	40 to 60 years
D	More than 60 years
E	-

Condition rating for visual inspections follow Table 3-22. Station inspections by Algoma Power Inc. are ranked between “Good”, “Fair” and “Poor”. Therefore, the condition rating is translated to a three-level score compared to the best practices of a five-level score.

Table 3-22: Criteria for Visual Inspection field (criteria #7-#15)

Condition Rating	Corresponding Condition
A	Good condition / No defect / No leaks
B	Fair condition
D	Poor condition

3.2.1.2 Results of Analysis

Age Assessment

Figure 3.16 presents the age profile of station power transformers in-service. Figure 3.17 presents the age profile of station spare and voltage regulator transformers. Figure 3.18 presents the age profile of ratio banks.

Figure 3.16: Station Power Transformer Age Demographic

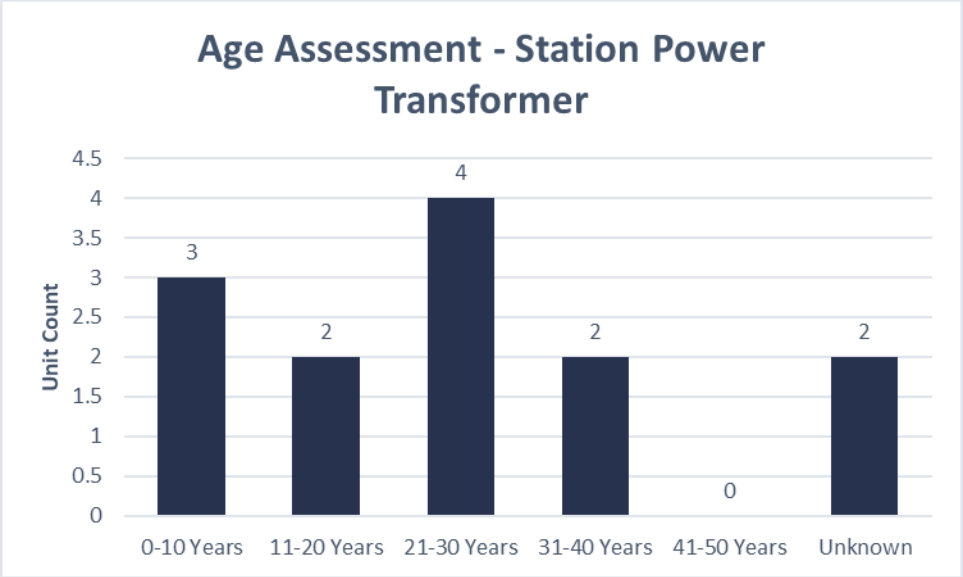


Figure 3.17: Spare and Voltage Regulating Transformer Age Demographic

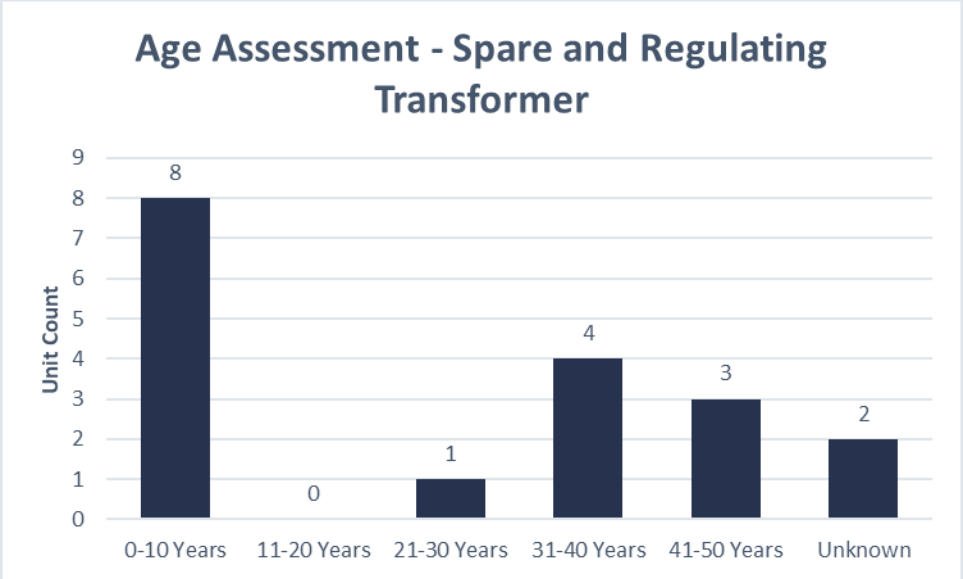
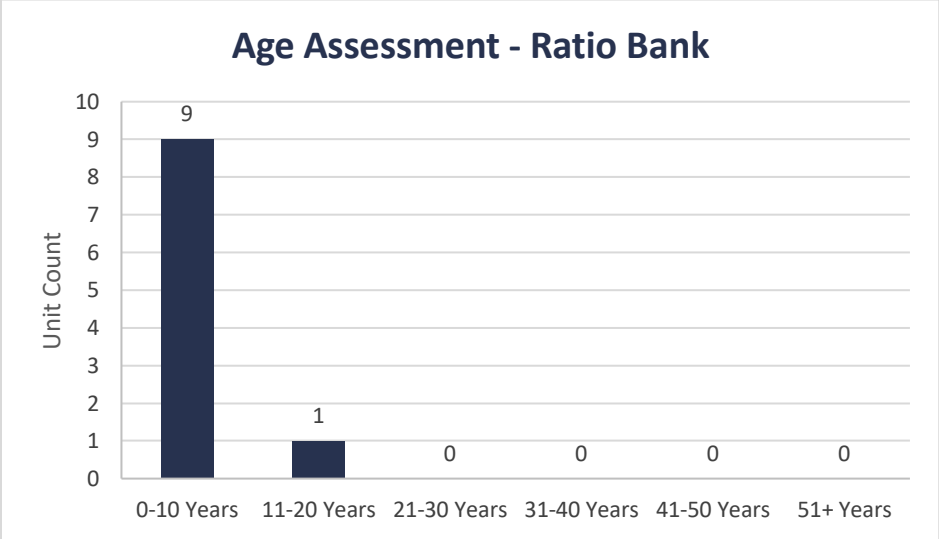


Figure 3.18: Ratio Bank Age Demographic



Condition Assessment

Algoma Power Inc.'s most recent transformer inspections were used to calculate the Health Index based on the criteria provided in Table 3-14. The Health Index distribution for in-service station power transformers is presented in Figure 3.19, spares and voltage regulating transformers presented in Figure 3.20, and ratio banks presented in Figure 3.21. Additionally, supporting tables are provided to highlight which specific unit (identified by Unit No.) is associated to the respective Health Index score.

Figure 3.19: Station Power Transformers Health Index Demographic

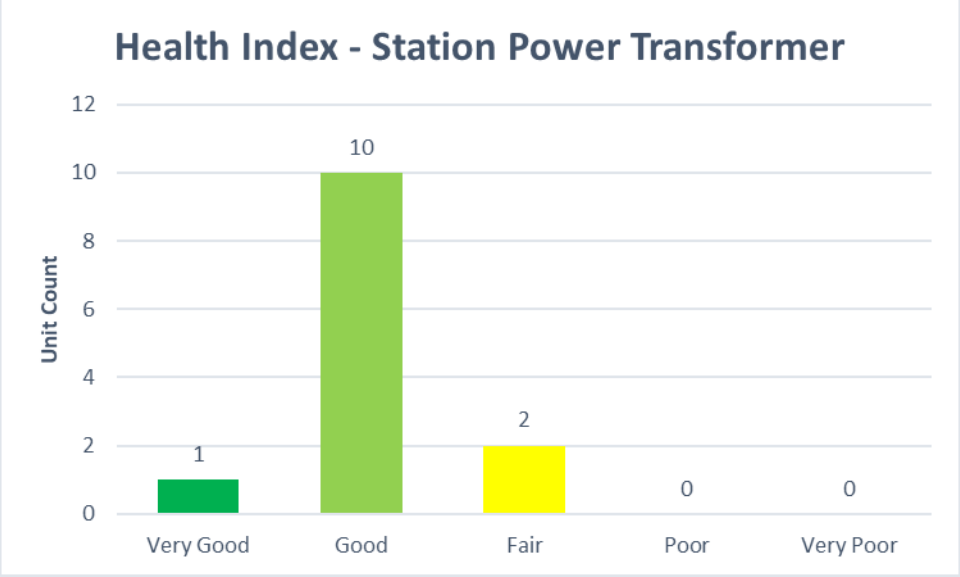


Table 3-23: Station Power Transformer Unit No. identification for Health Index category

Very Good	Good					Fair	Poor	Very Poor
8600	6095 7549	9318 8971	5108 4039	5236 5496	2165 2166	8224 00018		

Figure 3.20: Spare and Regulating Transformer Health Index Demographic

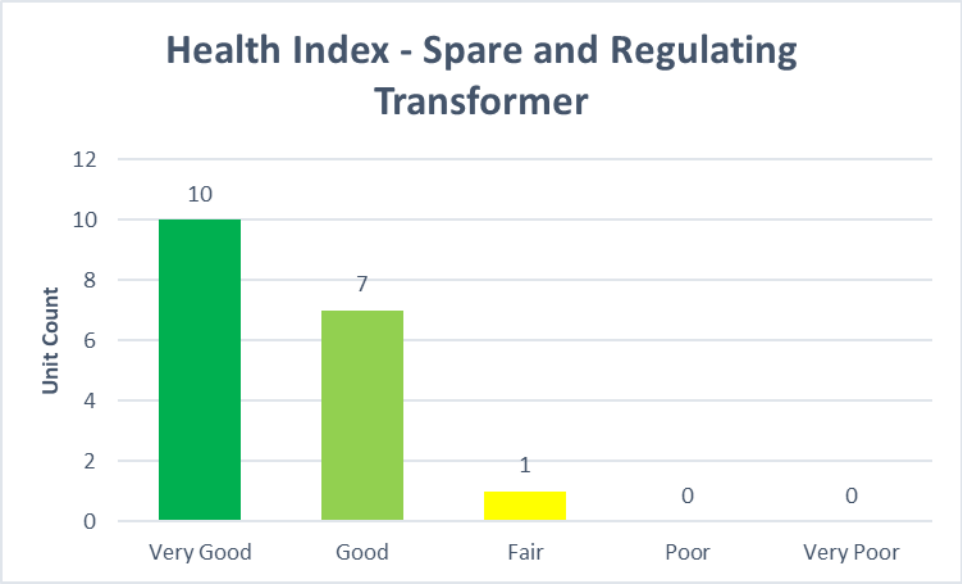


Table 3-24: Spare and Regulating Transformer Unit No. identification for Health Index category

Very Good	Good	Fair	Poor	Very Poor
SW5221-63 SW5220-62 SW3600-163 SW3600-164 SW3600-165 REG-ER1-A REG-ER1-B REG-ER1-C SW5121B-149 3298	SW5221-64 CO#6843 3296 3297 4633 6962 VR2	2164		

Figure 3.21: Ratio Bank Health Index Demographic

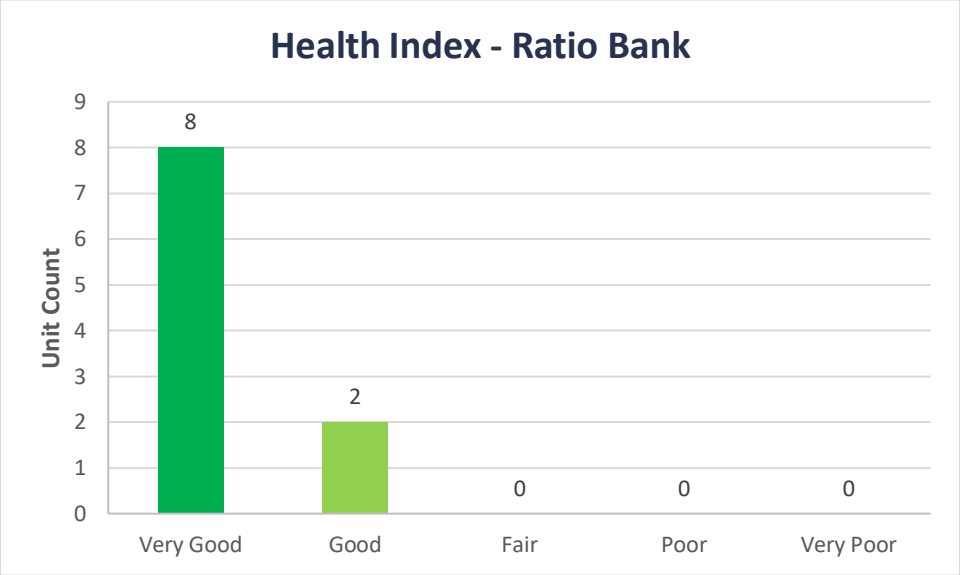


Table 3-25: Ratio Bank Unit No. identification for Health Index category

Very Good	Good	Fair	Poor	Very Poor
WawaSD9400-C T8400 001 T9711 001 T9711C 004 T9711 003 T8200 001 T8300 001 T9512 001	WawaSD9400-A WawaSD9400-B			

Data Assessment

The Data Availability Indicator (DAI) is created to measure the reasonably collected data to date by the utility for completion regarding parameters used in the Health Index algorithm. The class-average DAI for in-service station power transformer data, spare transformer data and voltage regulator data is 86%. The DAI for ratio bank data is 46% due to only age data being available for non-Wawa ratio banks. Section 4.0 provides recommendations for data collection for Health Index Formulation improvement.

3.2.2 Protection Relays

The function of protection relays on distribution systems is to detect and annunciate abnormal operating conditions and initiate a recloser trip to isolate faulty circuits from healthy circuits. Protection relays obtain their input from instrument transformers, process the information and automatically take corrective action with adequate speed and selectivity.

Algoma Power Inc. owns 33 protection relays within its service territory. Age data suggests that the overall relay population is very young, as seen in Figure 3.22. Of the total population, 31 units

are of Cooper Form 6 or SEL-651 type and were installed between the years of 2009 to 2016. No condition data is available and therefore no Health Index Formulation can be recommended at this time. Figure 3.23 presents the electronic controller/relay type in-service in Algoma Power Inc.. Figure 3.24 presents the distribution of recloser/breaker types for protection relays. Section 4.0 provides additional recommendations for data collection for Health Index Formulation improvement.

Figure 3.22: Protection Relay Age Demographic

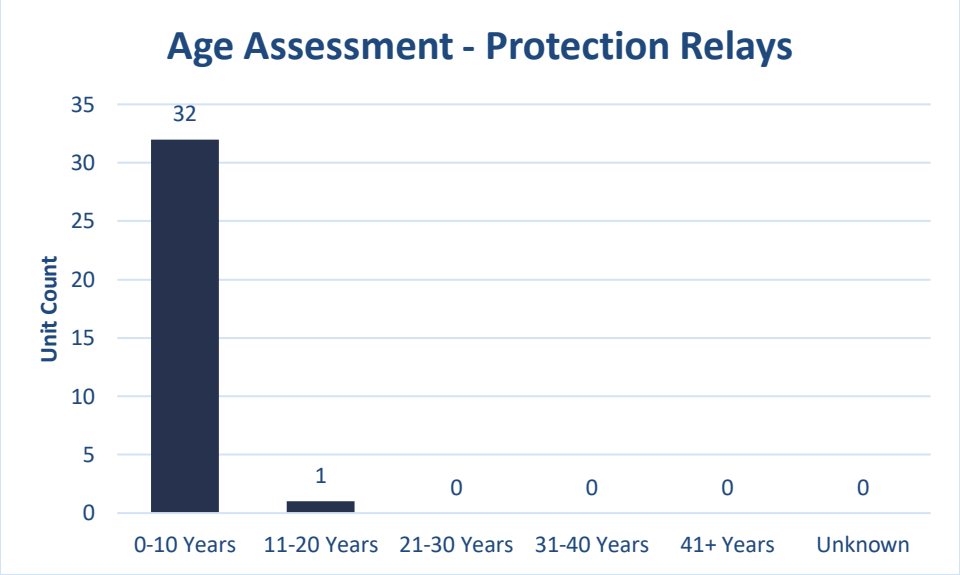


Figure 3.23: Electronic/Relay Demographic

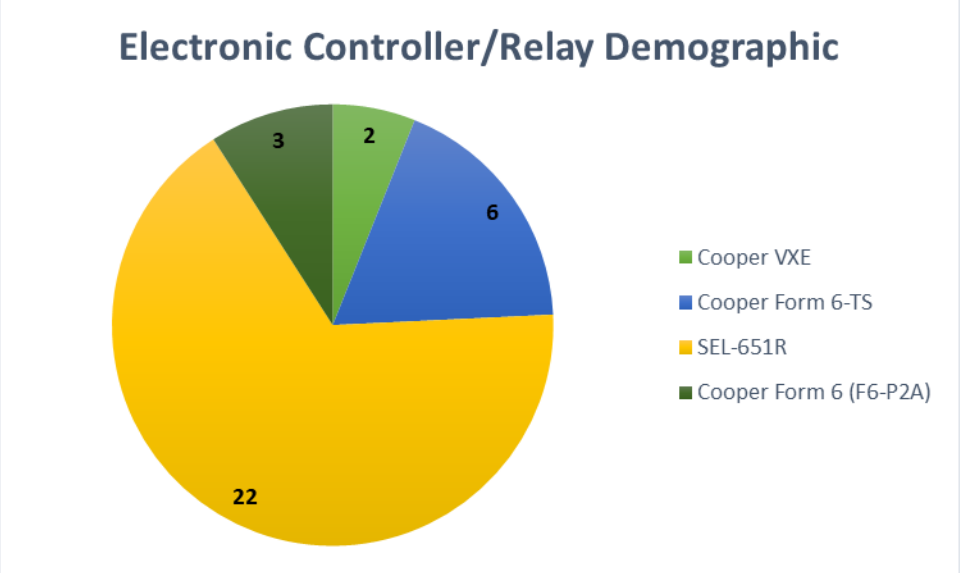
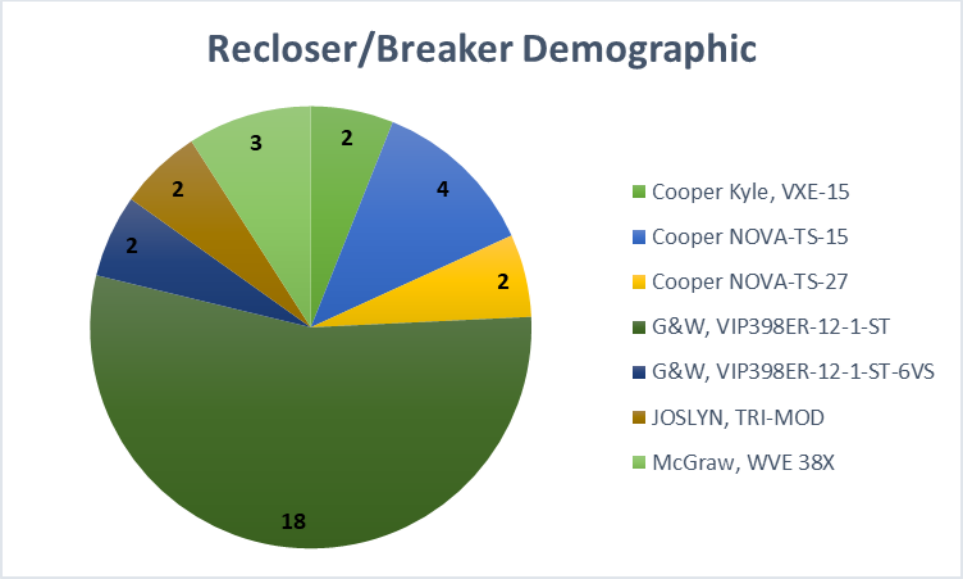


Figure 3.24: Recloser/Breaker Demographic



3.2.3 Ground Grids, Yards & Buildings

The Health Index for substations ground grids, yard, and buildings is calculated by considering only visual inspection records. Table 3-26 summarizes the methodology used to generate the Health Index. Table 3-27 translates the overall condition of the asset into a condition rating.

Table 3-26: Station Ground Grid, Yard and Building Health Index Algorithm

#	Condition Criteria	Weight	Condition Score	Factors	Maximum Score
1	Overall Condition	1	A,B,C,D,E	4,3,2,1,0	4
				MAX SCORE	**4**

Table 3-27: Criteria for overall condition

Condition Rating	Corresponding Condition
A	No deficiencies.
C	Only minor deficiencies.
E	Major deficiencies requiring immediate attention.

3.2.3.1 Results of Analysis

Figure 3.25 and Figure 3.26 present the Health Index distribution for substation ground grids and substation yard/buildings, respectively.

Figure 3.25: Ground Grid Health Index Demographic

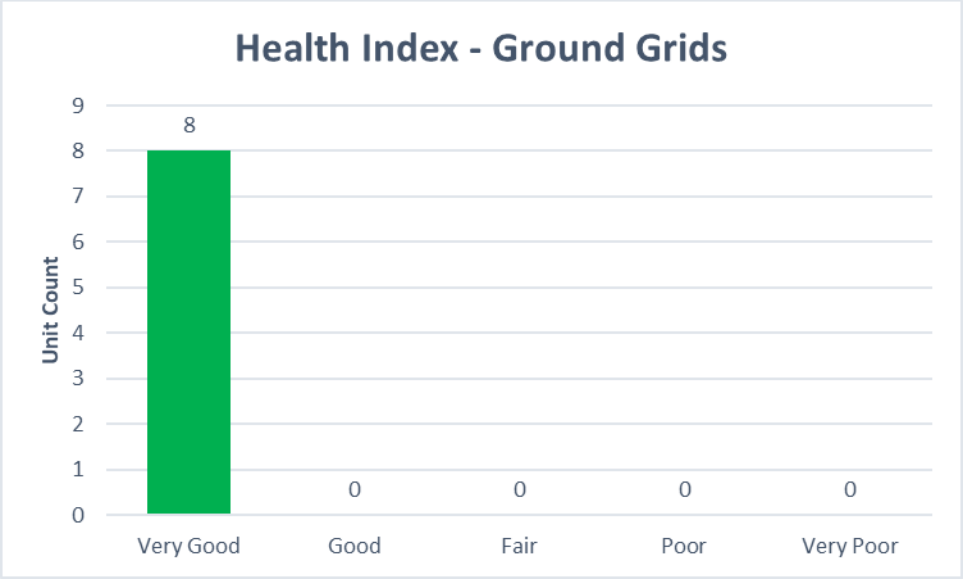
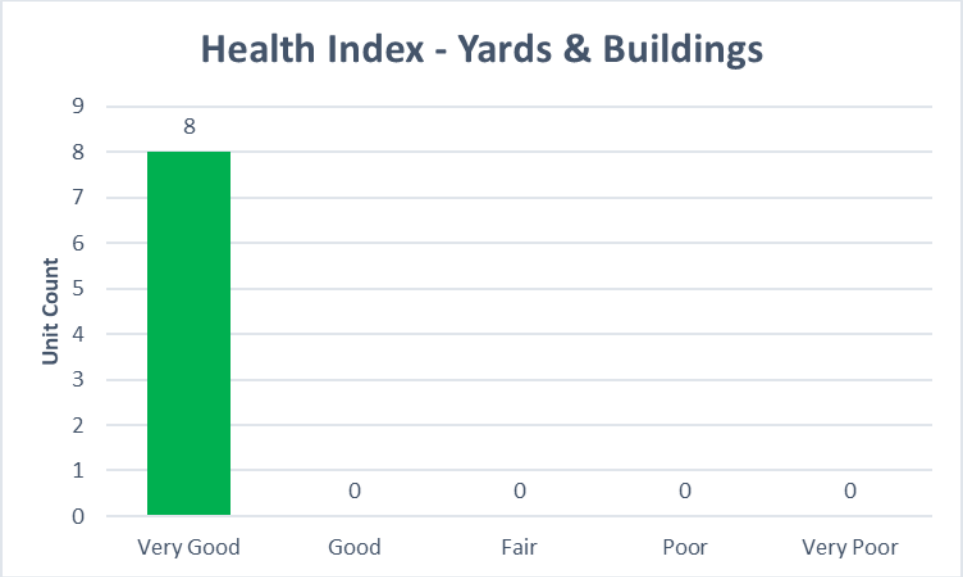


Figure 3.26: Ground Grid Health Index Demographic



4 Recommendations

While Algoma Power Inc. has been conducting regular visual inspections as per the DSC requirements, there are limited asset inspection records. Though it may be costly for a small utility, obtaining asset condition data is valuable in justifying capital and operational expenditures, maintenance activities, inspection intervals, and validating the collection of data points.

Additionally, keeping records of asset condition is good practice as it may assist in planning and assessing the quality of in-service assets being replace.

METSCO's strongest recommendation is that Algoma Power Inc. begin collecting and keeping condition records consistent for all assets inspected rather than checking for a pass/fail criterion, targeting the assets with a degraded nature. This will establish a stronger baseline of the asset health indices rather than being dependent on age. METSCO recommends Algoma Power Inc. incorporate a five-level grading scheme for any asset condition inspection, where applicable, and be generally consistent with ISO55000 practices. A five-level grading scheme will allow for more granularity between assets and their respective Health Index values that will be used for prioritizing assets for rejuvenation and replacement practices.

4.1 Wood Pole

The current Health Index Formulation for wood poles targets all major end-of-life criteria which represent an accurate depiction of a single wood pole's Health Index. Algoma Power Inc. currently has records for approximately half of the total in-service population. It is expected that with every passing year, the inspection record database will continue to grow, allowing for Health Indices to be calculated for the remaining population. METSCO recommends for Algoma Power Inc. to continue inspecting wood poles at the current pace and to re-evaluate the wood poles Health Indices every year. Additionally, Table 4-1 identifies one data point (Pole – Out of Plumb) that can be used as part of the Health Index Formulation and is collectible during routine inspection. We recommend for Algoma Power Inc. to investigate the possibility of collecting this data point moving forward to improve the Heath Index Formulation. A priority is given in relation to the currently collected end-of-life criteria for wood poles.

Table 4-1: Data Collection Recommendation for Wood Pole

Criteria	Reasoning	Priority
Visual Inspection - Out of Plumb	Poles with an excessive lean should be identified as accurately as possible. Poles with a large displacement are considered a large safety liability or reliability issue for the utility – the poles would be very likely to be at end of life.	**Low**

4.2 Overhead Primary Conductor

The Health Index for overhead primary conductors is determined with the use of two criteria: age and small conductor risk. Small conductor risk is a criterion as it is sometimes identified as having increased risk of becoming brittle and failing. Should Algoma Power Inc. not identify any small conductor in-service then the Health Index Formulation provided is accurate and does not require a change. However, if small conductors are in-service, it is recommended to remove the conductors to reduce the failure risk.

4.3 Underground and Submarine Primary Cable

The current in-service underground and submarine primary cable is significantly smaller than in-service overhead primary conductors. In comparison, underground and submarine primary cables constitute less than 1% of what Algoma Power Inc. has in-service for overhead primary conductors. The asset class is relatively new to the overall system and Algoma Power Inc. has not yet experienced any major failures associated with the asset class. METSCO recommends, as good data practice, to collect (at a minimum) the service age and outage records for these assets. Should cable be a root cause for failure in the future, this data can be used to aide post-failure analysis to identify possible defects within the cable.

It is noted that all underground and submarine cabling within the system is configured radially, meaning there are no contingencies available during an outage of these assets. To compensate, API has provided a fourth temporary cable and switching kiosk to avoid outage impacts along critical sections of these cable lengths, particularly those comprising express feeders.

Table 4-2 identifies additional data points that can be used as part of the Health Index Formulation. We recommend for Algoma Power Inc. to investigate the possibility of collecting these data points moving forward to improve the Heath Index Formulation. A priority is given in relation to other criteria recommended to be collected for the asset class. It should be noted that although in-service cable testing (Field Testing and Condition of Concentric Neutral) are high impact condition parameters and provide insights to the health of underground and submarine cable, the current configuration of these assets makes collection of this data extremely cost prohibitive. METSCO recommends that API remain aware of the recommendation to collect this data and to re-evaluate the feasibility of collecting this data during future asset condition assessments.

Table 4-2: Data Collection Recommendation for Underground and Submarine Primary Cable

Criteria	Reasoning	Priority
Cable Failure	By collecting cable failure results and identifying water tree samples throughout the service territory the utility would be able to have an improved knowledge of cable condition.	**High**
Service Age	A basic data parameter that would inform the asset's current strength level as well as how near it is to its typical useful life.	**High**
Field Testing	Like cable failure, field testing will result in an improvement of understanding the condition of the utility's asset.	**High**
Condition of Concentric Neutral	Like cable failure, testing of the concentric neutral will result in an improvement of understanding the condition of the utility's asset.	**High**
Outage Records	Collecting outage records with their known location would identify which feeder section are in poorer condition that will require replacement as it may be more cost effective to replace rather than maintain.	**Medium**
Loading History	Overloading cables results in temperature increases over time, causing accelerated degradation of the cable.	**Low**

4.4 Distribution Transformer

Table 4-3 identifies the recommended condition data points to be collected that can be used as part of the Health Index Formulation. We recommend for Algoma Power Inc. to investigate the possibility of collecting these data points moving forward to improve the Heath Index Formulation. A priority is given in relation to other criteria recommended to be collected for the asset class.

Table 4-3: Data Collection Recommendation for Distribution Pole-Mount Transformer

Criteria	Reasoning	Priority
Visual Inspection	Identifying defects present on an asset would inform the utility of degradation and potential maintenance tasks to be completed.	**High**
Peak Loading	Transformers that are overloaded will exhibit accelerated degradation of the insulation found within an asset.	**Low**

Table 4-4: Data Collection Recommendation for Distribution Pad-Mount Transformer

Criteria	Reasoning	Priority
Condition of Pad	It is likely that a failed transformer pad will also result in the replacement of the transformer it is supporting.	**High**
Visual Inspection	Identifying defects present on the asset would inform the utility of degradation and potential maintenance tasks to be completed.	**High**
Peak Loading	Transformers that are overloaded will exhibit accelerated degradation of the insulation found within an asset.	**Low**

4.5 Overhead Switch

Table 4-5 identifies the data points that can be used as part of the Health Index Formulation. We recommend for Algoma Power Inc. to investigate the possibility of collecting this data point moving forward to improve the Heath Index Formulation. A priority is given in relation to other criteria recommended to be collected for the asset class.

Table 4-5: Data Collection Recommendation for Switch

Criteria	Reasoning	Priority
Visual Inspection - Condition of Enclosure	Criterion affects life expectancy of a switch. Identification of condition over time leads to degradation information of an asset.	**Medium**
Visual Inspection - Condition of Interphase Barriers	Criterion affects life expectancy of a switch. Identification of condition over time leads to degradation information of an asset.	**Medium**
Visual Inspection and/or Corona testing - Condition of Terminations	Criterion affects life expectancy of a switch. Identification of condition over time leads to degradation information of an asset.	**Medium**
Visual Inspection - Condition of Blades	Criterion affects life expectancy of a switch. Identification of condition over time leads to degradation information of an asset.	**Medium**
Visual Inspection - Condition of Operating Mechanism	Criterion affects life expectancy of a switch. Identification of condition over time leads to degradation information of an asset.	**Low**

4.6 Reclosers

Table 4-6 and Table 4-7 identifies the data points that can be used as part of the Health Index Formulation for both oil-insulated and vacuum-insulated reclosers, respectively. We recommend for Algoma Power Inc. to investigate the possibility of collecting these data points moving forward to improve the Heath Index Formulation. A priority is given in relation to other criteria recommended to be collected for the asset class.

Table 4-6: Data Collection Recommendation for Oil Insulated Recloser

Criteria	Reasoning	Priority
Visual Inspection - Condition of Tank	Criterion affects life expectancy of a recloser. Identification of condition over time leads to degradation information of an asset.	**Medium**
Visual Inspection - Condition of Terminations	Criterion affects life expectancy of a recloser. Identification of condition over time leads to degradation information of an asset.	**Medium**
Counter Readings	Criterion affects life expectancy of a recloser. Identification of operation use over time leads to degradation information of an asset.	**Medium**
Visual Inspection - Condition of Operating Mechanism	Criterion affects life expectancy of a recloser. Identification of condition over time leads to degradation information of an asset.	**Low**
Visual Inspection – Oil Leaks	Criterion affects life expectancy of a recloser. Identification of oil leaks over time leads to degradation information of an asset.	**Medium**
Visual Inspection – Condition of Oil	Criterion affects life expectancy of a recloser. Identification of oil quality over time leads to degradation information of an asset.	**High**

Table 4-7: Data Collection Recommendation for Vacuum Insulated Recloser

Criteria	Reasoning	Priority
Visual Inspection - Condition of Enclosure	Criterion affects life expectancy of a recloser. Identification of condition over time leads to degradation information of an asset.	**Medium**
Visual Inspection - Condition of Terminations	Criterion affects life expectancy of a recloser. Identification of condition over time leads to degradation information of an asset.	**Medium**
Counter Readings	Criterion affects life expectancy of a recloser. Identification of operation use over time leads to degradation information of an asset.	**Medium**
Visual Inspection - Condition of Operating Mechanism	Criterion affects life expectancy of a recloser. Identification of condition over time leads to degradation information of an asset.	**Low**
Visual Inspection – Integrity of Vacuum Bottle	Criterion affects life expectancy of a recloser. Identification of condition over time leads to degradation information of an asset.	**High**

4.7 Capacitors

Table 4-8 identifies the data points that can be used as part of the Health Index Formulation for shunt capacitors. We recommend for Algoma Power Inc. to investigate the possibility of collecting these data points moving forward to improve the Heath Index Formulation. A priority is given in relation to other criteria recommended to be collected for the asset class.

Table 4-8: Data Collection Recommendations for Shunt Capacitors

Criteria	Reasoning	Priority
Visual Inspection – Capacitor Units	Criterion affects life expectancy of a capacitor. Identification of condition over time leads to degradation information of an asset.	**High**
Visual Inspection – Steel Mounting Structure	Criterion affects life expectancy of a capacitor. Identification of condition over time leads to degradation information of an asset.	**Low**
Visual Inspection – Capacitor Unit Fuses	Criterion affects life expectancy of a capacitor. Identification of fuse condition leads to degradation information of an asset.	**Medium**
Number of Alarms related to Capacitor Failures	Objective asset related value results identify asset condition over time, which leads to degradation information of an asset.	**Medium**
Doble and Capacitance Tests	Objective asset test with output results identify asset condition over time, which leads to degradation information of an asset.	**Medium**
Visual Inspection-Support Insulators	Criterion affects life expectancy of capacitor. Identification of condition over time leads to degradation information of an asset.	**Medium**

4.8 Substation Power Transformer

The current Health Index Formulation for power transformers, spares and voltage regulators targets all major end-of-life criteria which represent an accurate depiction of the asset's Health Index. It is expected that with every passing year, the inspection record database will continue to grow, allowing for Health Indices to be calculated every year and to identify any critical assets. METSCO recommends for Algoma Power Inc. to continue inspecting power transformers and collect these condition parameters. API currently has peak loading and IR scan results for 3 of the 10 ratio banks in the system. It is recommended that these inspection techniques be carried forward to the remaining 7 assets within the ratio bank population. Additionally, Table 4-9 identifies one data point (Foundation Inspection) that can be used as part of the Health Index Formulation for Substation Power Transformers. We recommend for Algoma Power Inc. to investigate the possibility of collecting this data point moving forward to minimally improve the Heath Index Formulation.

Table 4-9: Data Collection Recommendations for Substation Power Transformers

Criteria	Reasoning	Priority
Visual Inspection - Foundation	Identifying presence of wear compromises the foundation. Both the location and degree (low, medium, high) of wear presence should be captured over time.	**Low**

4.9 Protection Relays

Table 4-10 identifies the data points that can be used as part of the Health Index Formulation for protection relays. We recommend for Algoma Power Inc. to investigate the possibility of collecting

these data points moving forward to improve the Heath Index Formulation. A priority is given in relation to other criteria recommended to be collected for the asset class. Of note: age, model, firmware version, maintenance and reverification dates are collected by API, but need to be gathered within a centralized asset registry for future asset condition assessments.

Table 4-10: Data Collection Recommendations for Protection Relays

Criteria	Reasoning	Priority
Visual Inspection	Criterion affects life expectancy of a protection relay. Identification of fuse condition leads to degradation information of an asset.	**Medium**
Service Age	Criterion affects life expectancy of a protection relay. Identification of fuse condition leads to degradation information of an asset.	**High**
Defect and Test Reports	Objective asset test with output results identify asset condition over time, which leads to degradation information of an asset.	**High**
Mean Time Between Failures	Objective asset test with output results identify asset condition over time, which leads to degradation information of an asset.	**Medium**
Non-Discretionary / Discretionary Obsolescence	Criterion affects utilities asset management related objectives.	**Medium**

5 Asset Replacement Plan

5.1 Purpose

Based on the condition assessment of major assets employed in substations, overhead lines and underground distribution system, this section provides the projected quantities of assets that would likely require replacement for the next short-term planning, constituting years 2019 to 2024.

The following major classes of assets are considered:

- Distribution Poles
- Distribution Transformers
- Overhead Switches
- Reclosers
- Capacitors
- Substation Power Transformers

Overhead conductors typically outlive the poles which support them and are replaced when the poles are replaced; these assets are therefore are not considered. Additionally, underground primary cables and protection relays are not discussed within this section as the information collected to date does not encompass a recent representation of the current population. However, it is advised to look at the possibility of renewing some of the oldest units within these asset classes. The long-term trending approach considers expected aging and degradation for each asset and attempts to smooth investment requirements over the planning period.

5.2 Approach

The ACA provides the Health Index distribution for each asset. The Health Index is a percentage score between 0 and 100, used to assess the condition of an asset. The condition-based intervention approach based on the asset's condition is shown in Table 5-1. This is a general approach, which can vary between assts and based on budget constraints. For each asset type a ranged quantity of asset replacements for each year is estimated. However, the replacements are on Health Index, testing and field inspection of assets performed in samples. Continuous monitoring of the asset by inspectors will provide the most current asset condition.

Table 5-1: Health Index definition and intervention approach

Health Index (%)	Condition	Intervention Approach
85 - 100	Very good	None
70 - 85	Good	None
50 - 70	Fair	Replace within 3-10 years
30 - 50	Poor	Replace within 1-3 years
0 - 30	Very poor	Replace immediately

In addition to the condition of the assets, the asset's age, specifically the Typical Useful Life (TUL), can be a determining driver for asset renewal because as the asset reaches and passes the TUL, the rate at which the asset's condition deteriorates increases. Furthermore, even though visual

inspection records may result in a calculated Health Index to be in Good condition for an asset reaching or past TUL carries an increased risk of failing and quickly deteriorating from Good to Very Poor. Minimum, maximum and TUL values for Algoma Power Inc. are assumed based on Kinectrics' *Asset Depreciation Study for the Ontario Energy Board*, as summarized in Table 5-2.

Table 5-2: Useful life measures for selected asset classes

Asset Class	Minimum UL	TUL	Maximum UL
Wood pole	35	45	75
Pole-mount transformer	30	40	60
Pad-mount transformer	25	40	45
Overhead switch	30	45	55
Recloser	25	40	55
Power transformer	35	45	60
Shunt capacitor	25	30	40

5.3 Wood Pole

The age and Health Index demographics are depicted in Table 5-3 and Table 5-4, respectively. Approximately 2% of the poles are below Fair condition, whereas approximately 11% of wood poles have reached or passed the TUL.

Table 5-3: Age distribution for poles

Asset	0-10 Years	11-20 Years	21-30 Years	31-40 Years	41-50 Years	51+ Years
Wood Pole	5710	3361	3334	5772	5757	4170

Table 5-4: Health Index distribution for poles

Asset	Very Good	Good	Fair	Poor	Very Poor
Wood Pole	14098	11314	1976	96	620

To keep the risk of in-service equipment failure at acceptable levels and to mitigate deterioration in supply system reliability, Table 5-5 provides the replacement recommendation for the asset renewal of poles expected to reach the end of their useful service life during the next six years. The replacement plan for wood poles prioritizes those poles that are rated as Poor and Very Poor, as well as poles that are past the TUL of a wood pole. Based on the large amount of poles past their TUL, and to reduce the risk of failed wood poles due to age, it is recommended for Algoma Power Inc. to replace a significant amount of poles each year as shown in Table 5-5. However, the current condition data collected does not support that wood poles past the TUL are experiencing unfavorable conditions and require attention for replacement. METSCO recommends for Algoma Power Inc. to conduct a visual inspection on a subset of wood poles past their TUL to determine if the wood poles are in fact in acceptable service conditions or require asset intervention (i.e. asset renewal).

Should the outcome of the visual inspection of the subset show the condition of poles are acceptable for service, the recommended replacement can be revised for a decrease in wood poles to be replaced, shown in the table below. It is expected that with the rigorous risk management the TUL could be realized as 55 years, in which case replacing 450 poles per year

would maintain system health. This would allow for the proactive replacement of assets identified to be past the TUL or near failure (based on condition). The option of inspecting wood poles past the TUL provides the added benefit for Algoma Power Inc. to ensure that they are replacing assets that require replacement commensurate to their condition. This benefits customer service expectations as there are reduced outages, a reduced renewal budget, and maintained service reliability of the system.

Table 5-5: Projected replacement for poles

Quantity of Assets Recommended for Replacement						
Year	2019	2020	2021	2022	2023	2024
TUL = 45 years						
Wood Pole	660	660	660	660	660	660
TUL = 55 years						
Wood Pole	450	450	450	450	450	450

5.4 Distribution Transformer

The age and Health Index demographics are depicted in Table 5-6 and Table 5-7, respectively. Approximately 5% of the transformers are below Fair condition.

Table 5-6: Age distribution for distribution transformers

Asset	0-10 Years	11-20 Years	21-30 Years	31-40 Years	41-50 Years	51+ Years
Pole-mount transformer	750	1708	1604	548	171	19
Pad-mount transformer	48	80	4	0	0	0

Table 5-7: Health Index distribution for distribution transformers

Asset	Very Good	Good	Fair	Poor	Very Poor
Pole-mount transformer	750	1708	1604	548	191
Pad-mount transformer	48	80	4	0	0

To keep the risk of in-service equipment failure at acceptable levels and to mitigate deterioration in supply system reliability, Table 5-8 provides the replacement recommendation for asset renewal of transformers expected to reach the end of their useful service life during the next six years. However, the Health Index is solely dependent on age as a condition parameter and it is advisable to expand the algorithm to other condition parameters. Continuous monitoring of the asset's condition throughout the years will identify if any further condition degradation continues and if it is necessary for an asset to be replaced. Additionally, distribution transformers are often managed on a run to failure use-case, or are replaced through larger, planned renewal projects to minimize impacts and for optimal efficiency. The run to failure case is particularly true for overhead distribution transformers. Both cases will influence the replacement rate that Algoma Power Inc. will plan for in the short term. Furthermore, older pole-mount transformers are typically found on older wood poles and are replaced simultaneously for efficiency reasons.

Table 5-8: Projected replacement for distribution transformers

Quantity of Assets Recommended for Replacement						
Year	2019	2020	2021	2022	2023	2024
Pole-mount transformer	33	33	33	33	33	33
Pad-mount transformer	0	0	0	0	1	1

5.5 Overhead Switch

Algoma Power Inc. has limited data condition and age records for overhead switches in-service. Through continuous monitoring of the asset's condition throughout the years will identify if any further condition degradation continues and if it is necessary to be replaced. This includes Algoma Power Inc.'s continuous IR scanning of the overhead system. Algoma Power Inc.'s asset risk management is proactively managed by removing identified switches that exhibit abnormal heat spikes seen through IR scanning. Furthermore, Algoma Power Inc. currently has porcelain type switches in-service which historically have caused system issues for not only Algoma Power Inc. but other LDCs in Ontario. Algoma Power Inc. currently has an active switch replacement program that replaces porcelain switches for the new accepted standard of polymer switches. Replacing the remaining porcelain switches in-services will maintain the system's reliability and reduce the safety risk associated with the existing switch.

5.6 Reclosers

The known age demographics are depicted in Table 5-9. No Health Index is calculated for this asset due to the limited condition records.

Table 5-9: Age distribution for reclosers

Asset	0-10 Years	11-20 Years	21-30 Years	31-40 Years	41-50 Years	51+ Years
Recloser (in-service)	35	71	15	1	0	0

To keep the risk of in-service equipment failure at acceptable levels and to mitigate deterioration in supply system reliability, Table 5-10 provides the replacement recommendation for asset renewal of recloser that are beyond the TUL and those expected to reach the TUL within the next six years. The current replacement recommendation is solely dependent on age as a data parameter. It is advisable to continue monitoring and recording the asset's condition moving forward to identify those reclosers with a high-risk of failure and require immediate replacement.

Table 5-10: Projected replacement for reclosers

Quantity of Assets Recommended for Replacement						
Year	2019	2020	2021	2022	2023	2024
Recloser (in-service)	0	0	0	0	0	1

5.7 Capacitors

The age and Health Index demographics are shown in Table 5-11 and Table 5-12, respectively.

Table 5-11: Age distribution for capacitors

Asset	0-10 Years	11-20 Years	21-30 Years	31-40 Years	41-50 Years	51+ Years
Capacitor	4	0	0	0	0	0

Table 5-12: Health Index distribution for capacitors

Asset	Very Good	Good	Fair	Poor	Very Poor
Capacitor	2	1	1	0	0

Based on the Health Index calculation and age analysis, there is no recommended replacements within the next six years. Should the in-service assets continue to receive good maintenance and frequent inspections, it is expected the assets will continue to perform well. Should any in-service asset receive a poor condition record, an investigation is recommended to determine the root cause as well as appropriate remedial actions.

5.8 Power Transformer

The age and Health Index demographics are depicted in Table 5-13 and Table 5-14, respectively.

Table 5-13: Age distribution for power transformers, spares, voltage regulators and ratio banks

Asset	0-10 Years	11-20 Years	21-30 Years	31-40 Years	41-50 Years	51+ Years
Power transformer	3	2	4	1	0	0
Spares/Regulating Transformer	8	0	1	5	3	0
Ratio Bank	9	1	0	0	0	0

Table 5-14: Health Index distribution for power transformers, spares, voltage regulators and ratio banks

Asset	Very Good	Good	Fair	Poor	Very Poor
Power transformer	1	10	2	0	0
Spares/Regulating Transformer	10	7	1	0	0
Ratio Bank	8	2	0	0	0

Based on the Health Index calculation and age analysis, there is no recommended replacements within the next six years. Should the in-service assets continue to receive good maintenance and frequent inspections, it is expected the assets will continue to perform well. Should any in-service asset receive a poor condition record, an investigation is recommended to determine the root cause as well as appropriate remedial actions. METSCO notes that three spare transformers are approaching the TUL of a power transformer. Although these assets are not in-service and see no load, it is important to keep these assets maintained in case of emergency situations where they may be required within a short time period. If the risk of failure of the spare transformers is moderate to high, Algoma Power Inc. is advised to replace the spare transformers to address the risk by reducing it Algoma Power Inc.'s risk tolerance.

Attachment 4-VECC-27

Excel Version of Response (Excel Only)

Algoma Power Inc.
EB-2024-0007

Attachment 8-VECC-43

RTSR Model using 2023 RRR (Excel Only)

Algoma Power Inc.
EB-2024-0007