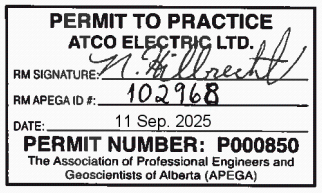
Distribution Deficiency Report

ATCO Fort McMurray Load Addition

11 Sep 2025
APEGA ID: 107245



Approvals	Signature	Date
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Revision History:

R0	Original Submission	Erin Young	June 26, 2023
R1	Updated with AESO comments	Erin Young	Sep 20, 2023
R2	Updated with AESO comments	Erin Young	Nov 1, 2023
R3	Updated requested amount of feeders for Transmission-Based Alternative 2	Erin Young	May 29, 2024
R4	Updated to correct requested ISDs	Erin Young	Sep 11, 2024
R5	Updated wording around request for transformers	Erin Young	Sep 18, 2024
R6	Updated revision log to reflect that R4 also included a change to the customer requested DTS from 34 MW to 51 MW	Erin Young	Oct 29, 2024
R7	Updated load forecasts for 2025	Erin Young	Aug 21, 2025

1 Executive Summary

ATCO Distribution Facility Owner (ATCO DFO) has received a request to serve a pump station development near Yeo 2015S in ATCO Electric's Fort McMurray area ("the Project"). Yeo 2015S POD substation is located approximately 40 km west of Fort McMurray in the Alberta Electric System Operator's (AESO) Northeast Planning Region.

ATCO DFO has considered the following alternatives:

Distribution-Only Alternative 1: Serve load from Yeo 2015S;

Transmission-Based Alternative 1: Add 25 kV Source at Dover 888S;

Transmission-Based Alternative 2: New POD near the Project location.

ATCO DFO has determined that Transmission-Based Alternative 2 is the only alternative that meets the needs of the customer's request.

The requested In-Service Date (ISD) of the proposed new POD is December 1, 2026.

2 Introduction

2.1 Customer Requests

ATCO DFO has received a load request from an industrial customer for a pump station development ("the Project") at the Legal Subdivision (LSD) NW 17-91-12-W4. The customer is planning to add 51 MW of operating load with 3x 25,000 hp motors with Variable Frequency Drive (VFD) starting assistance. The requested In-Service Date (ISD) is December 1, 2026 in order to complete site commissioning that will utilize 5 MW of load; the remaining 46 MW of the 51 MW load will be energized on May 1, 2027. Table 2.1-1 shows the customer request. ATCO assumes a power factor of 0.9 when modelling the proposed customer load.

Table 2.1-1: Fort McMurray Area New Customer Request

Location	Load Type Characterization	Total Load Size	Requested ISD
NW 17-91-12-W4	Industrial	5 MW	Dec 1, 2026
NW 17-91-12-W4	Industrial	46 MW	May 1, 2027
	Total:	51 MW	

2.2 Existing System

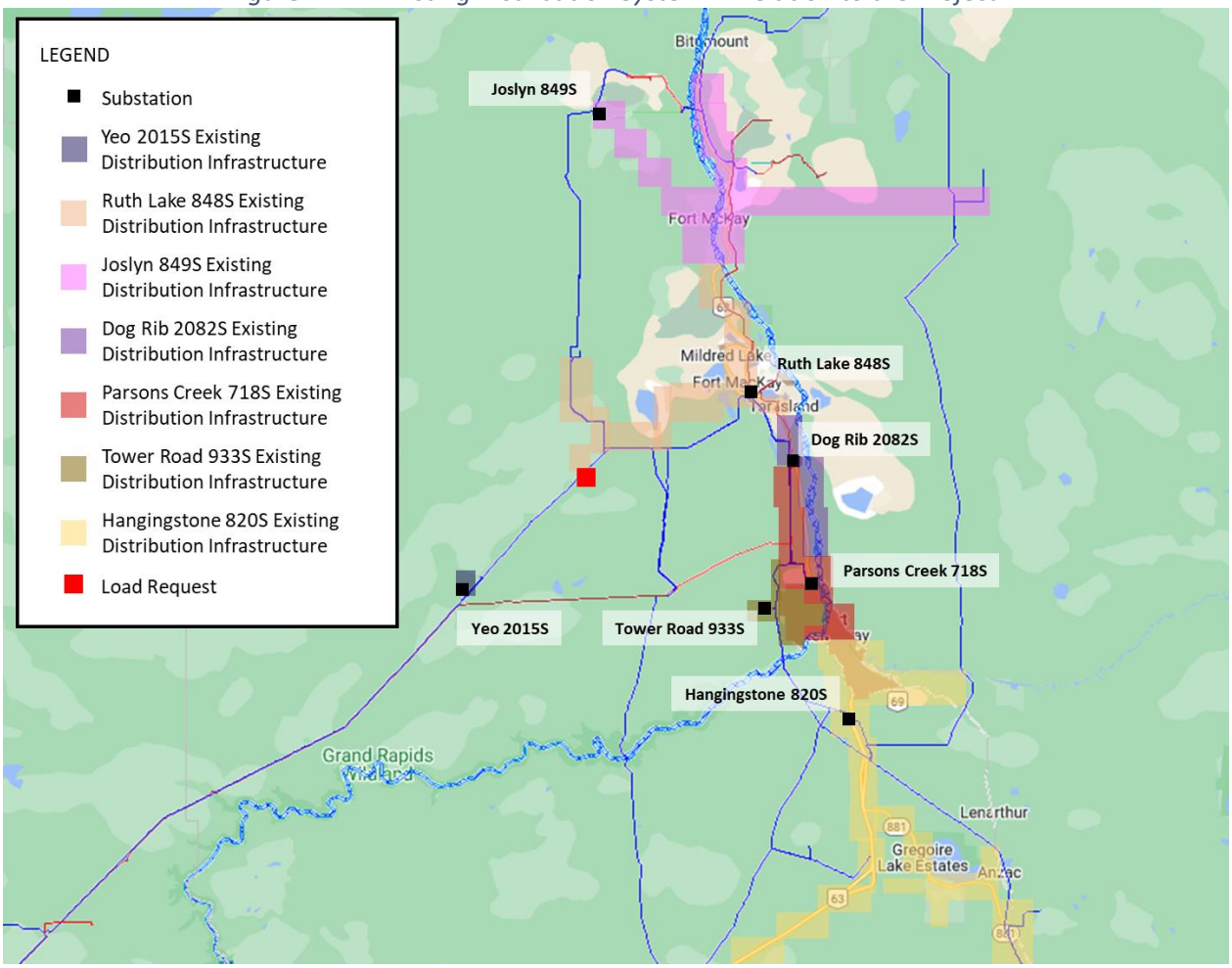
There are several PODs with 25 kV service near the Project. Table 2.2-1 below shows the distance between the Project location and surrounding 25 kV distribution systems. Note that Birchwood Creek 960S, Dover 888S, Thickwood 951S, and Halfway 2014S are substations near the project and were not included in the table as they have no 25 kV source.

Figure 2.2-1 shows the existing Distribution system in relation to the Project load request.

Table 2.2-1: Distribution Connection Distances from the Project to the Surrounding 25 kV Systems

POD	Distance from the Project (km)	Existing Load Type (%)				
		Commercial	Industrial	Residential	Farm	Total
Yeo 2015S	21.3	--	100.0	--	--	100
Ruth Lake 848S	23.7	41.9	58.1	--	--	100
Dog Rib 2082S	26.6	16.1	83.9	--	--	100
Tower Road 933S	29.6	15.2	--	84.8	--	100
Parsons Creek 718S	31.7	54.1	4.2	41.7	--	100
Joslyn 849S	45.3	71.1	21.2	7.7	--	100
Hangingstone 820S	46	63.9	7.0	29.0	0.1	100

Figure 2.2-1: Existing Distribution System in Relation to the Project



2.2.1 Yeo 2015S

Yeo 2015S is located at SW 34-89-14-W4.

This substation is equipped with two 30/40/50 MVA, 240/25 kV transformers and two 25 kV breakers. Figure 2.2-2 shows the SLD for Yeo 2015S.

Figure 2.2-2: Yeo 2015S SLD

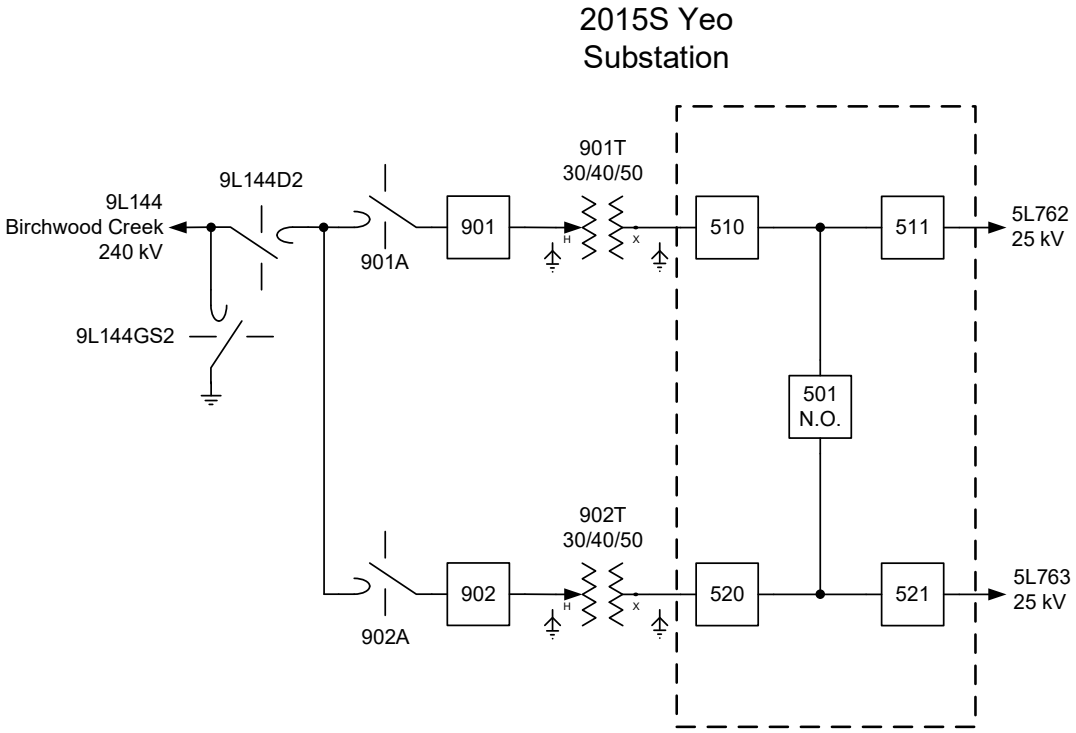


Table 5.1-1 in Appendix A shows the load forecast for Yeo 2015S.

There are no existing or planned distributed generators connected to Yeo 2015S.

2.2.2 Ruth Lake 848S

Ruth Lake 848S is located at NW16-92-10-W4. The substation was not considered in the Alternative Evaluation due to the substation distance from the Project, therefore the SLD and load forecast have not been included.

There are no existing or planned distributed generators connected to Ruth Lake 848S.

2.2.3 Dog Rib 2082S

Dog Rib 2082S is located at NW 25-91-10-W4. The substation was not considered in the Alternative Evaluation due to the substation distance from the Project, therefore the SLD and load forecast have not been included.

There are no existing or planned distributed generators connected to Dog Rib 2082S.

2.2.4 Tower Road 933S

Tower Road 933S is located at SE 27-89-10-W4. The substation was not considered in the Alternative Evaluation due to the substation distance from the Project, therefore the SLD and load forecast have not been included.

There are no existing or planned distributed generators connected to Tower Road 933S.

2.2.5 Parsons Creek 718S

Parsons Creek is located at NW 6-90-9-W4. The substation was not considered in the Alternative Evaluation due to the substation distance from the Project, therefore the SLD and load forecast have not been included.

There are no planned distributed generators for Parson Creek 718S. There is an existing distributed generator on feeder 5L702.

2.2.6 Joslyn 849S

Joslyn 849S is located at LSD 12-3-96-12-W4. The substation was not considered in the Alternative Evaluation due to the substation distance from the Project, therefore the SLD and load forecast have not been included.

There are no existing or planned distributed generators connected to Joslyn 849S.

2.2.7 Hangingstone 820S

Hangingstone 820S is located at NE 10-88-9-W4. The substation was not considered in the Alternative Evaluation due to the substation distance from the Project, therefore the SLD and load forecast have not been included.

There are no existing or planned distributed generators connected to Hangingstone 820S.

2.2.8 ATCO's Load Forecast Methodology

ATCO DFO's load forecasting methodology considers several factors:

- Historical Trend Load Growth
    - Historical load growth for the area (in %) is reviewed and conservative load growth is applied to future years. For example, ATCO typically applies an annual growth rate, except for dedicated industrial feeders which have a 0% load growth as load is expected to be steady.
- Distributed Energy Resources (DERs)
    - ATCO's load forecasts have the DERs effects removed from the historical data, so DER contributions are not considered in the net load.

2.2.9 Historical Performance Information

As this DDR is driven by load growth, the SAIDI and SAIFI information was not considered to be a driver and will not be considered further.

2.2.10 Restoration Times

As this DDR is driven by load growth, the restoration time information was not considered to be a driver and will not be considered further.

3 Alternative Evaluation

3.1 Distribution-Only Alternatives

3.1.1 Distribution-Only Alternative 1: Serve load from Yeo 2015S

As seen in Table 2.2-1 and Figure 2.2-1 , Yeo 2015S is the closest substation with a 25 kV source to the customer request. Table 5.2-1 shows the Yeo 2015S load forecast with the Project request of 51 MW. The Yeo 2015S connection would require building approximately 21.3 km of distribution line per feeder for a total of 42.6 km of distribution line built to serve the Project request.

The requested loading will result in feeder capacity overloading for feeder 5L763; The feeders are limited to a maximum of 600 A at 25 kV or 25.9 MVA.

Adding the customer load request on 5L762 results in violations to the ATCO DFO Planning Criteria – “25 kV Voltage Levels”, refer to Appendix B – ATCO DFO Planning Criteria. In order to serve the load, a voltage regulator followed by a series capacitor followed by a voltage regulator was modelled; The operating voltage modelled for the customer site when connected to Yeo 2015S is 0.790 per unit (pu). ATCO DFO standards allow a minimum of 0.97 pu at the 25 kV connection for industrial customers. Voltage drop levels for 5L763 were not analyzed as the connection is not feasible due to equipment overloading in steady state conditions.

No motor start information will be provided for the site because the low voltage issue is the primary driver for this DDR.

No other Distribution-Only Alternatives were investigated because Yeo 2015S is the closest substation with a 25 kV source and is unable to serve the load.

3.2 Alternatives Which Include Transmission

3.2.1 Transmission-Based Alternative 1: Add 25 kV Source at Dover 888S

Dover 888S is the closest substation without a 25 kV source to the customer site. A distribution connection from Dover 888S would require approximately 20.3 km of distribution line per feeder;

note that the proposed feeder distance is measured following existing distribution rights-of-way. This connection would entail installing three 25 kV breakers and 240/25 kV transformer(s) with sufficient capacity for the customer load request. Table 5.3-1 shows the load forecast for this alternative with the proposed load development of 51 MW. For illustrative purposes the load forecast is using one POD transformer, however the amount and sizing of transformers is at the TFO and AESO discretion.

Adding the customer load request of three feeders at 20.3 km from the 25 kV source results in violations to the ATCO DFO Planning Criteria – "25 kV Voltage Levels", refer to Appendix B – ATCO DFO Planning Criteria. In order to serve the load a voltage regulator followed by a series capacitor followed by a voltage regulator was modelled; The voltage modelled for the customer site when connected to Dover 888S is 0.828 pu. ATCO DFO standards allow a minimum of 0.97 pu at the 25 kV connection for industrial customers.

Due to these constraints, adding a 25 kV source at Dover 888S is not a viable solution to serve the Project.

3.2.2 Transmission-Based Alternative 2: Construct a New POD near the Project

The assumed transmission development for this alternative involves constructing a new transmission connection and a new 240/25 kV POD with sufficient capacity to serve the Project including three 25 kV breakers. Table 5.4-1 shows the new POD forecast for this alternative with the proposed load development of 51 MW. For illustrative purposes the load forecast is using one POD transformer, however the amount and sizing of transformers is at the TFO and AESO discretion.

ATCO DFO suggests the new POD be developed adjacent to the Customer proposed load centre to maximize the distribution connection's technical performance. Assuming 0.3 km per feeder length the voltage modelled at the customer 25 kV bus is 1.036 pu; no voltage regulators or series capacitors were used in this scenario.

3.3 Evaluation of Transmission Alternatives

Transmission-Based Alternative 1 provides insufficient voltages at the customer site and is therefore not viable. Transmission-Based Alternative 2 provides sufficient voltages at the customer site and raises no other Distribution concerns.

4 Conclusion

Since distribution deficiencies exist with both, Distribution-Only Alternative 1 and Transmission-Based Alternative 1, neither of these Alternatives are viable. Transmission-Based Alternative 2 is the only viable option which allows the connection of the Customer's load to the AIES. ATCO DFO requests an ISD for this development of December 1, 2026. A DTS of 5 MW is requested for

December 1, 2026, in order to complete plant commissioning with an increase to a DTS of 51 MW on May 1, 2027 when the full plant load is energized.

5 Appendix A – POD Load Forecast Tables

5.1 Existing Forecasts

Table 5.1-1: Yeo 2015S Load Forecast

					MVA LOADING - RECORDED						PREDICTED - Required Capacity									
				W	2020/2021	2021/2022	2022/2023	2023/2024	2024/2025		2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
SUB		CAPACITY		or	Peak	Peak	Peak	Peak	Peak		Peak	Peak	Peak	Peak	Peak	Peak	Peak	Peak	Peak	Peak
No	Feeder	T/R	MVA	S	MVA	MVA	MVA	MVA	MVA	PF	MVA	MVA	MVA	MVA	MVA	MVA	MVA	MVA	MVA	MVA
2015S	5L762	901T	50	W	0.7	0.7	0.7	0.7	0.7	91.0%	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
			901T Total		0.7	0.7	0.7	0.7	0.7		0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7

					MVA LOADING - RECORDED						PREDICTED - Required Capacity									
				W	2020/2021	2021/2022	2022/2023	2023/2024	2024/2025		2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
SUB		CAPACITY		or	Peak	Peak	Peak	Peak	Peak		Peak	Peak	Peak	Peak	Peak	Peak	Peak	Peak	Peak	Peak
No	Feeder	T/R	MVA	S	MVA	MVA	MVA	MVA	MVA	PF	MVA	MVA	MVA	MVA	MVA	MVA	MVA	MVA	MVA	MVA
2015S	5L763	902T	50	S	3.2	4.5	3.4	3.3	3.1	95.0%	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1
			902T Total		3.2	4.5	3.4	3.3	3.1		3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1
			2015S Total		3.4	5.0	3.6	3.6	3.2		3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2

Notes:

A transformer coincidence value of 0.848 was applied to 2015S transformers.

5.2 Distribution-Only Alternative 1

Table 5.2-1: Yeo 2015S Load Forecast with load request

					MVA LOADING - RECORDED						PREDICTED - Required Capacity									
				W	2020/2021	2021/2022	2022/2023	2023/2024	2024/2025		2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
SUB		CAPACITY		or	Peak	Peak	Peak	Peak	Peak		Peak	Peak	Peak	Peak	Peak	Peak	Peak	Peak	Peak	Peak
No	Feeder	T/R	MVA	S	MVA	MVA	MVA	MVA	MVA	PF	MVA	MVA	MVA	MVA	MVA	MVA	MVA	MVA	MVA	MVA
2015S	5L762	901T	50	W	0.7	0.7	0.7	0.7	0.7	91.0%	0.7	6.2	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5
			901T Total		0.7	0.7	0.7	0.7	0.7		0.7	6.2	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5

					MVA LOADING - RECORDED						PREDICTED - Required Capacity									
				W	2020/2021	2021/2022	2022/2023	2023/2024	2024/2025		2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
SUB		CAPACITY		or	Peak	Peak	Peak	Peak	Peak		Peak	Peak	Peak	Peak	Peak	Peak	Peak	Peak	Peak	Peak
No	Feeder	T/R	MVA	S	MVA	MVA	MVA	MVA	MVA	PF	MVA	MVA	MVA	MVA	MVA	MVA	MVA	MVA	MVA	MVA
2015S	5L763	902T	50	S	3.2	4.5	3.4	3.3	3.1	95.0%	3.1	3.1	3.1	3.1	40.9	40.9	40.9	40.9	40.9	40.9
			902T Total		3.2	4.5	3.4	3.3	3.1		3.1	3.1	3.1	3.1	40.9	40.9	40.9	40.9	40.9	40.9
			2015S Total		3.4	5.0	3.6	3.6	3.2		3.2	7.9	19.2	19.2	51.2	51.2	51.2	51.2	51.2	51.2

Notes:

A transformer coincidence value of 0.848 was applied to 2015S transformers.

Distribution Planning Criteria Violation

Feeder Capacity Exceeded

5.3 Transmission-Based Alternative 1

Table 5.3-1: Dover 888S Load Forecast with load request

					MVA LOADING - RECORDED						PREDICTED - Required Capacity									
				W	2020/2021	2021/2022	2022/2023	2023/2024	2024/2025		2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
SUB		CAPACITY		or	Peak	Peak	Peak	Peak	Peak		Peak	Peak	Peak	Peak	Peak	Peak	Peak	Peak	Peak	Peak
No	Feeder	T/R	MVA	S	MVA	MVA	MVA	MVA	MVA	PF	MVA	MVA	MVA	MVA	MVA	MVA	MVA	MVA	MVA	MVA
888S	5LNEW1	901T	YY									5.6	18.9	18.9	18.9	18.9	18.9	18.9	18.9	18.9
	5LNEW2												18.9	18.9	18.9	18.9	18.9	18.9	18.9	18.9
	5LNEW3												18.9	18.9	18.9	18.9	18.9	18.9	18.9	18.9
			901T Total									5.6	56.7	56.7	56.7	56.7	56.7	56.7	56.7	56.7

Notes:

A feeder coincidence value of 1.00 was applied to 888S Dover 901T feeders.

5.4 Transmission-Based Alternative 2

Table 5.4-1: New POD Load Forecast with load request

					MVA LOADING - RECORDED						PREDICTED - Required Capacity									
				W	2020/2021	2021/2022	2022/2023	2023/2024	2024/2025		2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
SUB		CAPACITY		or	Peak	Peak	Peak	Peak	Peak		Peak	Peak	Peak	Peak	Peak	Peak	Peak	Peak	Peak	Peak
No	Feeder	T/R	MVA	S	MVA	MVA	MVA	MVA	MVA	PF	MVA	MVA	MVA	MVA	MVA	MVA	MVA	MVA	MVA	MVA
XXXS	5LNEW1	901T	YY									5.6	18.9	18.9	18.9	18.9	18.9	18.9	18.9	18.9
	5LNEW2												18.9	18.9	18.9	18.9	18.9	18.9	18.9	18.9
	5LNEW3												18.9	18.9	18.9	18.9	18.9	18.9	18.9	18.9
			901T Total									5.6	56.7	56.7	56.7	56.7	56.7	56.7	56.7	56.7

Notes:

A feeder coincidence value of 1.00 was applied to New POD 901T feeders.

6 Appendix B – ATCO DFO Planning Criteria

ATCO DFO has developed planning criteria to ensure the safe and reliable connection and operation of loads to the distribution system. Criteria applicable in this report are highlighted below:

POD Capacity Planning – System Normal: Under system normal conditions, AE DFO must ensure sufficient substation transformer and voltage regulator capacity exists to carry all peak loads. In high growth areas, loading on substation transformers must remain below **95%** of the total nameplate rating of the POD transformers.

25 kV Voltage Levels: the voltage threshold on ATCO DFO's 25 kV systems, under normal conditions for urban residential transformers with multiple customer secondaries, and for loads greater than 1MVA, must remain above **0.97 Vpu** and below **1.04 Vpu**. For rural customers, the voltage must remain above 0.95 Vpu and below 1.04 Vpu.

Urban Feeder Loading: the maximum normal loading of 25 kV distribution feeders in a large urban area is **10.0 MVA**.

Rural Feeder Loading: the maximum normal loading of 25 kV distribution feeders in a rural area is **15.0 MVA**.

Urban 25 kV Bus Loading: the maximum normal loading of a 25 kV bus that serves a large urban area is **33 MVA**.