Need for Development

Jenner 275S Upgrade

August 15, 2016

	Name	Signature	Date
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Executive Summary

FortisAlberta Inc. (FortisAlberta) is requesting for system access service to address a distribution system capacity concern at the Jenner 275S substation.

The Jenner area is located 56 km north east of Brooks and is served by the Jenner 275S substation. Load studies indicate that three of the seven 25 kV distribution feeders supplied by the Jenner 275S substation are predicted to have load levels in excess of the 13 MVA normal feeder maximum:

- The 25 kV distribution feeder 275S-2269L is predicted to carry a peak load of 13.2 MVA in 2017, increasing to 16.4 MVA by 2025;
- The 25 kV distribution feeder 275S-2036L is predicted to carry a peak load of 15.0 MVA in 2016, increasing to 15.9 MVA by 2025;
- The 25 kV distribution feeder 275S-2175L is predicted to carry a peak load of 13.2 MVA in 2022, increasing to 14.1 MVA by 2025.

To address the distribution capacity concerns at Jenner 275S, the installation of one additional 25 kV feeder breaker at the Jenner 275S substation is requested.

The estimated distribution capital cost associated with this preferred solution is $2.8 million (±30%, 2017$).

The requested completion date for the preferred Jenner 275S facility upgrade is August 1, 2017.

The existing Demand Transmission Service (DTS) contract at the Jenner 275S substation is 65.5 MW. No DTS change is requested with this transmission upgrade project.

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1. Background

The Jenner area in southeast Alberta is located 56 km northeast of Brooks and is served by the Jenner 275S substation at LSD 09 SEC 19 TWP 20 RGE 08 W4M. This substation has two 245/26 kV 50/67/83 MVA source transformers supplying four 25 kV busses connected to seven 25 kV distribution feeder breakers and one 25 kV breaker supplying a 25/138 kV transformer.

The distribution load in this area consists of mainly of rural, industrial and oil & gas services. Load growth has generally been moderate. See Appendix A and Figure A-1 for an overview of the substation and the distribution facilities. Table 3-1 presents substation and feeder load levels with the growth rate information.

Based on the historical load levels, forecast growth and customer contracted load for the distribution system supplied by the Jenner 275S substation, three capacity-related issues are predicted within the 10 year planning horizon.

- The 25 kV distribution feeder 275S-2269L is predicted to carry a peak load of 13.2 MVA in 2017, increasing to 16.4 MVA by 2025;
- The 25 kV distribution feeder 275S-2036L is predicted to carry a peak load of 15.0 MVA in 2016, increasing to 15.9 MVA by 2025;
- The 25 kV distribution feeder 275S-2175L is predicted to carry a peak load of 13.2 MVA in 2022, increasing to 14.1 MVA by 2025.

2. Criteria

The analysis for the requested development in the area served by Jenner 275S substation has been conducted based upon the following criteria and assumptions:

- The maximum normal loading of FortisAlberta 25 kV distribution feeders is 13.0 MVA.
- FortisAlberta planning criteria for electrical load restoration requires that back-up supply for contingency situations be available subject only to switching time. Backup capability refers to the ability to restore service after an interruption without necessarily first repairing the cause of the interruption.
- Transmission equipment must not be operated at load levels in excess of the equipment ratings.

3. Existing System Assessment

The existing substation and distribution system in the Jenner area are shown in Figure A-1 in Appendix A.

3.1 Load Forecast

Table 3-1 provides FortisAlberta historical and forecast peak load levels for the substation and feeders in the study area. The load forecast is based on historical data, expected development trends and contracted new loads. This load forecast was used to assess all the alternatives presented in this Need for Development document.

Table 3-1: FortisAlberta Load Forecast: Existing System

			RECORDED - MVA LOADING						PREDICTED - MVA LOADING									
SUB	CAPACITY	W or S	2011 Peak MVA	2012 Peak MVA	2013 Peak MVA	2014 Peak MVA	2015 Peak MVA	2015 PF	2016 Year 1 MVA	2017 Year 2 MVA	2018 Year 3 MVA	2019 Year 4 MVA	2020 Year 5 MVA	2021 Year 6 MVA	2022 Year 7 MVA	2023 Year 8 MVA	2024 Year 9 MVA	2025 Year 10 MVA
275S Bus 1 & 4	T1 50/67/ 83	W	**42.0**	**41.8**	**44.2**	**44.7**	**42.2**	96%	**50.6**	**51.4**	**52.1**	**52.9**	**53.7**	**54.5**	**55.4**	**56.3**	**57.1**	**58.0**
275S Bus 1 Jenner		S/W	**26.2**	**26.1**	**27.1**	**27.3**	**26.6**	98%	**30.6**	**31.2**	**31.8**	**32.4**	**33.0**	**33.7**	**34.4**	**35.1**	**35.8**	**36.5**
275S 310LS	(Note 1)	S/W	18.2	19.0	17.9	17.6	17.4	99%	19.2	19.3	19.4	19.5	19.6	19.7	19.8	19.9	20.0	20.1
275S 2269L		W	9.4	9.5	10.1	11.3	10.2	95%	12.8	13.2	13.6	14.0	14.4	14.8	15.2	15.6	16.0	16.4
275S Bus 4 Jenner		W	**18.6**	**18.5**	**18.7**	**18.2**	**17.3**	92%	**22.1**	**22.3**	**22.5**	**22.7**	**22.9**	**23.1**	**23.3**	**23.5**	**23.7**	**23.9**
275S 2174L		S/W	7.0	7.1	7.1	7.4	7.2	94%	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9
275S 2036L		W	12.3	11.8	12.0	11.0	10.6	90%	15.0	15.1	15.2	15.3	15.4	15.5	15.6	15.7	15.8	15.9
275S Bus 2 & 3	T2 50/67/ 83	W	**24.4**	**26.9**	**31.9**	**25.6**	**23.8**	96%	**29.7**	**30.0**	**30.3**	**30.7**	**31.0**	**31.4**	**31.7**	**32.0**	**32.4**	**32.7**
275S Bus 2 Jenner		W	**14.3**	**13.3**	**14.0**	**14.0**	**13.2**	95%	**16.4**	**16.6**	**16.8**	**17.0**	**17.2**	**17.4**	**17.6**	**17.8**	**18.0**	**18.2**
275S 167LW		W	7.0	5.8	7.0	6.9	7.1	97%	8.0	8.1	8.2	8.3	8.4	8.5	8.6	8.7	8.8	8.9
275S 312LS		W	7.5	7.6	7.2	8.0	6.5	93%	8.7	8.8	8.9	9.0	9.1	9.2	9.3	9.4	9.5	9.6
275S Bus 3 Jenner		W	**17.0**	**17.5**	**18.4**	**18.4**	**17.5**	93%	**18.5**	**18.7**	**18.9**	**19.1**	**19.3**	**19.5**	**19.7**	**19.9**	**20.1**	**20.3**
275S 601L-T3	(Note 2)	S/W	6.7	6.7	6.7	6.7	6.7	90%	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7
275S 2175L		W	10.3	10.8	11.7	11.6	10.6	97%	11.8	12.0	12.2	12.4	12.6	12.9	13.2	13.5	13.8	14.1
275S Total Fortis Station Load		W	**67.5**	**68.6**	**67.5**	**69.4**	**65.5**	95%	**70.4**	**71.4**	**72.4**	**73.6**	**74.6**	**75.8**	**76.9**	**78.1**	**79.2**	**80.4**
275S Total Station with 601L		W	**73.0**	**74.9**	**73.0**	**74.2**	**71.0**	96%	**77.1**	**78.1**	**79.1**	**80.3**	**81.3**	**82.5**	**83.6**	**84.8**	**85.9**	**87.1**

Notes:

1 Large industrial customers are aware of and have accepted the consequences of high feeder loading.

2 601L on Bus 3 supplies T3, a 25/138kV transformer which supplies 601L to Wardlow 230S.

2016 Customer contracted load additions (MVA)

275S-2269L	1.11
275S-2174L	0.13
275S-2036L	1.10
275S-167LW	0.48
275S-312LS	0.52
275S-2175L	0.19

The Jenner 275S substation has three existing 25 kV distribution feeders namely 275S-2269L, 275S-2036L and 275S-2175L that are predicted to carry peak load in excess of 13 MVA within the 10 year planning horizon.

4. Alternatives Analysis

Two alternatives were considered and presented in this document. These two alternatives have either the least distribution system development or the lowest estimated distribution capital cost.

4.1 Alternative 1: Distribution Upgrades

4.1.1 Description

The distribution system supplied by the Jenner 275S substation has limited connections to adjacent distribution systems. FortisAlberta have considered various combinations of potential distribution upgrades and load shifting to address the predicted distribution feeder capacity concerns at the Jenner 275S substation. However, no viable distribution upgrades and load shifting can sufficiently address the feeder capacity concerns on 25 kV feeders 275S-2269L, 275S-2036L and 275-2175L for the 10 year planning horizon due to:

- Generally high feeder load levels and steady load growth – in 2016, the predicted peak load of any 25 kV feeder from the Jenner 275S is greater than 7.9 MVA.
- Configuration of the existing 25 kV feeders – the existing configuration of the 25 kV feeders distributing out from Jenner 275S results in limited long-term load shifting opportunities.
- Geographical load locations in the Jenner area – non-uniform concentration of loads along the 25 kV feeders, with significant loads at the end of the 25 kV feeders.

4.2 Alternative 2: Upgrades at the Jenner 275S substation

4.2.1 Description

In 2017, at the Jenner 275S substation:

- **Add one 25 kV feeder breaker**

Alternative 2 includes building or upgrading approximately 23 km of associated 25 kV distribution feeder construction and upgrades. Refer to Appendix B, Figure B-1 showing the requested system development for Alternative 2.

All 25 kV overhead conductors, new and existing, exiting the substation and distribution feeder ties shall be 477 MCM. All underground feeder cables, new and existing, shall be 750 MCM or equivalent. All 25 kV feeder breakers shall be equipped to enable under-frequency load shedding. All transmission components on the secondary side of the 25 kV source transformers, new and existing, shall be sized to enable the feeders to simultaneously supply 26 MVA per feeder. All 25 kV feeder breakers shall be equipped with associated equipment to enable under-frequency load shedding.

Transmission facilities must be equipped with the appropriate equipment for interconnection with FortisAlberta's Automated Metering system. Provisions must be

available to interconnect the substation transformer neutrals and the distribution line neutrals, as per AltaLink Management Ltd. (AltaLink) standards.

All 138 kV and 25 kV buses shall have adequate switch points and protection to minimize frequency and duration of outages associated with the maintenance or failure of substation components upstream of the 25 kV bus. Failure of such upstream components must not result in a total substation outage.

4.2.2 Load Forecast

The load forecast resulting from Alternative 2 is provided in Table 4-1.

Table 4-1: FortisAlberta Load Forecast for Alternative 2 – Upgrades at Jenner 275S

			RECORDED - MVA LOADING						PREDICTED - MVA LOADING									
		W	2011	2012	2013	2014	2015		2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
SUB No Feeder	CAPACITY T/R MVA	or S	Peak MVA	Peak MVA	Peak MVA	Peak MVA	Peak MVA	PF	Year 1 MVA	Year 2 MVA	Year 3 MVA	Year 4 MVA	Year 5 MVA	Year 6 MVA	Year 7 MVA	Year 8 MVA	Year 9 MVA	Year 10 MVA
275S Bus 1 & 4	T1 50/67/ 83	W	**42.0**	**41.8**	**44.2**	**44.7**	**42.2**	96%	**50.6**	**37.9**	**38.4**	**38.9**	**39.4**	**39.8**	**40.3**	**40.8**	**41.7**	**42.1**
275S Bus 1 Jenner		S/W	**26.2**	**26.1**	**27.1**	**27.3**	**26.6**	98%	**30.6**	**25.7**	**26.1**	**26.5**	**26.9**	**27.3**	**27.7**	**28.1**	**28.9**	**29.3**
275S 310LS	(Note 1)	S/W	18.2	19.0	17.9	17.6	17.4	99%	19.2	19.3	19.4	19.5	19.6	19.7	19.8	19.9	20.0	20.1
275S 2269L		W	9.4	9.5	10.1	11.3	10.2	95%	12.8	7.5	7.7	7.9	8.1	8.3	8.5	8.7	9.4	9.7
275S Bus 4 Jenner		W	**18.6**	**18.5**	**18.7**	**18.2**	**17.3**	92%	**22.1**	**13.8**	**13.9**	**14.0**	**14.1**	**14.2**	**14.3**	**14.4**	**14.5**	**14.6**
275S 2174L		S/W	7.0	7.1	7.1	7.4	7.2	94%	7.9	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1
275S 2036L		W	12.3	11.8	12.0	11.0	10.6	90%	15.0	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3
275S Bus 2 & 3	T2 50/67/ 83	W	**24.4**	**26.9**	**31.9**	**25.6**	**23.8**	96%	**29.67**	**40.7**	**41.1**	**41.6**	**42.0**	**42.4**	**42.8**	**43.3**	**43.3**	**43.7**
275S Bus 2 Jenner		W	**14.3**	**13.3**	**14.0**	**14.0**	**13.2**	95%	**16.4**	**29.8**	**30.1**	**30.4**	**30.7**	**31.0**	**31.3**	**31.6**	**31.9**	**32.2**
275S 167LW		W	7.0	5.8	7.0	6.9	7.1	97%	8.0	8.1	8.2	8.3	8.4	8.5	8.6	8.7	8.8	8.9
275S 312LS		W	7.5	7.6	7.2	8.0	6.5	93%	8.7	11.1	11.2	11.3	11.4	11.5	11.6	11.7	11.8	11.9
275S 2323L(NEW)		W						90%		11.3	11.4	11.5	11.6	11.7	11.8	11.9	12.0	12.1
275S Bus 3 Jenner		W	**17.0**	**17.5**	**18.4**	**18.4**	**17.5**	93%	**18.5**	**18.1**	**18.3**	**18.5**	**18.7**	**18.9**	**19.1**	**19.3**	**19.0**	**19.2**
275S 601L-T3	(Note 2)	S/W	6.7	6.7	6.7	6.7	6.7	90%	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7
275S 2175L		W	10.3	10.8	11.7	11.6	10.6	97%	11.8	11.4	11.6	11.8	12.0	12.2	12.4	12.6	12.3	12.5
275S Total Fortis Station Load		W	**67.5**	**68.6**	**67.5**	**69.4**	**65.5**	95%	**70.4**	**71.4**	**72.4**	**73.6**	**74.6**	**75.8**	**76.9**	**78.1**	**79.2**	**80.4**
275S Total Station with 601L		W	**73.0**	**74.9**	**73.0**	**74.2**	**71.0**	96%	**77.1**	**78.1**	**79.1**	**80.3**	**81.3**	**82.5**	**83.6**	**84.8**	**85.9**	**87.1**

Notes:

1 Large industrial customers are aware of and have accepted the consequences of high feeder loading.

2 601L on Bus 3 supplies T3, a 25/138kV transformer which supplies 601L to Wardlow 230S.

Load Transfer 2017 (MVA)

3.45 MVA from 2269L to 2323L

7.20 MVA from 2036L to 2323L

0.53 MVA from 2175L to 2269L

0.20 MVA from 312LS to 2174L

2.50 MVA from 2269L to 312LS

Load Transfer 2024 (MVA)

0.45 MVA from 2175L to 2269L

4.2.3 Cost Estimate

If Alternative 2 is considered, AltaLink will prepare a facility application for the requested transmission upgrades. This facility application will include an estimate of the transmission capital cost.

The distribution capital cost for Alternative 2 is estimated to be $2.8 million (2017$, ±30%).

5. Alternatives Assessment

The following section presents the technical and economic analysis of the alternatives considered in this Need for Development.

5.1 Technical and Economic Analysis

5.1.1 Alternative 1 – Distribution Upgrades

As per section 4.1.1, distribution upgrades and load shifting alone cannot address the 25 kV feeder capacity concerns at Jenner 275S substation for the 10 year planning horizon.

Alternative 1 is not a solution to address the feeder capacity concerns at the Jenner 275S.

5.1.2 Alternative 2 – Upgrades at the Jenner 275S Substation

Alternative 2 includes the addition of one 25 kV feeder breaker at the Jenner 275S substation with the associated 25 kV distribution feeder construction and upgrades. This alternative can address the 25 kV feeder capacity concerns at the Jenner 275S substation for the 10 year planning horizon.

Alternative 2 is a technically acceptable solution and the preferred alternative.

6. Conclusion

After considering the alternatives to address the predicted 25 kV feeder capacity concerns for distribution service in the area served by Jenner 275S substation, Alternative 2 is preferred because it is a technically acceptable solution. Alternative 2 requests the installation of one additional 25 kV feeder breaker at the Jenner 275S substation.

An estimate for the transmission system capital cost will be provided by AltaLink.

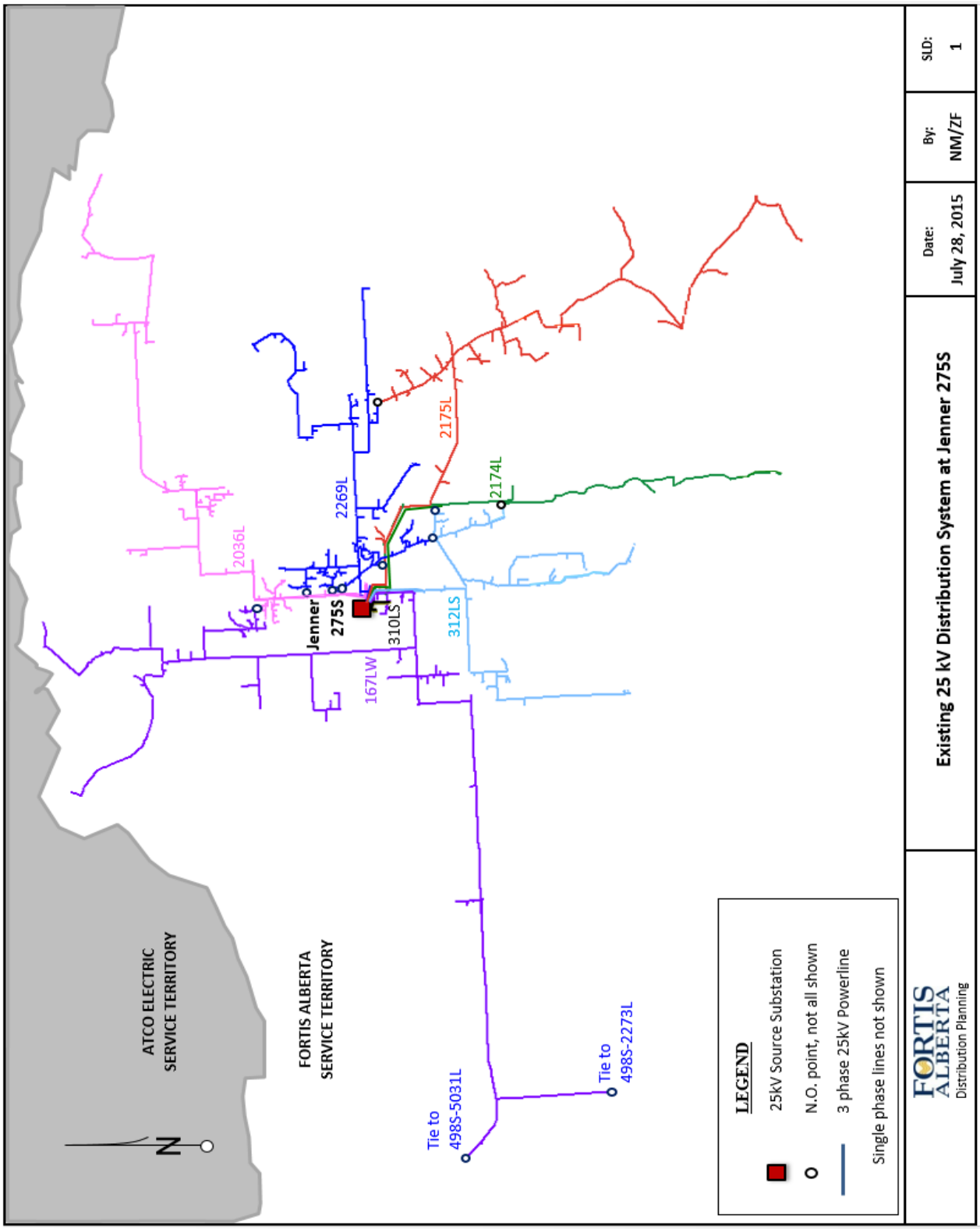
The estimated distribution costs associated with the requested alternative is $2.8 million (±30%, 2017$).

The requested completion date for the preferred Jenner 275S facility upgrade is August 1, 2017.

Upon completion of this transmission system upgrade, the existing DTS contract at the Jenner 275S substation will not change.

Appendix A – Existing System

Figure A-1: Existing System



Appendix B – Alternative 2 – Upgrades at the Jenner 275S Substation

Figure B-1: Alternative 2: Upgrades at the Jenner 275S Substation