Addressing Customer Demand Requirements in Jimboomba/Beaudesert: Request for Proposal

12 December 2019
Version 1.0

110kV Feeder F7351 Jimboomba to Beaudesert Limitation

EOI Period Starts: 29/11/2019
EOI Period Closes: 14/02/2020

Part of the Energy Queensland Group

EXECUTIVE SUMMARY

This Request for Proposal (RFP) document is an invitation to demand management (DM) proponents to submit non-network solutions to address the network constraint identified in the Jimboomba/Beaudesert area. This RFP provides:

- Background information on the network capacity limitation;
- The demand reduction required by load quantum and time;
- An invitation to submit credible non-network options; and
- Information on what to include in your submission.

Network Need:

Energex has an existing contract with a generator proponent providing network support to the Jimboomba and Beaudesert areas. The expiry of this contract means rural radial 110kV feeder F7351 will not meet Energex's legislated Safety Net planning criteria for an unplanned outage in April 2021, putting load at risk.

DM Solutions:

To be considered a feasible option, any DM solution must be technically feasible, commercially feasible; and able to be implemented in enough time for deferral of the network investment. A DM solution may involve one or more DM options that either reduces or fully services a network limitation, for one or more years.

Required:

The required characteristics of any DM solution are summarised in the table below:

Year	Minimum Customer requested capacity (MVA)	Shortfall hours per year	Availability	Dispatch time
2022	4.4	7.0	All year	Within 3 hours
2023	6.6	16.0	All year	Within 3 hours
2024	7.9	19.0	All year	Within 3 hours
2025	9.2	24.5	All year	Within 3 hours
2026	9.6	26.0	All year	Within 3 hours

Additional Option:

As part of this RFP Energex will also consider additional network support as summarised in the table below:

Year	Minimum Customer requested capacity (MVA)	Shortfall hours per year	Availability	Dispatch time
2022	10.0	N/A	All year	Within 12 hours
2023	10.0	N/A	All year	Within 12 hours
2024	10.0	N/A	All year	Within 12 hours
2025	10.0	N/A	All year	Within 12 hours
2026	10.0	N/A	All year	Within 12 hours

Submissions:

Energex is seeking submissions from DM proponents on potential credible options to address the network constraint in the Jimboomba/Beaudesert area. Only submissions received by **14 February 2020** will be accepted. Submissions will need to address the issues described in the RFP and are to be submitted to demandmanagement@energex.com.au.

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Ergon Energy Corporation Limited ABN 50 087 646 062
Energy Queensland Limited ABN 96 612 535 583
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1. Introduction

Energex is a subsidiary of Energy Queensland Limited, a State government-owned corporation. Energex distributes electricity to over 1.5 million residential, commercial and industrial customers across a population base of around 3.4 million in South East Queensland.

Energex is requesting stakeholders' submissions for credible options to address the identified need in the Beaudesert and Jimboomba networks. The report includes background information about the limitations in this area, highlights the identified need, provides the requirements that a non-network proponent would need to meet, and specifies the process for interested stakeholder submissions.

Submissions in response to this report may be submitted to demandmanagement@energex.com.au and are due by **14 February 2020.**

2. Existing Network

Feeder F7351 is a radial 110kV rural sub-transmission feeder approximately 21km from Jimboomba bulk supply substation (SSJBB) to Beaudesert bulk supply substation (SSBDS). SSBDS bulk supply supplies approximately 11,000 predominantly domestic customers connected to Beaudesert (SSBDT), Bromelton (SSBTN), Innisplain (SSIPL) and around half of Mount Tamborine (SSMTB) zone substations.

Geographic and schematic views of the network area under study are provided in Figure 1 and Figure 2.

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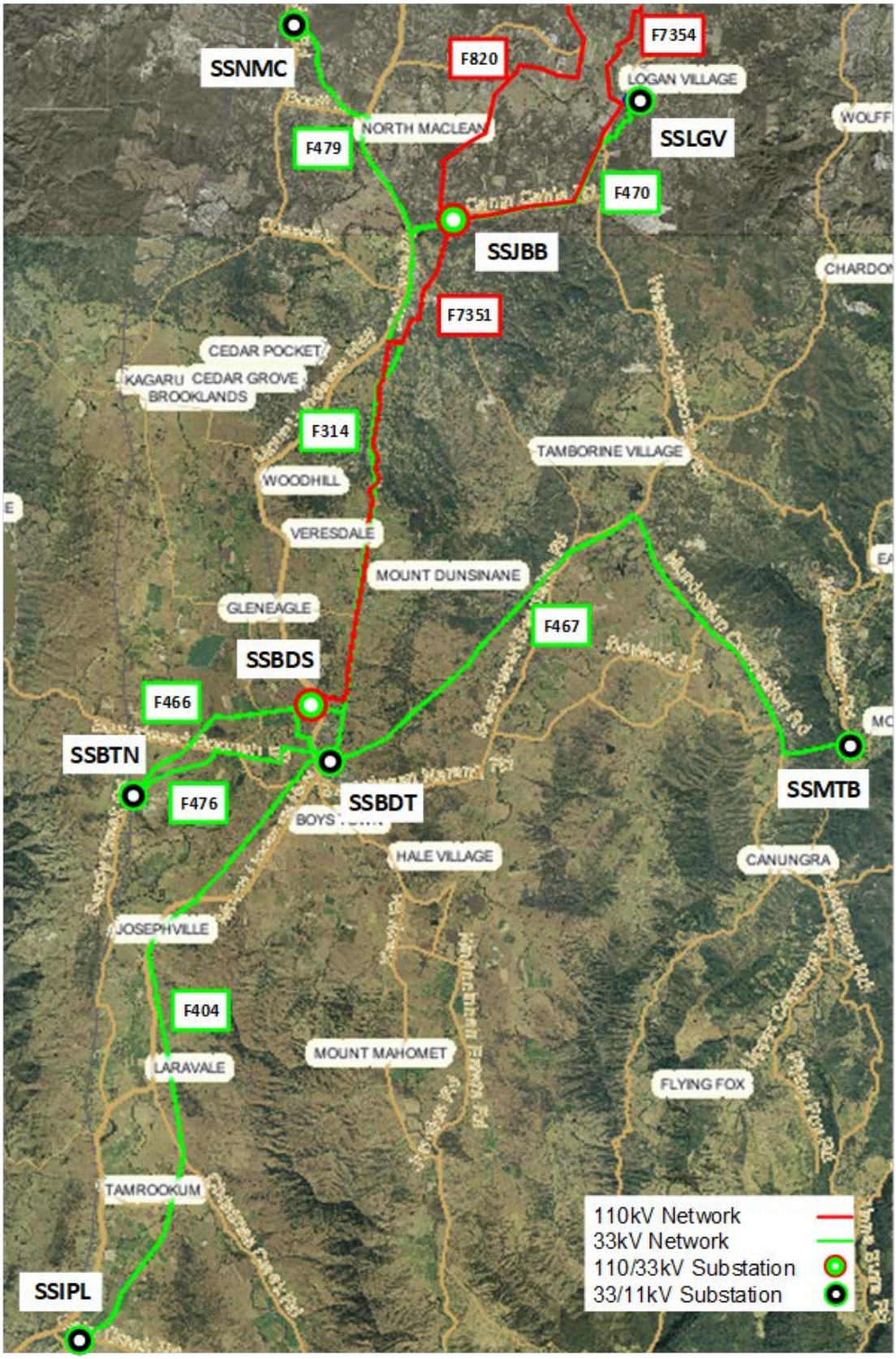


Figure 1: Existing Network Arrangement (Geographical View)

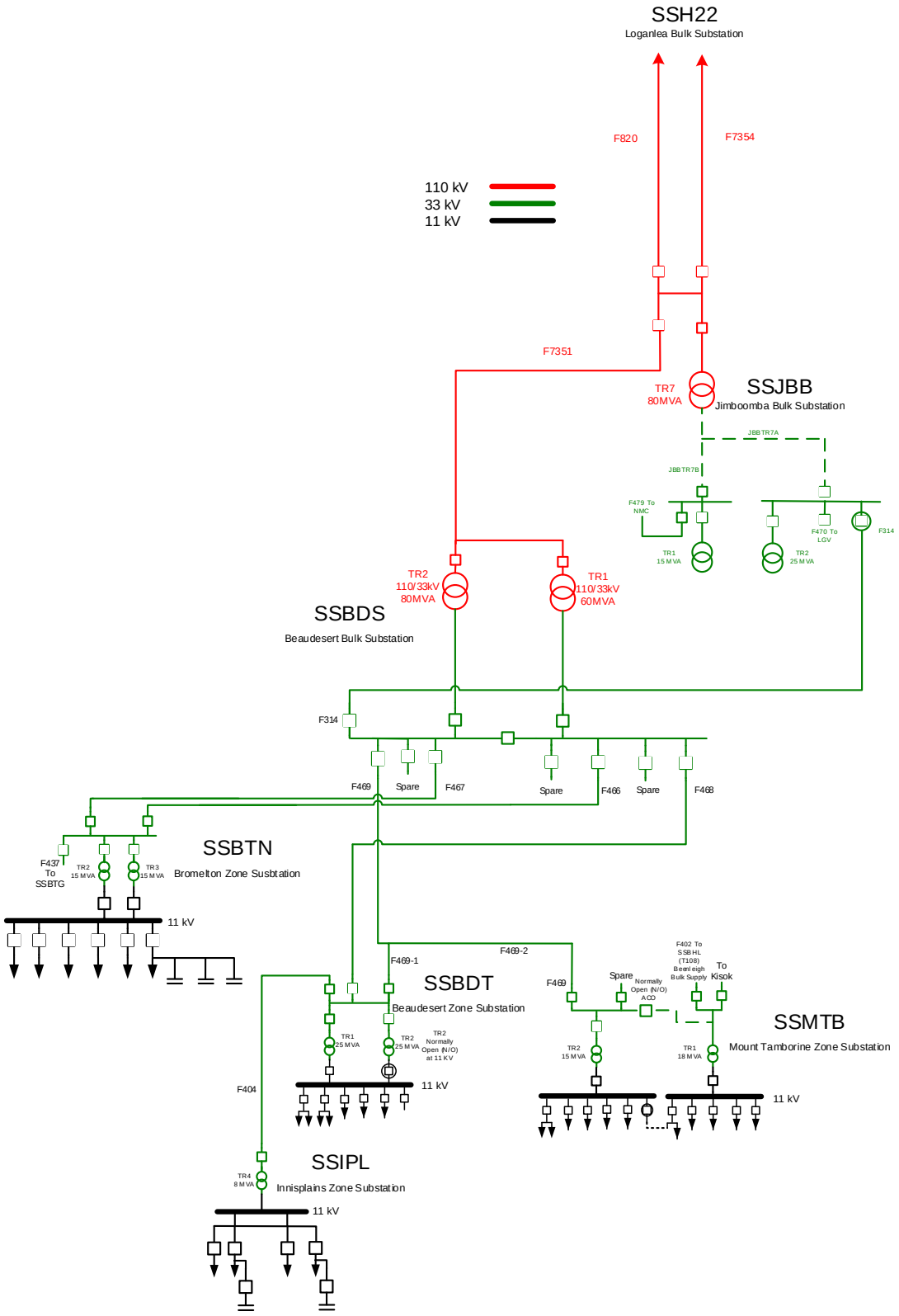


Figure 2: Existing Network Arrangement (Schematic View)

3. Applied Service Standards

Under its Distribution Authority, Energex must adhere to the Safety Net which identifies the principles for the operation of network assets under network contingency conditions. System contingency related capability is assessed against a 50% probability of exceedance (PoE) forecast load, available load transfers, emergency cyclic capacity (ECC) ratings, non-network response, mobile plant, mobile generators, and any short-term ratings of plant and equipment that are available. Energex's Distribution Authority can be accessed by the following link:

https://www.dnrme.qld.gov.au/__data/assets/pdf_file/0003/219486/distribution-authority-d0798-energex.pdf

The Safety Net defines the security of supply criteria for Urban and Rural feeders and substations. For the Jimboomba and Beaudesert network, the following service standards apply:

- For sub-transmission lines supplying rural zone substations, during a single contingency event, interruption of supply up to 40 MVA is permissible for the first 30 minutes, followed by a maximum interruption of up to 15 MVA, provided all load except for up to 10 MVA can be restored within 4 hours, and the remaining load fully restored after 12 hours. (Safety Net Category: Rural).
- For a rural zone substation, during a single contingency event, interruption of supply up to 40 MVA is permissible for the first 30 minutes, followed by a maximum of interruption of up to 15 MVA is permissible, provided all load except for up to 10 MVA can be restored within 4 hours, and the remaining load fully restored after 12 hours. (Safety Net Category: Rural).

4. Identified Need

The existing supply to the Jimboomba and Beaudesert areas does not meet the Safety Net for an unplanned outage of F7351. Future load growth will result in increased load at risk for an outage of F7351. The following section outlines the substation and feeder limitations of the existing network. The system normal condition is assessed against 10%PoE load forecast for SSJBB and feeder F7351. The 50%PoE load forecast is used for N-1 contingency analysis.

4.1. Substation Limitations

SSJBB Substation Limitations

SSJBB bulk supply substation (BSP) is equipped with a single 80 MVA 110/33 kV transformer. The substation capacity is limited by the transformer and has a Normal Cyclic Capacity (NCC), Emergency Cyclic Capacity (ECC) and 2 Hour Emergency Capacity (2HEC) as below:

- NCC – 88 MVA
- ECC – 0 MVA
- 2HEC – 0 MVA

Table 1 shows the limitations at SSJBB BSP:

Substation	Year	10% POE Load (MVA)	NCC (MVA)	NCC LAR (MVA)
SSJBB BSP (Jimboomba Bulk Supply)	2020	83.2	88	0.0
	2021	85.6	88	0.0
	2022	89.4	88	1.4
	2023	92.9	88	4.9
	2024	95.8	88	7.8
	2025	99.0	88	11.0
	2026	104.1	88	16.1

Table 1: SSJBB NCC Load at Risk

To address the NCC Load at Risk (LAR) at SSJBB BSP in Oct 2021, Energex is proposing to permanently transfer Logan Village (SSLGV) to Beenleigh bulk supply (SST108). This switching activity will be undertaken by Energex's Network Operations team remotely, meaning there is minimal cost to undertake this work and will not form part of any current or future RIT-D or Request for Demand Management Solution.

4.2. Sub-Transmission Network Limitation

SSJBB to SSBDS 110 kV Feeder F7351

F7351 has an NCC rating of 578A (110.1 MVA). Table 2 shows the limitations on F7351 under system normal conditions:

Feeder	Year	10% PoE Load (MVA)	NCC Rating (MVA)	Security Standard Load at Risk (MVA)
F7351 (SSJBB to SSBDS)	2020	48.82	110.1	0.0
	2021	49.48	110.1	0.0
	2022	51.61	110.1	0.0
	2023	53.71	110.1	0.0
	2024	55.57	110.1	0.0
	2025	56.94	110.1	0.0
	2026	57.60	110.1	0.0

Table 2: NCC Load at Risk F7351 SSJBB to SSBDS

As shown in Table 2, there are no limitations F7351 under System Normal conditions.

F7351 Out-of-service with supply restored using 33 kV Feeder F314

For an outage of feeder F7351, approximately 11,000 customers lose supply due to the loss of SSBDS; and resultant loss of SSBDT, SSBTN, SSIPL and SSMTB Bus 2. To restore supply, the following strategy is undertaken:

- An Auto Changeover (ACO) scheme is used to transfer Bus 2 of SSMTB to SST108, restoring approximately 7 MVA.
- During peak load conditions, SSLGV is transferred to SST108 and SSNMC is transferred to SSBPN through remote transfers to provide optimal support to the BDS network.
- F314 is used to remotely transfer the entire load of SSBTN and a portion of SSBDT from the 110 kV network to the 33 kV network.

F314 is rated to a Summer NCC of 512A (29.3 MVA). However, due to the length of the feeder and the resultant voltage drop issues, only 23MVA can be supplied by F314. Table 3 shows the limitations on F314 when transferring load from F7351 under a contingency.

Feeder	Plant OOS	Year	50% POE Load (MVA)	50% POE Load (Amps)	Auto Transfers Available (Amps)	Remote Transfers Available (Amps)	Manual Transfers Available (Amps)	Mobile Generation Required (Amps)	Security Standard Load At Risk (Amps)	Security Standard Load At Risk (MVA)
F314 (SSJBB to SSBDS	F7351 (SSJBB to SSBDS)	2020	42.06	220.8	38.1	196.5	0.0			
		2021	42.63	223.8	37.8	199.8	0.0			
		2022	44.46	233.4	37.6	120.2	0.0	75.5	23.0	4.4
		2023	46.27	242.9	37.5	118.0	0.0	87.3	34.8	6.6
		2024	47.87	251.2	37.3	120.1	0.0	93.9	41.4	7.9
		2025	49.04	257.4	37.2	119.2	0.0	101.0	48.5	9.2
		2026	49.58	260.2	37.3	120.2	0.0	102.7	50.2	9.6

*For consistency, the above load in “Amps” are all in 110 kV base.

Table 3: Feeder load at risk F314 with F7351 OOS

It should be noted that Energex has an existing contract with a generator proponent for network support, which will expire in 2021. This is shown above with the substantial decrease in Remote Transfers Available between 2021 and 2022.

As illustrated in Table 3, after these transfers are completed there is approximately 4.4 MVA load at risk in 2022, increasing to 9.6 MVA in 2026. To meet the Safety Net, any solution must deliver at least 4.4 MVA of additional capacity or load reduction and address the limitations on feeder F314 with feeder F7351 out of service, increasing to 9.6 MVA in 2026.

4.3. Demand Characteristics

Load at Risk

The F7351 annual load profile (MW) is shown in Figure 3, while Figure 4 illustrates the load duration curve for 110 kV feeder F7351 in MVA.

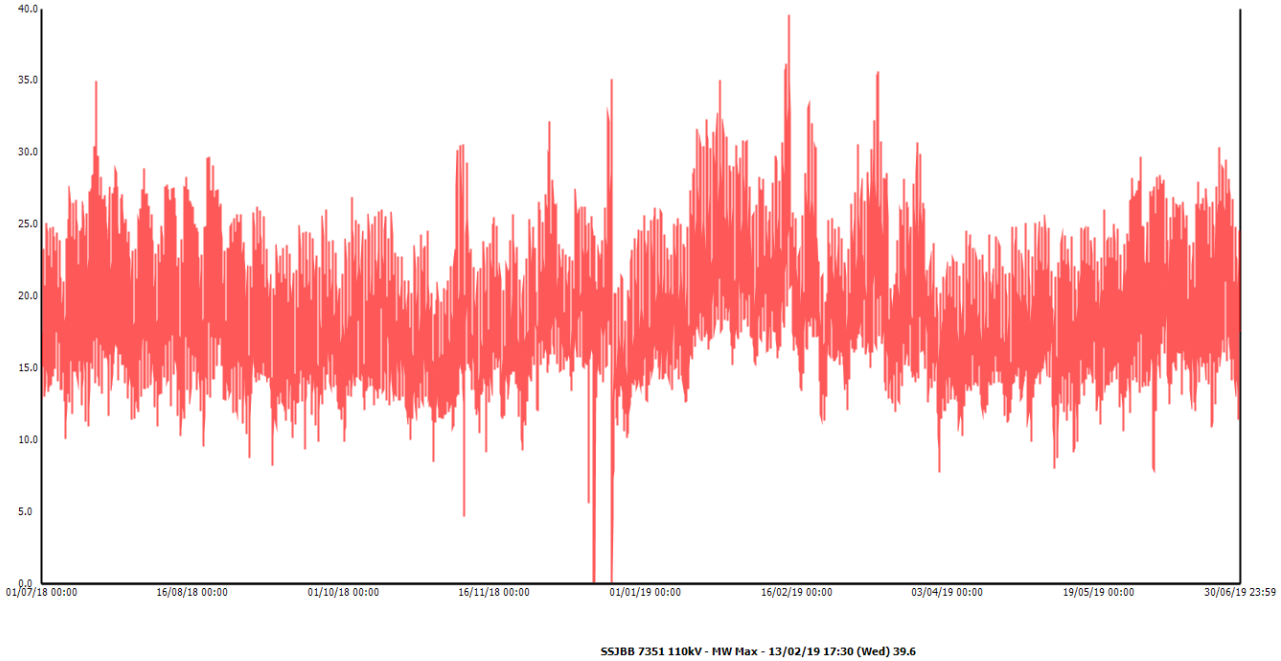
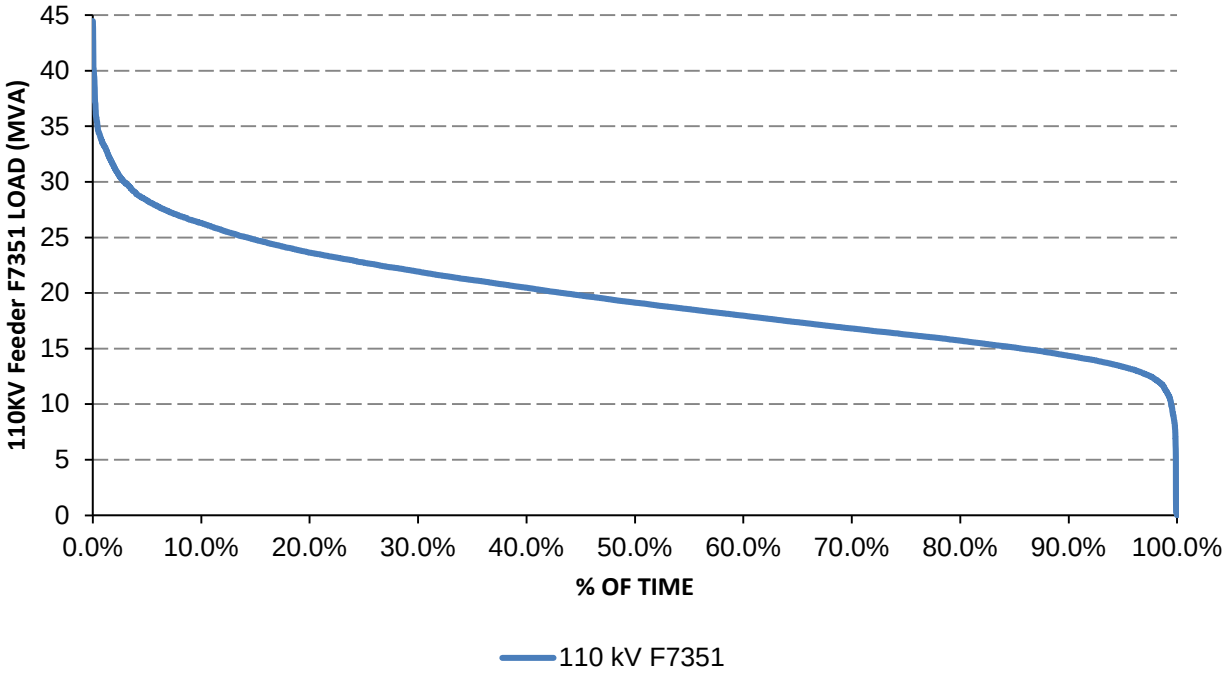


Figure 3: Annual Load Profile Curve (MW) for F7351

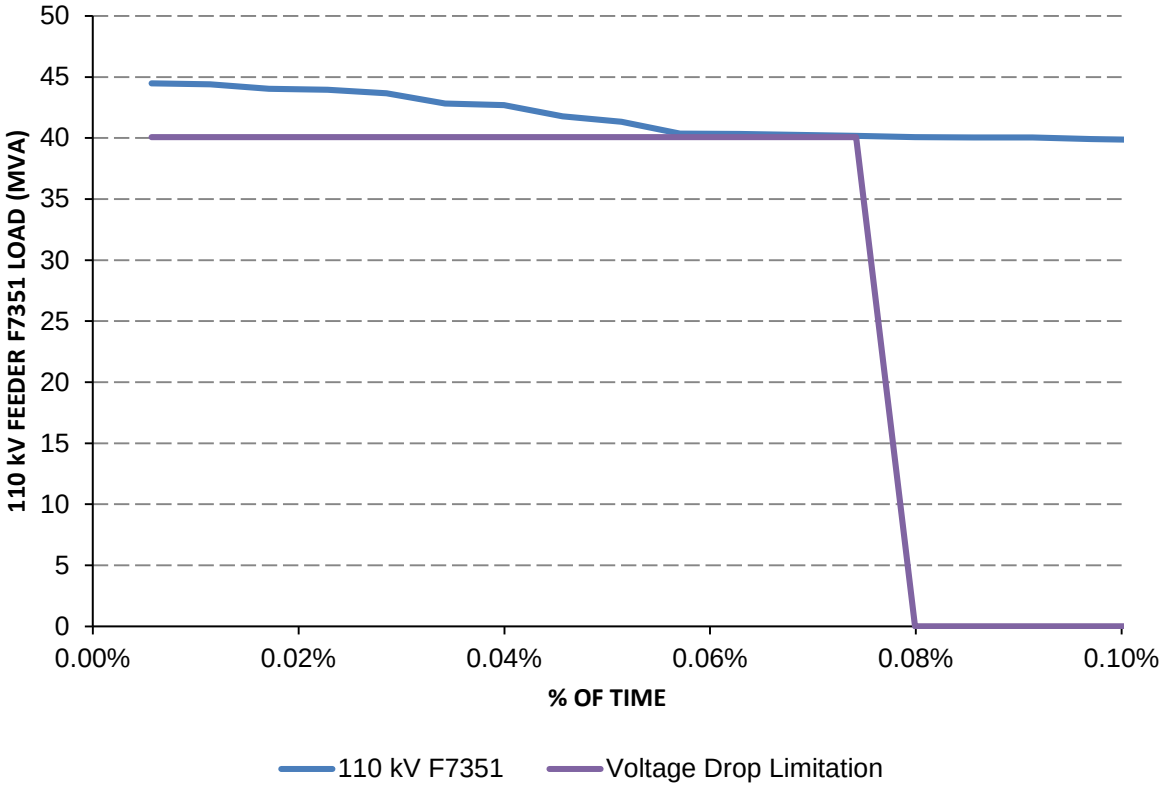


*The values for F7351 have been scaled to the 2022 peak forecast load of 44.46 MVA

Figure 4: Load Duration Curve of F7351

As previously discussed, there are capacity and voltage limitations on feeder F314. Load flow studies for this network for an outage of F7351 shows that the operational strategies to restore load is limited to 40.08 MVA of load at which time all transfers are exhausted, and voltage drop on the F314 network becomes excessive. This limitation has been calculated using the sum of the auto transfers (7.17MVA), remote transfers (22.91MVA) and 10MVA of mobile generation available for the year 2022. Because this limit is dependent on load transfers, this value changes over time.

Figure 5 below shows the load duration curve with this limit at 40.08 MVA and that approximately 0.08% (7 hours) of the time in a year the load is greater than the 40.08 MVA limit of F314.



*The values for F7351 have been scaled to the 2022 peak forecast load of 44.46 MVA

Figure 5: Load Duration Curve F7351 with F314 voltage drop limitation

Figure 6 and Table 4 shows the forecast load for each subsequent year and the amount of time the load will be at risk.

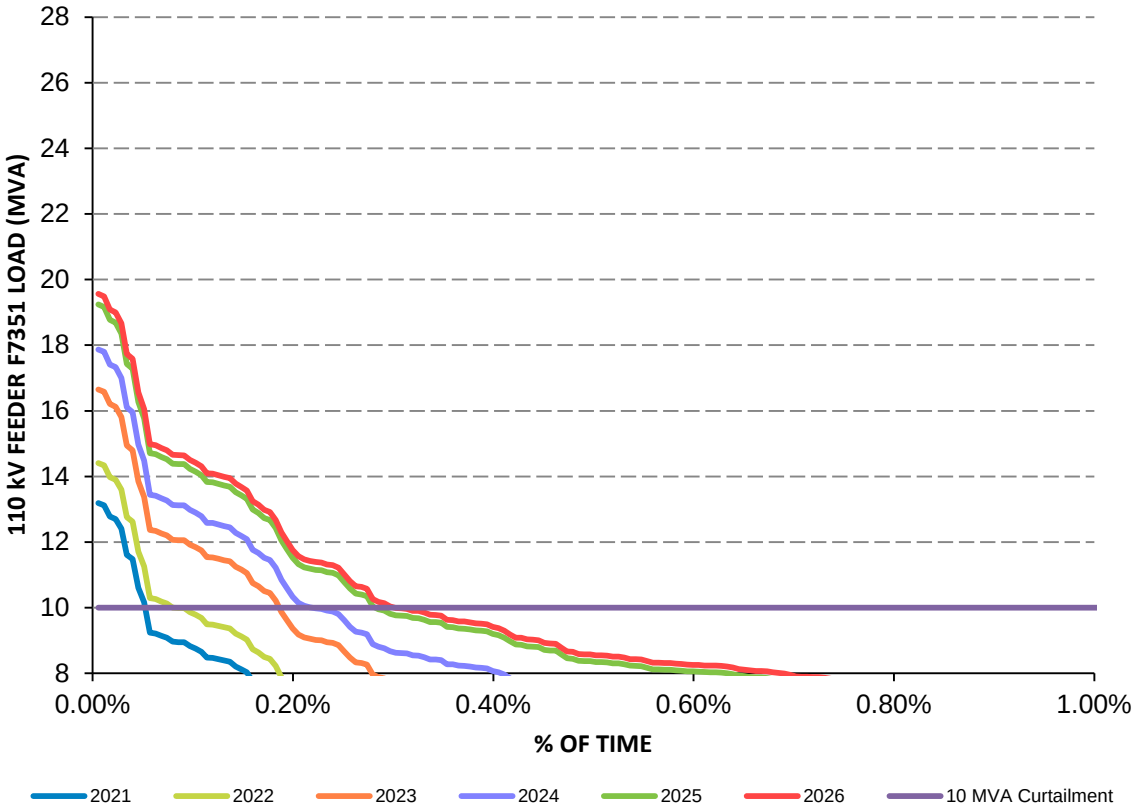


Figure 6: Load Duration Curve F7351 with 10MVA Curtailment

Year	Forecast 50 PoE Load (MVA)	Load at risk (MVA)	% of time above limit	Days over limit	Hours over limit
2022	44.46	4.4	0.08	0.3	7.0
2023	46.27	6.6	0.18	0.7	16.0
2024	47.87	7.9	0.22	0.8	19.0
2025	49.04	9.2	0.28	1.0	24.5
2026	49.58	9.6	0.30	1.1	26.0

Table 4: Forecast duration load at risk

Table 4 illustrates the amount of time support would be required for each year and is forecast to start with 7 hours in 2022 and increases to 1.1 days by 2026.

Energy at Risk

Energy Queensland utilises the AEMO 2014 Value of Customer Reliability (VCR) values as part of its investment and project planning process. VCR is an economic value applied to customers' unserved energy for any particular year and is intended to represent customers' willingness to pay for their reliability of electricity supply. VCR is used to supplement Energex's Jurisdictional Security Criteria requirements by helping compare project options in a project business case or RiT-D, where reliability is assessed to have a material impact. VCR analysis can also be used to demonstrate the customer benefits of investment above mandatory requirements, to achieve an improved, efficient customer reliability outcome, but in practice this application is very rare. Detail about how VCR is applied in investment analysis is included in each DNSP's Distribution Annual Planning Report (DAPR) under section 6.4 on Network Planning Criteria.

The likelihood of an outage on feeder 7351 resulting in a loss of energy is very low, however, Energex has identified a Safety Net risk at SSBDS which requires rectification. The Value of Customer Reliability cost for the case of supplying SSBDS via the 33kV feeder 314 has been modelled using the below assumptions:

- **VCR rate of $38.34/kWh –** on the basis of a load that is 34% domestic and 66% commercial.
- **Forced outage rate of 0.483 outages/year –** Energex uses an outage rate of 2.3 outages per 100km per year, with the feeder 7351 supplying SSBDS being around 21 km.
- **Load Transfers and Repair Time** – as discussed earlier, the load transfers available are to insufficient to transfer the total load required. As such, the transfers have been modelled for each year as according to Table 3, for this analysis. The repair time for a 110kV feeder has been assumed as 8 hours.

Figure 7 below shows the modelled VCR costs associated with supplying SSBDS with a single 33kV feeder 314.

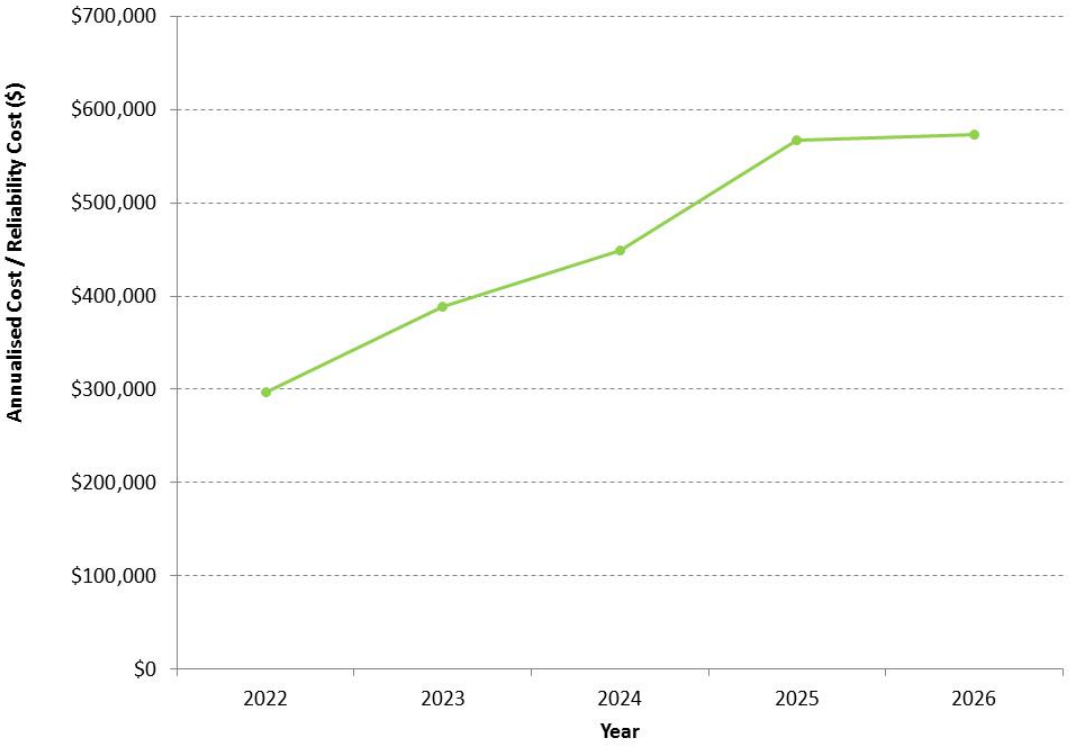


Figure 7: VCR Calculation Values for a single 33kV feeder 314 to supply SSBDS

Table 5 below shows that the energy at risk starts at 11GWh in 2022 and increases to 21GWh in 2026. This increase is also seen in the value of the energy at risk which is forecast to be $297,177 in 2022 and nearly doubles to $573,281 by 2026.

Year	Energy at Risk (kWh)	Probability Weighted Energy at Risk (kWh)	Value of Energy at Risk
2022	11,147,592	7,751	$297,177
2023	14,629,731	10,150	$389,147
2024	16,901,605	11,716	$449,176
2025	21,346,596	14,790	$567,007
2026	21,603,841	14,953	$573,281

Table 5: Forecast energy at risk

It should be noted that the network limitation is based on the forecast load exceeding Energex's Safety Net obligations, rather than on the basis of the forecast value of energy at risk. The above information is included for completeness.

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4.4. Summary of Non-Network Requirements

Table 3, Figure 5, Figure 6 and Table 4 show that to solve the identified need, a non-network proponent will be required to provide 4.4 MVA of network support, with a likely requirement for 0.08% (7.0 hours) of the year in 2022. This will increase to 9.6 MVA of network support for a likely requirement for 0.3% (1.1 days) of the year in 2026. While F7351 only breaches its limit for this relatively short period of time, Energex expects that network support will be available for the entire year, and that Energex may only be required to call on support following a contingency.

As part of its operational strategy following a contingency, Energex will deploy 10MVA of generation using its fleets of mobile generators. In addition to the requirement of 4.4MVA to 9.6MVA of network support, Energex would be interested in any network support solutions that provide a cost effective alternative to this requirement. Submissions to this request for proposal should clearly separate their proposal for this extra support opportunity from their proposed solution to the identified need for 4.4MVA to 9.6MVA.

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5. Credible Options

The identified need presented in this report is driven by Energex not meeting its Safety Net obligations. Specifically, an outage of the existing 110 kV rural feeder F7351 leads to a security standard load at risk of 4.4 MVA in 2022, increasing to 9.6MVA in 2026 under the current load forecast. Solutions that prudently and efficiently address these constraints will be considered. Any potential option may be determined not credible if it does not meet any of the following criteria:

- Address the identified need;
- Be technically and commercially feasible;
- Be implemented in a sufficient time to meet the identified need; or
- Satisfy all of the above requirements when forming a significant part of a credible option.

A non-exhaustive list of potentially feasible options includes:

- Embedded dispatchable network generation
- Embedded energy storage systems
- Embedded energy storage systems combined with generation (possibly dispatchable or non-dispatchable)
- Load curtailment agreements with customers to disconnect from the network following a contingency.

It should be noted that the above options may be aggregated across a number of substations in the network. For example, embedded solutions or load curtailment options could be implemented in the supply areas of SSBTN, SSIPL and SSBDT to provide the required network support.

Although the constraints of 4.4 MVA by 2022, increasing to 9.6 MVA by 2026, must be addressed, these are minimum requirements and solutions that are able to provide greater capacity to the network and improved reliability and security of supply may be considered. Furthermore, if a proponent is unable to support the total load required, Energex still encourages the submission of any solutions to reduce the constraints as it may be possible to aggregate multiple proposals to address the limitation.

Without attempting to limit a potential proponent's ability to innovate, unproven, experimental or undemonstrated technologies are unlikely to be considered as feasible options to address the identified limitation. Furthermore, any proposed option must be available by October 2021.

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6. Submission Steps

6.1. Submission from Proponents

Energex invites written submissions on this report from registered participants and interested parties. All submissions should include sufficient technical and financial information to enable Energex to undertake comparative analysis of the proposed solutions against the alternative options presented in this report. The proposals should include:

- Description of proposed demand management solution to address the identified need.
- Project execution strategy including design, testing and commissioning plans.
- Engineering network system studies and study reports.
- If the proposed solution is part of a credible option – a description of the other elements of the credible option.
- Reasonable estimate of:
    - Proposed solution's expected outputs, including amount of network demand (kVA per year) expected to be managed.
    - Full costs of completed works including delivery and installation where applicable.
    - Whole of life costs include operational costs.
    - Expected payments that would be required to be made to the proponent if contracted.
- Any other information relevant to determining whether a proposed solution would be a credible option, or part of a credible option, to address the identified need.

Energex will not be legally bound or otherwise obligated to any person who may receive this report or to any person who may submit a proposal. At no time will Energex be liable for any costs incurred by a proponent in the assessment of this report, any site visits, obtainment of further information from Energex or the preparation by a proponent of a proposal to address the identified need specified in this report.

Submissions in response to this report may be submitted to demandmanagement@energex.com.au and are due by **14th February 2020**