

Regulatory Test – Final Recommendation Report

Emerging Distribution Network Limitations in the Emerald Area

20 May 2014

Ergon Energy Corporation Limited

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1. EXECUTIVE SUMMARY

Ergon Energy Corporation Limited (Ergon Energy) is responsible (under its Distribution Authority) for electricity supply to the Emerald area in Central Queensland. Ergon Energy has identified emerging limitations in the electricity distribution network supplying the town of Emerald and adjoining areas. The loads on Ergon Energy's 66kV lines supplying Emerald have progressively increased such that augmentation is required if reliable supply is to be maintained.

The Emerald town, comprising approximately 8000 customers, is currently supplied from Ergon Energy's Emerald 66/22kV 3 x 20MVA zone substation which receives supply from a 66kV line from H015 Lilyvale bulk supply substation and a 66kV line from T032 Blackwater bulk supply substation. The Emerald load is presently 39MVA and is forecast to grow at over 2.5% per annum for the next 10 years. The Emerald load levels are such that the Blackwater 66kV feeder alone can supply only about half of the Emerald load and the Lilyvale feeder alone has marginally insufficient capacity to supply the full Emerald load. Therefore loss of either one of these long rural 66kV lines may result in load shedding at Emerald, with this potential load shedding being significant for loss of the Lilyvale 66kV line.

Ergon Energy has received a single customer connection application for a 25MVA load to the north of Emerald, which will be supplied by the 66kV feeder from Lilyvale. When this load is connected, the existing 66kV network will not be able to supply the full load with all feeders in service.

To provide firm capacity, and to meet the security of supply criteria for the Emerald area Ergon Energy needs an additional minimum of 40 MVA firm capacity at 66 kV to be provided to this area. This size has been matched to expected load requirements within Ergon Energy's typical 10 year planning horizon.

Ergon Energy published a Request for Information relating to this emerging network constraint on 8 October 2013. Three submissions were received by the closing date of 3 December 2013.

The evaluation process has considered all three external submissions, in conjunction with Ergon Energy's internally identified distribution network option. The recommended solution was identified as the construction of a new dual circuit 66kV feeder from T032 Blackwater Substation to Emerald Substation.

Ergon Energy published a Consultation and Draft Recommendation on 14 January 2014. One submission was received by the closing date of 11 February 2014.

The subsequent evaluation process has considered the external submission, in conjunction with Ergon Energy's internally identified distribution network option. The recommended solution was identified as the construction of a new dual circuit 66kV feeder from T032 Blackwater Substation to Emerald Substation.

This is now a Final Recommendation where Ergon Energy provides both economic and technical information about possible solutions, and our recommended solution, being Ergon Energy's internally identified option, which is to build a dual circuit 66kV feeder.

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2. INTRODUCTION

Ergon Energy has identified emerging limitations in the electricity distribution network supplying the Emerald Area in Central Queensland.

When a distribution network service provider proposes to establish a new large distribution network asset to address such limitations, it is required under the National Electricity Rules (NER)¹ clause 5.6.2(f) to consult with affected Registered Participants, AEMO and Interested Parties on possible options to address the limitations. These options may include but are not limited to demand side options, generation options, and market network service provider options.

Under clause 5.6.2(g) of the NER the consultation must include an economic cost effectiveness analysis of possible options to identify options that satisfy the Australian Energy Regulator's (AER) Regulatory Test, while meeting the technical requirements of Schedule 5.1² of the NER.

The Final Recommendation in this Paper is based on:

- The assessment that a reliable power supply is not able to be maintained in the Emerald Area.
- The Request for Information consultation undertaken, and subsequent Consultation and Draft Recommendation, by Ergon Energy to identify potential solutions to address the emerging distribution network limitations; and
- An analysis of feasible options in accordance with the AER's Regulatory Test.

¹ Version 53. The current version of the NER does not contain Regulatory Test obligations. Rather, this has been replaced with an obligation to perform a Regulatory Investment Test – Distribution from 1 January 2014. Transitional arrangements are prescribed in 11.50.5 of the NER. As such, all references to clause 5.6.2 of the NER relate to Version 53 and not the most recent version.

² Refer above. All references to Schedule 5.1 of the NER relate to Version 53 and not the most recent version.

3. BACKGROUND & REASONS AUGMENTATION IS REQUIRED

3.1. Background

If technical limits of the distribution system will be exceeded and the rectification options are likely to exceed \$10M, Ergon Energy is required under the NER³ to notify Registered Participants,⁴ AEMO and Interested Parties⁵ within the time required for corrective action and meet the following regulatory requirements:

- Consult with Registered Participants, AEMO and Interested Parties regarding possible solutions that may include local generation, demand side management and market network service provider options⁶.
- Demonstrate proper consideration of various scenarios, including reasonable forecasts of electricity demand, efficient operating costs, avoidable costs, costs of ancillary services and the ability of alternative options to satisfy emerging network limitations under these scenarios.
- Ensure the recommended solution meets reliability requirements while minimising the present value of costs when compared to alternative solutions⁷.

Ergon Energy is responsible for electricity supply to the Emerald area (under its Distribution Authority) and has identified emerging limitations in the electricity distribution network supplying it. Augmentation to the electricity distribution network supplying this area is required if reliable supply is to be restored.

3.2. Purpose of this “Final Recommendation”

The purpose of this Final Recommendation is to:

- Provide information about the existing distribution network in the Emerald area.
- Provide information about emerging distribution network limitations and the expected time by which action must be taken to maintain the reliability of the distribution system.
- Provide information about options identified and considered.
- Explain the process (including approach and assumptions) and the AER’s Regulatory Test used to evaluate alternative solutions, including distribution options.
- Recommend the solution Ergon Energy has decided on.

³ Clause 5.6.2(f)

⁴ As defined in the NER

⁵ As defined in the NER

⁶ NER clause 5.6.2(f)

⁷ In accordance with the AER’s Regulatory Test Version 3, November 2007

4. EXISTING SUPPLY SYSTEM TO THE EMERALD AREA

4.1. Geographic Region

The geographic region covered by this Final Report is the town of Emerald and surrounding areas. Emerald is located 240km west of Rockhampton in central Queensland. The map portion below shows Emerald and the subtransmission infrastructure in the vicinity.

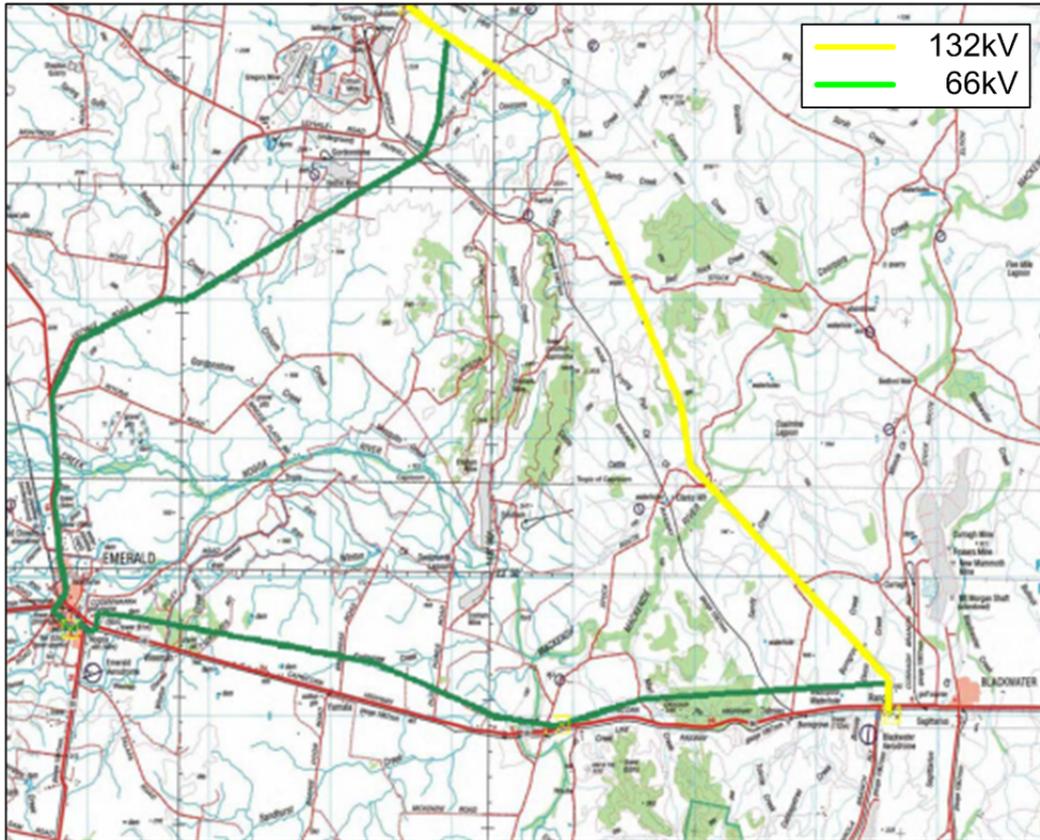


Figure 1 Blackwater, Lilyvale and Emerald Sub-Transmission System

4.2. Existing Supply System

The Emerald town, with approximately 8000 customers, is currently supplied from Ergon Energy's Emerald 66/22kV 3 x 20MVA zone substation which receives supply from a 66kV line from H015 Lilyvale bulk supply substation and a 66kV line from T032 Blackwater Bulk Supply Substation. The Blackwater line also supplies the Comet 5+2MVA zone sub via a tee-off.

The Emerald load levels are such that the Blackwater 66kV feeder alone can supply only about half of the Emerald load and the Lilyvale feeder alone will not be able to supply the full Emerald load within a couple of years. Therefore loss of either one of these long rural 66kV lines may result in load shedding at Emerald, with this potential load shedding being significant for loss of the Lilyvale 66kV line. Nothing can be done with the existing Blackwater-Emerald 66kV line to allow it to supply all the Emerald and Comet maximum demand loads by itself.

Ergon Energy has received a connection request for a 25MVA load that will be connected to the Lilyvale – Emerald 66kV feeder. The existing subtransmission system does not have sufficient capacity to supply both this new load and the Emerald load at times of high power demand.

Ergon Energy's planning criteria requires that subtransmission feeder loads in excess of 15MVA should be supplied at an N-1 security level (i.e. loss of a single line should not cause network outages).

Additional 66 kV feeder capacity is required to Emerald to meet future electricity demand.

5. EMERGING NETWORK LIMITATIONS

5.1. Limitations of the Existing Network

The 2012-13 peak load at Emerald was 39.1 MVA, and the N-1 capacity of the 66kV supply to Emerald is 20MVA. The Emerald maximum demand load is forecast to increase at 3.5% per annum over the next 5 years and 1.7% per annum after this.

The Comet substation load comprises a large proportion of water pumping and as water has not been available for the last couple of years, these years have shown a reduced demand. Over the longer term the Comet sub load is forecast to be 2.7MVA with zero demand growth expected.

A load forecast is shown in Table 1 below.

Feeder Name	Maximum Annual Demand (MVA)									
	Actual Load			Forecast Load						
	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2022/23	2027/28
Emerald Zone Sub	36.2	39.1	39.1	42.7	43.4	45.1	46.6	46.2	50.39	54.8
Comet Zone Sub	2.1	2.5	2.5	2.7	2.7	2.7	2.7	2.7	2.7	2.7

TABLE 1 – Emerald Area Zone Substations Load History & Forecast (MVA)

With the present network (Emerald 22kV capacitors in service) the 66kV lines can supply the following maximum loads:

Blackwater-Emerald line only: 20MVA at Emerald & 2.7MVA at Comet.

Lilyvale-Emerald line only: 35MVA at Emerald & 2.7MVA at Comet.

With the proposed 25MVA single customer load and both 66kV lines in service: 21MVA at Emerald & 2.7MVA at Comet. When load at Emerald exceeds 21MVA, Ergon Energy will not comply with the requirements of the National Electricity Rules regarding statutory subtransmission network voltage levels.

It is clear from the load data in Table 1 and the 66kV line transfer capacities given above that N-1 66kV feeder capacity to Emerald has been exceeded, and in order to connect the new 25MVA load, additional firm capacity will be required.

The above information also indicates that rebuilding the aged lower capacity single circuit Blackwater-Emerald 66kV line will still not restore N-1 66kV line capacity to Emerald as the newer higher capacity Lilyvale-Emerald 66kV line cannot supply the Emerald peak loads alone.

5.2. Timeframes for Taking Corrective Action

In order to ensure that security of supply to customers in the Emerald area complies with Ergon Energy's planning and security criteria, corrective action should be completed before 30 November 2015.

A decision about the selected option is required by May 2014 if any option involving significant construction is to be completed by 30 November 2015.

5.3. Known Future Network and Generation Development

(i.e. projects that have been approved and are firm to proceed)

Ergon Energy is not aware of any other network augmentations or generation developments in the Emerald area that could relieve the emerging network limitations described in section 5.1 above.

6. OPTIONS CONSIDERED

6.1. Consultation Summary

During its planning process, Ergon Energy identified that action would be required to address an anticipated distribution network limitation related to supply to the Emerald area.

On 8 October 2013 Ergon Energy released a Request for Information providing details of the emerging network limitations in the Emerald area. That paper sought information from Registered Participants, AEMO and Interested Parties regarding potential solutions to address the anticipated limitations.

Ergon Energy received three external submissions by 3 December 2013, being the closing date for submissions to the Request for Information paper.

The three external submissions and Ergon Energy's internally defined distribution network solution have been evaluated.

On 7 January 2014, Ergon Energy released a Consultation and Draft Recommendation Report. Ergon Energy received one submission by 11 February 2014, being the closing date for submissions.

6.2. Non-Network Options Identified

For information regarding the three submissions to the Request for Information of 8 October 2013, please refer to the Consultation and Draft Recommendation of 14 January 2014, which is available at Ergon Energy's website.

The external submission that was received to the Consultation and Draft Recommendation comprised a diesel generation solution.

6.3. Distribution Options Identified

In addition to the consultation process to identify possible non-network solutions, Ergon Energy carried out studies to determine the most appropriate distribution network solution. It was considered that a "do nothing" approach was unacceptable.

The distribution network option identified was to construct a dual circuit 66kV line from T032 Blackwater Bulk Supply substation to Emerald Zone Substation.

7. FEASIBLE SOLUTIONS

This section provides an overview of the feasible solutions identified. An NPV analysis is presented in Section 0.

Solution Description	Capital Cost
Ergon Energy Internal Option – New Dual Circuit 66kV Line Blackwater – Emerald	\$80.0M
External Option – 40MW Diesel Generation Plant – 10 or 20 year network support term.	\$5.0M + \$80.0M ¹

1. Capital cost in external option comprises \$5.0M for network connection of the Diesel Generation Plant, estimated by Ergon Energy. \$80.0M is the cost of the Dual Circuit 66kV Line which will need to be built when the existing line from Blackwater is expected to reach the end of its life in 2025.

The external submission provider specified two different options for provision of network support – being either a 10 or a 20 year Network Support Agreement term.

For this Final Recommendation Report, Ergon Energy has performed a more detailed analysis of the network thresholds. The analysis has revealed that Ergon Energy will fail to comply with the statutory subtransmission voltage levels defined in the National Electricity Rules when the load at Emerald exceeds 21MVA, with the proposed 25MVA load connected.

To evaluate the operational cost Ergon Energy would incur under the External Option, network support charges quoted by the submission provider has been used. The Diesel Generation Plant would be required to peak lop when the load at Emerald exceeds 21MVA.

The existing 66kV line from Blackwater to Emerald is expected to reach the end of its useful life around 2025, hence Ergon Energy will need to replace the line by this date. This has been accounted for in the NPV analysis presented in Section 0.

The option of a 20 year network support term has not been evaluated.

8. FINANCIAL ANALYSIS & RESULTS

8.1. Format and Inputs to Analysis

8.1.1 Regulatory Test Requirements

The requirements for the comparison of options to address an identified network limitation are contained in the Regulatory Test (version 3, November 2007) prescribed by the AER.

The Regulatory Test requires that, for reliability augmentations, the recommended option be the one that **“minimises the costs of meeting those requirements, compared with alternative option/s in a majority of reasonable scenarios”**. To satisfy the Regulatory Test, the proposed augmentation must achieve the lowest cost in the majority of (but not necessarily all) credible scenarios.

The Regulatory Test contains guidelines for the methodology to be used to identify the lowest cost option. Information to be considered includes construction, operating and maintenance costs and the costs of complying with existing and anticipated laws and regulations. The Regulatory Test specifically excludes indirect costs and costs that cannot be measured in terms of financial transactions in the electricity market.

8.1.2 Inputs to Analysis

A solution to address the future supply requirements for the Emerald area as outlined in this document is required to satisfy reliability requirements linked to Schedule 5.1 of the NER and the requirements of the *Queensland Electricity Act 1994*.

According to the AER's Regulatory Test, this means that the costs of all options must be compared, and the least cost solution is considered to satisfy the Regulatory Test. The results of this evaluation, carried out using a discounted cash flow model to determine the present value costs of the various options, are shown in section 0.

The cost to implement the network augmentations outlined in section 7 has been estimated by Ergon Energy. Sensitivity studies have been carried out using variations in capital cost estimates of plus or minus 20%. The operating and maintenance costs of new network infrastructure have been derived as a fixed proportion of capital cost. As a result, a variation in capital costs would be equivalent to separately varying the operating and maintenance cost.

The financial analysis considers all foreseeable cost impacts of the proposed network augmentations to market participants as defined by the regulatory process.

8.2. Financial Analysis

The economic analysis undertaken considered the present value of cost of alternative options over the 20 year period from 2013 to 2033.

8.2.1 Present Value Analysis

Financial analysis was carried out to calculate and compare the Net Present Value (NPV) of the costs of each option under the range of assumed scenarios.

A 20 year analysis period was selected as an appropriate period for financial analysis. A discount rate of 9.99% was selected as a relevant commercial discount rate.

The Base Case (Scenario A) was developed to represent the most likely market scenario.

Market scenarios B - I were formulated to test the robustness of the analysis to variations in load forecast, capital costs and the discount rate. As required by the Regulatory Test, the lower boundary of the sensitivity testing was the regulated cost of capital.

Under the Regulatory Test, it is the ranking of options which is important, rather than the actual present value results. This is because the Regulatory Test requires the recommended option to have the lowest present value cost compared with alternative projects.

The following table is a summary of the economic analysis. It shows the present value cost of each alternative and identifies the best ranked option, for the range of scenarios considered.

The summary shows that **Ergon Energy's Internal Option (New Dual Circuit 66kV Line) has the lowest Net Present Value under all scenarios.**

8.2.2 Summary of Economic Analysis

Emerald Economic Analysis, NPV Summary incl. Overheads (\$M)	Internal Option - 66kV Feeder	External Option - Diesel Gen. 10 year NSP Term
Present Cost of Capex	\$70.09	\$31.43
Present Cost of Opex	\$5.43	\$66.72
Present Value of Benefits	\$8.12	\$10.62
NET PRESENT VALUE/ (COST)	-\$67.40	-\$87.53
Value compared to best Option	\$0.00	-\$20.13

Sensitivity Analysis incl. Overheads (\$M)		Internal Option - 66kV Feeder	External Option - Diesel Gen. 10 year NSP Term
Scenario A - Base Case	PV (\$M) Rank	\$67.40 1	\$87.53 2
Scenario B - Low Load Growth +1 yrs	PV (\$M) Rank	\$60.83 1	\$84.46 2
Scenario C - High Load Growth -1 yrs	PV (\$M) Rank	\$74.60 1	\$90.88 2
Scenario D - Discount Rate = 12.00%	PV (\$M) Rank	\$67.34 1	\$78.14 2
Scenario E - Discount Rate = 9.72%	PV (\$M) Rank	\$67.35 1	\$88.88 2
Scenario F - Increased Opex Costs +20%	PV (\$M) Rank	\$68.48 1	\$100.87 2
Scenario G - Decreased Opex Costs -20%	PV (\$M) Rank	\$66.31 1	\$74.19 2
Scenario H - Increased Capital Costs +20%	PV (\$M) Rank	\$79.79 1	\$91.69 2
Scenario I - Decreased Capital Costs -20%	PV (\$M) Rank	\$55.00 1	\$83.37 2

8.3. Discussion of Results

The following conclusions have been drawn from the analysis presented in this report:

- There is no acceptable 'do nothing' option. If the emerging network constraints are not addressed by 2015, Ergon Energy will not be able to maintain acceptable reliability of supply in the Emerald area.
- The local generation options required comparatively low capital outlays, but would instead incur substantial ongoing network support and power purchase payments from Ergon Energy for 10 years, which was determined not to be economically viable.
- The economic analysis carried out indicates that Ergon Energy's internal solution, which is to build a new dual circuit 66kV line from Blackwater to Emerald, has the lowest net present cost.
- Sensitivity testing showed that the analysis is robust to variations in capital costs and the selected discount rate.
- As Ergon Energy's internal option is the lowest cost option in all scenarios, it is considered to satisfy the AER's Regulatory Test.

9. FINAL DECISION & RECOMMENDATION

Based on the conclusions drawn from the analysis in Sections 7 and 0 above, it is recommended that Ergon Energy proceeds with its internal option to:

- **Construct a new dual circuit 66kV line from T032 Blackwater Substation to Emerald Substation.**