Regulatory Test - Consultation and draft recommendation report

Emerging Distribution Network Limitations in the Emerald Area

14 January 2014

Ergon Energy Corporation Limited

Disclaimer

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. We have 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 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 has been identified as the construction of a new dual circuit 66kV feeder from T032 Blackwater Substation to Emerald Substation.

This is now a Consultation and Draft 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.

Submissions in writing are due by **11 February 2014** and should be lodged to:

Attention: Network Strategy and Planning

Email: regulatory.tests@ergon.com.au

Updated information will be provided on our web site:

http://www.ergon.com.au/community--and--our-network/network-management/regulatory-test-consultations

For further information and inquiries please submit to the email address above.

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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 5.1[2] of the NER.

The Consultation and Draft 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 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 NER[3] to notify Registered Participants,[4] AEMO and Interested Parties[5] 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 options[6].
- 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 solutions[7].

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 "Consultation and Draft Recommendation"

The purpose of this Consultation and Draft 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 Ergon Energy's preferred solution.

[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 Consultation and Draft Recommendation 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.

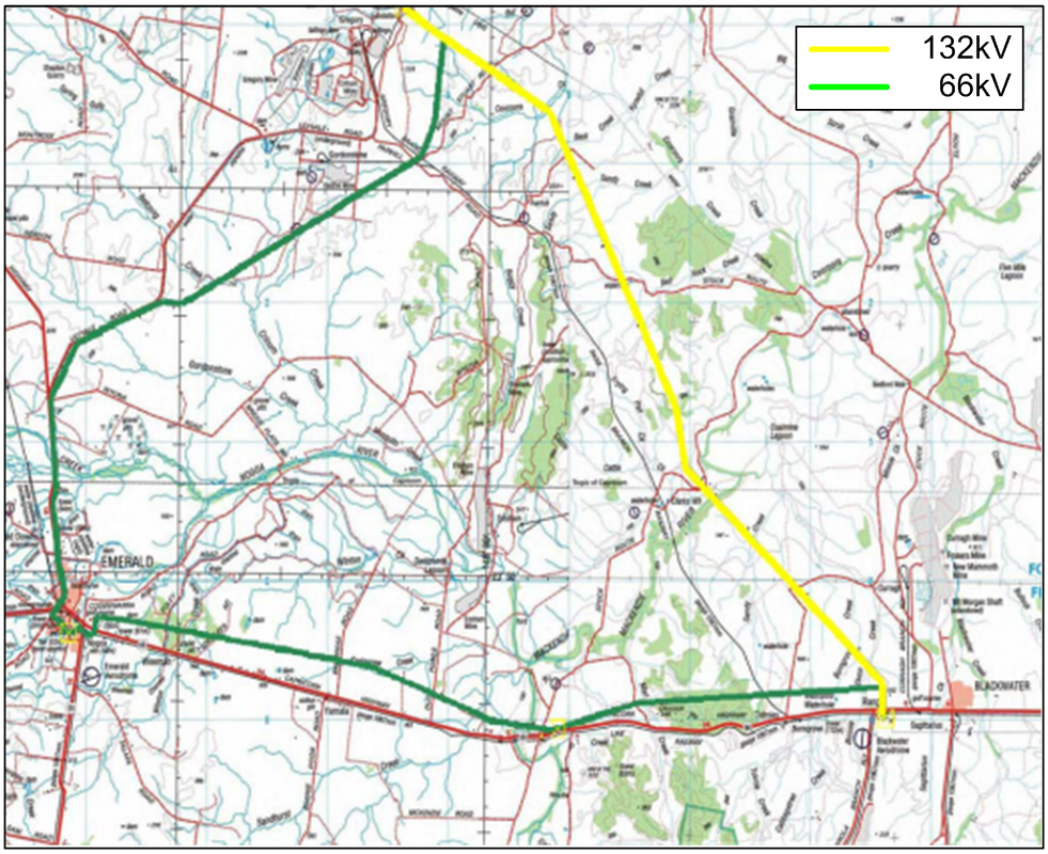

Figure 1 Blackwater, Lilyvale and Emerald Sub-Transmission System

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 load and both 66kV lines in service: 30MVA at Emerald & 2.7MVA at Comet.

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 February 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.

6.2. Non-Network Options Identified

All three external submissions that were received through the RFI process were identified as non-network options. A summary of the received submissions is presented below:

- One option comprised a solar thermal/biomass/natural gas hybrid generation solution.
- One option comprised a diesel generation solution.
- One option comprised a concentrated solar power/battery/diesel hybrid 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 A – 11.5MW Solar Thermal/11.5MW Biomass/11.5 + 25MW Natural Gas Generation Plant	$5.0M[1]
External Option B – 40MW Diesel Generation Plant	$20.0M[1]
External Option C – 160MW Concentrated Solar Power/960MWh Battery/40MW Diesel Hybrid Generation Plant	$5.0M[1]

1. *All capital costs in external options are network connection costs estimated by Ergon Energy. Submission providers are proposing Network Support and Power Purchase Agreements for a minimum of 10 years which will incur significant operational costs to Ergon Energy.*

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 A - Solar Thermal Biomass Natural Gas Hybrid	External Option B - Diesel Gen.	External Option C - Solar Battery Diesel Hybrid
Present Cost of Capex	$70.09	$4.38	$17.52	$4.38
Present Cost of Opex	$5.43	$258.45	$65.64	$490.24
Present Value of Benefits	$8.12	$0.50	$1.88	$0.50
NET PRESENT VALUE / (COST)	-$67.40	-$262.33	-$81.27	-$494.12
Value compared to best Option	$0.00	-$194.94	-$13.88	-$426.72

Sensitivity Analysis incl. Overheads ($M)			Internal Option - 66kV Feeder	External Option A - Solar Thermal Biomass Natural Gas Hybrid	External Option B - Diesel Gen.	External Option C - Solar Battery Diesel Hybrid
Scenario A - Base Case		PV ($M)	$67.40	$262.33	$81.27	$494.12
		Rank	1	3	2	4
Scenario B - Low Load Growth	+1 yrs	PV ($M)	$60.83	$261.92	$79.62	$493.71
		Rank	1	3	2	4
Scenario C - High Load Growth	-1 yrs	PV ($M)	$74.60	$262.78	$83.08	$494.57
		Rank	1	3	2	4
Scenario D - Discount Rate =	12.00%	PV ($M)	$67.34	$235.56	$71.80	$443.30
		Rank	1	3	2	4
Scenario E - Discount Rate =	9.72%	PV ($M)	$67.35	$266.25	$82.71	$501.55
		Rank	1	3	2	4
Scenario F - Increased Opex Costs	+20%	PV ($M)	$68.48	$314.02	$94.40	$592.17
		Rank	1	3	2	4
Scenario G - Decreased Opex Costs	-20%	PV ($M)	$66.31	$210.64	$68.15	$396.07
		Rank	1	3	2	4
Scenario H - Increased Capital Costs	+20%	PV ($M)	$79.79	$263.11	$84.40	$494.90
		Rank	1	3	2	4
Scenario I - Decreased Capital Costs	-20%	PV ($M)	$55.00	$261.56	$78.15	$493.34
		Rank	1	3	2	4

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 a minimum of 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. DRAFT RECOMMENDATION

Based on the conclusions drawn from the analysis in section 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.**

10. CONSULTATION

In accordance with the NER[8], Ergon Energy invites submissions from affected Registered Participants, AEMO and Interested Parties on this Consultation Paper and Draft Recommendation.

10.1. Timetable for Submissions

Submissions in writing (electronic preferably) are due by 11 February 2014 and should be lodged to:

Attention: Network Planning and Strategy

Email: regulatory.tests@ergon.com.au

10.2. Assessment and Decision Timetable

Ergon Energy intends to carry out the following process to assess what action should be taken to address the identified distribution network limitations:

Step 1	Request for (initial) Information - **Complete**.	Date Released: **8 October 2013**
Step 2	Submissions in response to the Request for Information - **Complete.**	Due Date: **3 December 2013**
Step 3	Review and analysis by Ergon Energy - **Complete**. This is likely to involve further consultation with proponents and additional data may be requested.	Date completed: **20 December 2013**
Step 4	Release of Ergon Energy's Consultation Paper and Draft Recommendation of solution which satisfies the Regulatory Test - **This document**.	Date released: **14 January 2014**
Step 5	Submissions in response to the Consultation Paper & Draft Recommendation.	Due Date: **11 February 2014**
Step 6	Release of Final Recommendation (including summary of submissions received).	Anticipated to be released by: **25 February 2014**
Ergon Energy reserves the right to revise this timetable at any time. The revised timetable will be made available on the Ergon Energy website http://www.ergon.com.au/community--and--our-network/network-management/regulatory-test-consultations		

Ergon Energy will use its reasonable endeavours to maintain the consultation program listed above. However this program may alter due to changing power system conditions or other circumstances beyond the control of Ergon Energy. Updated information will be made available on our website: http://www.ergon.com.au/community--and--our-network/network-management/regulatory-test-consultations

The consultation timetable is driven by the need to make a decision by February 2014 if any option involving significant construction is to be in place by November 2015.

At the conclusion of the consultation process, Ergon Energy intends to take steps to progress the recommended solution to ensure system reliability is maintained.

[8] Clause 5.6.2(f)