

Regulatory Test – Final recommendation report

Emerging Distribution Network Limitations in the Charleville Area

31 July 2013

Ergon Energy Corporation Limited

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EXECUTIVE SUMMARY

Ergon Energy is responsible (under its Distribution Authority) for electricity supply to the Charleville area in Southwest Queensland. Ergon Energy has identified emerging limitations in the electricity distribution network supplying the Charleville area.

The peak load on the Roma – Charleville 66kV line is above the Security of Supply Criteria threshold of 15MVA, which triggers work to enhance security of supply. The Charleville area is supplied via a single 276km 66kV sub-transmission feeder from Roma Bulk Supply Point.

With regards to Charleville's performance against the security criteria, during the 2010/11 financial year the load was above 15MVA for a total of 56 hours, spread out over 6 days.

Ergon Energy published a Request For Information (RFI) relating to this emerging network constraint on 23 May 2012 - 11 submissions were received by the closing date of 18 July 2012.

The evaluation process eliminated options that presented "battery only" or "solar and battery" solutions due to their inability to meet the partial contingency / risk management definition.

The other proposals were evaluated and scored with the proponents of the top three diesel/hybrid options, a solar thermal option and a renewable power station option invited to present to the evaluation panel.

Following the presentations and financial evaluations of each proposal, the recommended solution was identified as a diesel generation solution with potential for renewable integration.

Ergon Energy published a Consultation and Draft Recommendation on 5 June 2013. No submissions to the Consultation and Draft Recommendation were received by the closing date of July 2013.

In accordance with the requirements of the National Electricity Rules (NER), this is now a Final Report where Ergon Energy provides both economic and technical information about possible solutions, and our recommended solution to establish a diesel generation solution.

1. INTRODUCTION

Ergon Energy has identified emerging limitations in the electricity distribution network supplying the Charleville area.

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) 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 of the NER.

This Final Report is based on:

- the assessment that a reliable power supply is not able to be maintained in the Charleville 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.

This project has been considered under the reliability limb of the Regulatory Test as the service standards linked to the technical requirements of Schedule 5.1 of the NER and Ergon Energy's licence conditions are unable to be met, as detailed in Section 4 of this report.

This project was included in the Ergon Energy Network Management Plan 2010/11 to 2014/15.

Information relating to the consultation about this project is provided on our web site:

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

For further information, please email: regulatory.tests@ergon.com.au

2. BACKGROUND & REASONS AUGMENTATION IS REQUIRED

2.1. 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 NER¹ to notify Registered Participants,² AEMO and Interested Parties³ 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 options⁴.
- 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 solutions⁵.

Ergon Energy is responsible for electricity supply to the Charleville area (under its Distribution Authority) and has identified emerging limitations in the electricity distribution network supplying Roma to Charleville 66kV line. Augmentation to the electricity distribution network supplying this area is required if reliable supply is to be restored.

2.2. Purpose of this “Final Report”

The purpose of this Final Report is to:

- Provide information about the existing distribution network in the Charleville 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.
- Report the solution Ergon Energy has decided on.

¹ Clause 5.6.2(f)

² As defined in the NER

³ As defined in the NER

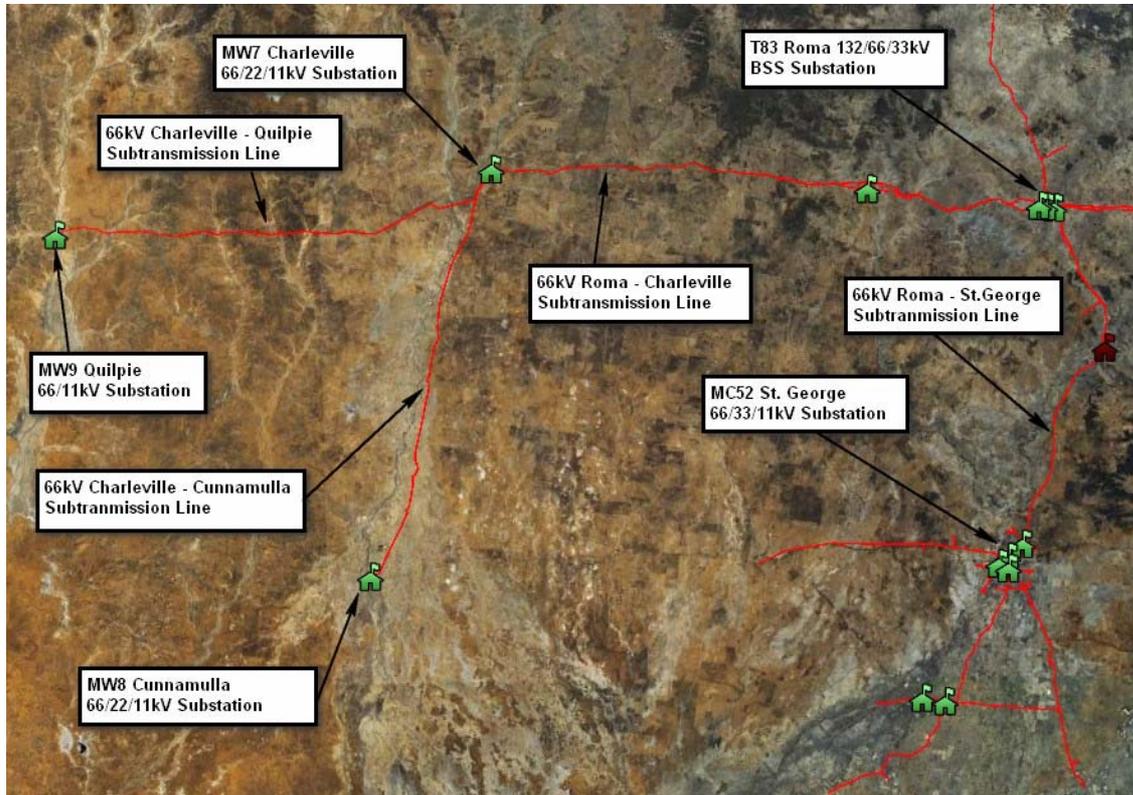
⁴ NER clause 5.6.2(f)

⁵ In accordance with the AER’s Regulatory Test Version 3, November 2007

3. EXISTING SUPPLY SYSTEM TO THE CHARLEVILLE AREA

3.1. Geographic Region

The geographic region covered by this Final Report is broadly described as the Charleville area as shown on the map below.



3.2. Existing Supply System

Charleville is located in the Maranoa area of the South West Region of Ergon Energy's network. The Charleville area is supplied via a single 276km 66kV sub-transmission feeder from T83 Roma Bulk Supply Point. Customers in Quilpie and Cunnamulla are supplied via separate 200km long 66kV feeders from Charleville. Distribution supply from Charleville and Cunnamulla is at 11kV for urban, and 22kV for rural customers. Supply from Quilpie zone substation is exclusively 11kV.

Charleville substation contains 1 x 66/11kV transformer, 1 x 66/22kV transformer, and also a 22/11kV transformer to link the 22kV and 11kV busbars and hence provide backup for each of the 66kV transformers. The MW07 Charleville zone substation contains a Static VAR Compensator (SVC) which is connected to its 11kV bus. The SVC is set up to control the 66kV bus voltage and has a range of 7MVAR inductive to 10MVAR capacitive. Cunnamulla substation has a similar arrangement to that of Charleville substation, but without an SVC.

The Charleville customer base is mainly domestic, with some commercial and rural customers. The residential base is the main driver of the network peak.

4. EMERGING NETWORK LIMITATIONS

4.1. Limitations of the Existing Network

The measured and forecasted peak loads on the receiving end of the Roma – Charleville 66kV line are shown below for a 20 year period, and have been provided by Network Forecasting. Peak loads beyond 2019/2020 have been calculated by extrapolating the 6 -10 year growth rate.

TABLE 1 – Charleville – Supply Substation Load History & Forecast

Zone Substation	Maximum Annual Demand Actual				Maximum Annual Demand Forecast					Compound Growth Factor		
	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	1-5 Year	6-10 year	
CHAR Summation of Charleville LV and Quilpie and Cunnamulla 66kV Feeders (i.e. receiving end of Charleville 66kV Feeder)	(MW)	16.64	16.52	16.27	15.07	17.28	17.61	17.93	18.26	18.58	1.87%	1.71%
	(MVA)	16.67	17.55	18.10	17.31	19.22	19.58	19.94	20.31	20.67	1.87%	1.71%

Zone Substation	Maximum Annual Demand Forecast								Compound Growth Factor			
	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	1-5 Year	6-10 year	
CHAR Summation of Charleville LV and Quilpie and Cunnamulla 66kV Feeders (i.e. receiving end of Charleville 66kV Feeder)	(MW)	18.91	19.23	19.56	19.88	20.22	20.57	20.92	21.28	21.64	1.87%	1.71%
	(MVA)	21.03	21.39	21.75	22.11	22.49	22.88	23.27	23.67	24.07	1.87%	1.71%

**Note: A more recent load forecast has been developed by Ergon Energy after the Request For Information was released, but is not presented within this document. The above load forecast was chosen for consistency with the Request For Information, and is considered adequate for the purpose of this Final Recommendation.*

With regards to Charleville’s performance against the security criteria, during the 2010/2011 financial year load was above the security of supply criteria threshold of 15MVA for a total of 56 hours, spread out over 6 days.

The capacity of the Roma – Charleville 66kV sub-transmission feeder is limited to well below its thermal capacity of 51.3MVA by its voltage regulation. Network modelling indicates that the maximum load that can be supplied to the Charleville area is approximately 16.5MW. There are some operational changes which can increase this by up to a further 1MW.

4.2. Timeframes for Taking Corrective Action

As mentioned above the load is above the levels recommended in the security of supply criteria stated in Ergon Energy/Energex Standards for Transmission and Distribution from 2010/2011, and options to enhance security of supply are to be investigated and implemented as soon as practical.

4.3. 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 approved network augmentations or generation developments in the Charleville area that could relieve the emerging network limitations described in section 4 above.

5. OPTIONS CONSIDERED

5.1. 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 Charleville area.

On 23 May 2012 Ergon Energy released a Request for Information providing details on the emerging network limitations in the Charleville area. That paper sought information from Registered Participants, AEMO and Interested Parties regarding potential solutions to address the anticipated limitations.

Ergon Energy received 11 submissions by 18 July 2012, being the closing date for submissions to the Request for Information paper.

On 5 June 2013, Ergon Energy released a Consultation and Draft Recommendation Report. Ergon Energy received no submissions by 3 July 2013, being the closing date for submissions.

5.2. Non-Network Options Identified

All 11 submissions received through the RFI process were identified as non-distribution options and can be categorised as follows:

- 5 options comprised of battery only or battery combined with solar solutions.
- 4 options comprised of diesel only or diesel combined with solar and battery solutions.
- 1 option comprised a solar thermal solution with diesel and battery contingency.
- 1 option comprised a geothermal power station.

5.3. 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 duplicate 66kV sub-transmission feeder from Roma Bulk Supply Point to Charleville. The distribution non-network option considered was the development of a network support power-station in conjunction with localised network demand management.

6. FEASIBLE SOLUTIONS

This section provides an overview of the feasible solution identified, with full details of the financial analysis contained in Section 7.

6.1. Non Feasible Solutions

The distribution option identified internally to construct a duplicate 66kV sub-transmission feeder from Roma Bulk Supply Point to Charleville was eliminated on the basis that it was not economically viable. The capital cost of the feeder alone was estimated at \$52.7 million and the net present cost of the distribution option is estimated at \$54.4 million, which is inclusive of operation and maintenance.

From the RFI respondents' proposals:

- The 5 options which comprised of battery only or battery and solar solutions were eliminated on the basis of their inability to meet the partial contingency / risk management requirements.

6.2. Feasible Solutions

Of the 6 feasible solutions identified, 4 were to design and construct generation solutions with a diesel component, 1 was a solar thermal power station and 1 was a geothermal power station option as follows:

Generation Components	Capital Cost
6 X 1MW Diesel	\$4.2M
3 X 2.25MW Diesel	\$5.4M
6MW Solar / 4MW Battery / 6 X 1MW Diesel	\$27.1M
6MW Solar / 4MW Battery / 5.6MW Diesel	\$42.3M
<i>*Note: Proponent specified a unit scaling and costing of proposed solution, which has been upscaled to satisfy Ergon Energy's requirements. Specified unit costs of \$9.05M were still higher than the lower cost alternatives.</i>	
24MW Solar Thermal Power Station / 144MWh Battery / 6MW Diesel (owned and operated)	\$Nil
10MW Geothermal Power Station (owned and operated)	\$Nil

The 6 feasible solutions were evaluated by the panel based on the following criteria:

- Scope & technical validity
- Financial and management capability
- Experience and corporate culture
- Network compatibility / customer & stakeholder impacts

The power station proponents and the top 3 highest scoring diesel/hybrid proposals were short-listed and invited to present their solutions to the evaluation panel.

7. FINANCIAL ANALYSIS & RESULTS

7.1. Format and Inputs to Analysis

7.1.1 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.

7.1.2 Inputs to Analysis

A solution to address the future supply requirements for the Charleville 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 7.2.2.

The cost to implement the network augmentations outlined in section 6 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 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. Estimated savings in the cost of network losses have been excluded from the analysis because they were not found to differ significantly over the 20 year study period.

7.2. Financial Analysis

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

7.2.1 Present Value Analysis

Financial analysis was carried out to calculate and compare the Present Value (PV) 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 - G 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 the Diesel solutions have the lower present value under all scenarios.

7.2.2 Summary of Economic Analysis

CHARLEVILLE ECONOMIC ANALYSIS NPV SUMMARIES		Internal Diesel \$M	Option A Diesel \$M	Option B Diesel \$M	Option C Hybrid \$M	24MW Solartherm \$M	10MW Geotherm \$M
Present Cost of Capex		\$4.45	\$3.77	\$4.80	\$24.08	\$0.00	\$0.00
Present Cost of Opex		\$2.73	\$2.73	\$3.51	\$0.79	\$25.32	\$93.55
Present Value of Benefits		-\$0.93	-\$0.88	-\$1.09	-\$12.03	\$0.00	-\$4.08
NET PRESENT COST		\$6.25	\$5.62	\$7.22	\$12.83	\$25.32	\$89.46
Sensitivity Analysis excl Overheads (\$M)		Internal	Option A	Option B	Option C		
Scenario - Base Case		-\$6.25 2	-\$5.62 1	-\$7.22 3	-\$12.83 4		
Scenario - Escalation Opex -High	+20%	-\$6.80 2	-\$6.17 1	-\$7.92 3	-\$12.99 4		
Scenario - Escalation Opex -Low	-20%	-\$5.70 2	-\$5.07 1	-\$6.52 3	-\$12.67 4		
Scenario - Discount Rate - High	12.00%	-\$5.65 2	-\$5.03 1	-\$6.48 3	-\$13.94 4		
Scenario - Discount Rate - Low [REG]	9.72%	-\$6.34 2	-\$5.71 1	-\$7.33 3	-\$12.64 4		
Scenario - Increased Capital costs	+20%	-\$7.14 2	-\$6.37 1	-\$8.18 3	-\$17.65 4		
Scenario - Decreased Capital costs	-20%	-\$5.36 2	-\$4.87 1	-\$6.26 3	-\$8.02 4		
Scenario - Commercial Benefits	-20%	-\$6.44 2	-\$5.79 1	-\$7.44 3	-\$15.24 4		

7.3. Discussion of Results

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

- There is no acceptable 'do nothing' option. The load is already above the levels recommended in Ergon Energy's security of supply criteria.
- The power station options were 'own and operate' proposals which although required no capital outlay, required substantial ongoing network support payments from Ergon Energy for a minimum of 10 years – which was determined to be not economically viable in both cases.
- The economic analysis carried out indicates a diesel generation solution has the lowest net present cost. This is primarily due to the solution required being for security (back-up supply) rather than for base load purposes. Consequently, expected run times (and the resulting operational costs) are low, so proposals minimising the capital costs will be the most cost effective.
- Costings provided by the RFI proponents were high-level in nature. The external diesel generation quotes were consistent with the internal benchmark. Option A has marginally the lowest net present cost.
- Sensitivity analysis indicates that Option A has the lowest net present cost in all scenarios.
- As diesel generation options provide the lowest cost options in all scenarios, they are considered to satisfy the Regulatory Test.

8. FINAL DECISION & RECOMMENDATION

Based on the conclusions drawn from the analysis in sections 6 and 7 above, **it is recommended that Ergon Energy proceed to a closed tender to optimise a diesel generation solution for the Charleville region.** This solution will address Ergon Energy's security of supply requirements.

Technical details relevant to the proposed recommendation are contained in section 6.2.

Ergon Energy will commence actions to progress the solution decided on to ensure system reliability is maintained.