Reasonableness Test RT 001/13

Bungama to Peterborough 33kV Line Voltage Constraint

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This Reasonableness Test has been prepared in accordance with section 3 of ESCOSA Guideline 12 – Demand Management for Electricity Distribution Networks for the purpose of consulting with Registered Participants, Interested Parties and customers regarding a potential network augmentation.

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It is important to note that SA Power Networks as Distribution Network Service (DNSP) provider can only consider benefits available to the DNSP in evaluating the viability of Demand Management initiatives, e.g. transmission benefits, the possibility of reducing spot market prices and wider benefits like reducing green house gasses have not been considered.

GUIDELINE 12 REASONABLENESS TEST

Constraints on the Bungama to Peterborough 33kV Network.

1. CURRENT SUPPLY ARRANGEMENT

Bungama to Peterborough 33kV Line

The Bungama to Peterborough 33kV Line is part of the Upper North 33,000 V (33 kV) electricity distribution system. The line supplies approximately 3900 customers at Gladstone, Jamestown, Peterborough, Terowie and surrounding areas.

The Bungama to Gladstone section is approximately 32km in length while the Gladstone to Peterborough section is approximately 64km, resulting in a total of 96km of line between Peterborough and the connection point at Bungama 132/33kV substation. A tee off at Jamestown supplies the township of Terowie and surrounding areas as shown in Figure 1.

Gladstone substation consists of a 4MVA 33/11kV substation to supply local customers and a 33kV 10MVA Regulator to maintain 33kV line voltage beyond Gladstone to Peterborough, Jamestown and Terowie.

The Bungama to Peterborough 33kV line has adequate thermal capacity for approximately a further 10 years (based on present forecasts). However, the 33kV line capacity based on voltage has been determined to be limited to 10.8MVA. Beyond this load level the 11kV bus voltage at Peterborough falls below 98% of nominal voltage which is deemed inadequate to maintain suitable voltages at the point of supply to customer's installations and is therefore unacceptable.

Based on this, the constraint is not related to the thermal capacity of the 33kV line, but rather, the ability to maintain adequate voltage at the customer's point of supply within the limits prescribed by ESCOSA's Electricity Distribution Code under normal conditions post 2014/15. This constraint will only be exacerbated as the load increases from 2014/15 onwards.

The overall supply arrangement within the region is shown in Figure 1 below.

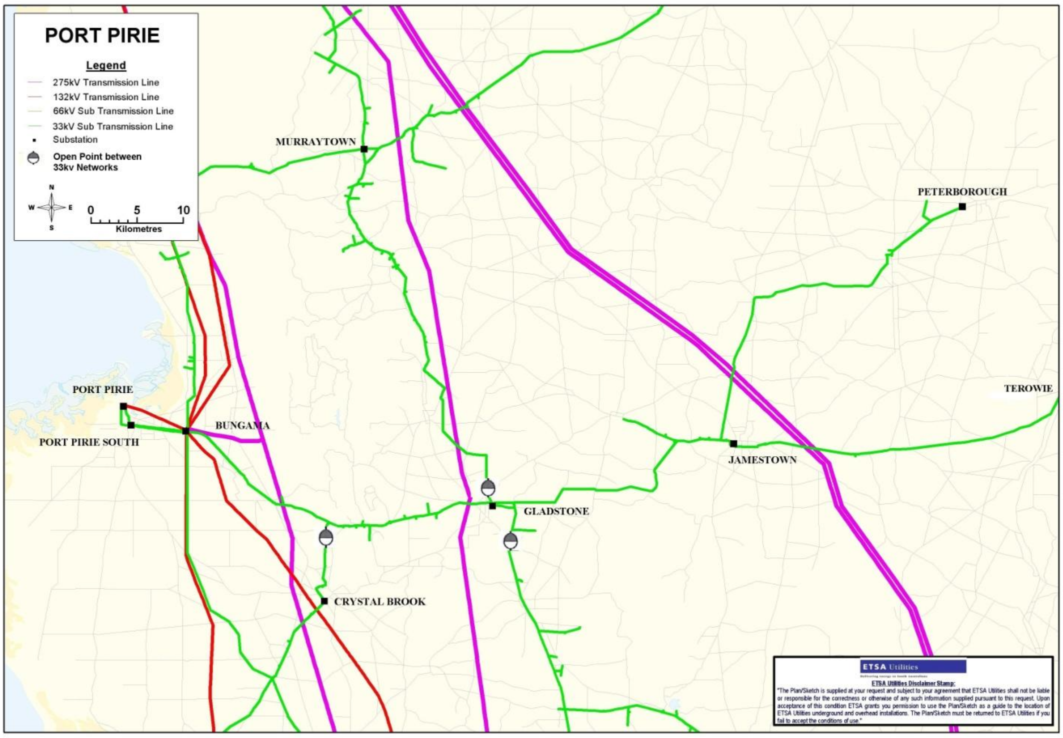

Figure 1: Port Pirie Electricity Supply System

2. FORECAST LOAD AND CAPACITY

The load type for the Bungama to Peterborough 33kV line consists of residential, rural and some commercial/retail sites. During hot weather in the summer months, residential air conditioning contributes a significant proportion to the peak load. Likewise in winter, electric heating contributes a significant proportion to the winter peak load. The region is characterised by hot, dry summers and cold, frosty winters. Both summer and winter peak loads are therefore similar and are expected to grow at approximately the same rate (i.e. 3.0 to 3.5% for the region).

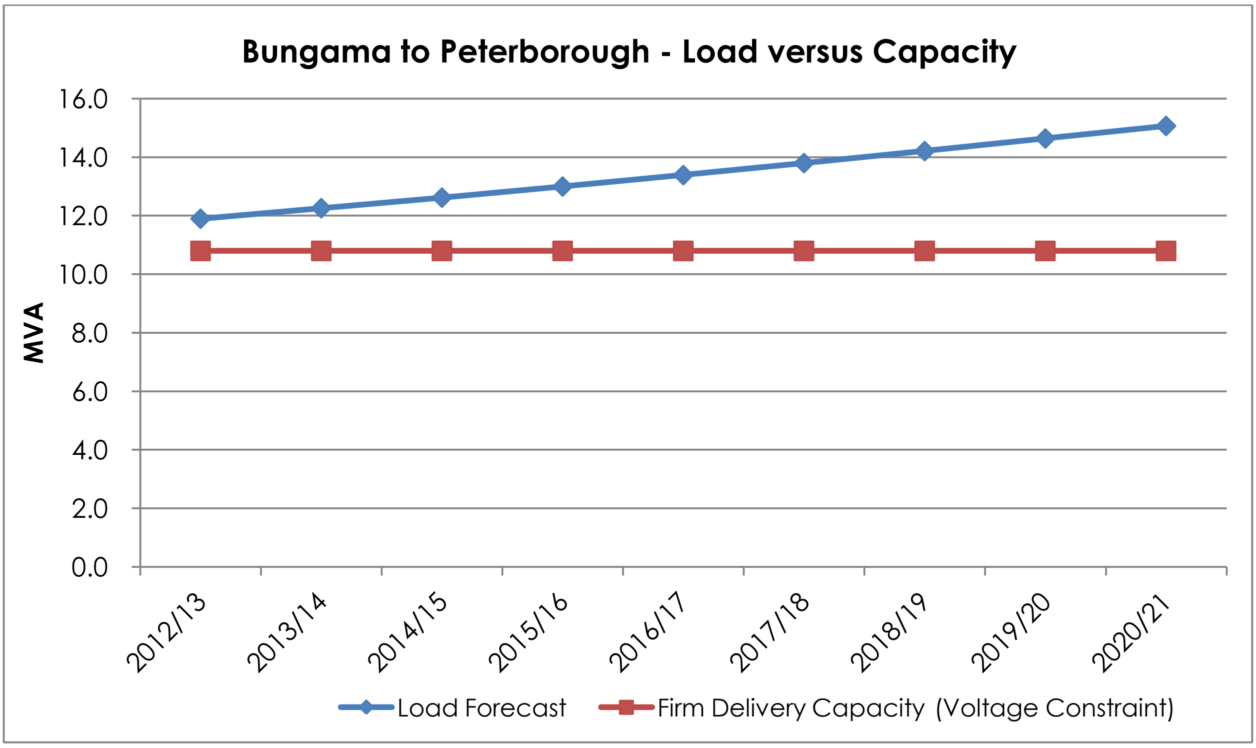

Figure 2: Load versus capacity Bungama to Peterborough.

3. LOAD CHARACTERISTICS

Bungama to Peterborough 33kV line

The peak daily load curve, experienced on the 30th January 2009 (figure 3.1) shows that high loads occur from about 12.00pm through to 8.00pm, as could be expected for air-conditioning load. The load duration curve for the 2008/09 financial year (figure 3.2) shows that Gladstone, Jamestown, Terowie and Peterborough regions experience high loads for relatively short periods during summer heat wave events. Winter peak loads are also experienced in the area, these can be up to 90% of the Summer peak load.

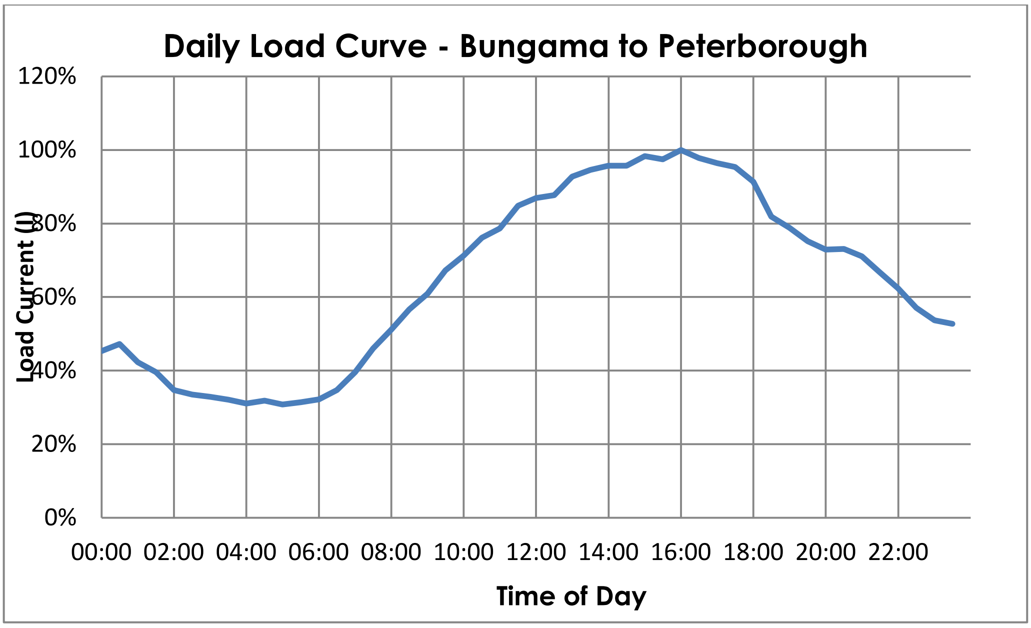

Figure 3.1: Bungama to Peterborough 33 kV Daily Load Curve (30 January 2009)

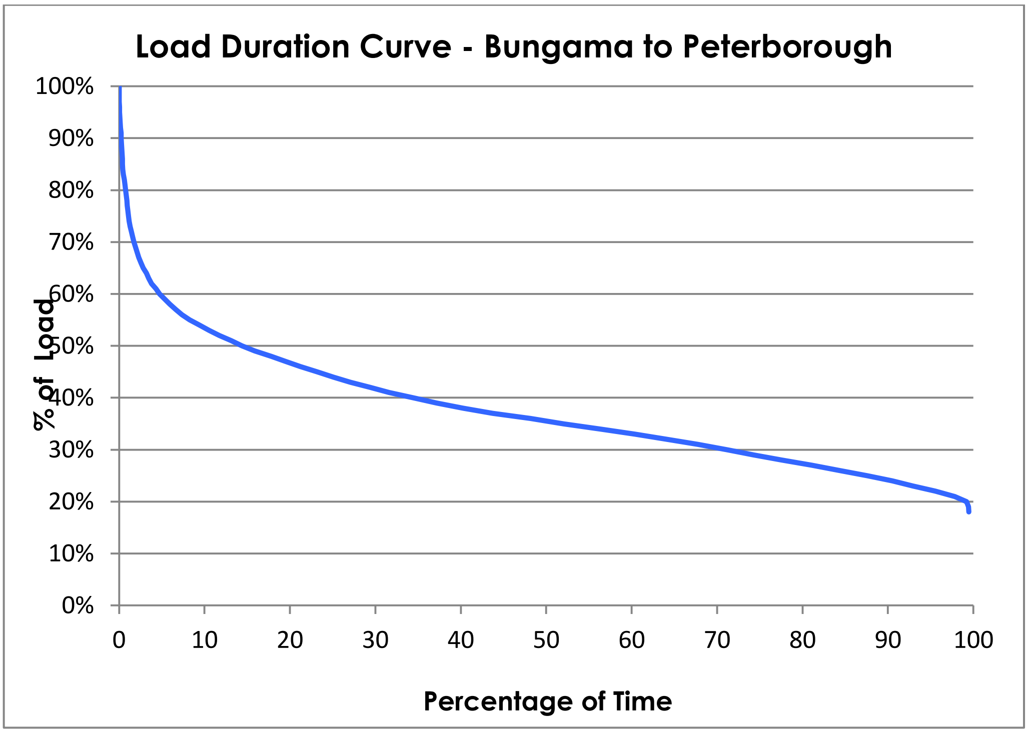

Figure 3.2: Bungama to Peterborough 33 kV Load Duration for 30/6/2008 to 1/7/2009

4. NETWORK UPGRADE

To prevent the forced shedding of load at peak times (in both summer and winter) and to avoid inadequate customer voltage levels at the point of supply, reinforcement of the Bungama to Peterborough 33kV network is required to improve 33kV voltages at Peterborough substation.

A 33kV, 10MVA voltage regulator is presently located at Gladstone substation to boost the 33kV line voltage beyond Gladstone. To provide additional voltage support, the construction of a new regulator station at Hughes Gap has been determined as the preferred network upgrade solution.

The new Hughes Gap 33kV regulator station is to be located between Bungama and Gladstone substations and will include one 20MVA, 33kV ground mounted regulator and one 33kV recloser. The indicative cost for this project is in the order of $3.0 million.

5. DEMAND MANAGEMENT ANALYSIS

5.1 Required Demand Management Characteristics

Bungama to Peterborough 33kV Line

At peak load times, the load profile of Bungama to Peterborough is dominated by residential air-conditioning for summer cooling and winter heating loads. Peak loads can be expected during summer when temperatures exceed 38°C and during winter when maximum daytime temperatures are less than 12°C over several consecutive days. Peak loads are equally likely to occur on both weekdays and weekends due to the predominance of residential loads.

The Bungama to Peterborough 33kV line's load forecast in 2014/15 is 12.62 MVA. During peak load conditions, up to 1.82 MVA of load may need to be unsupplied for up to 6 hours to ensure suitable voltages are maintained. This equates to more than 562 customers which would need to be shed for up to 6 hours during normal peak load conditions. This peak is expected between 12.00pm and 8.00pm.

5.2 Demand Management Value

The following table indicates the amount of load reduction required in each year and the $/kVA required to make Demand Management viable compared with the proposed network solution. Oversubscription is allowed for within the $/kVA available, in order to guarantee the load reduction required is achieved to relieve the identified constraint. A range of deferral benefit values are provided. The stated benefits also include an allowance to cover administrative costs.

Table 1 $ per kVA available for Demand Management

Year	Load Reduction Required (kVA)	Typical number of Days at Risk	$/kVA available per year for DM
2014/15	1,820	4	60 – 100
2015/16	2,200	5	52 – 87
2017/18	2,590	8	46 – 76

5.3 Demand Management Options Considered

Various Demand Management (DM) technologies were considered to determine their viability to assist in reducing the demand in the constrained area. These DM options were evaluated for both technical feasibility as well as cost effectiveness.

5.3.a Standby diesel generators

Establish contracts with customers who have standby diesel generators on their premises and utilise the generators at peak load times or install peak lopping generators to reduce load at peak times. This option is unviable as there are not enough large customers with standby diesel generators within the region to make this option feasible.

5.3.b Install power factor correction

This option is not technically feasible as there are not enough large customers supplied by the Bungama to Peterborough Network to make power factor correction viable. In addition, the existing power factor at Bungama is in excess of 0.92.

5.3.c Retrofit commercial lighting with efficient lighting.

This option relies upon the ability to upgrade existing commercial fluorescent lighting to T5 lighting. Based on the upgrade of an existing 400W fluorescent bank with a 2x 80W efficient bank to provide the equivalent lumen output, the demand saving per bank is 240W.

The estimated cost for this option is $2,500/kVA. Significant disruption to the customer while the retrofit is carried out can be expected, which may influence the number of willing participants.

5.3.d Peak load control – direct load control

Direct load control technology may be available where tripping multiple small air conditioning units supplied from a single distribution transformer can be performed. Recent experiences have shown the costs of such solutions to range from $300 to $800/kVA.

5.3.e Peak load control – curtailable load

This involves establishing a contract with one or more large customer’s requiring them to reduce their load by either turning off the power supply to part of their business or shifting load to “off peak” times. Practically, there are no suitable customers with a load large enough to individually have a material impact on the network load for this option to be viable.

5.3.f Residential compact fluorescent lamp (CFL) program

This option was deemed not relevant due to peak load conditions occurring in daylight hours. Load contribution from residential housing lighting during daylight hours is believed to be minimal.

5.3.g Thermal storage systems

Installation of this form of storage system at a suitable site in a previous trial revealed a saving in load in the order of 150kVA. The expected cost for this size of installation ranges from $1,000-1,600/kVA. Smaller scale installations have also been trialled and are still very much in the development stage (more expensive per kVA).

5.3.h Energy Storage

Use of energy storage technology such as flow batteries is typically in the order of $6000 per kVA.

6. CONCLUSION

Based on the Demand Management options considered when compared to the preferred network solution, it is not possible that sufficient Demand Management measures could be implemented to achieve the demand reduction required to make project deferral technically and economically viable.

The voltage constraint on the Bungama to Peterborough 33kV line has therefore failed the Reasonableness Test and a Request for Proposal (RFP) will not be issued.