ETSA Utilities

REASONABLENESS TEST

RT 007/09

Projected Distribution Network constraint:

Overload of Bordertown Substation

Issue 1.0 – December 2009

DISCLAIMER

The purpose of this document is to inform customers, Interested Parties, Registered Participants and solution providers of the outcome of the application of the Reasonableness Test to the network constraint of overload of the Bordertown Substation. This document is not intended to be used for other purposes, such as making decisions to invest in generation, transmission or distribution capacity. This document has been prepared using information provided by, and reports prepared by, a number of third parties.

While care was taken in the preparation of the information in this paper, and it is provided in good faith, ETSA Utilities accepts no responsibility or liability for any loss or damage that may be incurred by any person acting in reliance on this information or assumptions drawn from it.

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.

The Reasonableness Test has been prepared with consideration for pertinent information provided by a number of third parties. It contains assumptions regarding, among other things, economic growth and load forecasts that, by their nature, may or may not prove to be correct. ETSA Utilities advises that anyone proposing to use this information should verify its reliability, accuracy and completeness before committing to any course of action. ETSA Utilities makes no warranties or representations as to its reliability, accuracy and completeness and ETSA Utilities specifically disclaims any liability or responsibility for any errors or omissions or not.

It is important to note that ETSA Utilities 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 Bordertown Substation

1 CURRENT SUPPLY ARRANGEMENT

Bordertown substation is part of the South East 33,000 V (33kV) electricity distribution system. The substation is supplied directly from a 33kV sub-transmission line and operated at 33kV stepped down to 11kV. The substation is part of a radial 33kV system with one 33kV sub-transmission line from Keith 132kV/33kV Connection Point. Bordertown substation has four 11kV feeders that exit from the substation to supply the local rural residential and commercial load.

Bordertown 33/11kV substation contains two 5MVA 33/11kV transformers with a summer cyclic rating of 12.5MVA. The substation is forecast to be overloaded at peak times by 2011/12 and to be suffering from low voltages approximately four years later in 2015/16. The overload in 2011/12 may require the shedding of 1.3 MVA or approximately 270 customers.

The Keith Connection Point (CP) has a firm delivery capacity of 37 MVA which is expected to be exceeded in 2011/12.

The 33 kV sub transmission line between Keith CP and Bordertown is approximately 47 km of 0.1 ASCR with a summer peak rating of 13MVA. The line has high losses at peak times.

To defer the upgrade works, load transfers to the Keith 33/11kV substation are not possible due to long distances and unacceptable voltage levels.

Bordertown substation supplies residential and commercial customers in the township of Bordertown and surrounding rural areas (approximately 2,700 customers).

The overall supply arrangement is shown in Figure 1 on the next page.

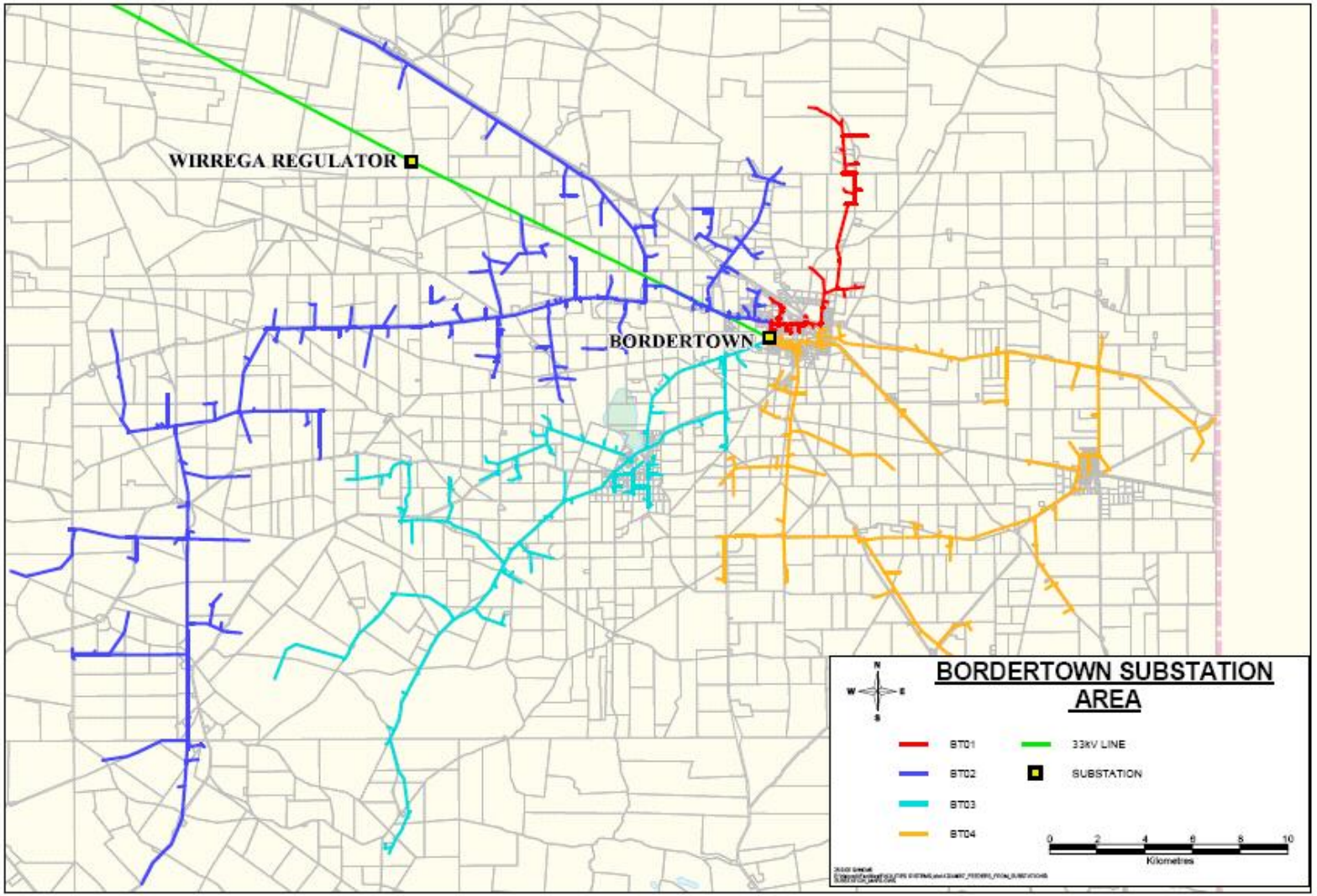
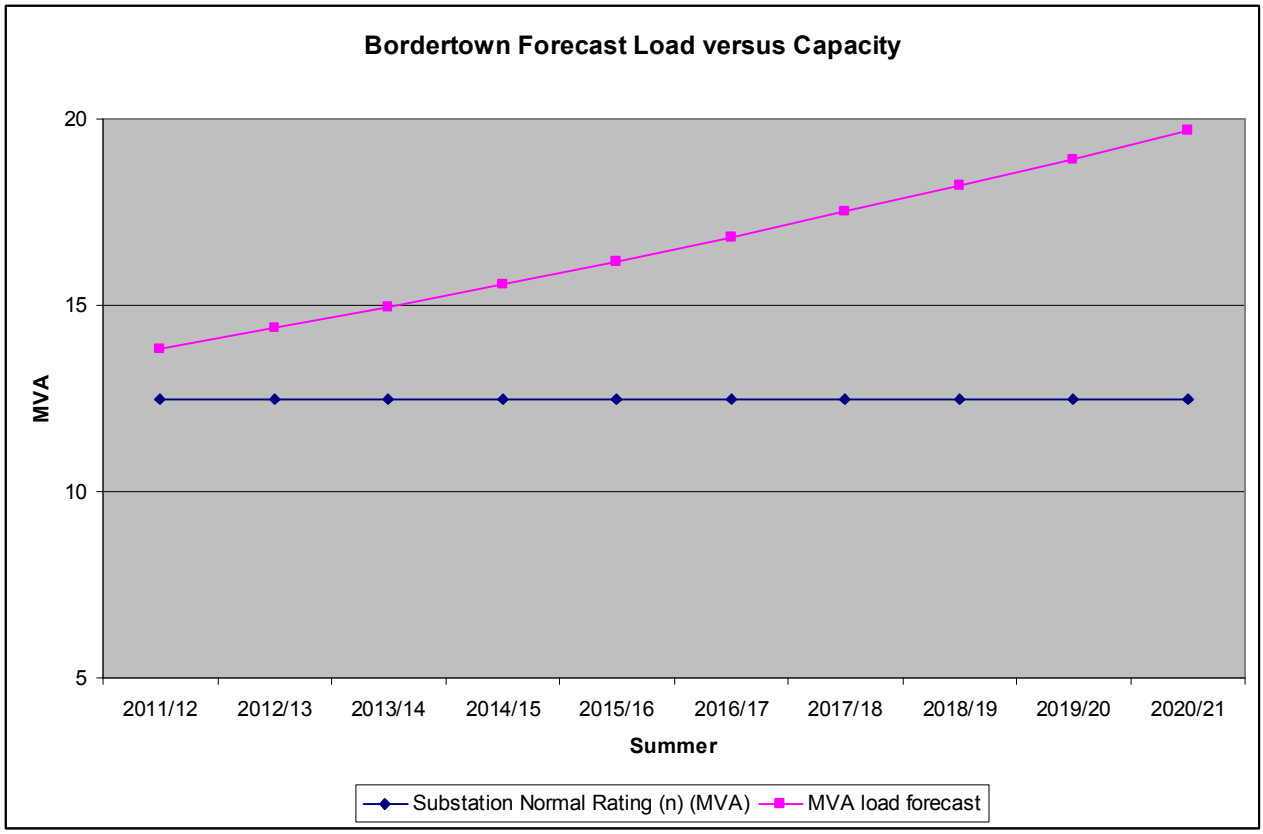


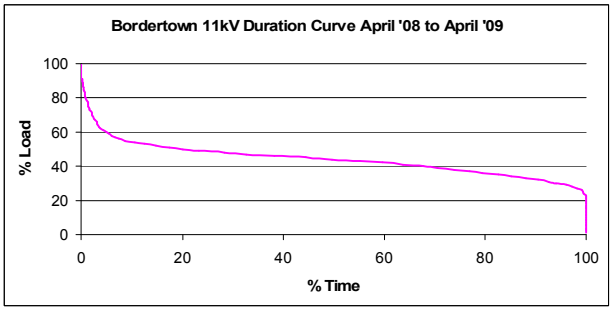
Figure 1: Bordertown Electricity Supply System

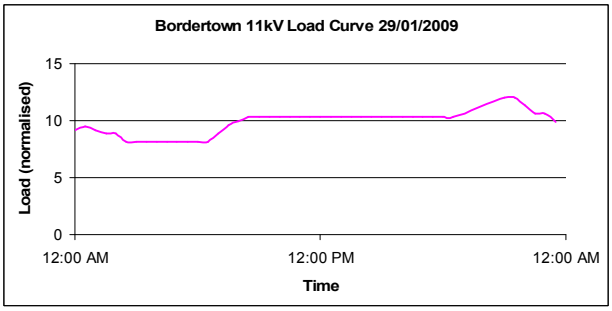
2 BORDERTOWN SUBSTATION FORECAST LOAD AND CAPACITY

The load type at Bordertown substation contains contributions from residential, agricultural and commercial/retail sites. During hot weather in the summer months residential air conditioning contributes a significant portion to the peak load at Bordertown substation. The winter peak load is 59% of the summer peak and is not expected to grow faster than the summer peak load.



3 BORDERTOWN SUBSTATION LOADING CHARACTERISTICS





4 NETWORK UPGRADE OPTIONS

To prevent the forced shedding of load at peak times the capacity of the Keith Connection Point to Bordertown system must be increased.

Four network augmentation options exist to address the three constraints:

- Build a new 3.8MVA 33/11kV substation near Wirrega, construct one short 11kV feeder and transfer load from Bordertown substation. This relieves the Bordertown capacity constraint for up to four years and delays the voltage and Keith CP capacity constraints by approximately one year at a cost of $3.5 to $4 million.

- Upgrade Bordertown substation with an additional 5 MVA transformer, new 11kV circuit breaker and upgraded 33kV protection. This resolves the Bordertown capacity constraint by up to eight years and delays the voltage and Keith CP. capacity constraints by a year. This option is estimated to cost between $4 million and $5 million.

- Add additional VAr support at Bordertown. It will delay the Bordertown capacity constraint by 1 year and the voltage and Keith CP. capacity constraints by up to three years. This will cost in the order of $1 million to $2 million.

- Upgrade the sub transmission line by adding a second circuit of 0.244 ACSR to run in parallel with the existing 0.1 ASCR. An upgrade of the 30 kilometres between Keith and Wirrega regulator is estimated to cost between $7million and $10 million. This would delay the Bordertown capacity constraint by a year, the voltage constraint by many years and the Keith CP capacity constraint by about 4 years.

Preferred Network Solution

None of the above solutions by themselves are ideal given the high cost per kVA of additional capacity and the limited impact that they have on all three problems. The best solution is likely to be a combination of VAr support, additional transformer support and an eventual upgrade of the line. While no value has been calculated a minimum cost of $10 million spread over a number of years is a reasonable estimate.

5 DEMAND MANAGEMENT ANALYSIS

5.1 Required Demand Management Characteristics

At peak load times the load profile for Bordertown substation is dominated by residential air conditioning, and to a lesser extent commercial/retail sites and pumping stations. Peak loads can be expected at the substation during times of sustained hot weather in summer when several consecutive days with ambient temperatures greater than 38 deg C are experienced. Peak loads are more likely to occur on weekdays due to combined residential air conditioning and commercial/retail sites.

Given Bordertown substation's load forecast in 2011/12 of 13.8MVA, during peak load conditions up to 1.3MVA of load may need to be shed, which would require the shedding of approximately 270 customers. The summer peak rating of Bordertown substation is expected to be exceeded for a total of 8 hours in 2011/12. Peak expected between 19:00h and 21:30h. Actual numbers of customers without supply will be greater, as it is not possible to switch exact number of customers at high voltage (need to switch at existing switching locations on feeders).

5.2 Demand Management Value

The following table indicates the amount of load reduction required in each year and the available $/kVA amount available to make Demand Management viable. To allow for oversubscription in order to guarantee the load reduction required, 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
2011/12	1,300	3	>$300
2012/13	1,890	5	> $250
2013/14	2,460	7	>$200

5.3 Demand Management Options Considered

Various Demand Management 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.

(a) Standby diesel generators

Establish contracts with customers who have standby diesel generators on their premises and utilise the generators at peak load times.

Alternatively it may be possible to connect diesel generators to the network at Bordertown specifically to support the network at peak times. This option is complicated by the anti – islanding requirements of the electricity distribution code that require signalling to turn generators off if supply from Keith CP is lost.

(b) Install power factor correction

This option is technically feasible as the Bordertown load power factor is 0.91 and there is at least one large customer supplied out of the substation. Note that 2.5 MVAr of capacitors are already installed at Bordertown for a substation power factor of 0.98.

(c) Retrofit commercial lighting with efficient lighting.

Upgrade existing commercial fluorescent lighting to T5 lighting. Based on the upgrade of a 400W fluorescent bank with a 2x 80W efficient bank provides 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.

(d) Peak load control – direct load control

Direct load control technology is available where (via a power line carrier) tripping many small air conditioning units supplied from a single distribution transformer can be performed. Recent experiences have shown the costs to range from $300 to 800/kVA.

(e) Peak load control – curtailable load

Establishing a contract with one or more large customer's involving turning power supply off to part of their business or shifting load to off peak times was investigated. There is at least one large customer with a load large enough to individually impact the network, and it would appear from the load profile that some of the load is agricultural in nature and may be amenable to time shifting.

(f) Residential Direct Load Control

Demand Management trials using residential metering and control devices indicate take-up rates vary depending on the area. From this response and the expected percentage of suitable air conditioning units residential direct load control is estimated to cost between $335 and $600/kVA.

(g) 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.

(h) Thermal storage systems

A recent installation at a suitable site revealed a saving in load of 150kVA. The expected cost for this type 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).

6 CONCLUSION

Based on the Demand Management options considered it is possible that sufficient Demand Management could be implemented to achieve a demand reduction to make project deferral technically and economically viable.

The constraint on the Bordertown substation has passed the Reasonableness Test and a Request for Proposal (RFP) will be issued.