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Reducing electricity costs through Demand Response in the South West Interconnected System

A report funded by EnerNOC

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1 Introduction

EnerNOC Pty Ltd asked CME to produce estimates of the network costs that could be avoided through Demand Response (DR) in the South West Interconnected System (SWIS). This report follows a similar report funded by EnerNOC, relating to the National Electricity Market.

DR is an over-arching description for activities and technologies that reduce peak electrical demand when the economic value of that demand reduction far exceeds the value that consumers derive from consuming electricity.

The rationale for DR is that it reduces capital expenditure and subsequent fixed operating and maintenance expenditure in generation, transmission and distribution without detriment to reliability and security of supply. It does this by reducing the need for supply-side infrastructure that is only used for short periods of time, typically less than 100 hours per year. As a result it improves efficiency in the production and delivery of electricity, and potentially reduces the exercise of market power in wholesale markets. Through this, DR delivers lower electricity prices to all consumers.

The two questions that we have been requested to answer are:

a) what has been the marginal cost of expanding the network in the SWIS to meet peak demand. This is the marginal network expenditure that DR could avoid; and
b) what actual network costs would have been avoided if various DR technologies and programs had avoided 500 MW of the peak demand growth (in the SWIS)?

The intention with these questions (and their answers) is to produce sound estimates that are useful for policy-level analysis of the merits of DR programs, processes and technologies. Our response should be considered to be a broad estimate of avoided costs, rather than a precise estimate of the avoided costs associated with a specific DR program, process or technology.

Section 2 describes our calculations and Section 3 summarises the results.

2 Calculations

The expenditure that is avoided through DR includes capital outlays to expand capacity, and subsequent fixed operations and maintenance expenditure on that additional capacity.

Western Power regulatory account information published by the Economic Regulation Authority of Western Australia (ERAWA) shows that Western Power spent $766million (2011$) between 1 July 2007 and 30 June 2012 to augment transmission and distribution capacity on the SWIS to meet rising demand. Over this six year period, the simultaneous peak demand increased by 465 MW, according to the "Metered Schedule Load" data provided by the Independent Market Operator. The marginal cost of network augmentation, per MW of additional demand, was therefore $1.65million per MW over this period.

For the period from 1 July 2012 to 30 June 2017, Western Power proposed to ERAWA that it be allowed to set regulated charges to reflect $1,394million of capital expenditure to meet demand growth, that it estimated would rise by 619 MW over this period. ERAWA reviewed this expenditure and determined an allowance of $1,270million. Over this period, the marginal cost of network augmentation, per MW of additional demand, would therefore be $2.05million per MW (based on ERAWA's decision) or $2.25million per MW (based on Western Power's proposal).

Over the full period from 2007 to 2017, using actual expenditure between 2007 and 2012, and ERAWA's approved augmentation expenditure between 2012 and 2017, the total actual expenditure (to 30 June 2012) and proposed expenditure (to 30 June 2017) on the augmentation of distribution and transmission infrastructure in WA will be $2,036million.

Over this eleven year period the trend rate of annual peak demand growth (the slope of the straight line established through the least squares regression of actual demand to 2012 and Western Power's rebased[1] projected demand from 2012 to 2017) is 110 MW per year. The marginal avoidable capital expenditure associated with avoided demand over this full period is therefore $1.85million / MW. To express this as an avoided cost associated with DR, this needs to be grossed-up for the avoided network losses arising from demand reductions at the point of use, which we have assumed to average 10% in total for distribution and transmission. The resulting estimate of avoidable network capital expenditure associated with DR is therefore $2.05million / MW.

[1] Western Power's demand projection from its 2011 Annual Planning Report was used in its regulatory proposal to ERAWA. It envisaged that peak demand to 30 June 2012 would be 4,003 MW. Actual peak demand to 30 June 2012 as measured by "Metered Schedule Load" was 3,897 MW. As a result, we have reduced Western Power's demand projection for each year from 2013 to 2017 by 105 MW to reflect the same rate of growth that Western Power had projected, but also the fact that the based demand in 2012 was actually 105 MW lower than they had projected.

Avoidable operating expenditure

In our report for EnerNOC on avoided costs associated with DR in the NEM, we estimated avoided operating costs, stated as a present value, of $0.3m / MW. We have no reason to believe that the avoided operating expenditure would be meaningfully different in the SWIS than in the NEM, and so propose to use this estimate of avoidable operating expenditure in our calculations.

3 Results

The results of our analysis are summarised in Table 1 below. The second column is the marginal avoided costs. The third column in the total avoided cost, assuming 500 MW of DR. The fourth column states the avoided cost per energy user in the SWIS. This is an estimate of the benefit that could be realised, per energy user, from the implementation of 500 MW of DR in the SWIS.

Table 1. Avoided costs

	Marginal avoided cost ($million/MW)	**Total avoided cost assuming 500 MW of DR**	**Avoided cost assuming 500 MW of DR, per energy user in the SWIS**
Transmission and distribution	$2.05	$1,025 million	$967

Our estimate of the marginal avoided network costs in the SWIS - $2.05 million per MW- is twice the lower bound estimate of our assessment of marginal avoided network costs in the NEM - $1.0 million per MW - but a little under half our Central Estimate in the NEM - $4.45 million per MW. This reflects the evidence that augmentation to meet rising demand in the SWIS has been more expensive than the lowest cost region in the NEM (Victoria) but less expensive than the higher cost regions (New South Wales, Queensland and Tasmania).