Security and Reliability Council

Results of the Electricity Authority's investigations into the value of lost load

11 March 2015

Note: This paper has been prepared for the purpose of the Security and Reliability Council (SRC). Content should not be interpreted as representing the views or policy of the Electricity Authority.

Background

The Security and Reliability Council's (SRC) functions include offering advice to the Electricity Authority (Authority) on reliability of supply.

The Authority Board receives the draft minutes of SRC meetings. Upon receiving the draft minutes of the 21 October 2014 SRC meeting, the Board requested that Authority staff provide the SRC with a summary of the results of the Authority's investigations into the value of lost load (VOLL). This was not a request for advice from the SRC; the Board wanted to be sure the SRC had been made aware of the Authority's VOLL investigation.

The purpose of this paper is to fulfill that request and enable the SRC to discuss the topic further (if needed). It may also serve as useful background to the following presentation to the SRC from the chairperson of the Quality of Supply and Incentives Working Group.

VOLL is an attempt to quantify the value of reliability

VOLL is relevant to the functions of the SRC because it can be used to quantify the economic cost of outages to consumers. To be able to determine whether consumers are getting an *efficient* level of reliability is dependent upon knowing how much consumers value reliability.

VOLL can be calculated, but one figure for all consumers is inappropriate

The Authority published the results of its investigations into VOLL in July 2013. The table of contents and executive summary of that report are attached to this cover paper.[1]

The key findings of the investigation were that:

- a single VOLL figure is an inappropriate measure of the value that New Zealand electricity consumers place on unserved energy
- a carefully designed survey-based approach to estimating the VOLL works.

The SRC may wish to consider the following questions.

Q1.	Does the SRC require further information relating to VOLL?

[1] The complete report is available from http://www.ea.govt.nz/development/work-programme/transmission-distribution/investigation-of-the-value-of-lost-load/development/stage-3-report-on-methodology-and-key-findingsq/

Investigation into the Value of Lost Load in New Zealand

Report on methodology and key findings

23 July 2013

Market Design

797427-1

Contents

Tables

Figures

Executive summary

What is the value of lost load?

The value of lost load (VOLL) is a measure of the economic value given to an amount of electricity that is prevented from being delivered to consumers (i.e. is 'unserved') as a result of a planned or unplanned outage of one or more components of the electricity supply chain.

The VOLL is therefore the economic cost attributed to such an outage.

In the Electricity Industry Participation Code (Code), the VOLL is referred to as "the value of expected unserved energy" and is:

- $20,000/megawatt-hour (MWh), or
- such other value as the Electricity Authority (Authority) may determine.

The summary key findings of the Authority's VOLL study

The Electricity Authority (Authority) has recently completed a study of the VOLL in New Zealand, which was commenced under the former Electricity Commission. The summary key findings of this study are:

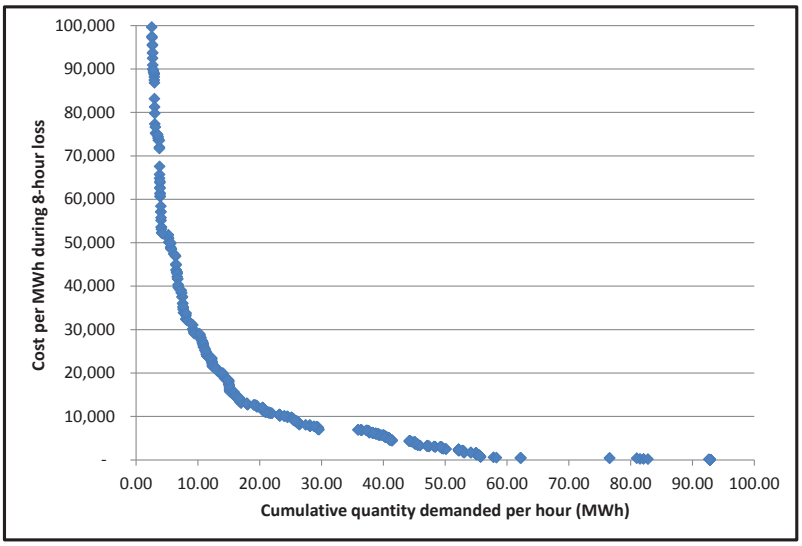
1) a single VOLL figure is an inappropriate measure of the value that New Zealand electricity consumers place on unserved energy

2) a carefully designed survey-based approach to estimating the VOLL works.

Key finding 1: A single VOLL is inappropriate

At best the VOLL is a range of values that different kinds of electricity consumer consider to be the economic cost of power outages. These values can be treated as a distribution, with parameters to describe the average and the spread of values, as shown in Figure 1.[1]

Figure 1 'Demand' curve for unserved energy, for Auckland 2010 VOLL survey respondents, 8 hour power outage



Source: NZIER

[1] The demand curve in Figure 1 is limited to $100,000 on the y-axis and 80 MWh on the x-axis for presentation purposes, but there are data outside those ranges (although the graph shows nearly all of the survey sample).

Instead of representing the VOLL as a distribution of values, tables of VOLLs can be generated that are based on these values. An example of this approach is shown below, where regional VOLLs for Auckland, Christchurch and Taranaki have been calculated using data from the survey undertaken in Stage 2 of the VOLL study.

To put the residential values in these tables into context, if a household loses power for 8 hours on a winter evening, and that household's average electricity consumption over those 8 hours is 3 kilowatts (kW), the economic cost faced by that household from the outage is approximately:

- $288 if the household is in Auckland
- $356 if the household is in Christchurch
- $505 if the household is in Taranaki.[2]

Table 1 VOLL for Auckland respondents, 8 hour outage

By respondent type and average across samples

Respondent	VOLL
Residential	$11,980
Small non-residential	$56,815
Medium non-residential	$27,992
Large non-residential	$3,906
Average	**$14,900**

Source: NZIER

Note: The average is weighted by consumption, so it is not the mean of the other figures shown in the table.

Table 2 VOLL for Christchurch respondents, 8 hour outage

By respondent type and average across samples

Respondent	VOLL
Residential	$14,818
Small non-residential	$69,761
Medium non-residential	$46,686
Large non-residential	$10,940
Average	**$18,690**

Source: NZIER

Note: The average is weighted by consumption, so it is not the mean of the other figures shown in the table.

[2] Taking the example of the Auckland residential electricity consumer, $11,980/MWh is equivalent to $11.98/kWh, which is then multiplied by the consumer's (average) hourly usage (3 kWh) and the duration (8 hours) of the power outage, which gives a cost to the consumer of $287.52 ($11.98/kWh x 3kW x 8 hours).

Table 3 VOLL for Taranaki respondents, 8 hour outage

By respondent type and average across samples

Respondent	VOLL
Residential	$21,049
Small non-residential	$32,101
Medium non-residential	$9,906
Large non-residential	$7,383
Average	**$9,377**

Source: NZIER

Note: The average is weighted by consumption, so it is not the mean of the other figures shown in the table.

Key finding 2: A survey-based approach to estimating VOLL works

Estimating a VOLL is not straightforward because there is no market for electricity consumers to choose between purchasing different levels of security of electricity supply (i.e. choosing between purchasing different price/reliability packages). Consequently there are no readily identifiable prices for differing levels of electricity reliability.

The use of surveys is by far the most popular approach to estimating a VOLL. The VOLL study has confirmed that a survey method using a combination of the 'choice modelling' and 'direct measurement' survey approaches can be used to derive VOLL figures.

The VOLL study has been very beneficial in confirming (and in some instances extending) various guidelines for conducting VOLL research in this regard.

Purpose of this technical report

This technical report summarises the findings of Stage 2 and Stage 3 of the VOLL study, and describes the research approach used in each stage.

A companion document entitled 'Investigation into the Value of Lost Load in New Zealand: Guideline for conducting a VOLL survey' describes a suggested methodology for researching the VOLL in New Zealand.