

Case Studies of New and Emerging Technologies

As part of the assessment of the network costs associated with current and emerging technologies, NERA Economic Consulting is undertaking a number of case studies. The purpose of these case studies is to investigate the principal issues associated with cost reflective network tariffs for each of four specific technologies. This memo sets out a description of each of the case studies and the methodology that we will apply to carry them out.

1. Case studies

Working with AEMC staff, we have agreed that the four case studies will consider the following four technologies:

- solar photovoltaic systems (PVs);
- solar PVs used in combination with battery storage;
- electric vehicles; and
- air conditioners.

The remainder of this section describes each of the four proposed case studies, and the rationale for the geographic location adopted for each case study.

Case Study 1: Solar PV in South Australia

- **Distribution Area:** SA Power Networks
- **Rationale:** South Australia has the highest penetration of solar PVs of any NEM region, and so provides an excellent example of a network where PV systems are prevalent.

Case Study 2: Air conditioners in Victoria

- **Distribution Area:** SP-Ausnet
- **Rationale:** Victoria is prone to heat waves in summer meaning periods of high air conditioner usage are frequent and relevant to market outcomes.

Case Study 3: Battery storage in Queensland

- **Distribution Area:** Energex
- **Rationale:** Queensland has the largest amount of installed capacity of solar PV in the NEM, and so is a relevant market to examine the potential effect of battery storage.

Case Study 4: Electric Vehicles in New South Wales

- **Distribution Area:** Ausgrid

- **Rationale:** Given that the other three case studies examined South Australia, Victoria and Queensland, it follows that this final case study should consider New South Wales.

2. Methodology

Our methodology for this project comprises the following four steps:

1. Determining the change in load profile resulting from a consumer adopting each of the four technologies.
2. Assessing the effect of each technology on network revenue.
3. Assessing the effect of each technology on network costs.
4. Assessing the effect of each technology on customer bills.

Table 1 illustrates these steps and highlights the relationship between each of these steps and our assessment of the efficiency of network pricing for each technology.

Table 1
Steps of the method

	<u>Without new technology</u>	<u>With new technology</u>	<u>Change</u>
Step 1	Generate a representative customer load profile	Generate a representative customer load profile	Change in load profile
Step 2	Calculate DNSP revenue	Calculate DNSP revenue	Change in DNSP revenue
Step 3	Calculate the DNSP's costs of meeting network requirements	Calculate the DNSP's costs of meeting network requirements	Change in DNSP costs
Step 4	Calculate customer bill	Calculate customer bill	Change in customer bill

2.1. Step 1: Determining the change in load profile

The first step of our methodology is to determine the change in load profile. We will do this by:

- establishing 'base-case' load profiles for each representative customer profile;
- calculating the load (or potentially generation) profile associated with each technology, which we term the 'technology load profile'; and

- combining each base case load profile with each technology load profile.

We will be informed by de-identified data of representative customers in each of the networks. We intend to obtain data from the relevant DNSPs.

2.2. Step 2: Assessing the effect of each technology on network revenue

The second step is to identify the network tariffs and associated network charges for each representative customer. In practice this involves:

- developing a model that calculates the fixed and variable charge components of network tariffs for any given consumption profile; and
- applying that model to each representative customer profile, with and without each technology.

We intend to calculate the network charges under two separate tariff structures, namely:

- current network tariffs; and
- a set of network tariffs that we design with the intention of providing the most efficient price signal possible – hereafter referred to as the ‘alternative tariffs’.

The output of the model will be a set of network charges for each representative customer, both for the base case and for each technology considered within the study, under the current and alternative tariffs.

2.3. Step 3: Assessing the effect of each technology on network costs

The third step of the process is to compare the network costs with and without each technology to identify the cost imposed by the technology on the network. The relevant network cost is the incremental increase in future operating and capital network costs incurred as a consequence of increasing use of the relevant technology. This then allows the long-run marginal cost (LRMC) of network services for customers with those technologies to be estimated.

Having estimated the LRMC of network services for customers with the relevant technology, it can be compared with prevailing network tariffs for those customers to evaluate whether the current tariff promotes efficient use of network services.

We anticipate that it will be necessary to understand how:

- the time profile of the use of the technologies impacts on the costs imposed on the network from use of the technology; and

- network-specific characteristics change the costs imposed on the network by a given technology.

The principal output for this part of the study will be estimates of the LRMC for representative customers with each of the relevant technologies, within each of the distribution networks considered in the case studies. In addition, we propose to test the sensitivity of the representative LRMC estimates to the assumptions made.

2.4. Step 4: Assessing the effect of each technology on a customer’s bill

As part of this step we will calculate the retail bills for customers, both with and without each of the subject technologies. Similar to the network analysis, retail bills will be calculated via applying retail tariff data to each of the load profiles described above.

Using a similar approach to that described in step 2, we will calculate the retail bills using:

- a set of current retail tariffs; and
- a set of retail tariffs implied by the alternative network tariffs.

3. Results

Applying our methodology, the above steps will yield results in the form set out in Figure 1. These results will facilitate comparisons of both:

- the incremental network cost or benefit associated with a technology, and the network charges associated with that customer; and
- the customer bill impact of moving from current tariffs to the alternative tariffs.

Figure 1
Results of the analysis

		Without technology	With technology	Change	
Step 2	Network revenue	Current tariffs	\$x	\$x	\$x
	Network revenue	Alternative tariffs	\$x	\$x	\$x
Step 3	Network cost		\$x	\$x	\$x
Step 4	Retail bill	Current tariffs	\$x	\$x	\$x
	Retail bill	Alternative tariffs	\$x	\$x	\$x