Demand management of electric vehicle charging using Victoria’s Smart Grid

Project report

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Alternative Technology Association
Level 1, 39 Little Collins St, Melbourne
VIC 3000, Australia

Department of Mechanical Engineering
The University of Melbourne
VIC 3010, Australia

Department of Transport, Planning and Local Infrastructure
Electric Vehicle Trial
121 Exhibition Street, Melbourne
VIC 3000, Australia

United Energy
PO Box 449, Mount Waverley
VIC 3149, Australia

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The views presented in this report represent those of the report authors alone and should not be considered those of the contributors or the organisations that they represent

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1 Executive summary

This demonstration project has delivered the world’s first use of a Smart Grid for electric vehicle charging demand management. In doing so, the project has demonstrated significant benefits for consumers and utilities from the Australian state of Victoria’s rollout of Smart Meters. It has also highlighted opportunities to ensure these benefits are fully realised as Victoria’s Smart Grid matures and electric vehicles become more widespread.

As part of the demonstration, electricity demand was managed for the first time using the Victorian Advanced Metering Infrastructure (AMI). In managing Electric Vehicle (EV) charging through the Smart Grid, the project has demonstrated how EVs can be integrated into our electricity networks – easily, conveniently and cheaply.

For drivers, the benefits are clear. Based on residential electricity tariffs and the project outcomes, Victorian electric vehicle drivers could save around $250 per year, or around 50 per cent on their charging costs, by adopting ‘Smart’ charging practices. Grid-integrated ‘Smart’ charging technology would deliver this saving without sacrifice or effort on their part.

A grid-integrated ChargeIQ home charging terminal plugged into a Mitsubishi i-MiEV
For utilities, the potential challenge posed in adding electric vehicle charging to existing demand may actually be an opportunity. Managing electric vehicle charging at the network level will not only defer costly infrastructure upgrades through peak demand management, but may deliver better returns on existing investments through improved asset utilisation. Grid-integrated ‘Smart’ charging technology would deliver these benefits and avoid creation of a ‘second peak’ in electricity demand as drivers individually defer charging to the off-peak period. Importantly, the outcome from these improvements will be lower costs for all electricity consumers – not just those who drive EVs.

The project also demonstrated how the relationship between utilities and consumers is a key to delivering the best outcomes for all. Consumers have indicated a willingness to defer their vehicle charging, including having it managed remotely, if provided with easy, convenient and financially-beneficial options. For a utility to control a potentially significant load on their network, consumer cooperation may be increased through the provision of real-time information via the Advanced Metering Infrastructure.

The importance of a fully integrated solution was also highlighted by the project. The home charging solution deployed for the project integrated the vehicle, the grid and the driver seamlessly and effectively. Differences were observed in the control strategies for different vehicle types, and grid integration required an approach tailored to the arrangements adopted by the electricity utility. The drivers received and responded to information provided through the web, their smartphone and via email/text message. The project home charging solution was successful in bringing these elements together with little effort from drivers or the electricity utility.

While the demonstration was successful in showcasing the benefits of Victoria’s Smart Grid, it also highlighted opportunities for improved outcomes. Easy, open and reliable access to the AMI Consumer Home Area Network (HAN) would assist consumers and utilities alike. Clarity on the Consumer HAN roles and responsibilities should also be a priority for action – refer below for the full list of recommendations.

The report documents the demonstration project as follows:

- Section 2 provides a brief introduction to electric vehicle charging, the Smart Grid and demand management
- Section 3 is an overview of the demonstration project
- Section 4 describes the project inputs, including the participants and the demand management strategies
- Section 5 explains the technologies used and their operation
- Section 6 reports the project outputs, including the system performance, charging profiles and participant acceptance
- Section 7 summarises key findings and implications, including recommended actions to ensure the benefits of Smart Grid investment are fully realised
- Section 8 concludes the report and summarizes the recommendations
Recommendations

Based upon the findings from the demonstration project, a range of recommendations have been identified for consideration that will aid in fully realising the benefits from Victoria’s Smart Grid investment – for more detail refer to Section 7:

Smart Grid

- **Reduce the barriers to market access** for Smart device providers by facilitating AMI Consumer HAN device interoperability across Distribution Network Service Providers (Recommendation no.1)

- **Improve consumer access to and confidence in Victoria’s Smart Grid** by addressing issues relating to the AMI Consumer HAN connection, performance and governance (Recommendation no’s 2 – 5)

- **Promote Smart Grid innovation** by establishing performance levels for various applications based on system response time (Recommendation no.6)

Demand management

- **Promote electricity demand management** through consideration of consumer costs, benefits and information requirements (Recommendation no’s 7, 8 and 10)

- **Reduce uncertainties relating to demand management effectiveness** by clarifying utility expectations and device capabilities (Recommendation no’s 9 and 11)