

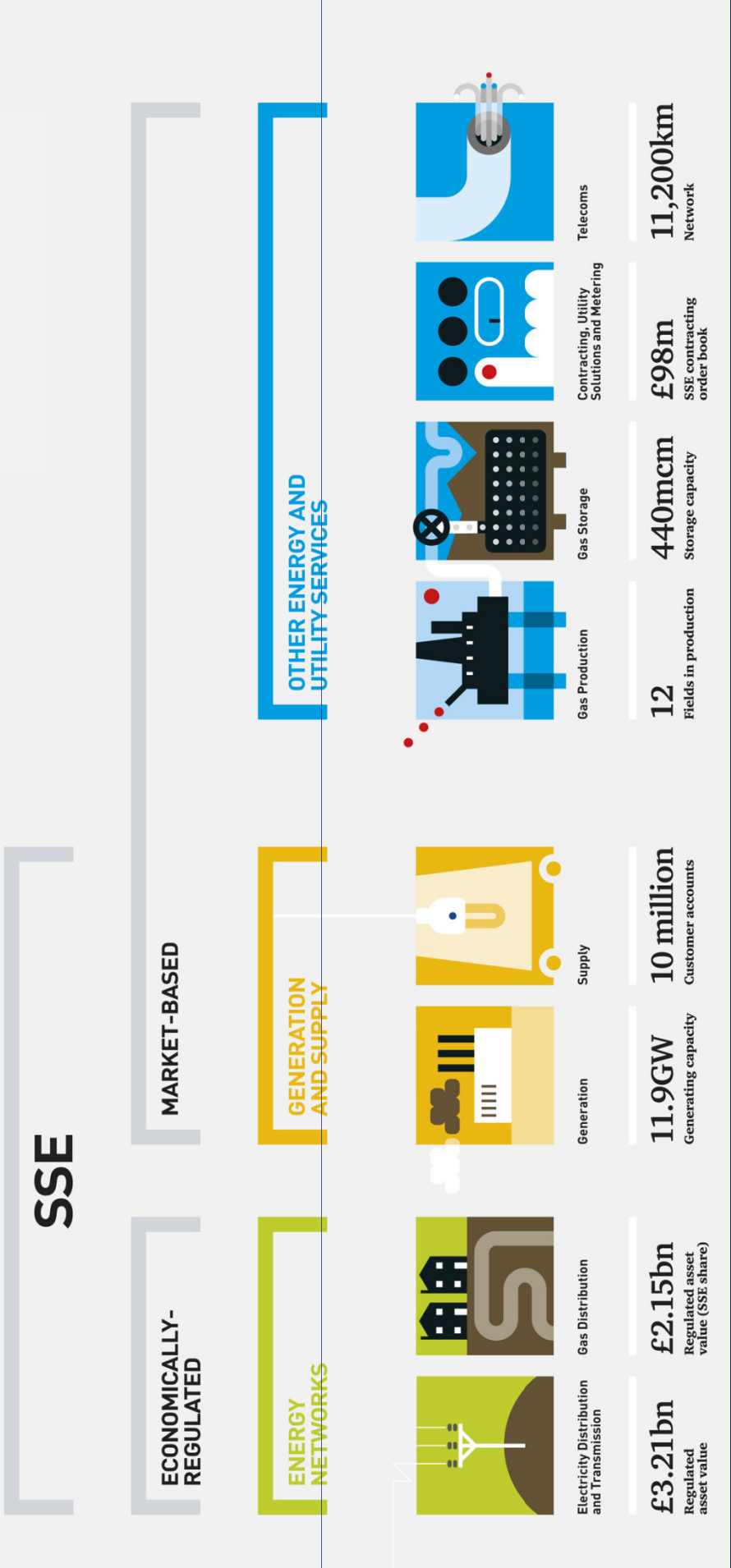
SSE and Electric Vehicles LCV 2011

www.sse.com

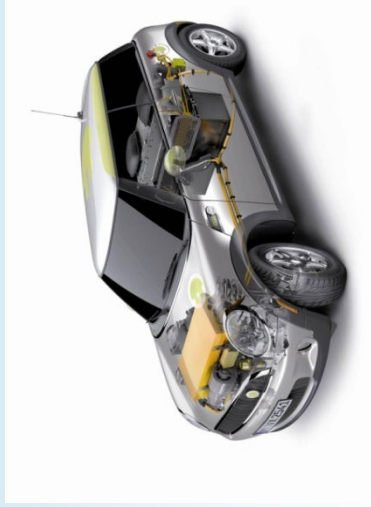
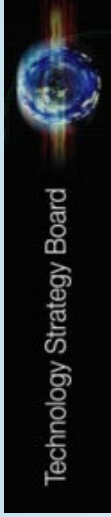


SSE's business activities

Market-based and economically regulated



SSE's Ultra Low Carbon Vehicle Demonstrations



BMW Group

**OXFORD
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Feel the difference



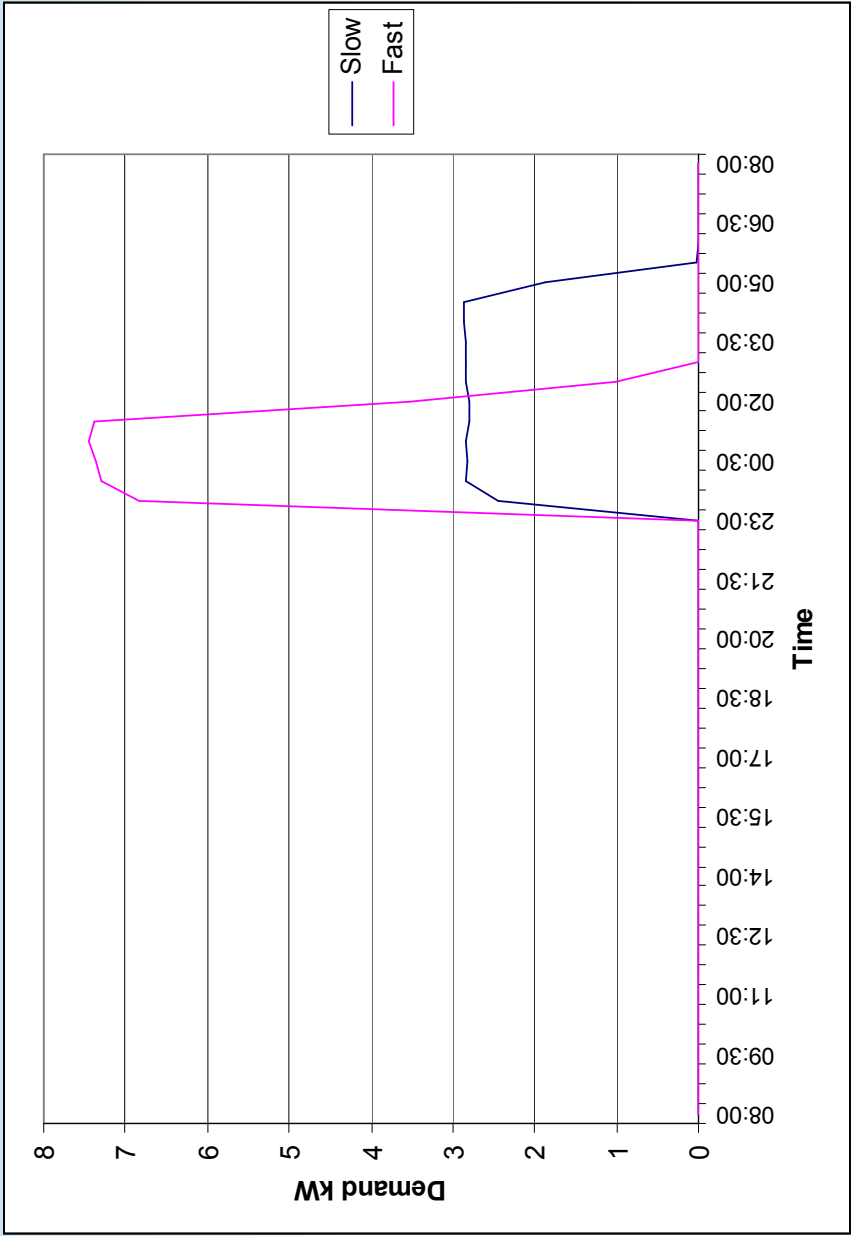
SSE Objectives

- **Understand domestic charging behaviour**
- **Gather data on network loading and power quality to understand future reinforcement requirements**
- **Gather data on use of other charging facilities to understand the consequential impact on home charging**

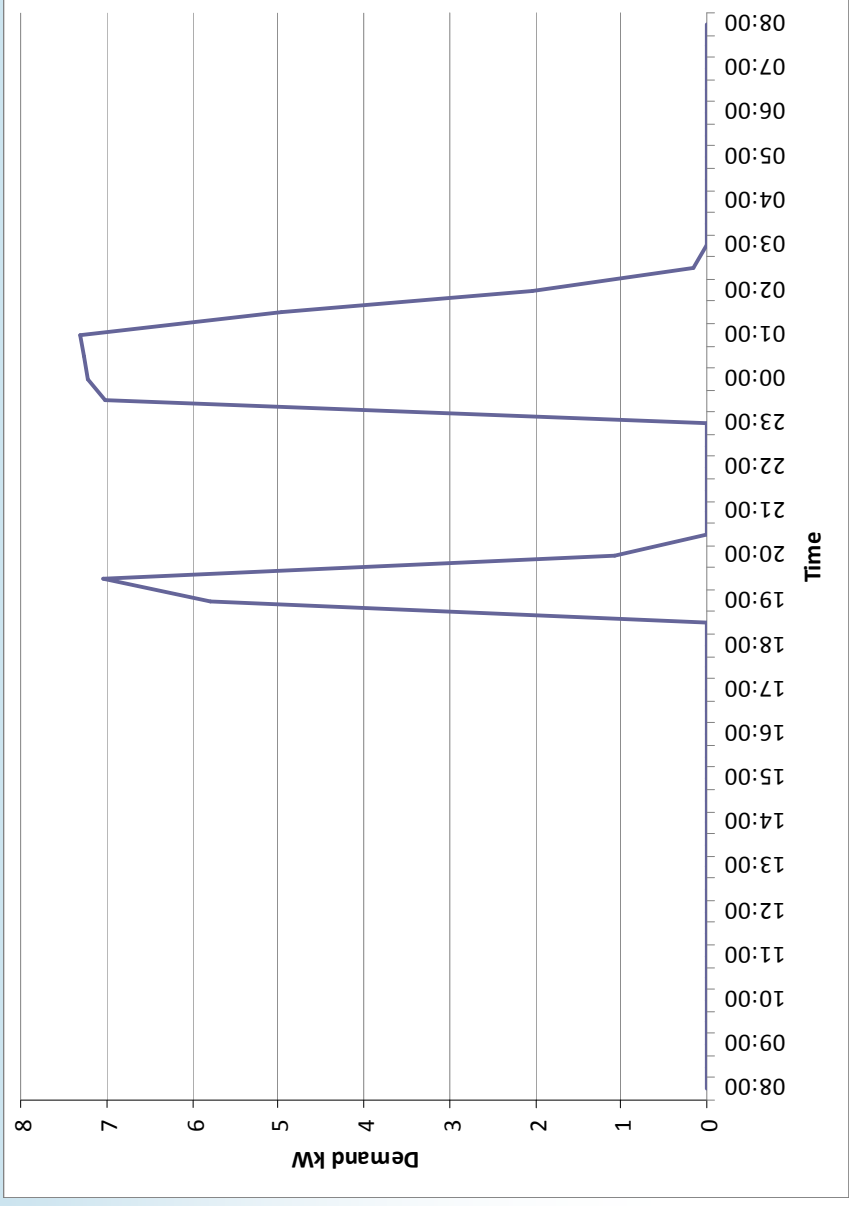
Domestic Charging

- **Two rate meter installed with off-peak tariff to provide financial incentive to charge overnight**
- **Configured to charge overnight by default, but**
- **Boost button to override for instant top-up**

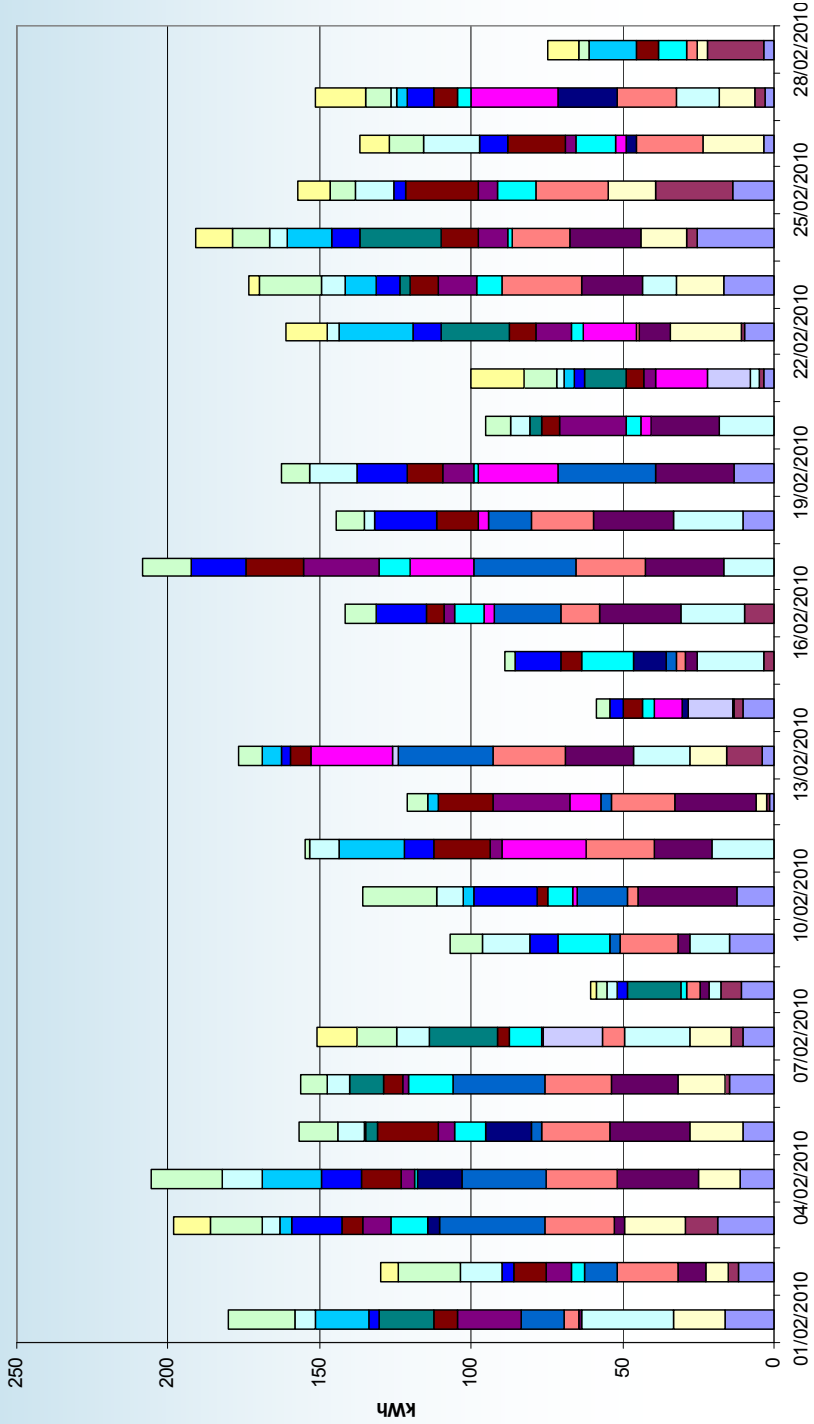
Normal Charge Pattern



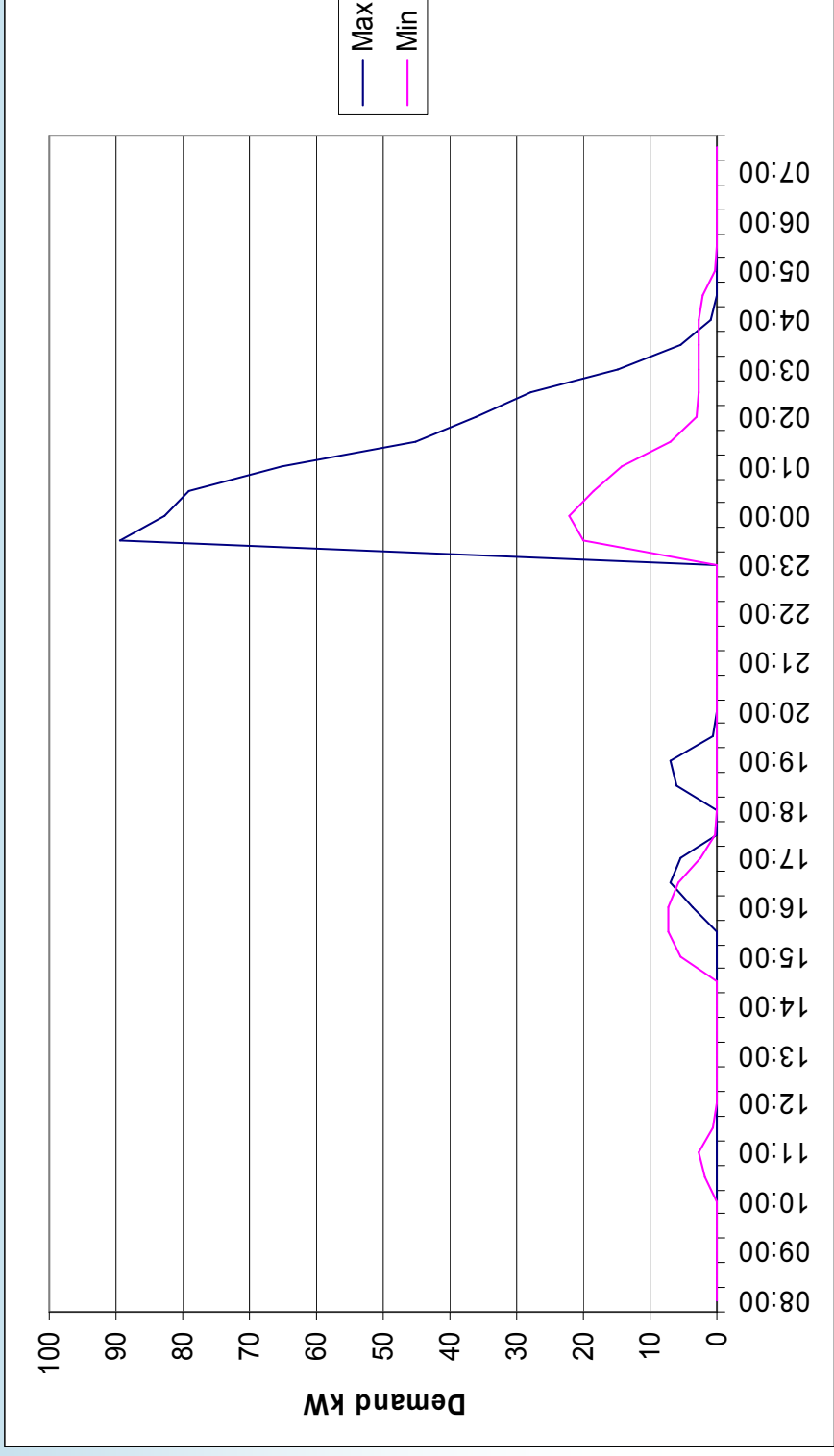
Charging with Boost



Daily energy requirements

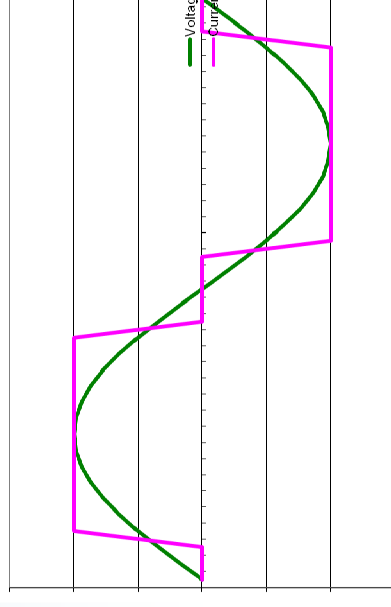
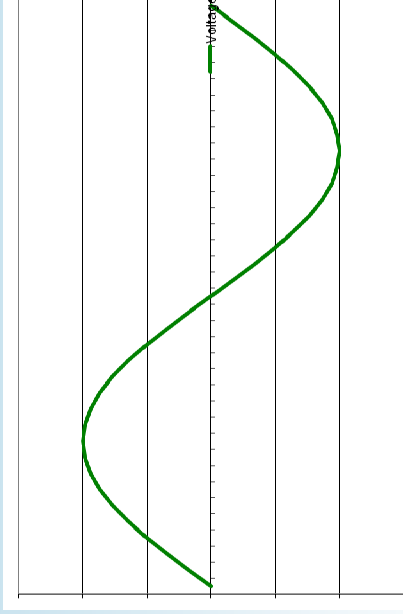


Network Loading



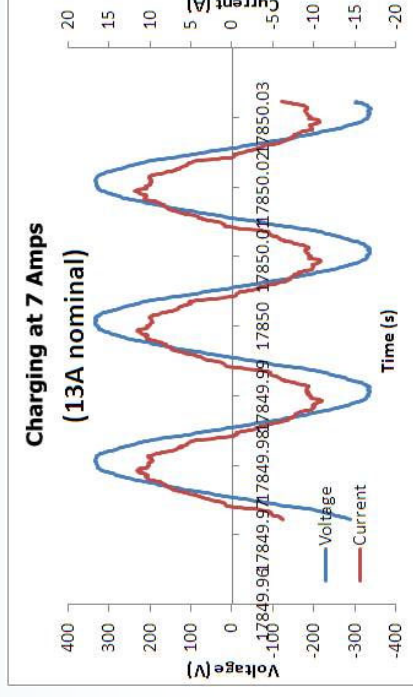
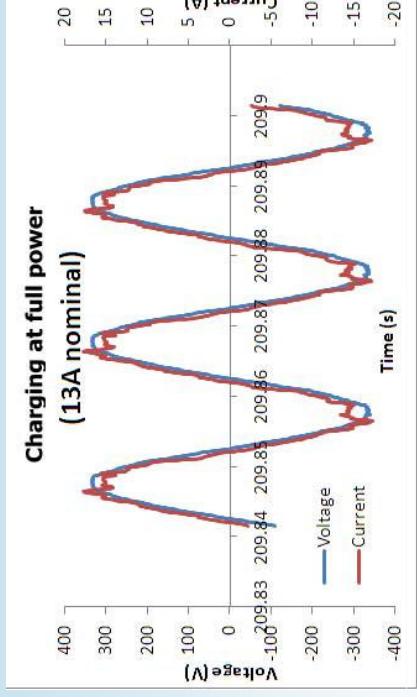
Power Quality

- Power is delivered using Alternating Current (“AC”) at a fundamental frequency of 50 Hertz
- The voltage is a smooth “sine wave”
- Current depends on the equipment itself, and can cause “harmonics”
- This can cause overheating and electrical interference



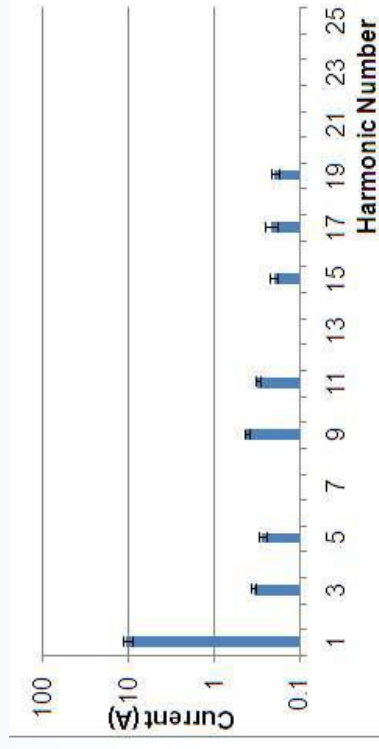
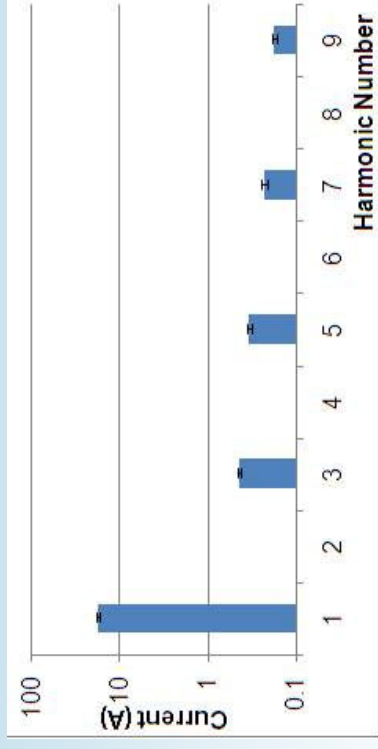
Harmonic Analysis - Examples

- Inverters change AC input to DC for battery charging
- This process causes harmonics due to the characteristics of the inverter
- Current waveform shows some distortion



Harmonics - Results

- Well designed inverters produce low levels of harmonics
- Should not be an issue but further research about aggregation and resonance



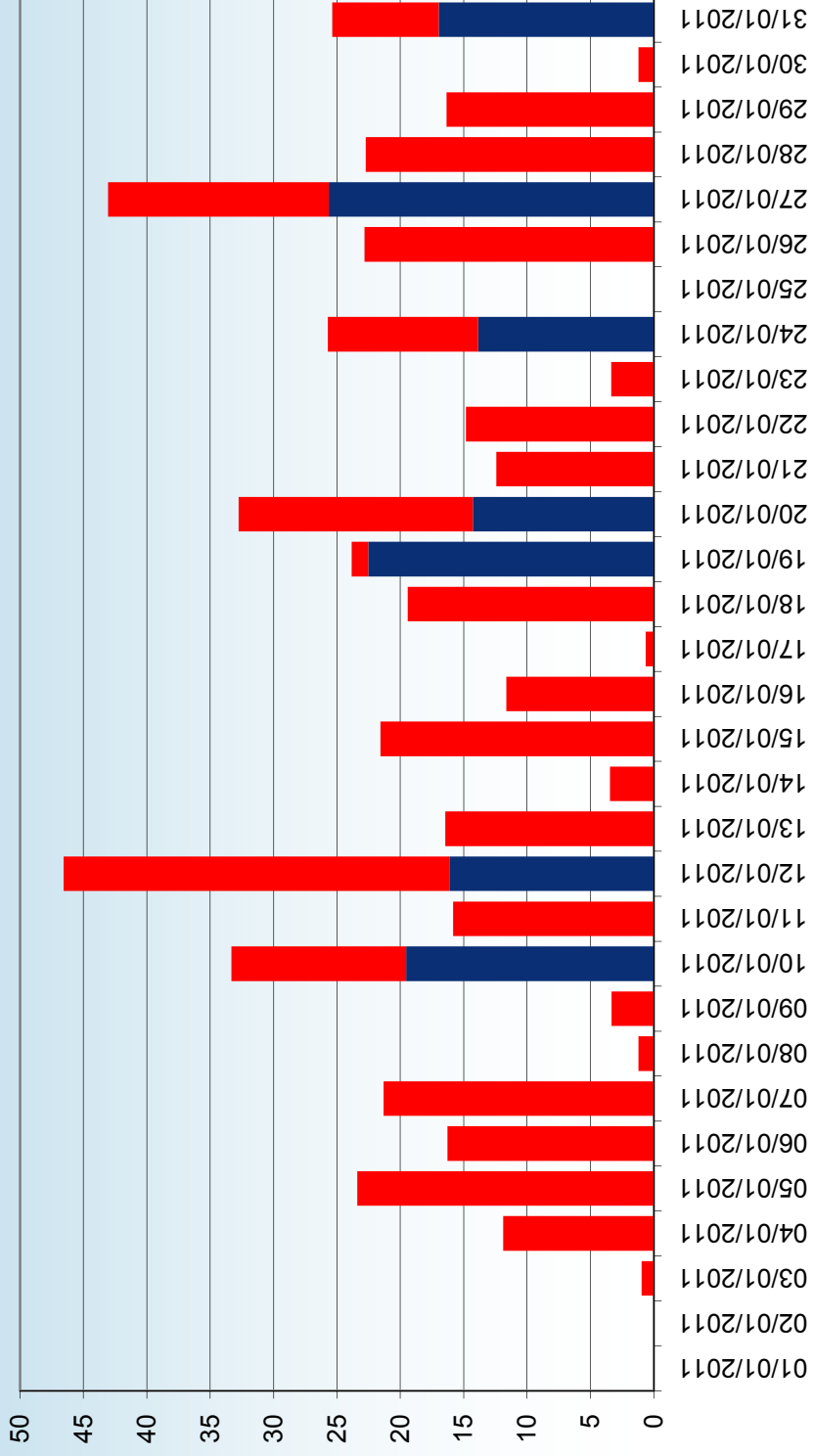
Conclusions on Domestic Charging

- **Most charging takes place overnight taking advantage of off-peak electricity**
- **At most only about half of the cars are plugged in**
- **Clustering of EVs would cause network problems unless charging can be spread over the entire off peak period**
- **Harmonics not a problem provided the chargers are designed to relevant standards**

Other Charging Facilities

- **Hierarchy of requirements:**
- **Workplace**
 - Most frequently requested additional charge point
 - Suitable for business users as well as drive to work
- **City centre car parks**
- **Park and Ride**
- **Leisure facilities**

Effect of workplace charging

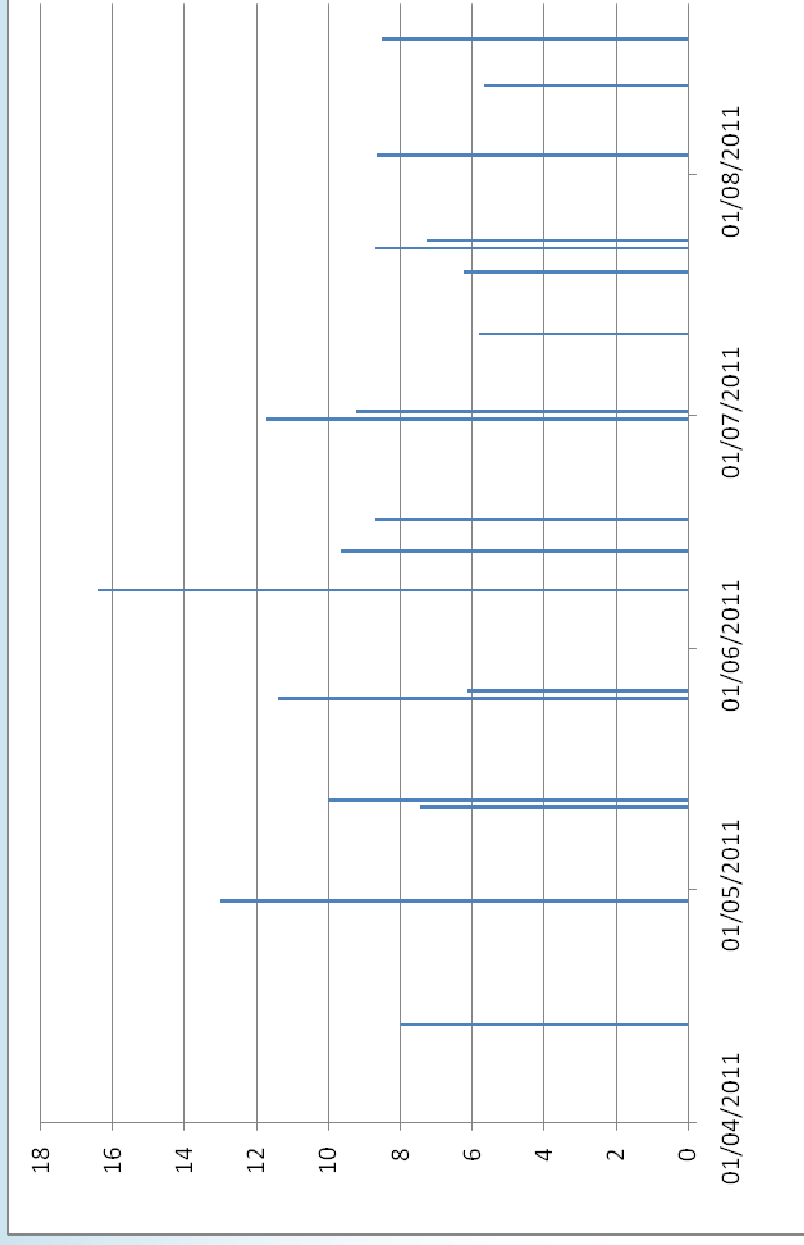


Public Infrastructure

Home Charging Post Locations Post Consumption User Consumption User List Staff List Logout

Welcome to the Charging Posts administration centre
The map above shows the current charging post availability.

Public Infrastructure - City Centre Car Park



Conclusions

- **Availability of work place charging has a profound effect on amount of domestic charging**
- However – in future will depend on costs of using the facility
- **Public charging points will be used if in the right place**
- **Level of use dependent on access model**