

How to increase EV user acceptance

Green eMotion Recommendations

Margaret O'Mahony, Patrick Morrissey and Peter Weldon
Trinity College Dublin

How to get electromobility on the road
Event at the EESC, 25th February 2015



Coláiste na Tríonóide, Baile Átha Cliath
Trinity College Dublin
Ollscoil Átha Cliath | The University of Dublin



Demo Region	Charging Points
Berlin	293
Stuttgart /Karlsruhe	90
Denmark	700
Barcelona / Malaga	220
Ataun / Madrid	12
Strasbourg	108
Ireland	253
Italy	563
Malmo	10
Total	2249

Demo Region	Vehicles
Stuttgart /Karlsruhe	11
Bornholm	10
Copenhagen	4
Denmark	227
Barcelona / Malaga	43
Ataun / Madrid	90
Strasbourg	71
Ireland	15
Italy	182
Malmo	7
Total	660

- Household, office parking, public access, other

- 4 use cases: private, business, captive fleet, rental.
- ‘Health warning’ on data

Main findings – charging infrastructure

- Low levels of night time charging observed
- High demand for charging in evening periods (17:00 – 21:30)
- Charge consumption per event low relative to battery capacity (2 – 9 kWh)
- Significant demand for office and household charging
- Concentration of short charge durations (<240 mins)
- Longer charge durations at office locations

Main Outcomes from EV Charging Behaviour Analysis



- Significant levels of charging event starts early in the morning (~8am) particularly for business vehicles
- Large variations in business vehicle charging patterns later in the day
- Peak in charging activity in the early evening observed for private vehicle users
- Large variations in charging patterns by captive fleet vehicles
- Charging patterns at weekends were more sporadic and generally lower numbers of charging events were evident
- Significant preference for low consumption charging
- Average state of charge before charge event not less than 50%
- Distance covered since last charge event significantly lower than the range of the battery
- Captive fleet vehicles travelled less since last charge event compared with other use cases
- Average time since last charge event less than 24 hours
- Peak occurs at charge durations in the 90-120 min range
- Charge duration distributions influenced by battery capacity of vehicles



- High level of trip activity throughout the working day with peaks evident during morning and evening commutes for private use vehicles.
- A large proportion of trips were in the short distance range, 73% <10km, 92% <20km. These distances are not specific to EV vehicles and are comparable with average ICEV trip distances estimated in urban based travel surveys across Europe.
- Maximum trip distances ranged from 48 - 129km.
- Captive fleet vehicles tended to make shorter journeys with business use and rental vehicles making longer trips
- Average daily distances were well within the battery range.
- The average daily distance travelled is somewhat lower than that reported for ICEVs in national surveys.
- Number of trips per vehicle per day in the range 2-6 trips.
- High proportion of trips begin with a large SOC in the vehicle battery
- Majority of trips end with >65% on average SOC remaining in battery
- Measured average speeds range between 22 and 46 km/hr – comparable to ICEV values

Captive Fleet and Business Use Vehicles Policy Recommendations



Policy Recommendations

1. Introduce guidance to employees/vehicles users on the capability of the vehicles in terms of battery range to reduce unnecessary high frequency charging
2. Provide on-board equipment/smart phone apps to make employees/users aware in real-time about the driving demands they are placing on the vehicle and flagging whether or not the vehicle needs to be charged after a particular trip
3. Explore the possibility of night time charging, through smart energy management, to reduce peaks in charging in the mornings, mid-afternoons and evenings, particularly in the case of the latter as this peak coincides with maximum load on the grid
4. Introduce smart energy management so that the vehicles can be charged over the weekends if they are only in use during weekdays
5. Encourage existing captive fleet users to 'tell their story' about their EV experience, and to particularly highlight the great match between urban based captive and business fleet demands and current EV capability
6. Target other local government and municipality fleets encouraging them to move all/some of their fleet to EVs using the findings from the user behaviour measurement on GeM to convince them.



Vehicle Use Type Domain	Policy Recommendations
Vehicles used for private use	<ol style="list-style-type: none"> 1. Introduce pricing incentives and/or smart charging to encourage night time charging to reduce peak loading on the grid in the early evenings 2. Produce and distribute information leaflets covering the capability of the vehicles in terms of battery range relative to their typical daily demands to discourage unnecessary high frequency charging and promote more confidence in the vehicles. 3. Provide information on real time range and charging facilities through the use of GPS sat-navigation devices and/or smartphone/tablet apps to encourage users to both engage in efficient charging practises and also to undertake longer trips. 4. Recommend that local authorities use local EV user information groups and 'EV ambassadors' to serve as effective methods in communicating and encouraging more effective use of EVs amongst private users.
Rental vehicle use management	<ol style="list-style-type: none"> 1. Provide information on real-time range and charging facilities through the use of GPS sat-navigation devices and/or smartphone/tablet apps to encourage these users to engage in efficient charging practises. 2. Produce and distribute information leaflets covering the capability of the vehicles in terms of battery range.

Charging Infrastructure Domain Policy Recommendations



Charging Infrastructure Domain	Policy Recommendations
Household Located Charging Infrastructure	<ol style="list-style-type: none"> 1. Introduce time differential pricing incentives and/or smart charging to encourage night time charging to reduce evening peak loading. 2. Time differential pricing incentives would not be necessary at weekends because there is little evidence of significant charge peaking 3. Produce and distribute information leaflets covering the capability of the vehicles in terms of battery range relative to typical daily trip activity.
Office Located Charging Infrastructure	<ol style="list-style-type: none"> 1. Time allocation management by employers for users on charging facilities will be necessary as the number of EVs increases. 2. Evidence from the dataset indicates that many users who are charging at work have already sufficient charge in the battery to return home. Employers may wish to educate the EV users on the capability of the vehicles and batteries. 3. Employer and office based charging infrastructure will need to be scaled up to cope with additional demand as EV penetration increases in vehicle fleets. 4. Employers are in a unique position to encourage more EV use by offering free charging facilities and free parking to employees who use EVs. There would be benefit in targeting large employers to include EV related policies as part of their strategic 'green' management and transport plans
Street Located Charging Infrastructure	<ol style="list-style-type: none"> 1. Provide free or reduced parking charges for users to encourage more use of street charging facilities 2. Offer public street located charging infrastructure to apartment block dwellers at night time when other demands on street charging facilities are low when shops/businesses are closed.



Thank you.



Coláiste na Tríonóide, Baile Átha Cliath
Trinity College Dublin
Ollscoil Átha Cliath | The University of Dublin

