CROSSING BORDERS

# CROSSING BORDERS
# WORK PACKAGE 2
# CONCEPT & NETWORK PLANNING

Presseevent & Nationale Konferenz
“Green eMotion meets CROSSING BORDERS”

Vienna, 8 October 2014

**Mag. Bernhard Fürst**

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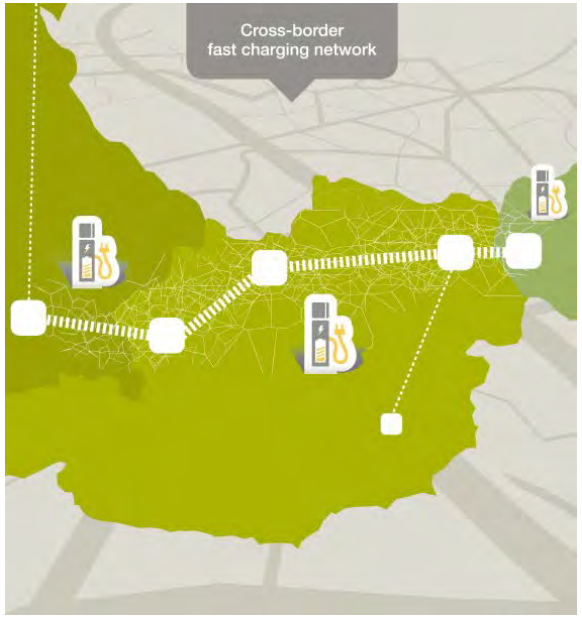
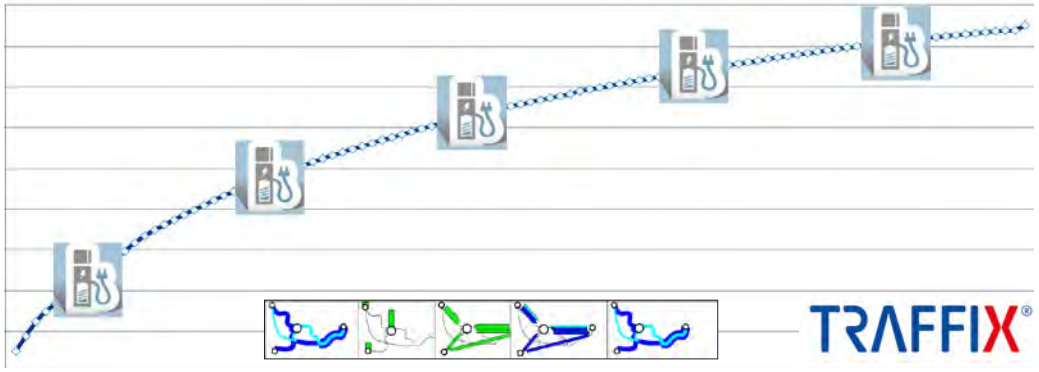



# WP 2 Network Planning – Overview

- design of an efficient cross-border fast charging infrastructure network
- network plan of optimized charging station locations
- development of standardized optimization algorithm (software prototype) which will also be applicable for other regions
- Research on use cases, target groups and user behaviour



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# Use cases

| Use case ID | Use case name | Short description |
|---|---|---|
| 1 | **Emergency charging** | Charging at a public fast charging station in case of unexpected low battery status in order to make it to the destination of a trip |
| 2 | **Range extension** | Using a public charging station in order to cover trips longer than the battery range |
| 3 | **Ad hoc charging** | Combine activities and charging: Use a charging station during an intended stay at a point of interest (e.g. retail, shopping, services) |
| 4 | **Car park and intermodality** | Recharge EV while parked at a public Car park or Park + Ride facility |

# Study area and general approach

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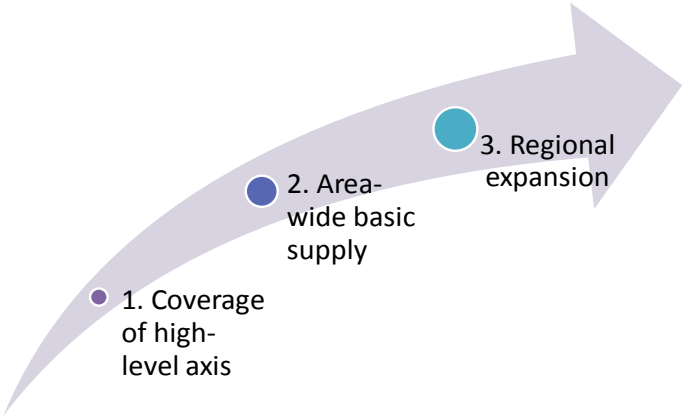

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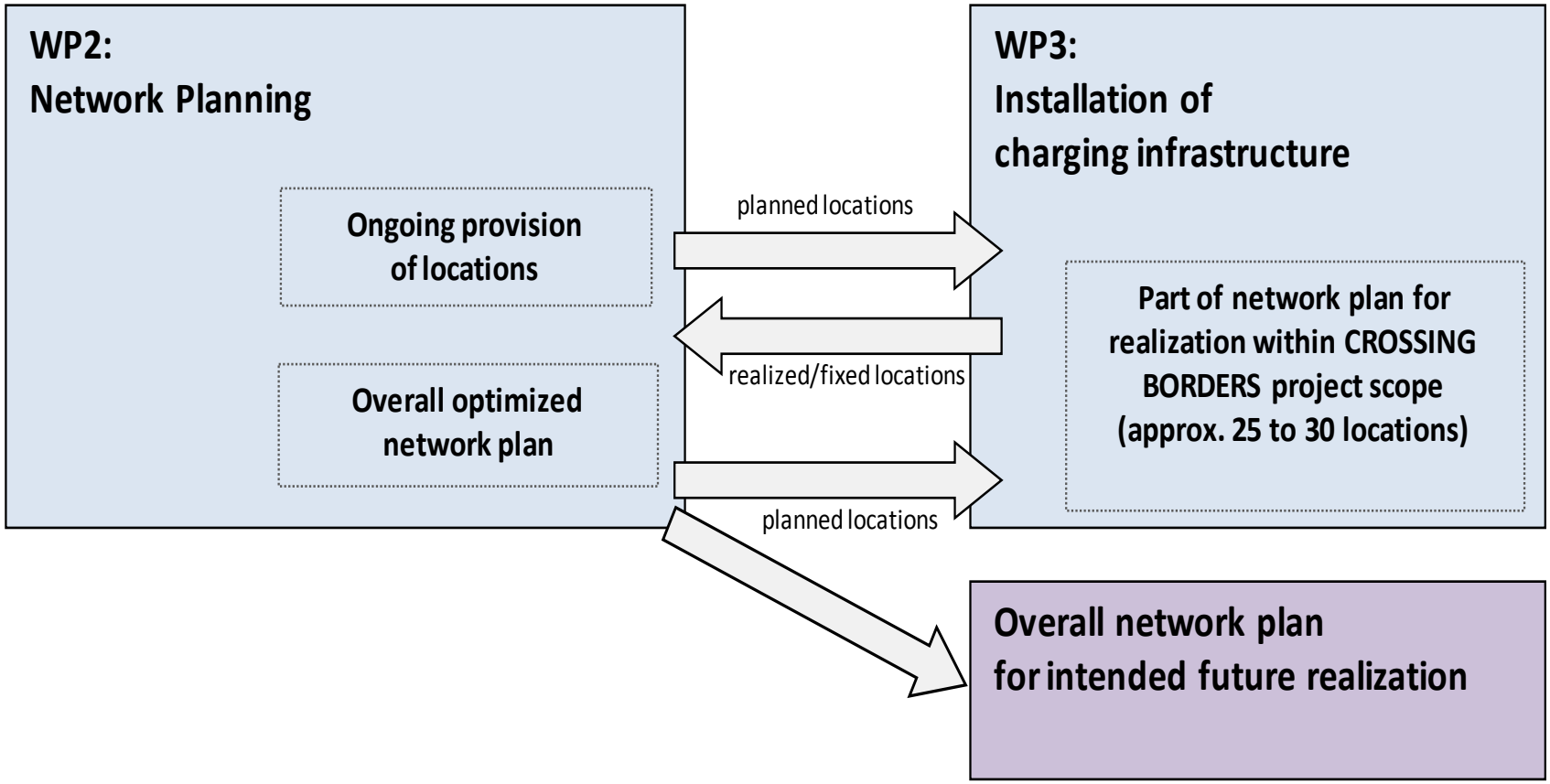
# Locations for realization within the project and overall network plan



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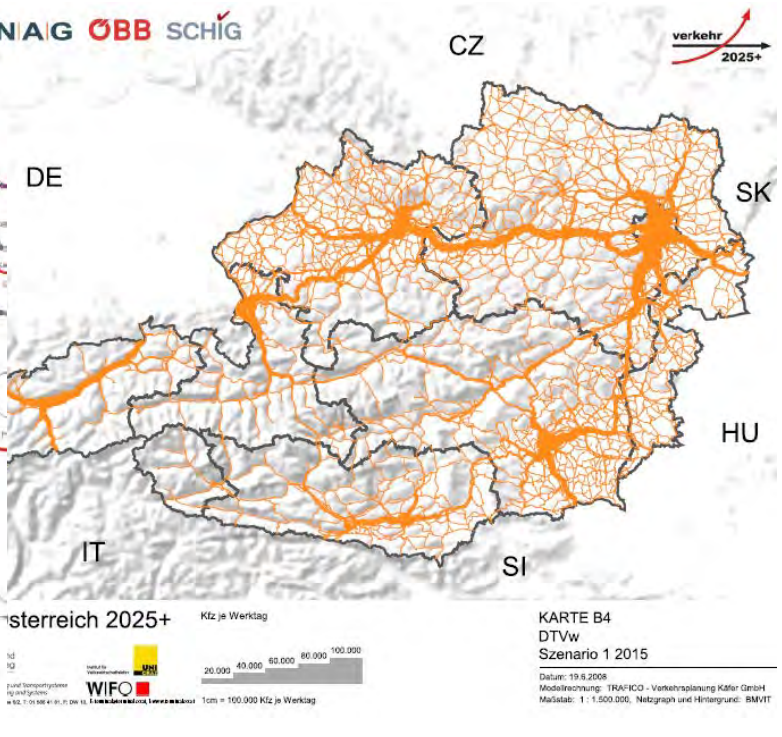
# Data sources: Traffic model data

- road network graph
- traffic demand model
- OD-matrices, differentiated by trip purposes and trip distances etc.
- traffic flows on road network

| Bezirke | | | 10101 | 10201 | 10301 | 10302 |
|---|---|---|---|---|---|---|
| | Name | 305487040.... | Eisenstadt | Rust | Breitenbrunn | Donnerskirc... |
| | 305487040.... | Summen | 51071.464 | 4075.424 | 4701.899 | 3101.508 |
| 10101 | Eisenstadt | 51071.464 | 20923.508 | 526.277 | 219.498 | 500.934 |
| 10201 | Rust | 4075.424 | 526.277 | 1373.599 | 32.055 | 71.694 |
| 10301 | Breitenbrunn | 4701.899 | 219.498 | 32.055 | 1369.548 | 135.689 |
| 10302 | Donnerskirc... | 3101.508 | 500.934 | 71.694 | 135.689 | 701.135 |
| 10303 | Großhöflein | 3418.535 | 864.668 | 15.117 | 4.387 | 10.842 |
| 10304 | Hornstein | 5488.032 | 459.762 | 13.008 | 4.261 | 9.584 |
| 10305 | Klingenbach | 2724.978 | 378.028 | 20.853 | 3.840 | 8.982 |
| 10306 | Leithaproder... | 2096.425 | 128.812 | 2.463 | 1.949 | 4.510 |
| 10307 | Mörbisch am... | 3614.084 | 393.984 | 271.286 | 17.947 | 32.222 |



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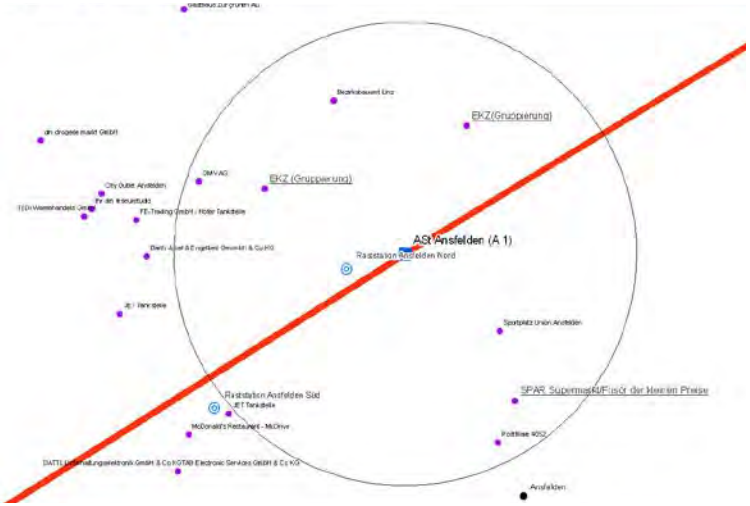
# Data sources: Set of potential locations

**Geomarketing location data:**

- Address-related and georeferenced (XY-coordinates)
- Differentiated by categories/types
- Additional attributes (e.g. customer frequency, parking etc.)
- Area-wide availibility

**Categories/types of locations:**

- motorway service areas
- shopping centers
- retail (e.g. supermarkets, department stores)
- leisure (e.g. cinema, sports facilities)
- etc.



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# Optimization algorithm

## – Objectives and constraints

- Minimize number of locations
- Maximize average profit value
- Coverage OD-relations on global and regional scale (scenarios regarding minimal coverage rate)
- Additional: Coverage of population in urban regions

## – Mathematical problem definition

## – Development of software prototype using exact and heuristic approaches

$$\bigcup_{R \in \mathcal{R}^{\mathrm{M}}} R = V, \; R_1 \cap R_2 = \emptyset, \; \forall R_1, R_2 \in \mathcal{R}^{\mathrm{M}}, \; R_1 \neq R_2$$

$$g * \frac{\sum_{k \in K_R} n_k}{N}$$

$$\{o_k, d_k\} \cap R \neq \emptyset, \; \forall k \in K_R.$$

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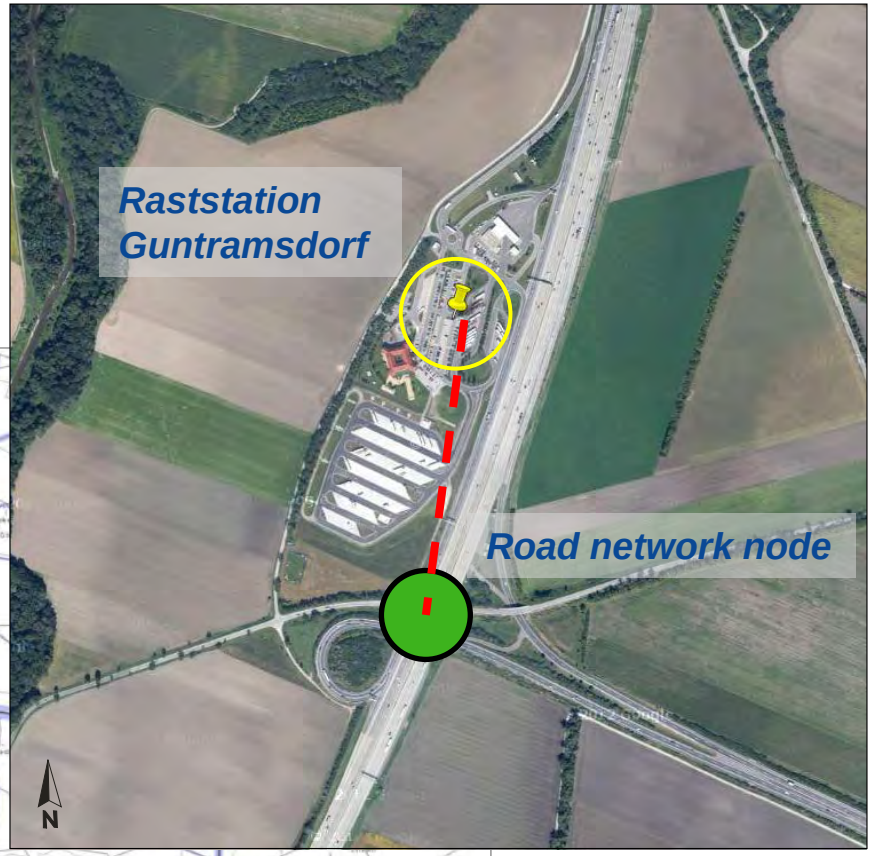
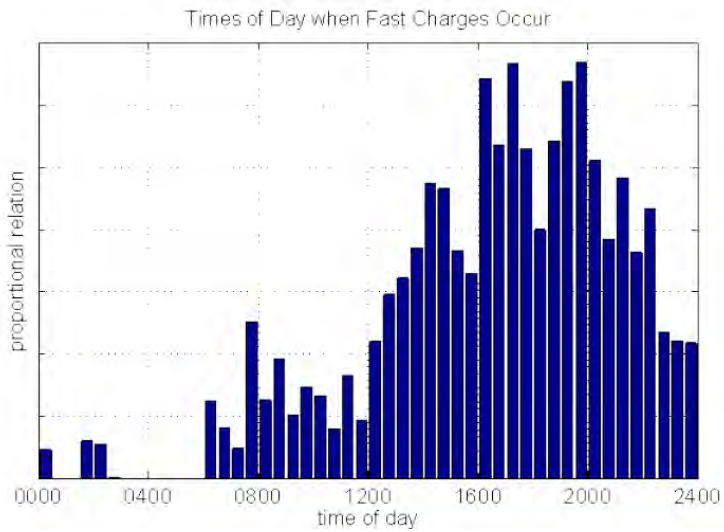
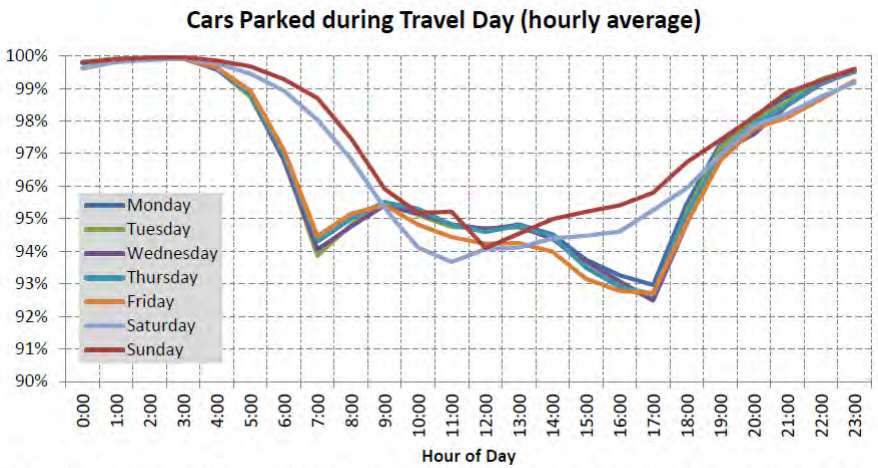
# Optimization algorithm



# Outlook: Capacity analysis

- Analysis regarding required capacity of charging stations (**required number of charging spots**)
- Based on **temporal distribution of traffic demand**
- **Scenarios regarding number of EVs**




Data source: National Household Transportation Survey, 2009. Graph published in: *Assessment of Electric Cars' Range Requirements and Usage Patterns based on Driving Behavior recorded in the NHTS of 2009;* Contact: Rob van Haaren (rv2216@columbia.edu)

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# Thank you for your attention!

**Mag. Bernhard Fürst**

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# The Rapid Charge Network

www.rapidchargenetwork.com

The RCN project is co-financed by the European Union's Ten-T programme.

Co-financed by the European Union
Trans-European Transport Network (TEN-T)

# The development and study of a network of rapid charge points across the UK and Ireland.

Olivier Paturet, Zero Emission Strategy, Nissan Europe

www.rapidchargenetwork.com

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# Electrifying connections across the UK and into Ireland

**74 CHARGE POINTS**

A network of multi-standard charge points across the UK and Ireland.

**THE RIGHT CONNECTIONS**

Linking five seaports and five airports.

**1,100km**

**COVERAGE**

Covering 1,100km of major spine roads.

**4 LEADING MANUFACTURERS**

The support of four major vehicle manufacturers.

The Rapid Charge Network project will support the uptake of electric vehicles by developing a network of 74 multi-standard, interoperable EV rapid charge points. The project is funded by the European Union's Ten-T programme.

This is the first time major car manufacturers have joined forces with Member States, universities and major utilities to deploy a fully multi-standard and interoperable fast charging network.

The project aims to break down one of the major barriers to the uptake of electric vehicles and increase the adoption of electric vehicles along its route.

www.rapidchargenetwork.com

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# Project aims

- establish a pilot network of 74 multi-standard rapid chargers along the European Union's Priority Projects road axes 13 and 26.
- develop a comprehensive strategy with a detailed roadmap, appropriate guidelines and recommendations for the development of an interoperable EV rapid charge network to support other EU countries and cities to develop similar networks.
- test, operate and monitor the use of this pilot network of rapid charge points. This will explore cross-border solutions which meet the needs of both drivers and charge point operators, delivering valuable insights into the feasibility of similar transnational networks.
- disseminate the findings of the study widely locally, nationally and across Europe.



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# Helping EV drivers, drive further

EV owners in the UK and Ireland will be able to drive further, secure in the knowledge that they will never be far from a rapid charge point.

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# The study

## SUPPORTING THE DEVELOPMENT OF INNOVATIVE CHARGING NETWORKS ACROSS EUROPE

**A major part of the project is to support other towns, cities and countries across Europe to develop similar charging networks.**

The Rapid Charge Network project, therefore, will be actively sharing and exchanging information, best practice, recommendations and lessons learnt. Throughout the project, a full research study will be taking place to analyse the introduction, operation and consumer use of the 74 rapid charge points. This study and the subsequent strategy document will aim to inform the roll-out of innovative electric vehicle charging networks across European road networks and encourage the swift harmonization of rapid charge point standards suitable for the future.



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# Timescales

October 2013
**Project officially launched by European Union's *TEN-T Programme***

April 2014
**First Rapid Charge Network points installed**

August 2014
**Driver research begins**

October 2014
**50% of Rapid Charge Network points installed**

December 2014
**All Rapid Charge Network points installed**

June 2015
**Report and Strategy under development**

November 2015
**Report and Strategy launched**

The RCN project is co-financed by the European Union's Ten-T programme
Co-financed by the European Union
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## Industry Partners

NISSAN

BMW

ESB

RENAULT

## Supporting Partners

Zero Carbon Futures

Innovative Transport North East England

Newcastle University



The RCN project is co-financed by the European Union's Ten-T programme

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# FIND OUT MORE

rapidchargenetwork.com

## Co-financed by the European Union

### Trans-European Transport Network (TEN-T)

The Rapid Charge Network project is co-financed by the European Union through the Trans-European Transport Network (TEN-T) programme.

**Project Cost:** €7,358,000

**Percentage of EU support:** 50%

**Maximum EU contribution:** €3,679,000

Energy for generations

Department for Regional Development
www.drdni.gov.uk

# TEN-T International Green Electric Highways

## Deirdre Arthur

**Project Start Date: April 2012**

**Project Completion Date: September 2014**

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# International Green Electric Highways

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## Presentation Outline:

- Setting the scene
  - Europe
  - Ireland
- Project Overview
- Achievements
- Conclusions
- Recommendations
- A Real Experience
- Technical Lessons Learned
- Summary
- Partner Opportunities

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**Energy Supply Risk**

- 55% of all EU Oil imports are for Transport
- 84% of oil for Transport is imported

**Impact on Balance of Payments**

- Oil Imports up to €1 Billion per day

**Renewable Energy Directive**

- 20% of all Energy and 10% of Transport Energy

**Emissions from Transport**

- 30% of total EU $CO_2$ Emissions (2009)
- Target Reduction is 60% by 2050
- Particulate Matter and NOx Emissions in Cities

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# Northern Irish Government Targets / Motivations

- EU Legislation
- UK Governmental Targets
- Northern Ireland Executive Targets

| GHG Emissions | NI Executive Programme for Government |
|---|---|
| Transport = 2nd highest contributor to GHG at 21%<br><br>2020 GHG emissions reduction of 34%<br><br>2050 GHG emissions reduction of 80% | 2025 reduce GHG emissions by at least 35% on 1990<br><br>Over past 4 years transport emissions have reduced by 9% |

**Stormont rewards ecar NI**

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# Irish Government Targets / Motivations

- 10% of Overall Fleet to be electric by 2020, circa 230k vehicles
- EU Targets on emissions
- AFI Directive Guidelines

| 20% reduction in non ETS emissions by 2020 | Fossil Fuels Imports are 10% of all Imports | High Levels of wind available | Small Car Market |
|---|---|---|---|
| Agriculture = 50% Increase = 20%<br><br>Transport = 30%<br><br>Transport needs to reduce to achieve target reductions | €6bn per annum<br><br>99% of transport energy is from imported oil products | Wind Generation = 20%<br><br>Wind Generation Target by 2020 = 40%<br><br>System penetration required = 75% | No indigenous car industry<br><br>No car manufacturing or assembly<br><br>Some high tech auto supply chain business |

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# International Green Electric Highways

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## Key Project Objectives

- Provide understanding of customer attitude to fast charging
- Develop understanding of requirements for a national fast charging infrastructure
- Validation of fast charging technology
- Validation of supporting IT requirements (CPMS & CPPS)
- Trial cross-border roaming capability
- Reduction in emissions
- Input towards development of EU standards
- Validation of Market Model
- Promotion of inter-modality with other low carbon forms of transport

**TEN-T Charger in Belfast used twice as often as non TEN-T Charger in Belfast**

**Cross border EV journeys increased by 15%**

**30% of EV owners using more than nine fast chargers nationwide**

**90% of EV owners view fast chargers as essential to EV driving**

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# International Green Electric Highways

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## Project Start: April 2012

## Project Completion: September 2014

## Before TEN-T

## After TEN-T

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# International Green Electric Highway

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**Official Launch: July 2013, on a rainy day in Dublin…**

**Launched in Dublin Port by Minister Pat Rabbitte, Dept of Energy**

**Barney McGahan, DRD NI and Jerry O' Sullivan, Director of ESB Networks**

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# International Green Electric Highways
# Meet the Team……..

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Project Board: Senan McGrath, Dermot McArdle, Donal Herraghty, Irene Breen, Deirdre Arthur, Sinead Bruton

Project Manager
ESB ecars
Deirdre Arthur

Infrastructure
ESB ecars
John Whelan

IT & Project Support
ESB ecars
Gillian Talbot

Marketing
ESB ecars
Sinead Bruton

Data Analysis
ESB ecars
Mark Daly

**Commercial**
**ESB ecars**
**Andrew O'Connell**

**Infrastructure**
**ESB ecars**
**Joe Mooney**
**Conor Cooney**

**Ops Technology**
**ESB ecars**
**Danny Clinton**

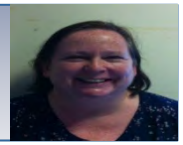
**Marketing**
**ESB ecars**
**Marie O'Donnell**

**Events Manager**
**ESB ecars**
**Conor O'Brien**

ESB NETWORKS

Project Manager
ecar NI
Irene Breen

**ecar NI**
**Project Team**
**Una Kearney**



**ecar NI**
**Project Team**
**David Strain**

**NIE**
**Infrastructure**

Northern Ireland Electricity

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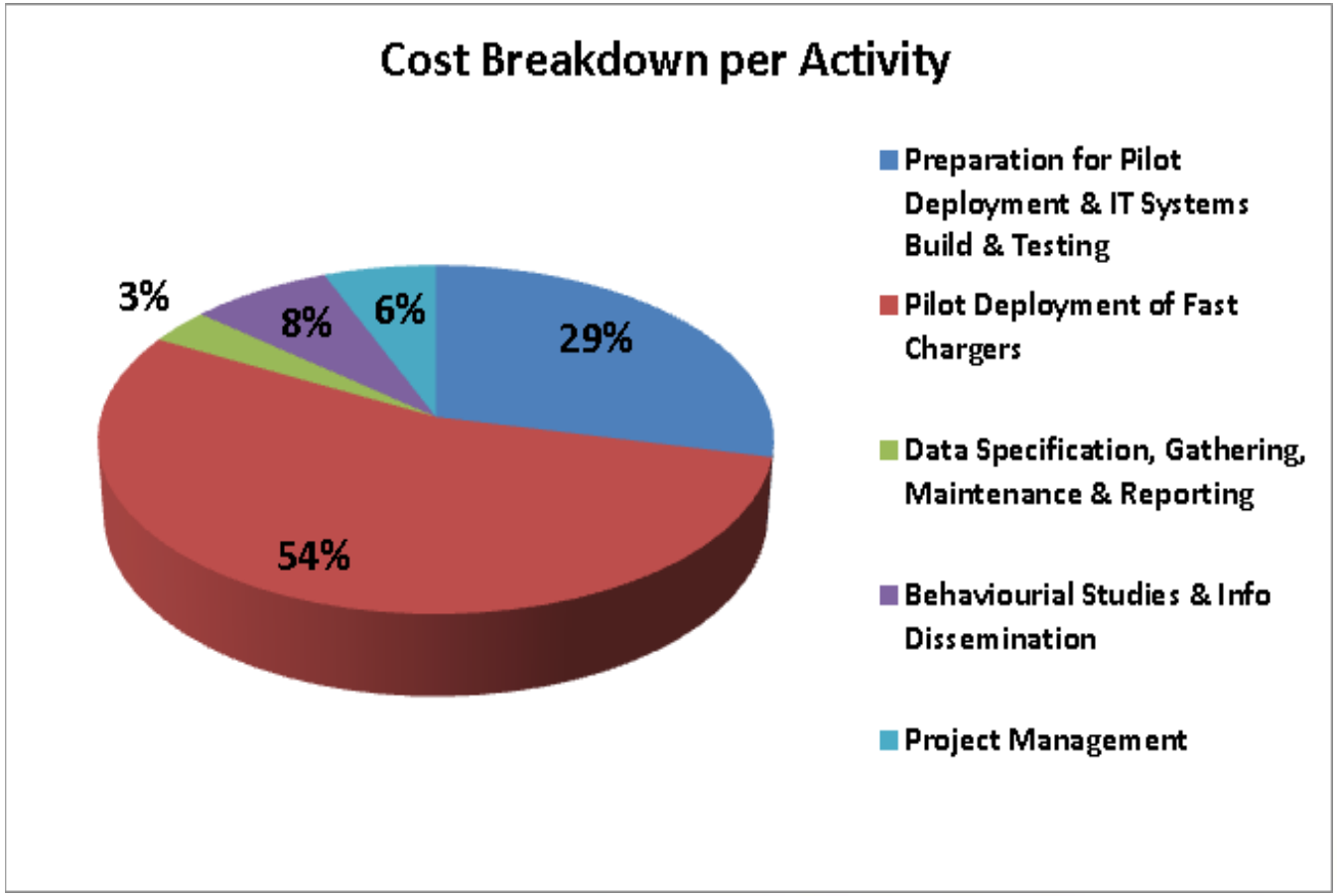
# International Green Electric Highways Budget Breakdown

**Overall Project Budget €4.2m**

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# International Green Electric Highways Achievements

- All Island Coverage – 46 Fast Chargers installed 41 ROI and 5 NI
- 10 Intermodal Sites at Irish Rail Train Stations
- Reduction of 50 Tonnes of $CO_2$ emissions
- Fully Interoperable, cross jurisdictional Charge Point Management System (CPMS)
- Cross border roaming available and used regularly
- Core & Comprehensive TEN-T routes covered
- Increased awareness of EU Co-Funding
- Extensive Media Coverage including National News and Major Print Press

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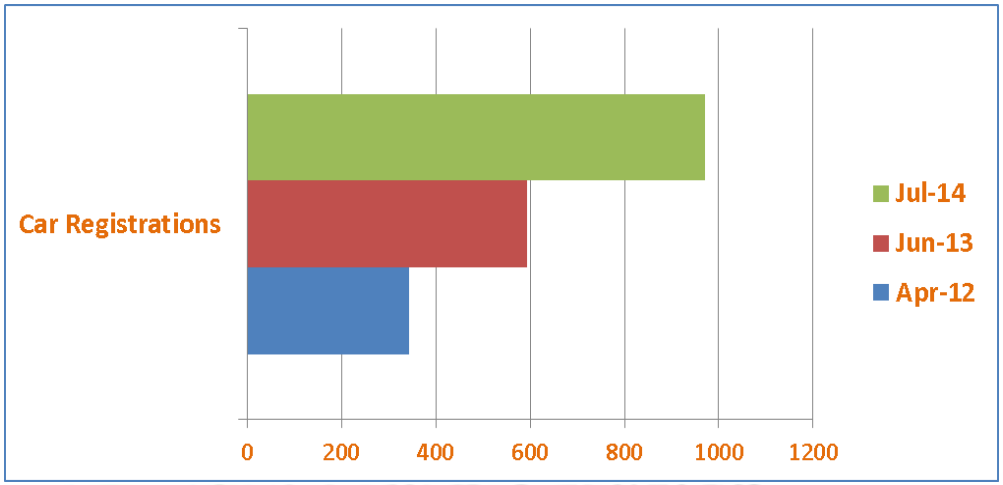
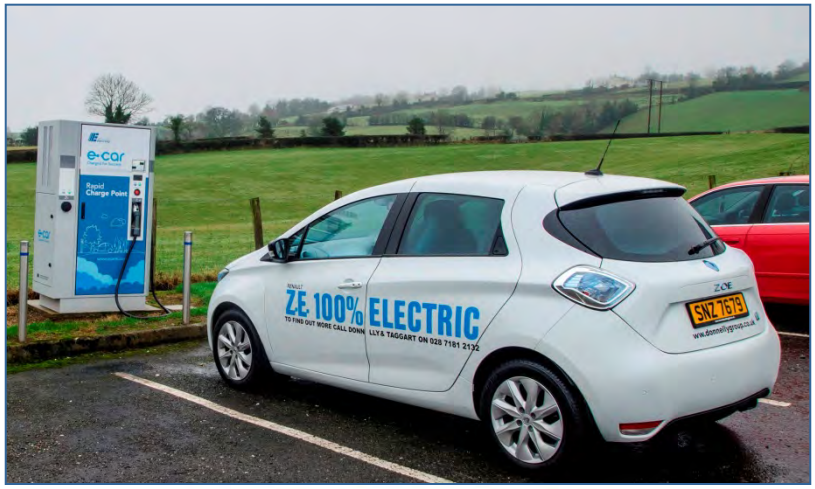
# International Green Electric Highways Conclusions

- Availability of fast charging increases driver distances and expands the range of EVs
- Availability of fast charging has contributed to an increase in EV sales by 183% since April 2012
- Cross border EV journeys increased by 15% over the lifetime of the project
- Nationwide dissemination on all project activities has increased awareness of EU co-funding
- Successful project management was facilitated by regular communications and use of recognised project management tools
- 24/7 customer support utilising the CPMS to remotely manage charging infrastructure increases consumer confidence

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# International Green Electric Highways Recommendations

- **INEA**
  - Location of fast charging infrastructure should be focused on the end user requirements
  - The DSOs have a pivotal part to play in the roll out of integrated infrastructure

- **New EV Projects**
  - Multi faceted approach to host selection, if possible target hosts with multiple sites nationwide – one framework agreement with multiple sites available nationwide or Europe wide
  - Use of an end to end project management system is essential for successful management and delivery of all projects

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# International Green Electric Highways Recommendations

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## New EV Projects

- Continuous and regular communications between project team, project Board, INEA and other major stakeholders is imperative for successful project delivery
- Fully developed Dissemination plan to get the best value for money in terms of public awareness of the project and its co-funding by EU
- Open protocols such as OCPP are an essential part of providing interoperable access to a charging Infrastructure across Europe
- Employment of independent specialist organisations for surveys and data analysis ensures reliable study results

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# International Green Electric Highways
# A real experience!

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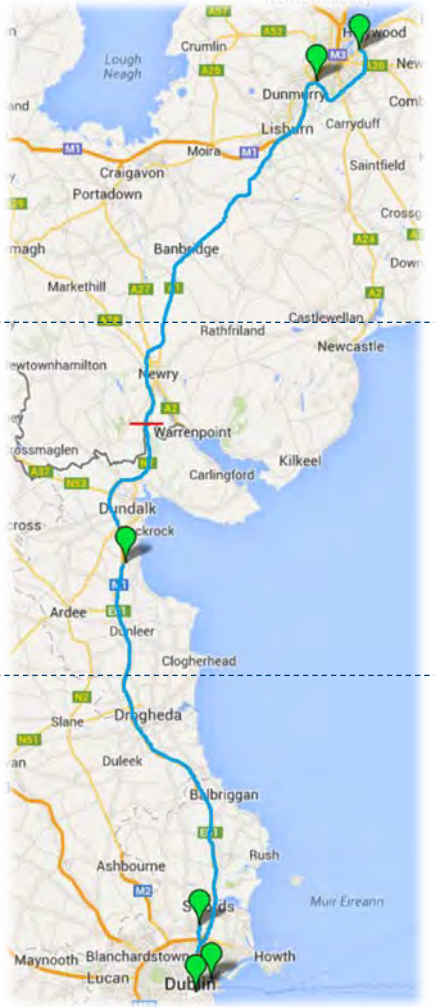


- Collection from George Best Belfast City Airport on 24th June 2014 at 12:50
- Travel 11.5km
- Charge for 30 minutes at TEN-T fast charger in Retail Park in Belfast leaving at 13:50.

- Travel 64.5km and cross border between Northern Ireland and Republic of Ireland
- Travel 26.1km and stop for 30 minute charge at TEN-T fast charger at Castlebellingham Motorway Service Area leaving at 15:40

- Travel 71.8km for inspection of TEN-T fast charger at Dublin Port
- 6.1km to ESB Head Office for meetings
- 15.4km to Dublin Airport on 25th June 2014

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# TEN-T International Green Electric Highways Technical Lessons Learned

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# Pilot Deployment: Lessons Learned

1. Host Contract Negotiations
2. Electricity System Capacity
3. Equipment Delivery
4. On-Boarding – CPMS – Mobile Telecoms Network

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# Pilot Deployment: Lessons Learned

1. Host Contract Negotiations

- ❑ Approach
- ❑ Awareness
- ❑ Attitude
- ❑ Benefits and Risks
- ❑ Legal
- ❑ Ownership of the Site

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# Pilot Deployment: Lessons Learned

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## 2. Electricity System Capacity

- Local Electrical Network feeding arrangements
- Existing Demand on the network
- Impact on the Network
- Feeding Transformer capacity
- Additional Costs and Time

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# Pilot Deployment: Lessons Learned

3. Equipment Delivery

- New Technology
- Standards still Developing
- Number of Suppliers
- Fast Charging for All
- Challenge to Equipment Tender

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# Pilot Deployment: Lessons Learned

## 4. On-Boarding – CPMS – Mobile Telecoms Network

- Latest OCPP Standard
- Whitelist
- Local Mobile Network
- 4G Rollout
- Modem Configuration

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# Pilot Deployment: Lessons Learned

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## Things that Went Well

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# International Green Electric Highways

TEN-T Fast Chargers M1

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# Partner Opportunities

# Hosts & Client Services – Who?

- Motorway Services
- Shopping Centres
- Retail Parks
- Independent Fuel Outlets
- Hotels
- Public Transport Car Parks

  - 24/7 Opening Hours
  - WC / Restrooms Facilities
  - Café Services
  - Safe & Secure
  - Well lit public locations
  - Good phone signal available

# Hosts & Client Services – Why?

- **Host Benefits**
- **Revenue & Value Impact**
  - Increased footfall = Increased sales

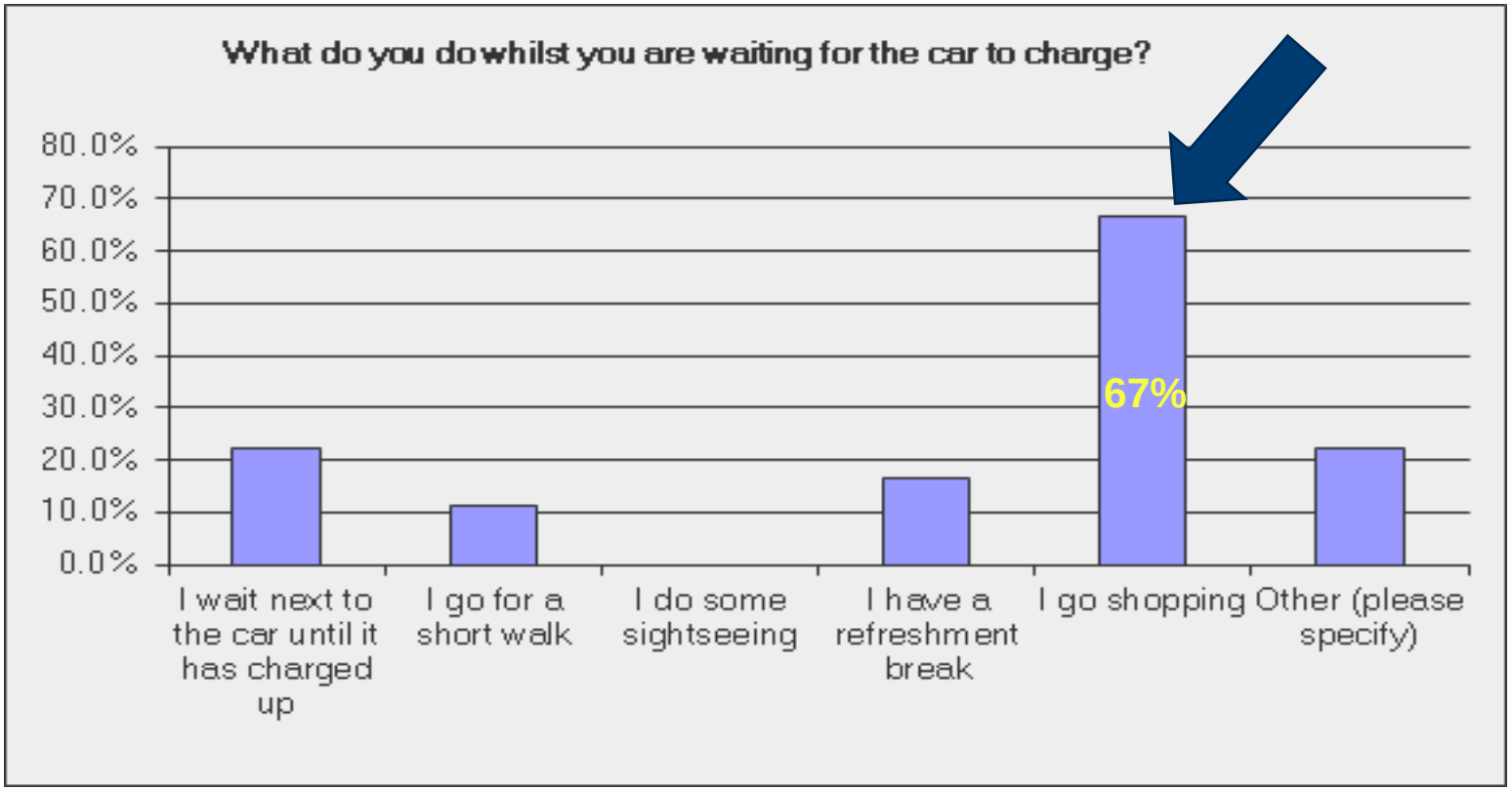
  - Captive Audience for a minimum of 20 minutes
  - Recent Study in UK PiP demonstrates unplanned spend by customer using fast charger is between £11 and £15
  - Include Hosts on ecar map and car GPS system
  - USP Value of having a Fast charger at a host location

# Hosts & Client Services – Why?

- **Host Benefits**
  - **PR & Marketing Value**
  - All fuel types available at one location – one stop shop!
  - Partnering leading edge technology
  - Adoption of new technology
  - Dual branding opportunity
  - Marketing / PR opportunities

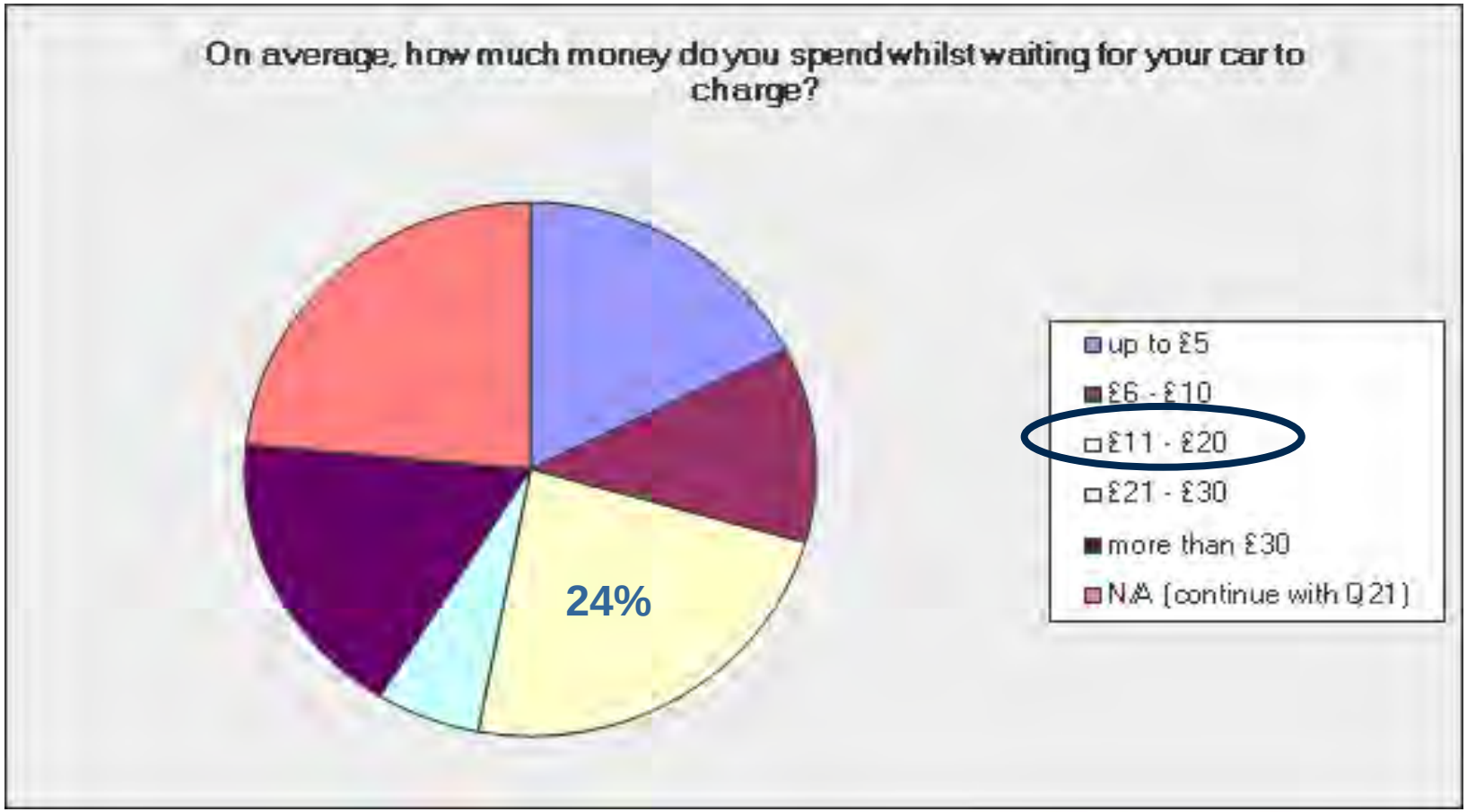
# Hosts & Client Services – Statistics

## What do you do whilst waiting for your EV to charge?



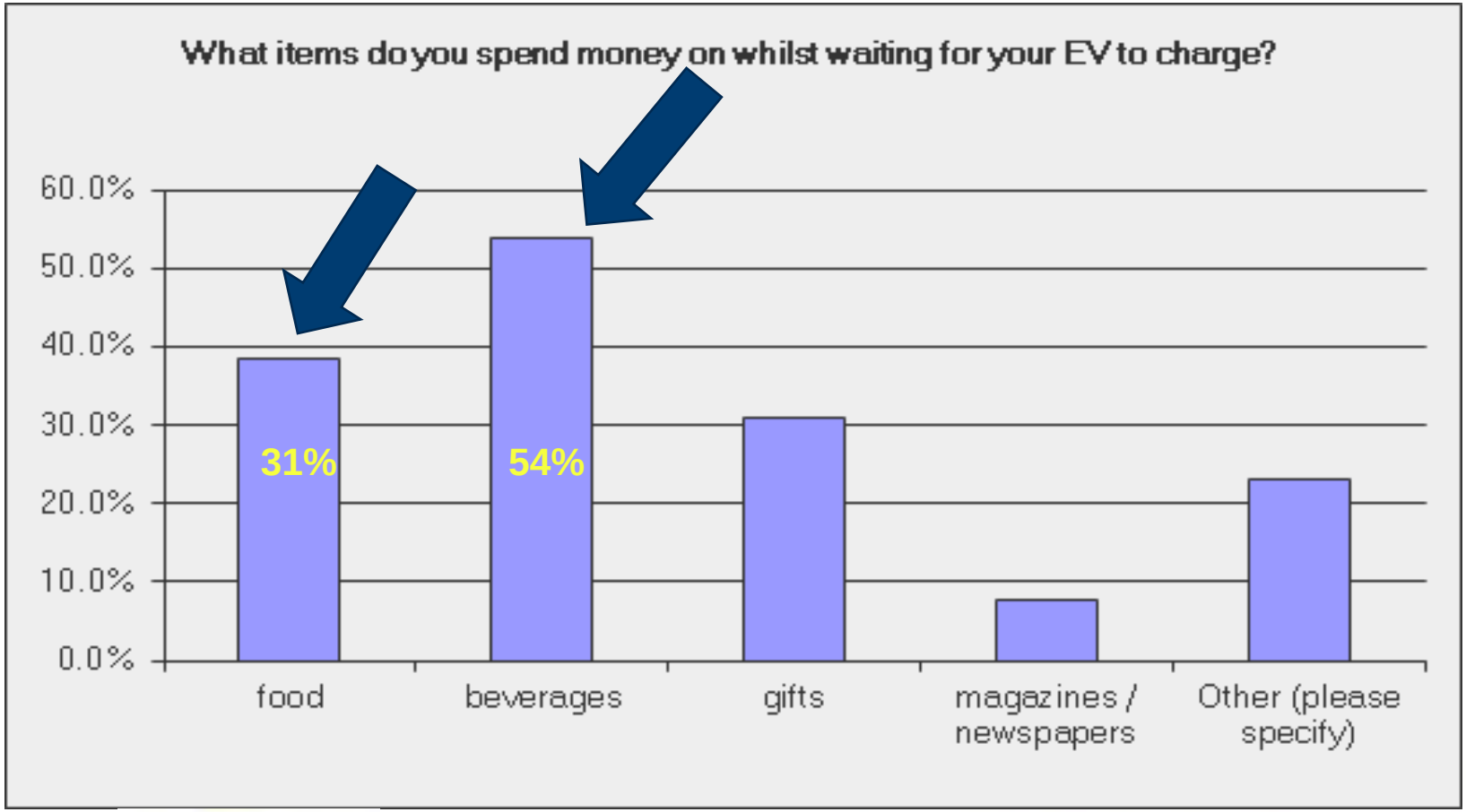
# Hosts & Client Services – Statistics

## On average how much do you spend whilst waiting for your EV to charge?



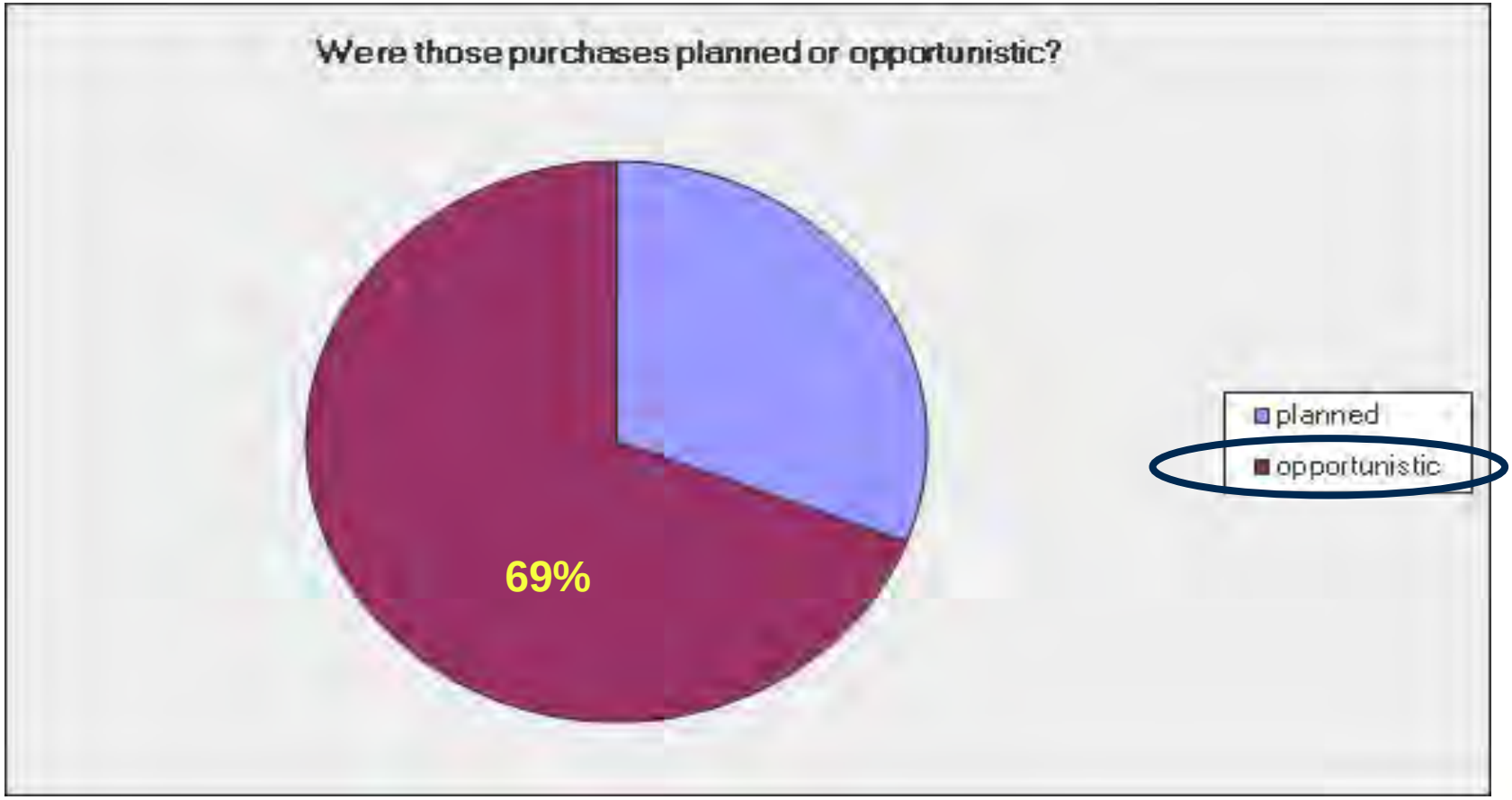
# Hosts & Client Services – Statistics

## What items to you spend money on whilst waiting for your EV charge?



# Hosts & Clients Services – Statistics

## Where those purchases planned or opportunistic?



# Hosts & Client Services - Example

Department for Regional Development www.drdni.gov.uk

ESB Energy for generations

## ❑Host Benefits

❑Customers change habits to avail of Fast charging

**Sample Data at 6th October 2014**

**Park Pointe Retail Park, Dun Laoghaire**

| Park Pointe Retail Park TEN-Charger Dun Laoghaire | Sample Data |
|---|---|
| Date of Service | 28/03/2014 |
| Charging Events | 1,122 |
| Customers | 108 |
| Energy Usage kWhr | 7,313 |

Green eMotion

Department for Regional Development
www.drdni.gov.uk

ESB Energy for generations

# Thank you for listening
# Any Questions????

Co-financed by the European Union
Trans-European Transport Network (TEN-T)

Green eMotion

# Zukünftige Services beim Laden:
# Geht das Konzept „shop & charge“ auf?

**DI Peter Breuss, Direktor Technische Abteilung**
**08.10.2014**

REWE GROUP

# Warum interessiert sich REWE für E-Mobilität?

Mobilität befindet sich im Wandel und REWE hat als Nahversorger eine besondere gesellschaftliche Verantwortung.

***Visionäres Ziel:***
***„E-Mobilität als fester Bestandteil der zukünftigen Kundenlogistik“***

Alternative Mobilität für die Mitarbeiter und Kunden leben und dabei sowohl meinungsbildend wirken, als auch Umsatz generieren.

- Umweltschonende Mobilität und $CO_2$-Einsparung
- Verbesserte Rahmenbedingungen für E-Auto-Nutzer
- Weniger Verkehr und bedarfsorientierte Mobilität

# Was hat REWE seit 2010 umgesetzt?

## *Ladestationen (Stand Anfang 2014):*

**20 frei zugängliche Ladestationen**

**3 Ladestationen in der Zentrale**

**12 SMATRICS Ladestationen**

# Was hat REWE umgesetzt?

## *E-Autos und deren Nutzung*

**Pool-Autos**

**Nutzfahrzeug für EDV**

**CarSharing am Flughafen**

**Fahrgemeinschaften**

# Was hat REWE umgesetzt?

## *Impuls-Projekt: EMIL*

Seit 2012 Carsharing in Salzburg, ausschließlich mit E-Autos, gemeinsam mit Salzburg AG

- ✓ 18 Autos
- ✓ 13 Ausleih-Stationen

EMIL
DAS E-MOBIL ZUM AUSLEIHEN

REWE GROUP & Salzburg AG

# Welche Erfahrungen hat REWE gemacht?

## *Ladestationen*

Wenn ein Service bzw. Infrastruktur angeboten wird, muss dies zuverlässig verfügbar sein …

**→ daher Kooperation mit SMATRICS:**

- ✓ Moderne Ladestationen, wo in kurzer Zeit ausreichend geladen werden kann
- ✓ Sicherstellung der Funktionalität
- ✓ aber Zugang nur mit Karte und FlatFee

**Reaktionen der Kunden:**

***Davor:***

- ➢ Begeisterung über die kostenlose, barrierefreie Lademöglichkeit
- ➢ Probleme mit nicht funktionierenden Ladestationen

***Danach:***

- ➢ Nicht noch eine Karte für‘s Laden!
- ➢ Warum nicht mehr kostenlos?

**Akzeptanz der Kunden ist durch Erklärungen leicht wieder zu erlangen, aber:**
Es muss für den Kunden egal sein, zu welchem Provider er gehört, d.h., wenn er jede benötigte Ladestation leicht nutzen kann (einfacher Zugang und unbürokratische Abrechnung bzw. Roaming), dann ist er auch bereit, diese Leistung zu bezahlen.

# Welche Erfahrungen hat REWE gemacht?

## *E-Autos*

Akzeptanz ist erst gegeben, wenn E-Autos „vollwertig“ sind, keine ausgelieferten Prototypen.
Wenn die Qualität (Komfort, Sicherheit) des fossilen Fahrzeugs erreicht wird und die E-Auto-Features noch dazu kommen, dann fällt der Umstieg leicht.

- ✓ Poolfahrzeuge Zentrale:
  Motivation für Nutzung ist mit vollwertigen E-Autos gestiegen
- ✓ EMIL Carsharing:
  Deutlich bessere Auslastung der moderneren E-Autos im Vergleich zu den Vorgänger-Modellen.

**Fuhrpark – Dienstauto:**
Neben den üblichen Ängsten wie Reichweite und lange Ladezeiten hemmt der unveränderte Sachbezug für das teurere E-Auto die Bereitschaft, umzusteigen.

# Shop & Charge?

## Status heute:

- Direkte Rückmeldungen von Kunden nur ganz vereinzelt, dann aber meist positiv.
- Synergien zwischen Laden und Einkaufsverhalten wahrscheinlich gegeben, aber nicht nachweisbar.
- Derzeit kaum Erfahrungen mit Zusatzangeboten, da der Kundenkreis viel zu klein ist, um die Auswirkungen überhaupt erkennen zu können.
- Daher auch noch keine breit angelegten Angebote und Services, die auf E-Mobilität zugeschnitten sind.

## Entwicklung in Zukunft?

Bei größerer Durchdringung mit E-Autos sind eigene Aktionen für E-Auto-Nutzer denkbar, z.B.

- Reduzierte Lade-Tarife für Kundenclub-Mitglieder
- Limitierte Angebote des LS-Betreibers für Kundenclub-Mitglieder
- Einlösen von Bonus-Punkten für E-Mobilitätsthemen
- …

# Learnings

## Wer lädt wo?

- Langsamladung bedeutet lange Verweildauer am Parkplatz, passt nicht zum Lebensmittelhandel
- Beschleunigte Lademöglichkeit passt zu den kurzen Verweilzeiten im Geschäft, ABER
  damit schließt man viele Pioniere aus (Schuko-Dose erforderlich!)
- „Zapfhahn“ statt eigenes Kabel erhöht den Komfort für den Kunden und kann ev. die Stecker-Thematik entschärfen

## Standorte:

Nur jene Parkplätze mit Ladestationen versehen, wo sichergestellt werden kann, dass genug Platz ist, ansonsten Verärgerung aller Kundengruppen:

- Leere, für E-Autos reservierte, Parkplätze missfallen den konventionellen Fahrern
- Von fossilen Autos zugeparkte Ladestationen verärgern E-Auto-Nutzer

Kurzsichtige Landesverordnungen bezüglich hoher Anzahl von zwingend vorgeschriebenen Ladepunkten werden diesen Konflikt verschärfen.

## Wo sind die Prioritäten für den E-Auto-Nutzer?

### Dort, wo…

- die Lademöglichkeit zu seinem Fahrzeug passt
- er einen einfachen Zugang zu **jeder** Ladestation hat
- Roaming und einfache Abrechnung eine Selbstverständlichkeit darstellen
- …

Erst dann werden Mehrwertangebote wirksam und signifikant.

**Wir sehen diesem Zeitpunkt erwartungsvoll entgegen und werden uns zeitgerecht mit passenden Services einstellen!**

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