Practical issues with implementing smart charging

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CTO Emerging Technologies

Energy in Motion

Introduction

- A quick introduction to Narec, Charge Your Car and Enevate
- Why do we need to consider smart charging techniques?
- Electric Vehicle charging technology:
  - Where we are now in the UK
  - Where we need to be for effective Smart Grids integration
- Case study: The North East's Plugged in Places project

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What is Narec?

- Narec is an independent, cross-disciplined R&D platform
- Mission: Enable energy industry to advance technology in order to reach sustainability
- How: By supporting the design, deployment, testing and commercialisation of sustainable energy technologies

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north east england

North East England: Plugged in Places

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- The project to install electric vehicle charging points across North East England
- Part of a national programme funded by the Office for Low Emissions Vehicles
- With the aim of creating a comprehensive charging infrastructure within 3 years (until March 2013)
- North East England now has almost 400 charging points installed made up of a mix of quick, standard and home charging points – more than any other region in the UK
- The project also sets out to advance common standards in charging infrastructure
- And help research and understand EV driver behaviour
- The project also operates www.chargeyourcar.org.uk giving access to the charging points to members

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Work Packages and Actions

Electric Vehicle Technology

- Supply chain analysis
- Instruments to develop strong supply chain

Sustainable Energy Supply Infrastructure

- Knowledge building
- Transnational consultation and research
- Tool kit development and evaluation

Market Drivers and E-Mobility Concepts

- Define integrated sustainable E-Mobility concepts
- Market analysis of user acceptance
- Scenario building
- Developing support instruments

Pilots

- Analysis of EV Pilots in NWE
- Implementation of ENEVATE findings in regional pilots
- Finalising guidelines and lessons learned

Enabling / Innovation Accelerator

- Creation of E-Mobility road map and policy recommendations
- Stimulation and active coaching of EV supply chain
- Facilitate acceleration of E-Mobility innovation
- Implementation of training programs

Accelerating E-Mobility

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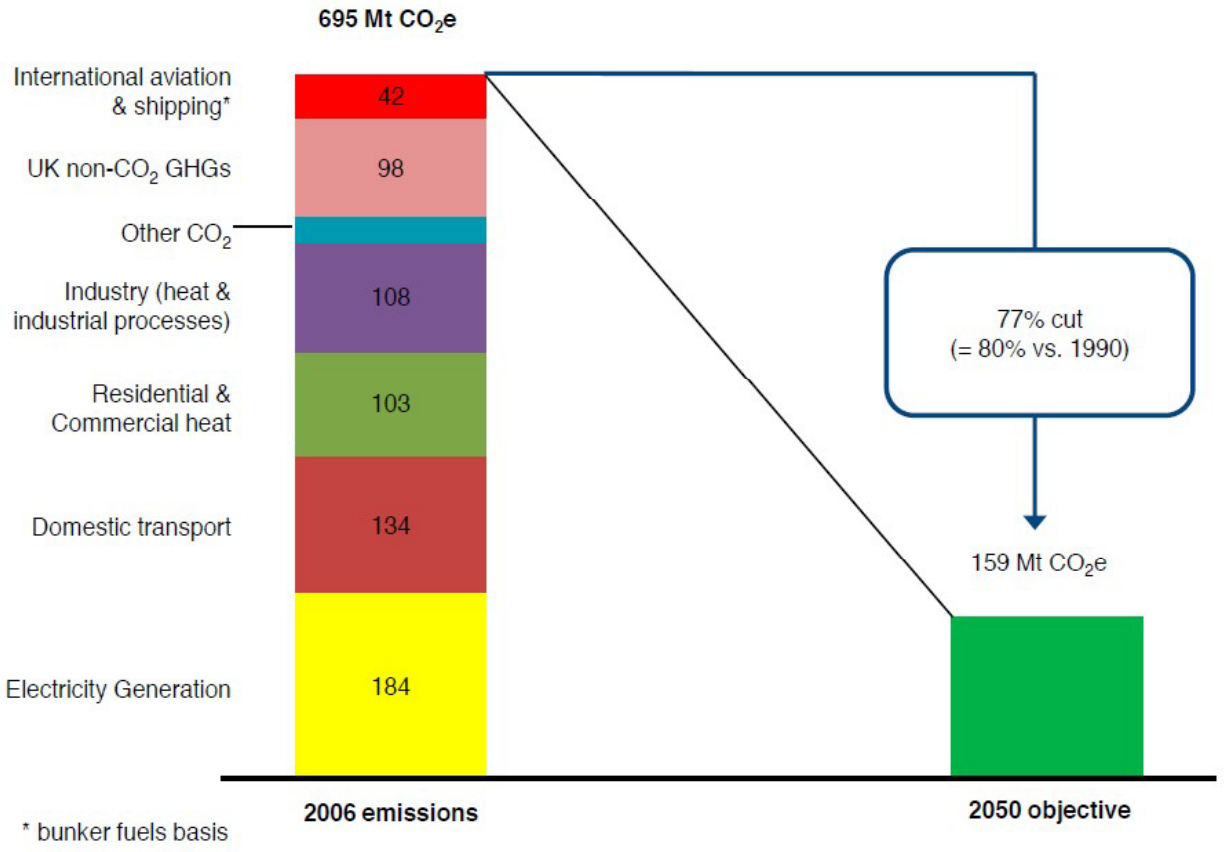
The challenge is to meet the UK GHG targets:



Source: UK National Atmospheric Emissions Inventory (2008).

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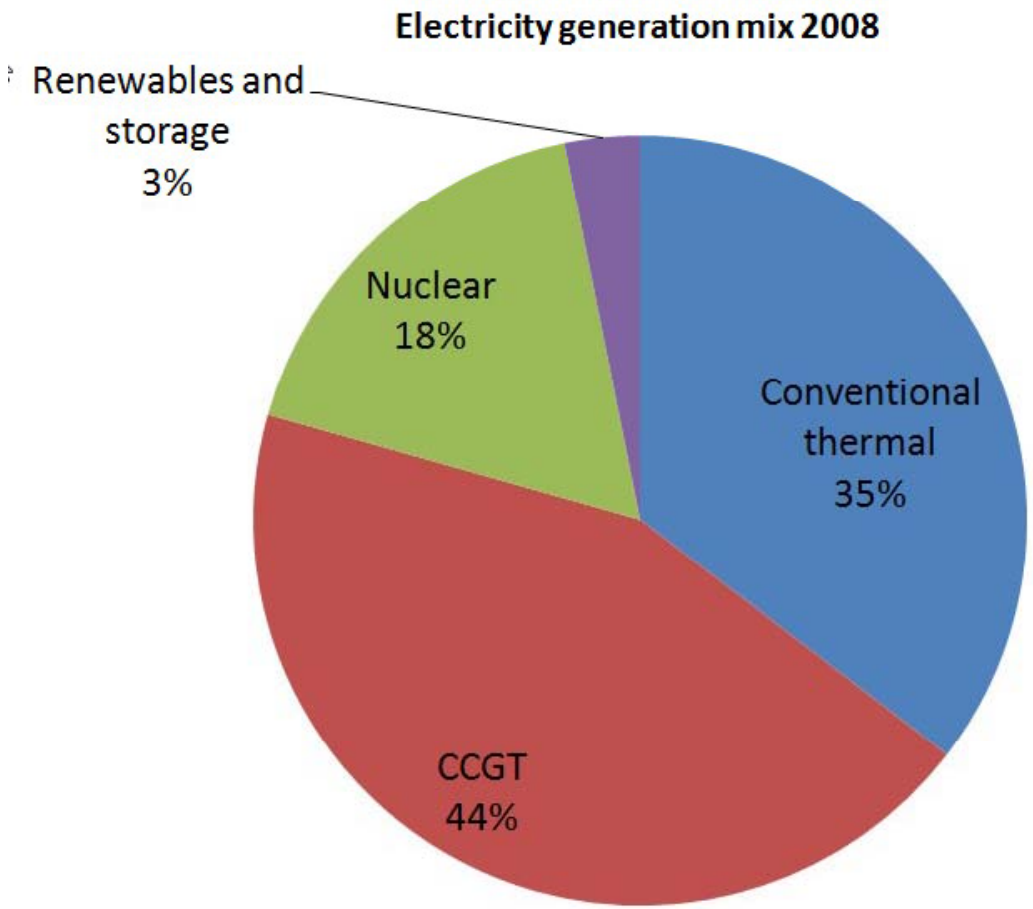
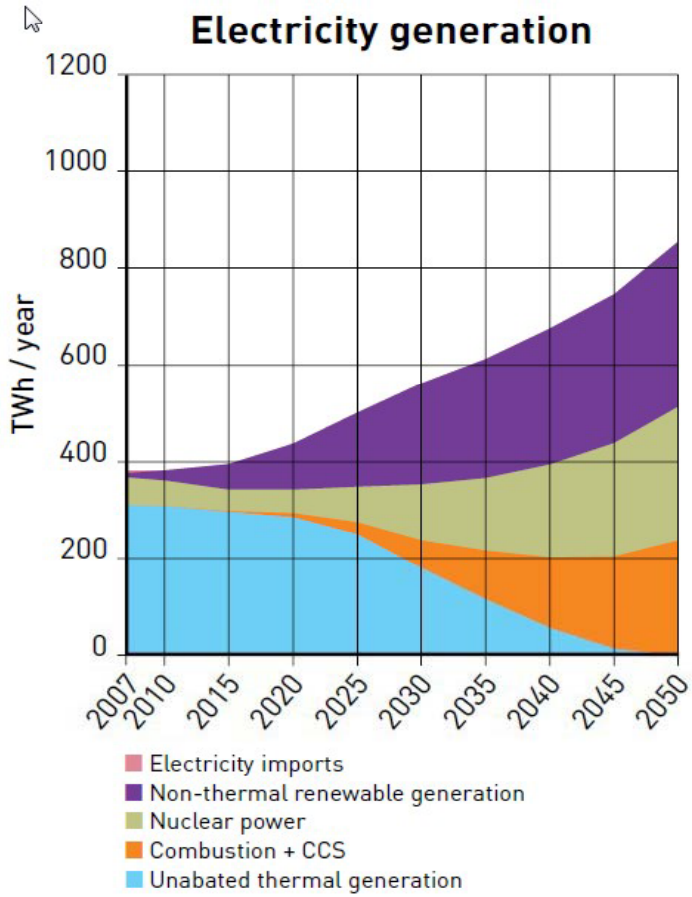
Mobility and the home - today



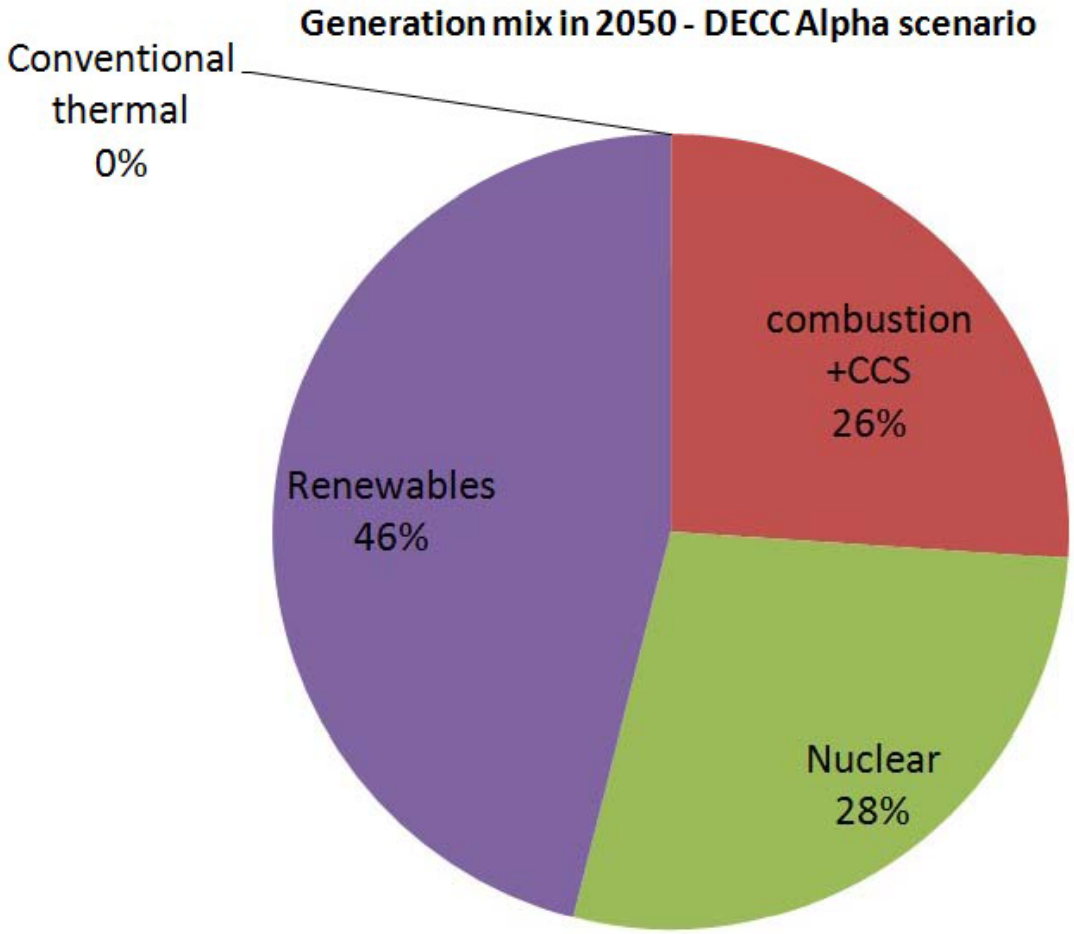
Electricity generation – future

- Alpha scenario – largely balanced effort from:
  - Conventional thermal with CCS
  - Nuclear
  - Renewables
- Doubling of demand



Source – DECC – pathways analysis report

Mobility and the home - future



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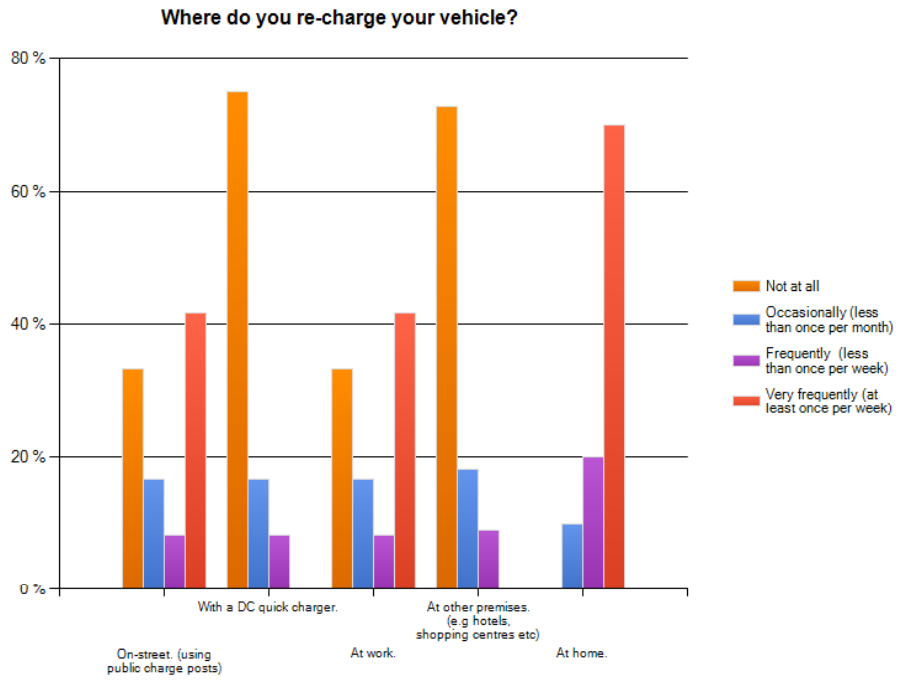
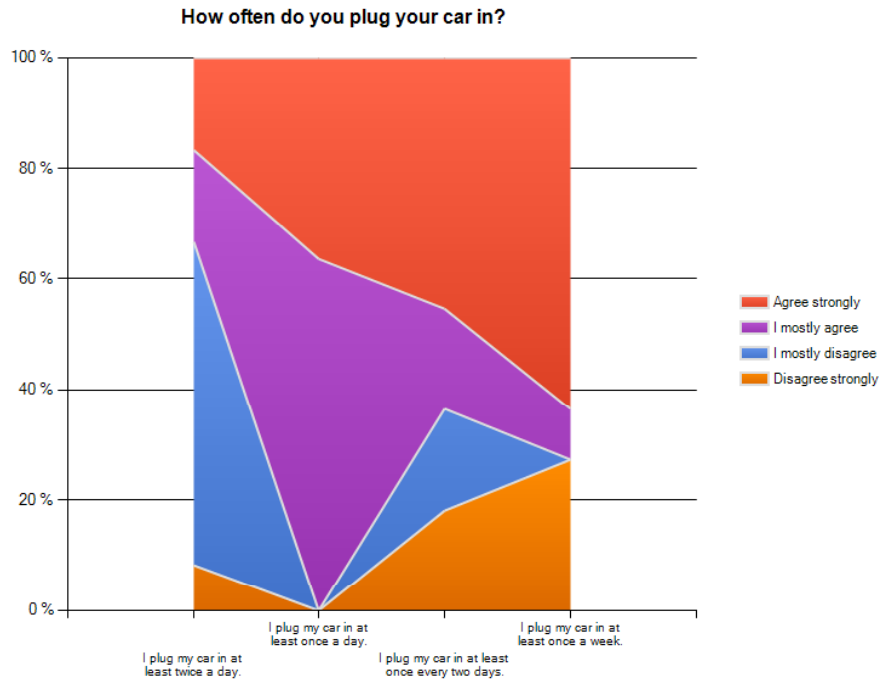
So where do people usually charge their cars?

Most charge at home



Most charge daily



Source - Survey of vehicle users in the NE PIP area

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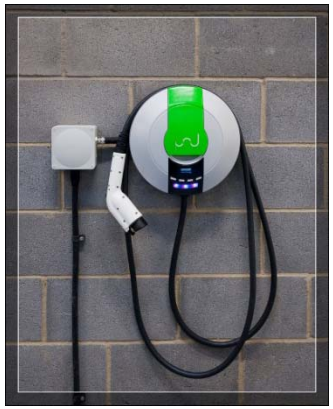
Vehicle charging

- Two main classes:
  - Publicly accessible, multi user charging:
    - Workplaces
    - Car parks
    - Streets
  - Private user charging:
    - Homes and dwellings
    - Private car parks

"domestic charging"



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Vehicle to charge post communications

- UK position:
  - Current EV charging infrastructure has no smart grid functionality enabled.
  - Some basic issues; yet to get agreed standard on plug for mode 3 capability (first step)
  - Domestic smart-meters in trials are not yet EV enabled

Mode 1 (2), "traditional" 3-pin plug

Mode 3, type 2, "Mennekes" plug

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Charge point communications

Public charge point

- In general GSM to the "back office"
- In poor signal areas IP can be used over a LAN.
- Presently, metering is carried out as a separate function
  - In the North East it is separate from the charge point, even though the charge point has a meter in it!

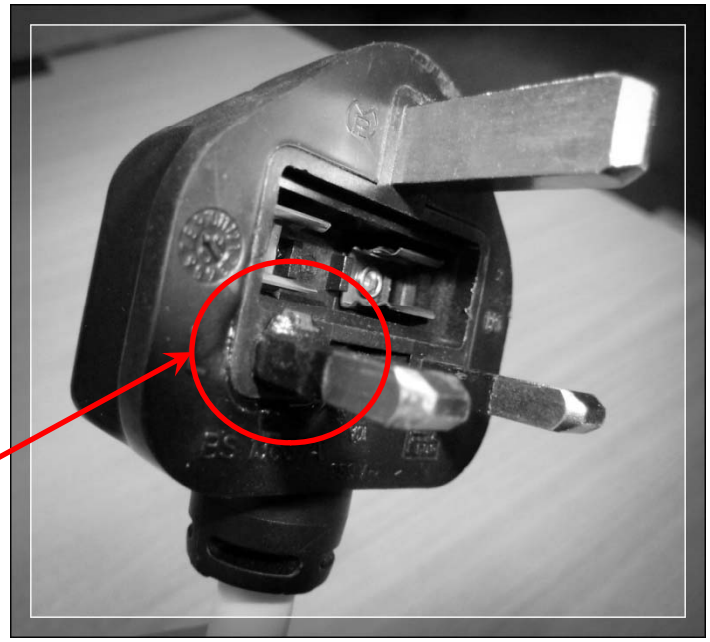
Domestic charge point

- No communications installed at present
- Some trials of smart meters but functionality limited to:
  - Maximum power curtailment
  - User informatics
  - Feedback to utility
  - Some single load switching which could be used to prevent peak time operation of EV charge point

Domestic charging challenges - short term

- Low levels of EV penetration:
  - Local connection reinforcement
  - Metering
  - Standards
  - Safety
  - Education

Current focus areas



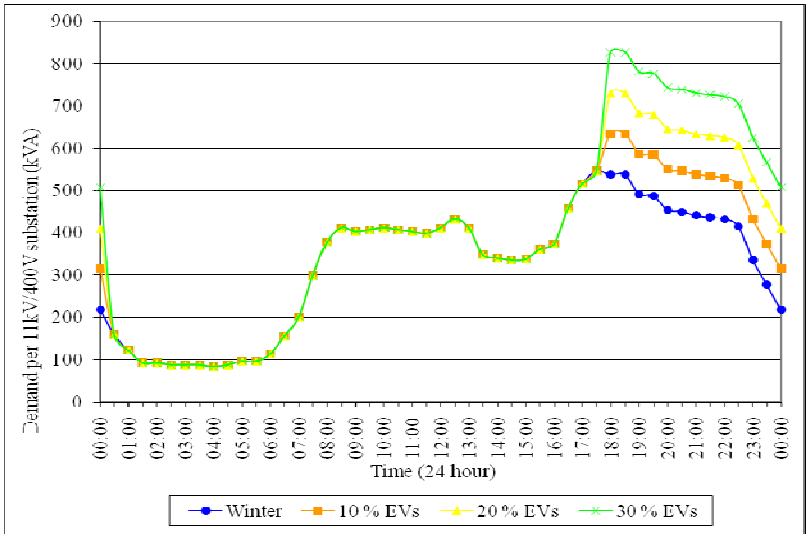
Damage to BS1363 plug due to use in EV charging
Source: ESB

Focussing on issues with domestic vehicle charging?

- Location and type of load is unique
  - Long duration of operation
  - Outdoor connections
  - Relatively high power
  - Plug in time will typically coincide with evening peak demand

Domestic challenges - medium term

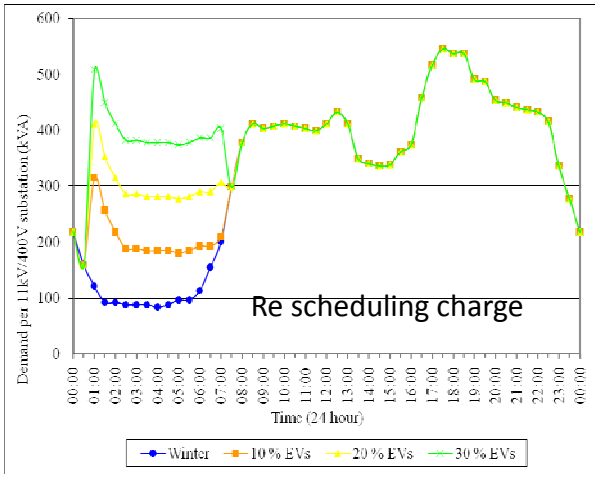
- Increased levels of EV penetration:
  - Localised impact of large numbers of domestic chargers
  - Combined impact of EV chargers with embedded generation
  - Smart meter/grid integration
  - Provision for customers without off-street facilities
    - Dedicated posts?
    - Inductive pads?

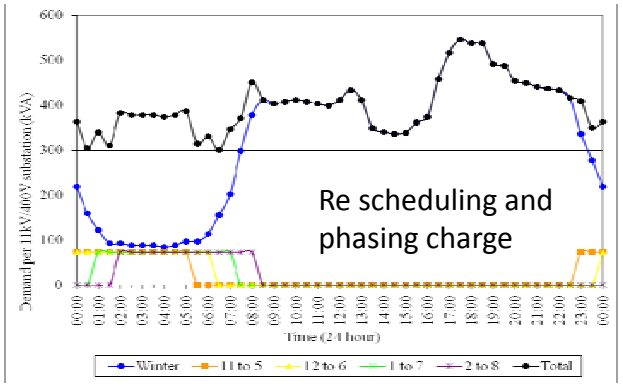


Source : Impact of Electric Vehicles on Power Distribution Networks G.A. Putrus et al.

What's needed

- Communications between charge point, smart meter and energy provision services
- Vehicle centric control of charge process
  - Price signals (especially for V to G)
  - Local constraints
  - Consideration of local generation/loads
  - Car must be ready to roll when needed
  - Asynchronous charging to avoid peaks





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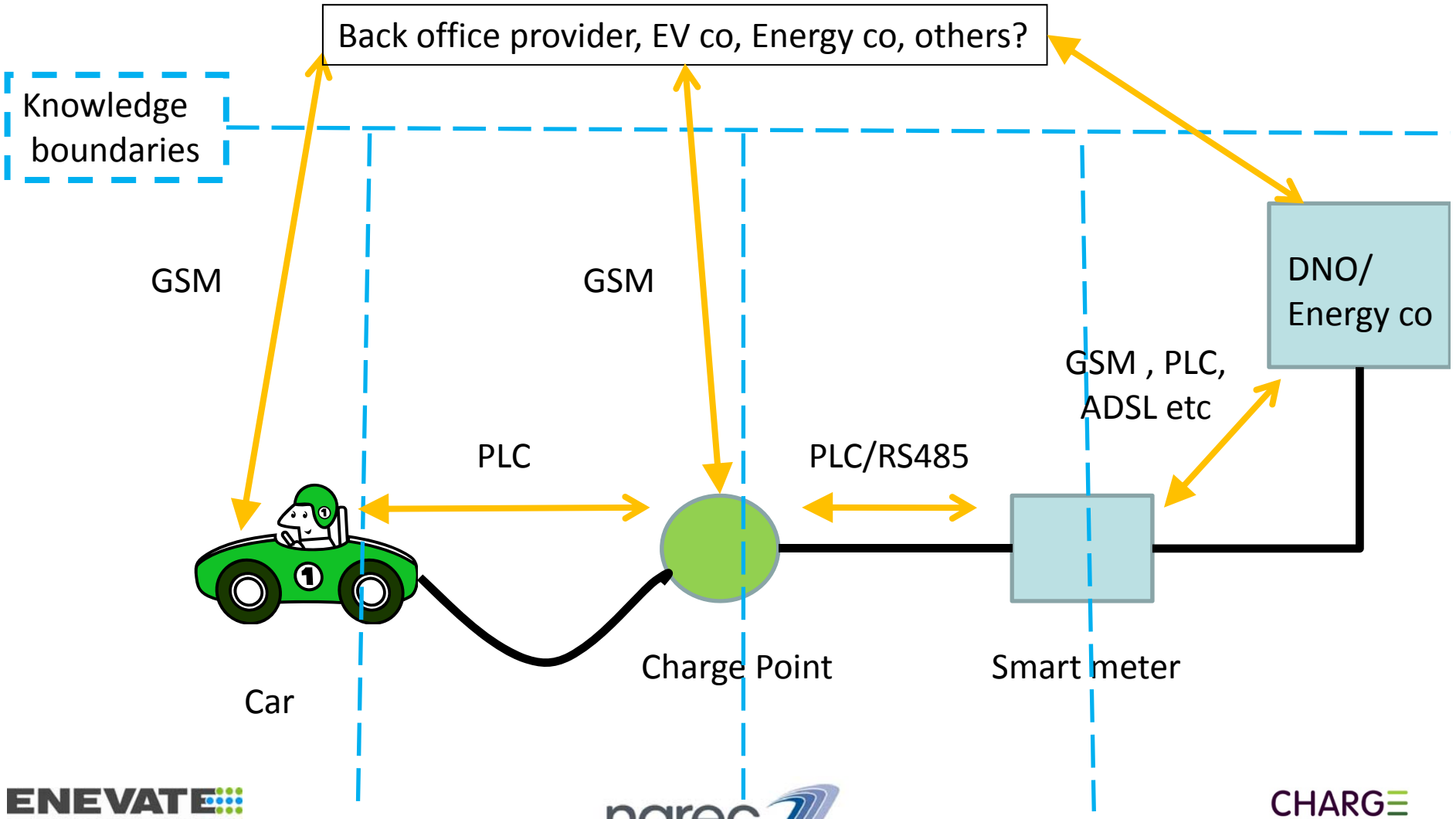
Local Information Paths



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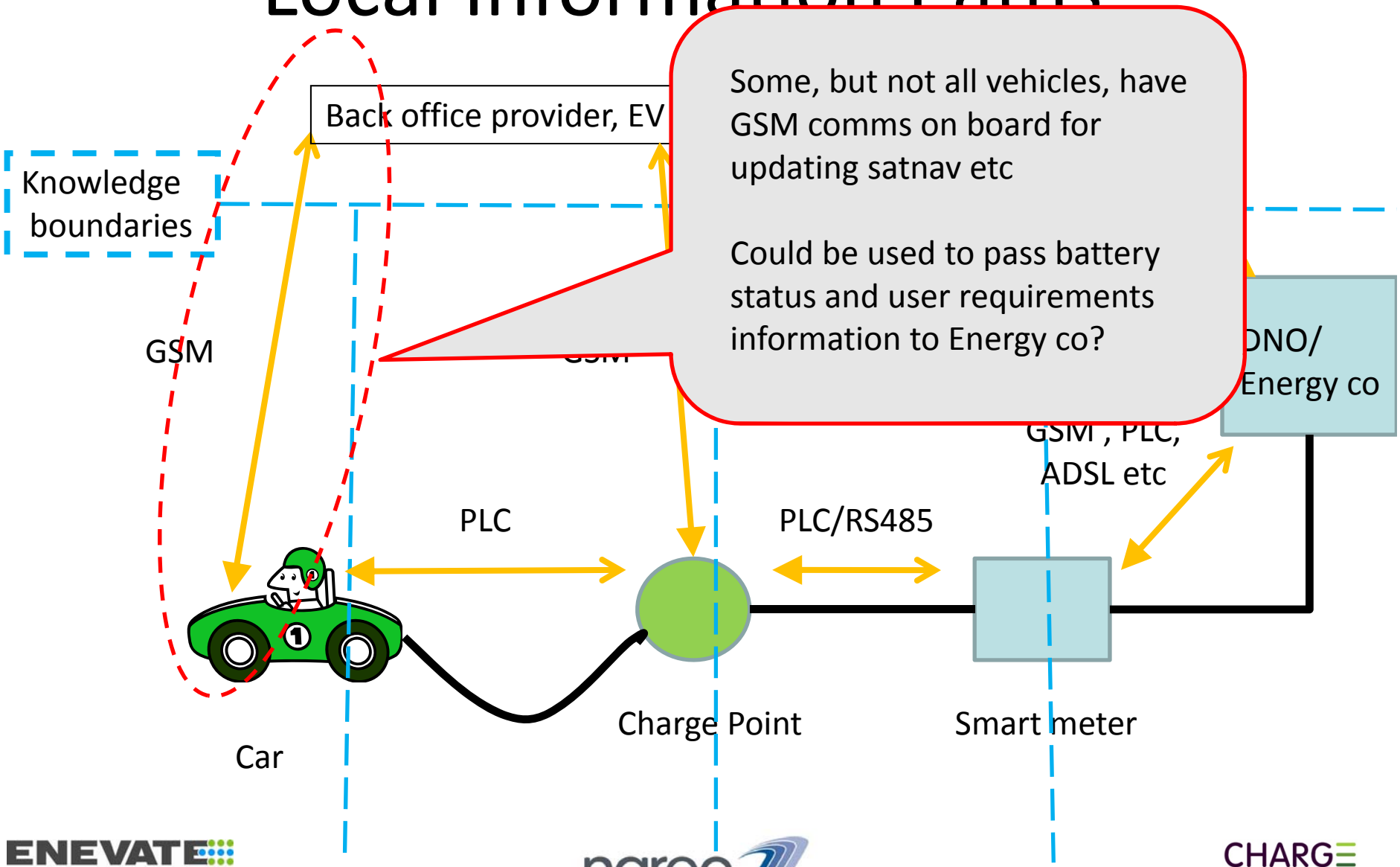

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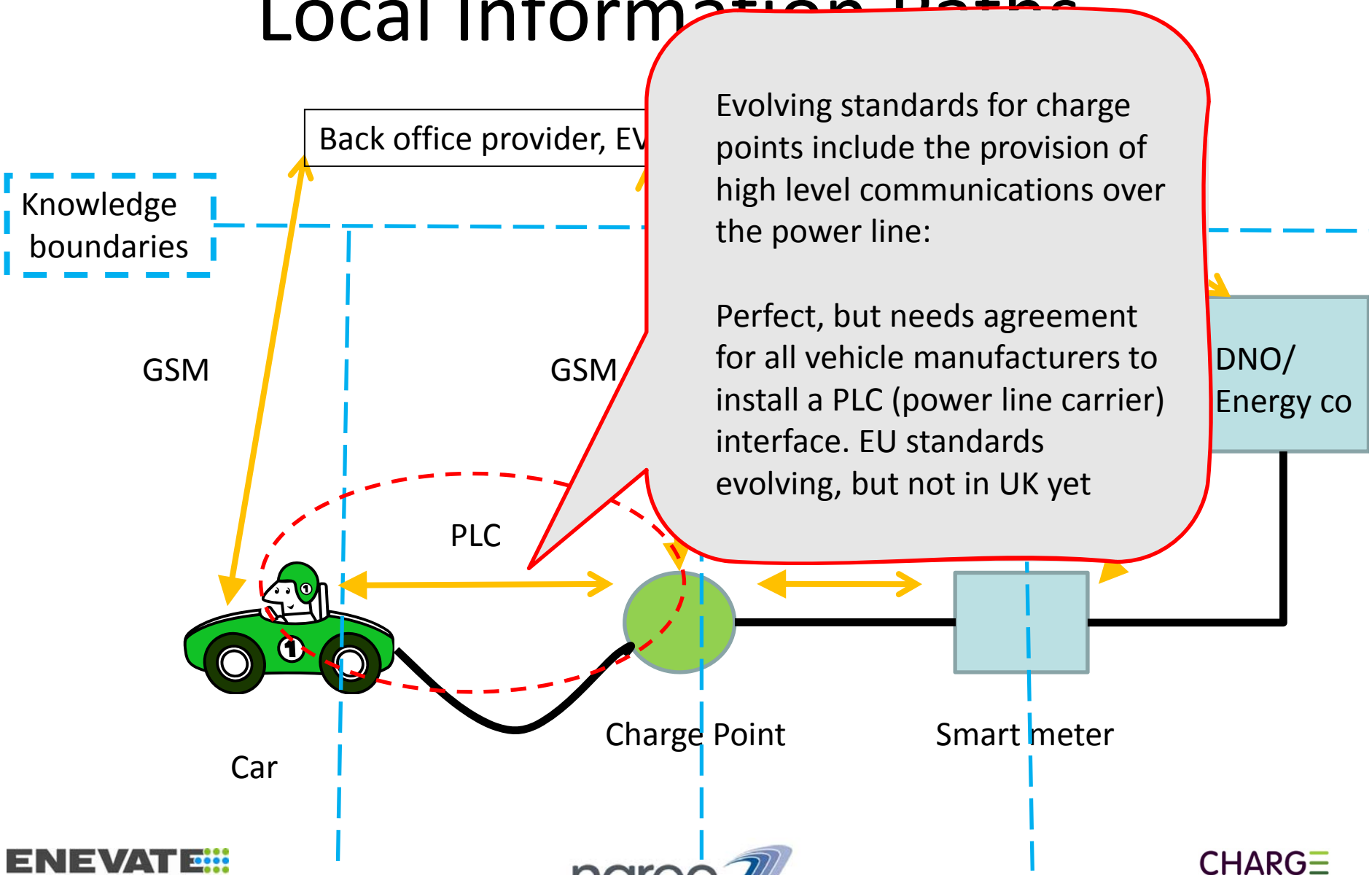
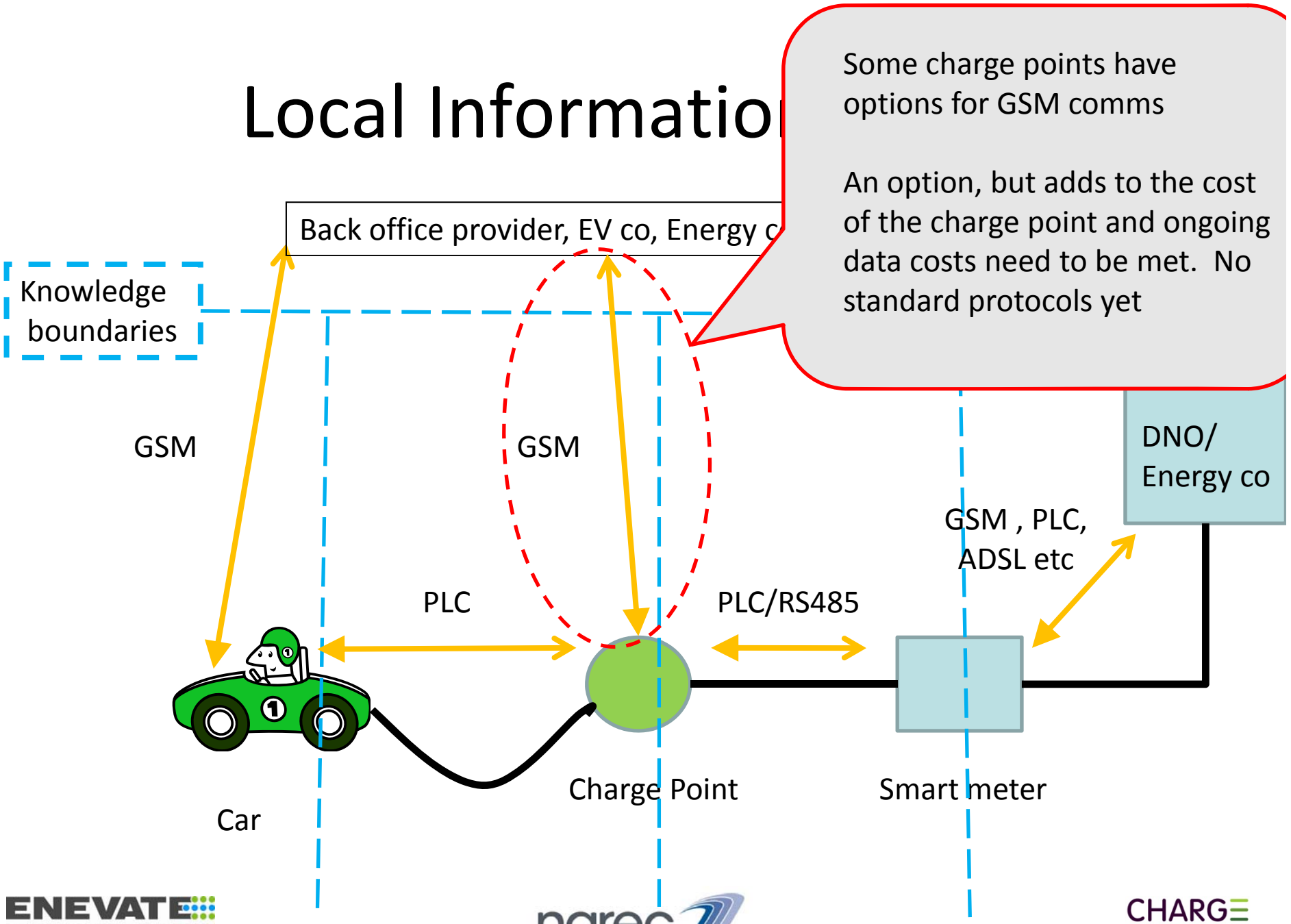


Local Informatio



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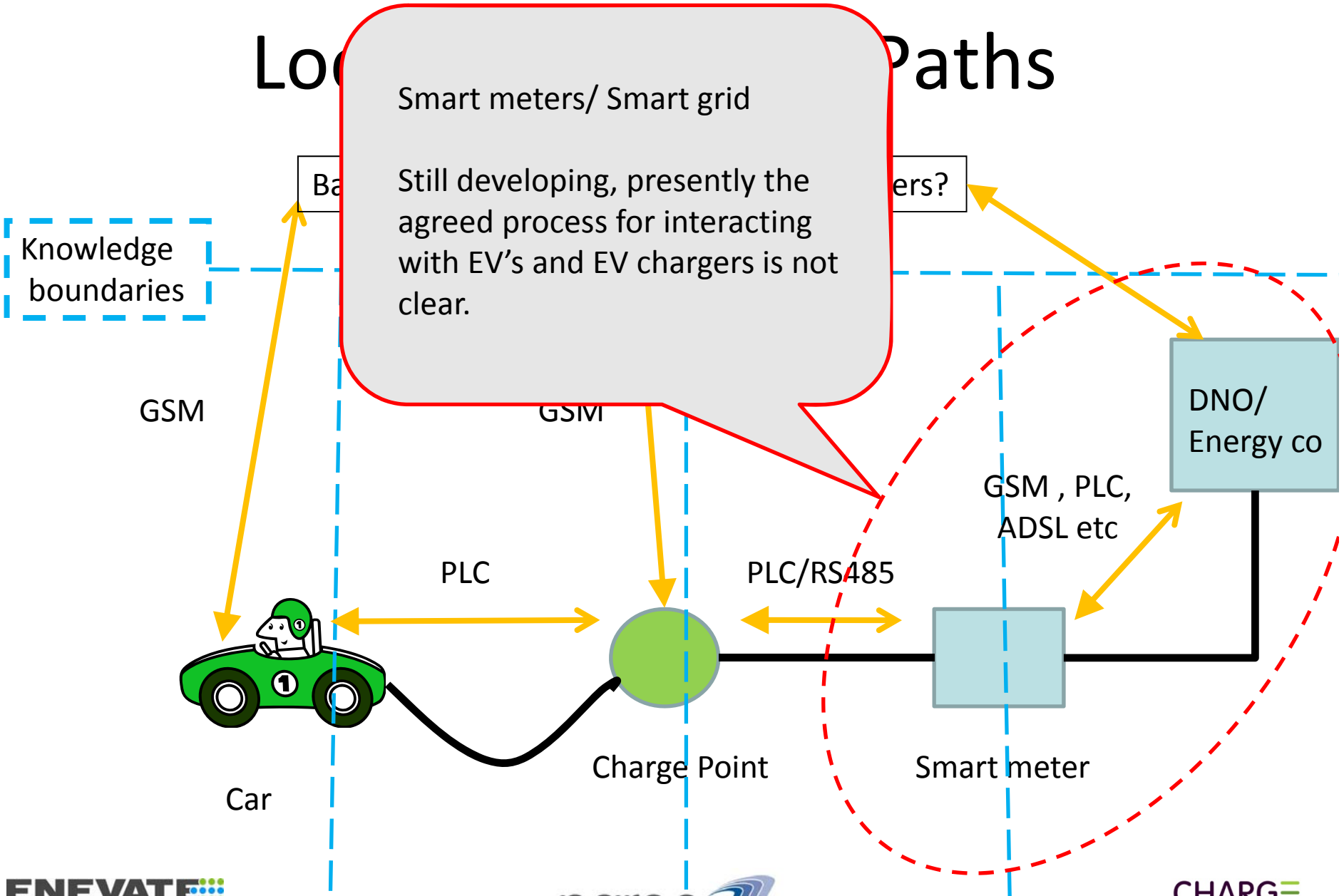

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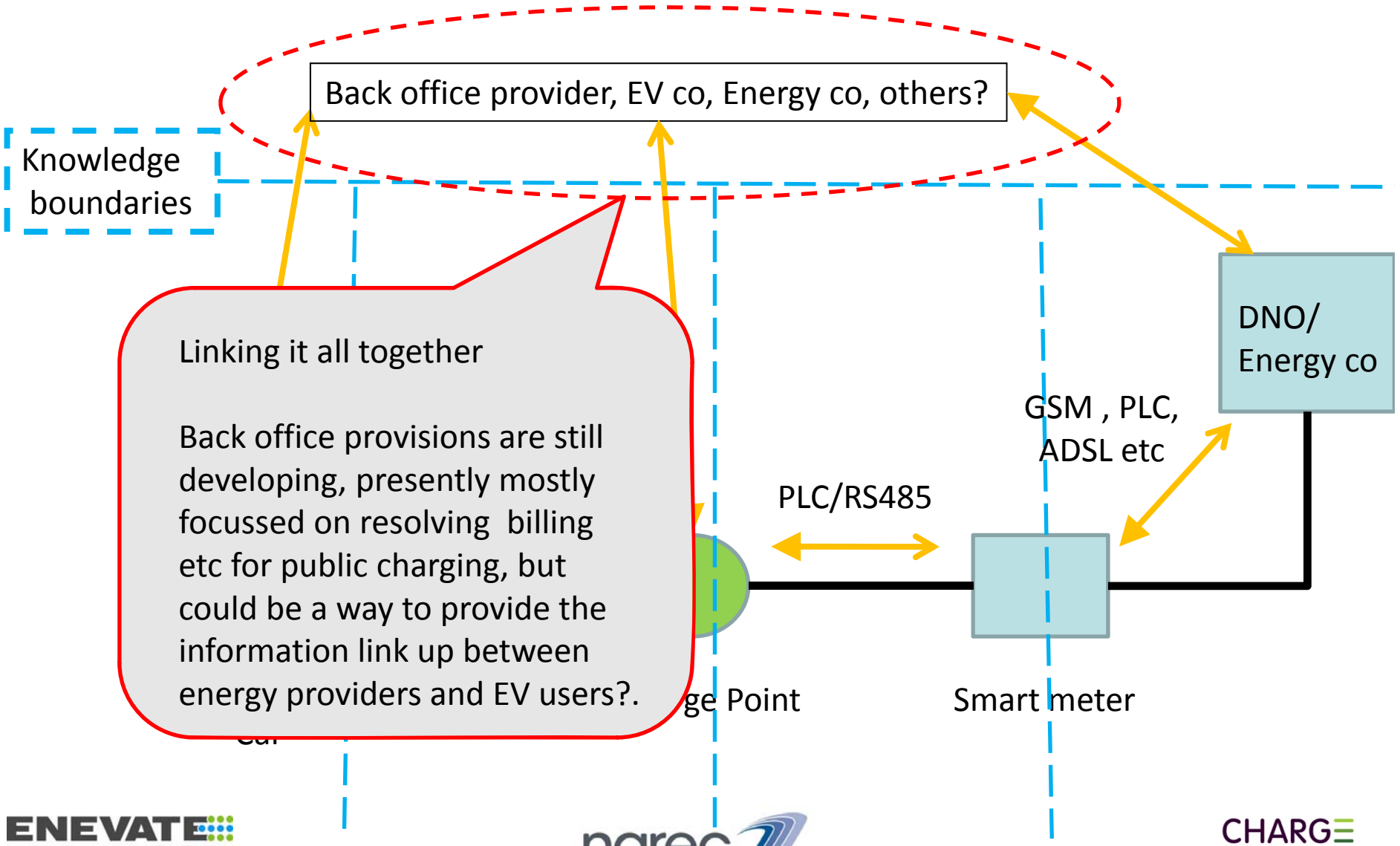

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A look at what we are doing in the NE PIP project

- Charging points
  - Standard public posts
  - Domestic charge points
  - Quick chargers
- Back office
  - Managing users initially
  - Future developments
- Smart networks integration
- Induction charging evaluation

Modern electric vehicles have progressed
A little!

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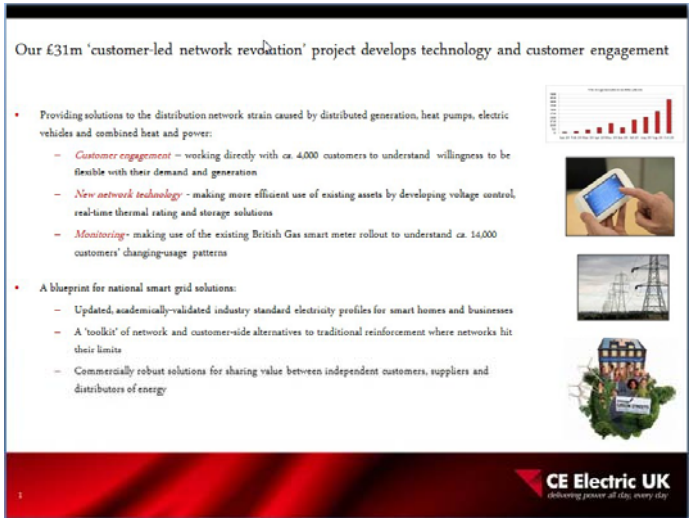
Actions

- investigate the integration of EV charging with smart-meters:
  - Working with CE –Electric, G4S and Podpoint.
  - Power usage monitoring
  - Communications
  - User behaviour
  - Integrated system approach

“THE UK’S BIGGEST SMART GRID PROJECT LANDS IN THE NORTH OF ENGLAND”



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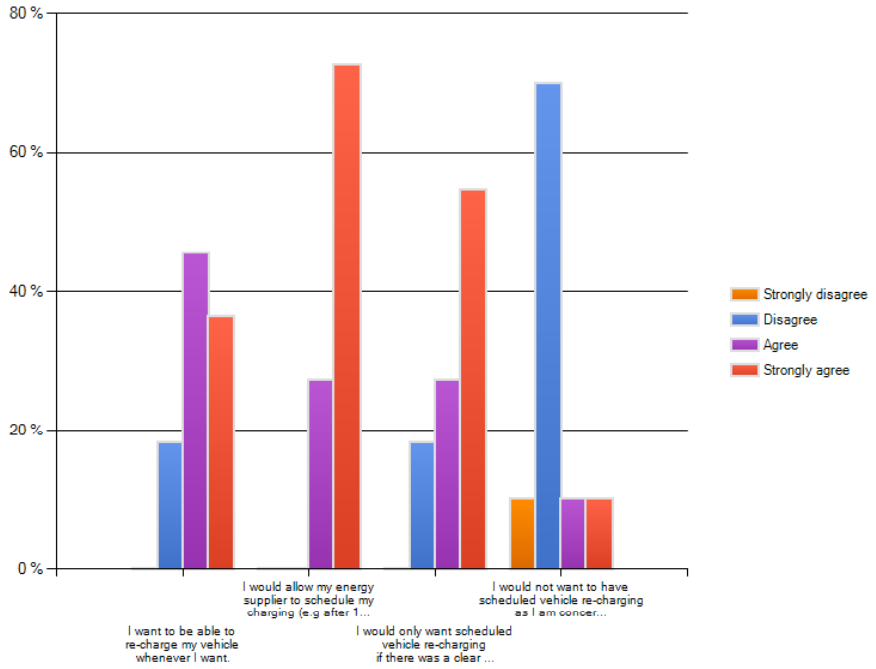
Charge point functions

- Collect data on the usage behaviour of EV owners. This will include some network specific information such as line voltages, harmonics etc
- Assess user response to economic tariff incentives
- Assess user response to restricted hours tariffs
- Investigate direct control scenarios – for example, reducing EV demand if the network is congested

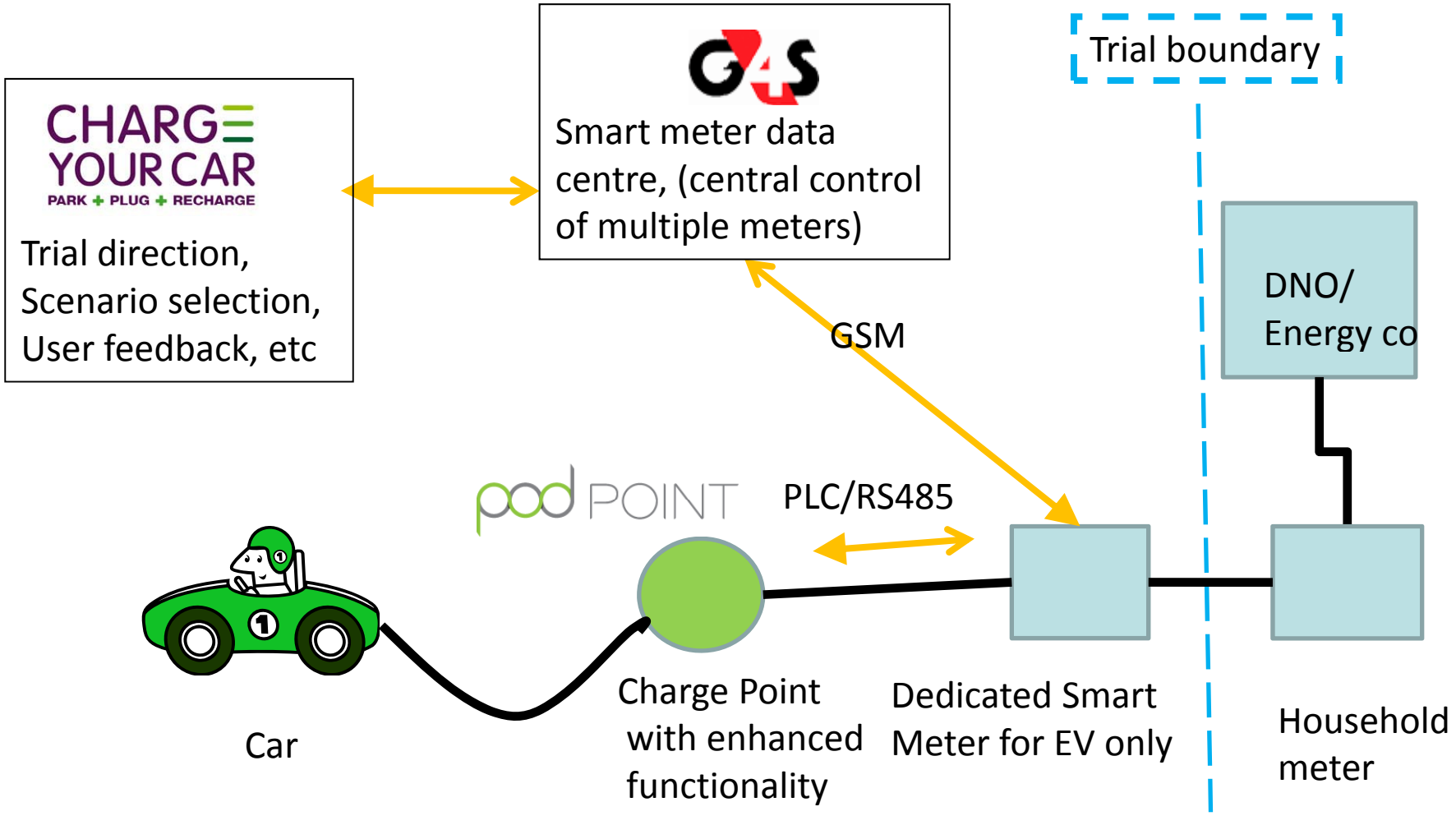
EV users appear to be receptive:

- Users will generally accept having their charging controlled externally if:
  - They can override it if necessary
  - Will benefit financially
  - Car is ready when needed.



Source - Survey of vehicle users in the NE PIP area

Smart EV charging trials



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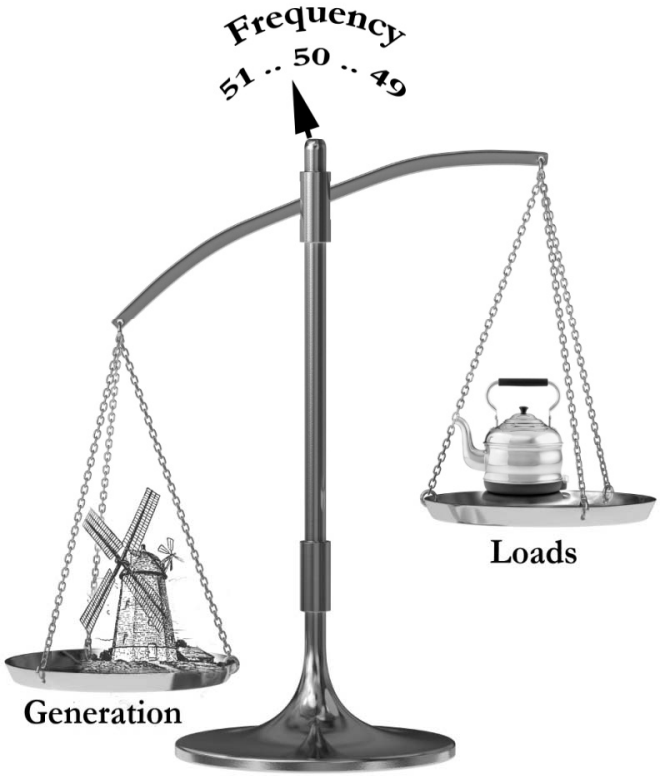
key messages

- Private and public charging require different Smart Grid approaches.
- Private (domestic) more likely to interface with smart meters directly
- Public is developing a life of its own, future remains unclear, back offices are a key issue.
- Grid balancing solutions must not be overlooked in both, but domestic is the primary target..
- We are working to resolve some of the challenges



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