UKPN – SmartCAR

Electric Vehicle Energy Taskforce Stakeholder Engagement Seminar

THE SUNDAY TIMES 25 BEST BIG COMPANIES TO WORK FOR 2018

Utility Week Awards 2016 WINNER Utility of the Year

INVESTORS IN PEOPLE | Gold

UK Power Networks
Delivering your electricity

Purpose

- About UK Power Networks
- SmartCAR project objectives
- Project research approach
- Design Principles
- Hierarchy of smart charging mechanisms- Our position
- Next Steps

About UK Power Networks

Measure	Data	% of industry
Plug-In vehicles connected	55k	32%
Population served	c.20m	30%
New metered connections per annum	46,000	32%
Distributed generation connected	9.1GW	31%
Energy distributed	84.8TWh	28%
Peak demand	16GW	N/A
Number of substations	147,000	-

Three distribution networks:

- London
- East of England
- South East of England

SmartCAR Objectives

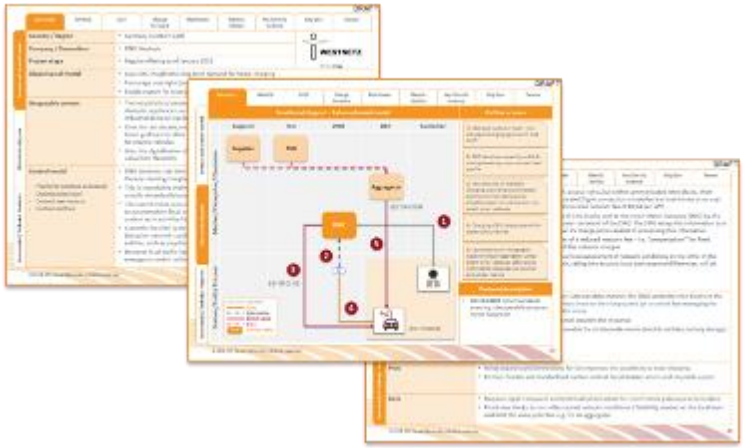
1) **Identify** the range of smart charging models which could be used (building on international experience);
2) Establish and work with a key **stakeholder group** to identify the most relevant EV charging models for the UK;
3) Determine **our strategy** for enabling smart charging;
4) Define the **core systems architecture** required to support the range of most relevant EV charging models;
5) Identify the costs and benefits associated with smart charging to determine the **value of EV flexibility**; and
6) Develop a **roadmap** that describes how to deliver the core architecture.

Stakeholder Group

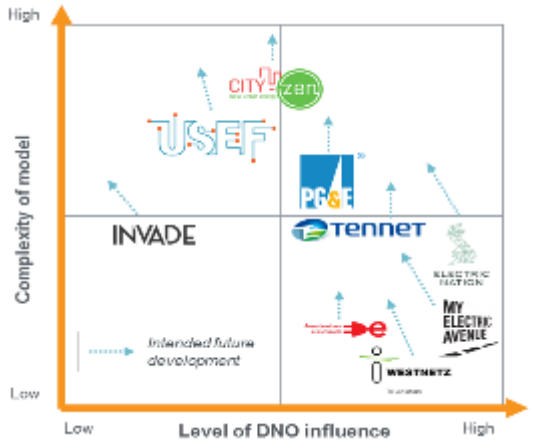
SmartCAR – Research Approach

An overview of initial research into strategic approaches to smart charging

International case studies



Comparison of approaches



Framework of design options

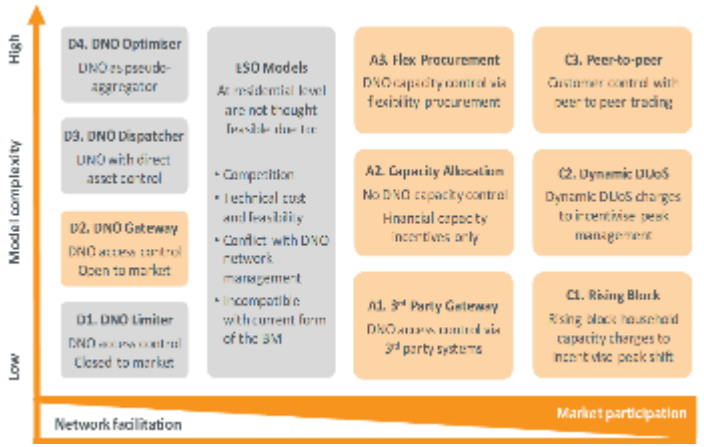
Control model	Primary system driver	Network capacity	System services	Wholesale energy	
	Optimisation level	Local	Regional	National	
	Control mechanism	Network connection	Asset		
	Control entity	DNO	TSO	3rd Party	Customer
	Primary control signal	Direct control	Contracted services	Price signals	
Commercial model	Network access rights	Non-firm	Hybrid	Firm	
	Tariff	Flat (access based)	Rising block	Static ToU	Dynamic ToU
	Settlement	Existing	Local/Regional	Central	Distributed ledger
	Form of influence	Real-time	Ex-ante		
Technical features	Push data channel	Specific channel	Generic internet	Secure network	
	Response telemetry	Specific channel	Meter data	LV telemetry	
	Power flow direction	Load only	Bidirectional (V2G)		
	DER Scope	EV only	All distributed energy		
	Connection type	General connection	Dedicated CP connection		

Design principles

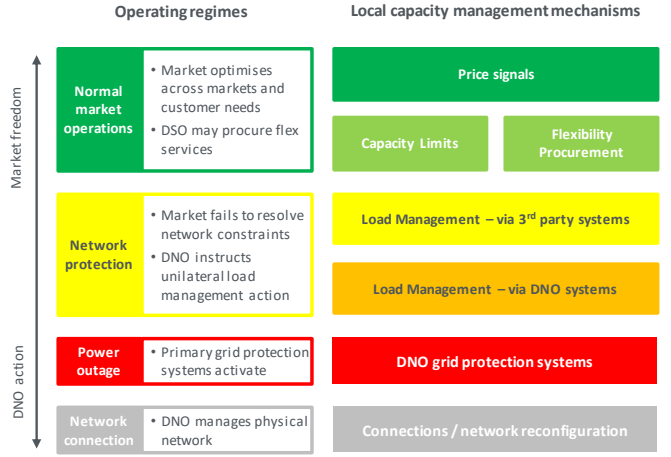
Design Principles

1. Deliver consumer requirements in terms of access to mobility, value for money and choice
2. Ensure network access is not a barrier to electric vehicle uptake
3. Allow DNOs to maintain the operational integrity and safety of the networks, acting in a transparent and non-discriminatory manner
4. Minimise the risk of regret investment in DNO assets
5. Be consistent with the DNO's risk profile (financial, technical, reputational, cyber security)
6. Protect customer privacy
7. Ensure that the flexibility value of EV batteries can be realised where it is most valued to the customer
8. Enable competition between different business models and technologies (through interoperability)
9. Be equitable for all network users (including non-EV adopters and other forms of DER)
10. Be compatible with upcoming regulatory led change to network access and charging, and the DSO transition

Spectrum of models



Hierarchy of smart charging mechanisms



This research will be made available in a report to be published later this month.

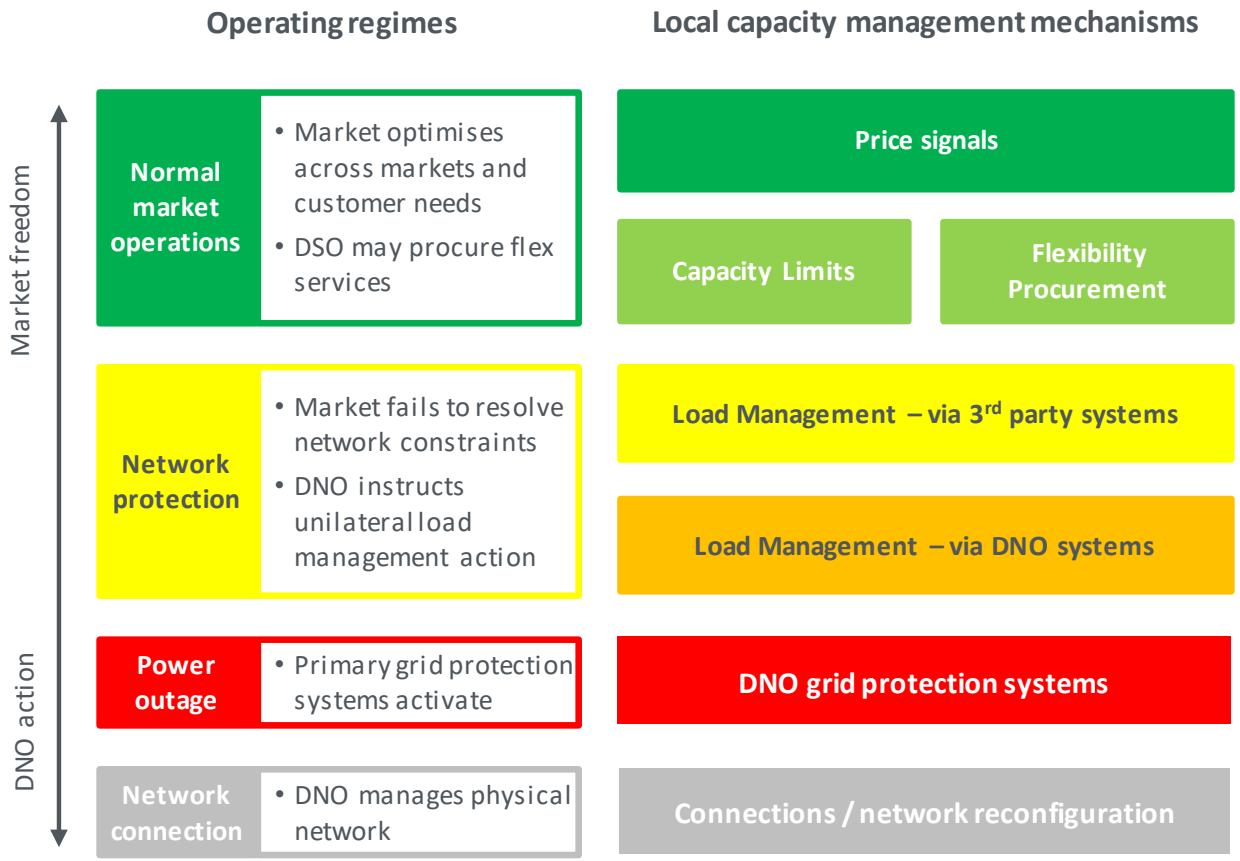
SmartCAR – Design Principles

A suitable approach to residential smart charging in the UK should:

1. Deliver consumer requirements in terms of access to mobility, value for money and choice
2. Ensure network access is not a barrier to electric vehicle uptake
3. Allow DNOs to maintain the operational integrity and safety of the networks, acting in a transparent and non-discriminatory manner
4. Minimise the risk of regret investment in DNO assets
5. Be consistent with the DNO's risk profile (financial, technical, reputational, cyber security)
6. Protect customer privacy
7. Enable competition between different business models and technologies (through interoperability)
8. Be equitable for all network users (including non-EV adopters and other forms of DER)
9. Be compatible with upcoming regulatory led change to network access and charging, and the DSO transition

Hierarchy of smart charging mechanisms

Our research points to a hierarchy of smart charging mechanisms, with different approaches likely to be more suitable for different areas of the network and customer types



Broad conclusions

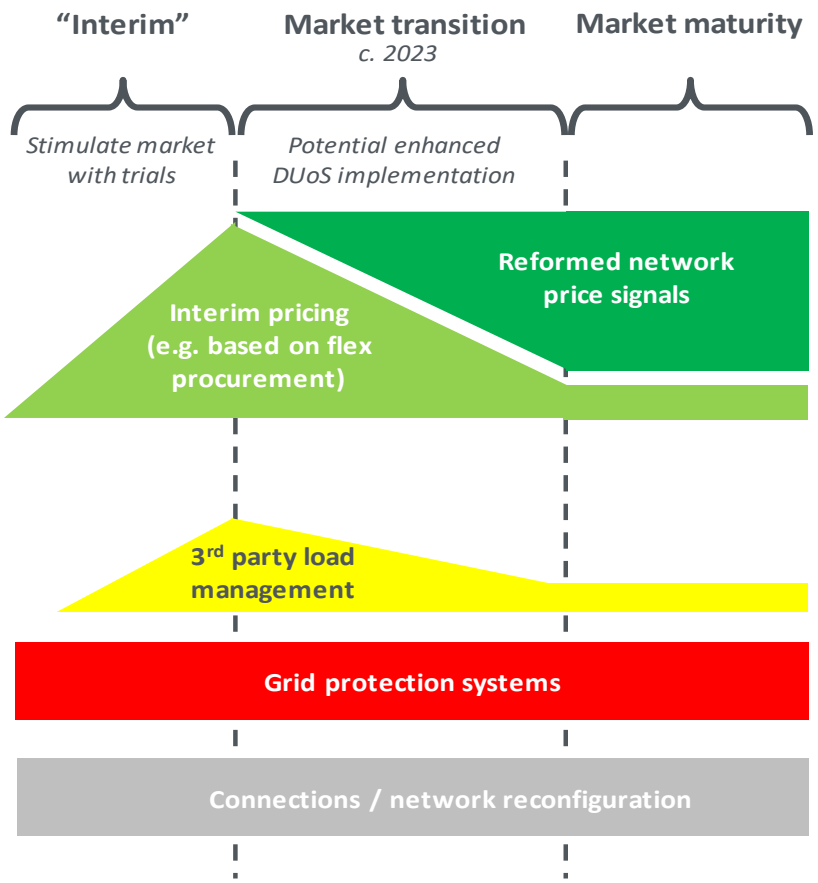
- Across the spectrum of models we identified a hierarchy of mechanisms – starting with maximum market freedom, moving down through increasing DNO facilitation
- We have developed high-level process and systems architecture designs to support each of these mechanisms
- Increasing DNO facilitation may be appropriate:
  - If the market cannot fully manage constraints, or
  - In high-risk areas of the network
- Different mechanisms seem more appropriate for different customer types (e.g. large fleet vs. residential)
- The overall approach may utilise various elements and may evolve over time

Other networks are running projects to develop and test DNO load management solutions; we will focus on market-based solutions in which we enable 3rd parties to manage customer EV loads via price signals.

Smart charging – Our position

We will support maximum market freedom, pursuing a market based "interim pricing solution" before resorting to any "DNO unilateral load management" option

Potential market evolution over time



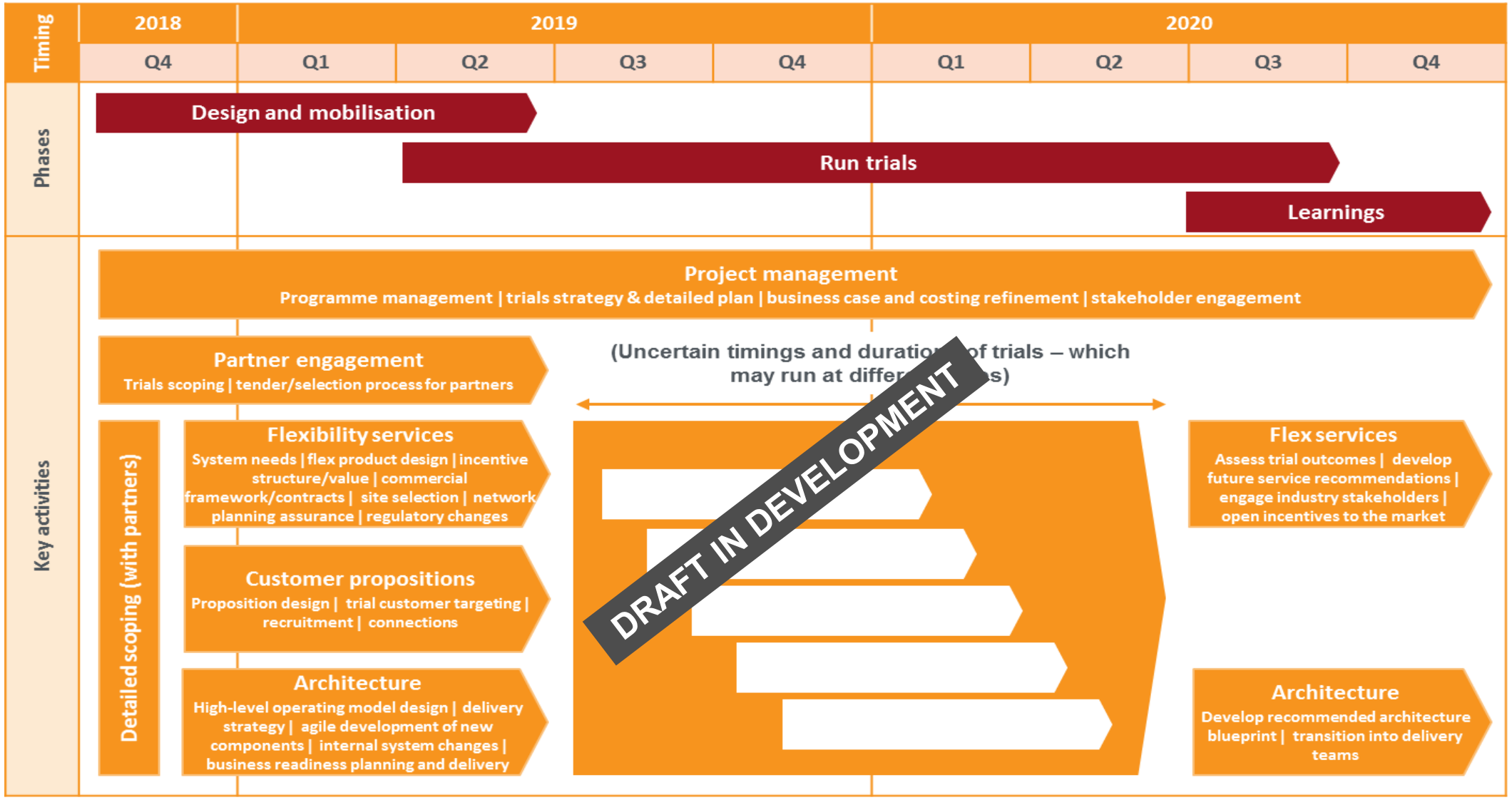
1. **We will promote transparency of customer and network needs**
   - Publishing emerging constraint data regularly and at a granular level
2. **We will maximise capacity through network reconfiguration**
3. **We will facilitate the market to manage emerging constraints, through:**
   - Advocating a regulatory framework that incentivises the facilitation of EV uptake, and encourages market-based solutions for smart charging
   - Providing a market for flexibility procurement
   - Supporting market participants in the development of smart charging propositions based on price signals:
     - Supporting Ofgem in charging and access reforms for the long term solution
     - In the interim, pursuing an interim pricing approach to stimulate the market, via flexibility procurement and broader trials
4. **Where necessary, utilise 3rd parties for load-management, on an opt-in basis, compensated, and enacted via 3rd party infrastructure**
5. **Where economic to do so, we will reinforce the network**

Smart Charging – Next steps

Having defined our smart charging strategy, and enabling architecture, we will now learn through doing- by mobilising trials to develop live solutions and prove market-based approaches

Trials objectives
• Stimulate the development of market-led smart charging solutions, working with market participants to develop, enable and trial customer propositions
• Understand the market response to published DNO constraints
• Understand the customer response to these propositions, and the network impacts in a controlled environment
• Develop and test processes, systems components and commercial arrangements to enable these propositions
• Develop a scalable solution that can be expanded to a large volume of customers through the 2020s
• Inform Ofgem's longer-term access and network charging reform

Smart Charging trials Plan



Thank you