



The 27th **INTERNATIONAL  
ELECTRIC VEHICLE  
SYMPOSIUM & EXHIBITION**

**BARCELONA**  
17th-20th November 2013



**Accelerating E-Mobility**



# Accelerated Introduction of Electric Vehicles in North-West Europe

## ENEVATE: Project Lay-Out and Results

Dr. Kord Pannkoke

Matthew Lumsden

Huw Davies

Edwin Bestebreurtje

Harm Weken

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# ENEVATE – Accelerating E-Mobility

## European Network of Electric Vehicles and Transferring Expertise

- Introduction of ENEVATE
- Electric Vehicle Supply Chain Management dr. Kord Pannkoke - Bayern Innovativ
- Sustainable Energy Supply Infrastructure Matthew Lumsden - FTS
- Market Drivers & Mobility Concepts Huw Davies - Cardiff University
- Pilot experiences
- SWOT & Policy Recommendations Edwin Bestebreurtje - FIER Automotive
- What's next: ENEVATE 2.0 Harm Weken - EASN

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## Why a NW-European Networking Project on E-Mobility?

- Most regions spend large public funds on EV & E-Mobility programs, pilots & stimulation → with no learning effects over the regional borders
- Europe is scattered in strategy, programs and implementation.
  - ✓ The competition comes from China, Japan and even US
  - ✓ With a much more coherent approach
- Integral approach is absent. On national, regional and city level
- User acceptance is the question mark. Should be driver for mobility concepts and industry development
- The many promising SME companies working on EV, are not to be found by the Vehicle Manufacturers
- Electric energy / infrastructure & automotive are historically isolated from each other



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## ENEVATE aims to

facilitate and support an accelerated and well informed introduction of electric mobility in North-West Europe through structured trans-national co-operation between public authorities and business representatives.



And at same time to boost innovation and competitiveness of the rapidly developing electric vehicle sector in NW Europe.

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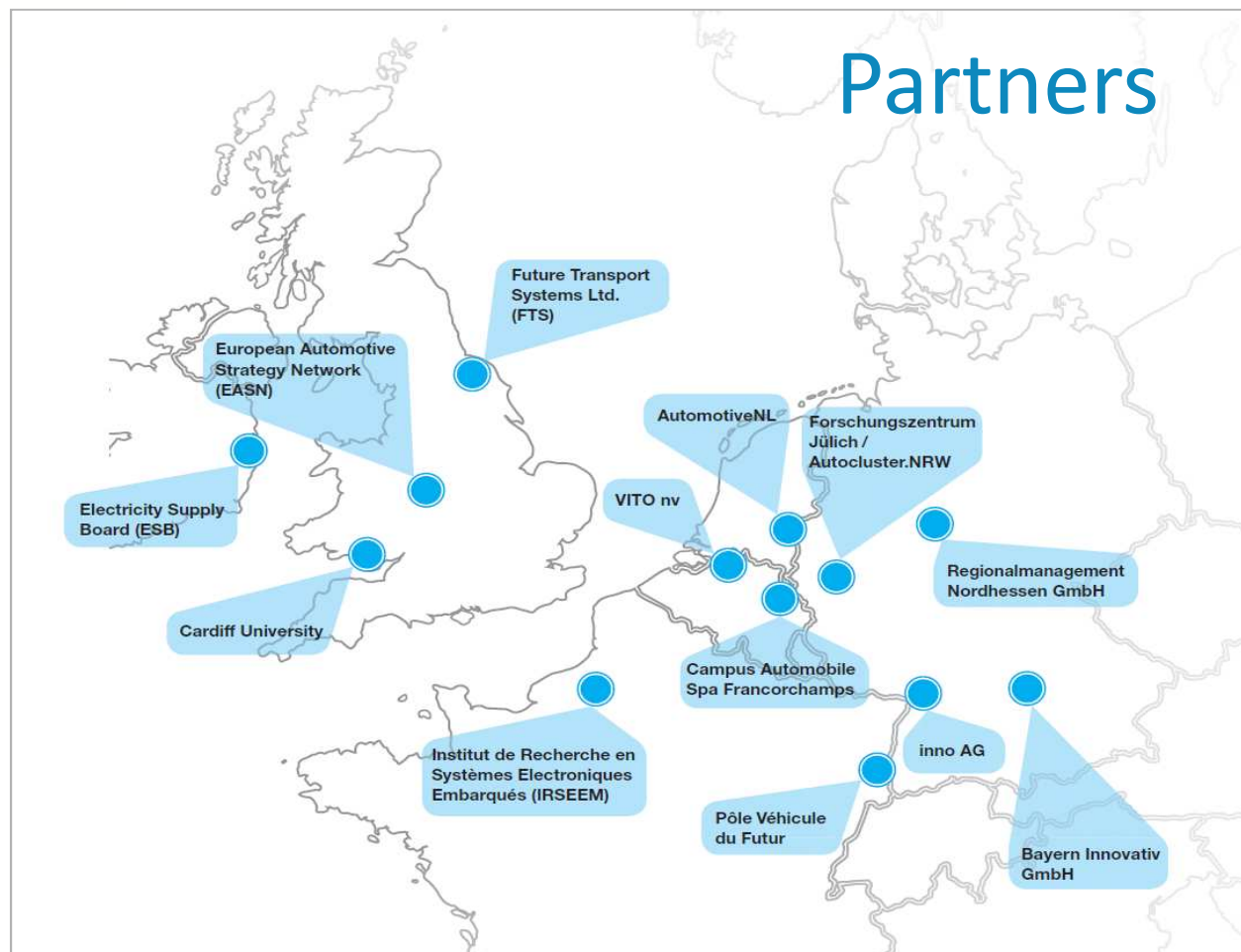
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## Work Packages



### Electric Vehicle Supply Chain Development

Lead: AutoCluster.NRW, GER



### Sustainable Energy supply infrastructure

Lead: Future Transport Systems, UK



### Market drivers and mobility concepts

Lead: Cardiff University, UK



### Pilots

Lead: Automotive NL



### Enabling / Innovation Accelerator

Lead: Bayern Innovativ, Regionalmanagement Nordhessen, GER



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# Work Packages and Results



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## Electric Vehicle Supply Chain Development

WP1



Lead: AutoCluster.NRW, Germany

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## Methodological approach with following steps

WP1.1	Analysis of the conventional supply chain
WP1.2	Technical analysis of electric vehicles
WP1.3	Conception of a supply chain for electric vehicles
WP1.4	Comparison of ICE and BEV supply chain
WP1.5	Validation of findings
WP1.6	Database generation and analysis of the European BEV competencies map
WP1.7	International benchmark to leading regions
<p>➔</p> <p><b>Analysis report</b></p> <p><b>Online portal</b> for the EV industry and related sectors</p> <p><b>Training sets</b> for target audiences on EV technology and supply chain</p> <p><b>Information packages</b> for target audiences on EV technology and supply chain</p>	

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## The BEV and ICE value chain differ significantly and will change in future...

### Upstream Value Creation Process



**The valued added distribution will change significantly and makes a change in the minds of OEMs and suppliers mandatory:**

- A BEV comes along with ~63 % more value added. Especially suppliers of battery cells and systems profit.
- Around 75 % of the ICE drivetrain production value is falling away.
- The product portfolio of suppliers may be endangered and makes a deeper analysis of the future compliance with the electrified drive trains necessary.



**A make or buy analysis for all BEV components gives an insight on the future task sharing – but multiple strategies will be seen in the next years:**

- OEMs will most likely focus on brand shaping and strategic relevant components.
- Attractive chances for suppliers are shown in interchangeable components and systems.



**Often, xEV & ICE vehicles will be produced on the same flexible production lines.:**

- Therefore the same process structure will be applied, but experience in the supply relations needs to be build up especially within the electronics industry.
- Sophisticated know-how in production technology is therefore a strategic asset for OEMs.

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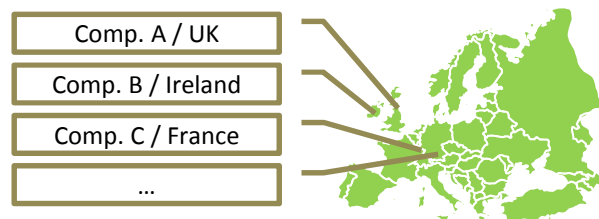


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There are competencies all over Europe as basis for a strong EV supply chain.

#### ENEVATE Approach

#### North West Europe (NWE)



In whole North West Europe more than 900 companies are active in the automotive industry, but distributed over many locations.



Source: Database - [www.enevate.eu](http://www.enevate.eu)

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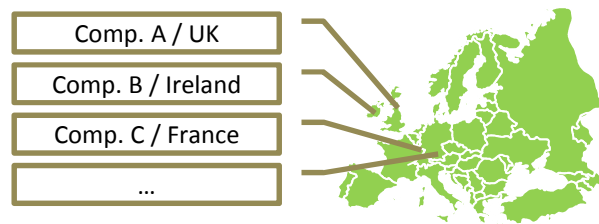


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There are competencies all over Europe as basis for a strong EV supply chain.

#### ENEVATE Approach

### North West Europe (NWE)



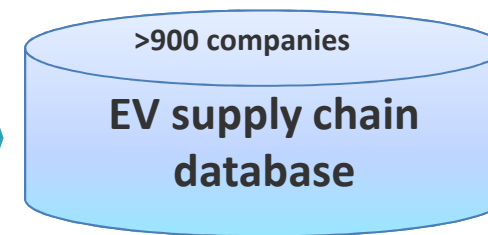
In whole North West Europe more than 900 companies are active in the automotive industry, but distributed over many locations.

### Systematic Determination

	Consulting	Design	Assembly	Chassis	Wheels & Tyres	Drivetrain & Chassis	Interior
Powertrain & Drivetrain	X					XX	
Transmission & Drivetrain	X	X				X	
Chassis & Drivetrain	X					X	
Drivetrain & Chassis						X	
Interior & Drivetrain							X
Recycling							

The competencies of all identified companies have been systematically determined for each field (electric motor, suspension ...)

### Database Analysis



The EV supply chain database allows a 'white spot analysis' for competencies in each region

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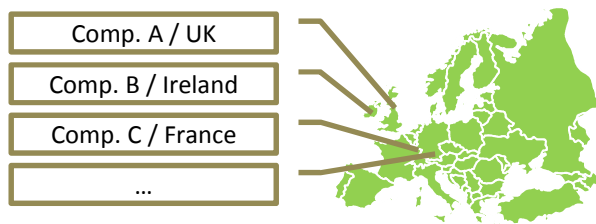




There are competencies all over Europe as basis for a strong EV supply chain.

#### ENEVATE Approach

### North West Europe (NWE)



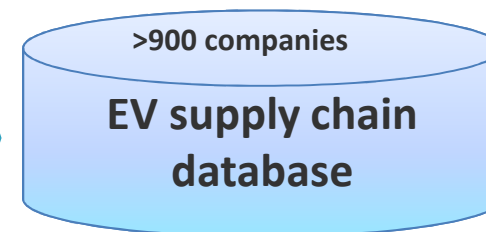
In whole North West Europe more than 900 companies are active in the automotive industry, but distributed over many locations.

### Systematic Determination

	Consulting	Interior	Exterior	Chassis	Wheels & Tyres	Drivetrain	Powertrain
Research & Development	X						
Production & Validation	X	X				XX	
Manufacturing	X					X	
Assembly							
Recycling							

The competencies of all identified companies have been systematically determined for each field (electric motor, suspension ...)

### Database Analysis



The EV supply chain database allows a 'white spot analysis' for competencies in each region

#### Evaluation

Each separate region doesn't cover all competencies required to build a BEV. **The white spot analysis shows the lack of competencies and capacities in the regions.**

Research and Development	●	Fully covered
Testing and validation	●	Fully covered
Manufacturing (Low / High volume)	◐	Nearly all important BEV components are available within NWE
Reuse & Recycling	◑	Recycling for electric components is a white spot

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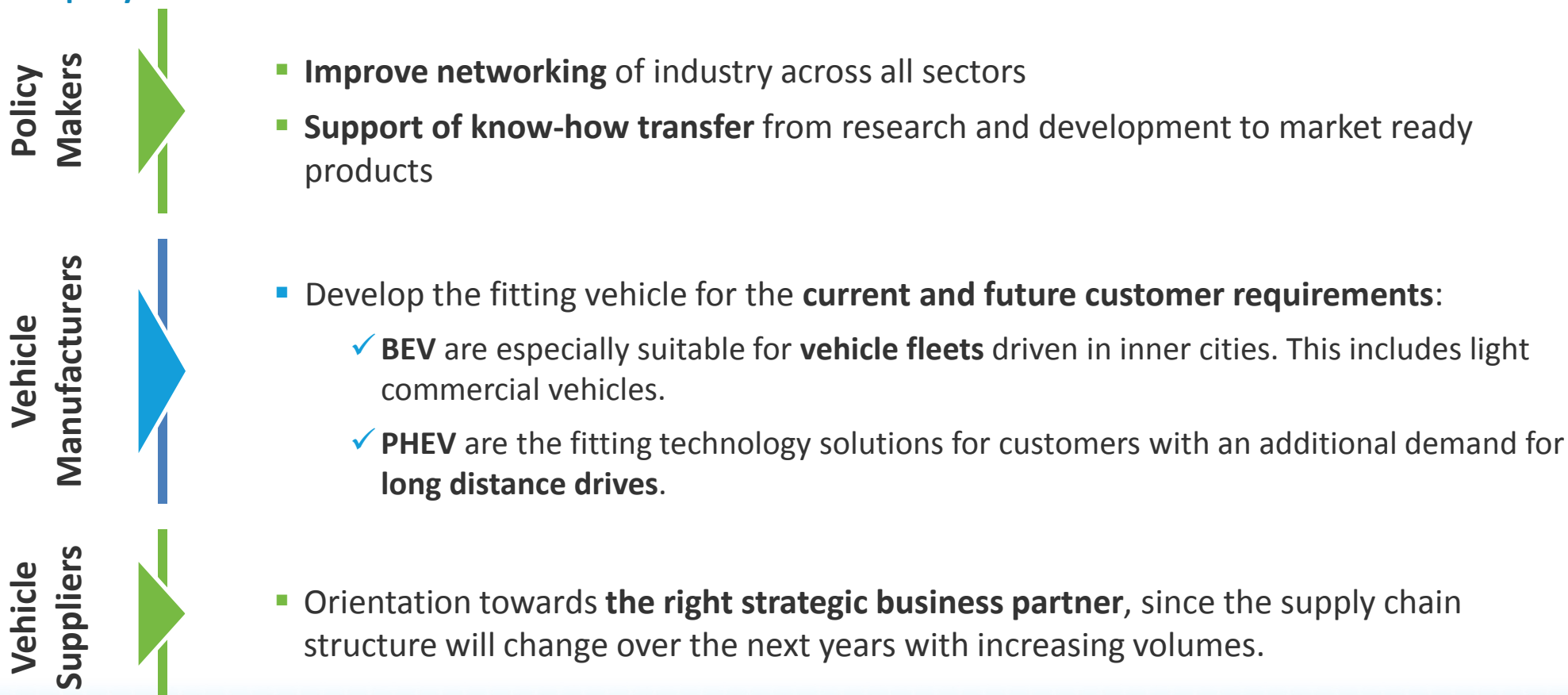


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## All actors need to set the right course to establish a strong electric mobility value chain.

### Exemplary recommendations for action:



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# ENEVATE – Accelerating E-Mobility

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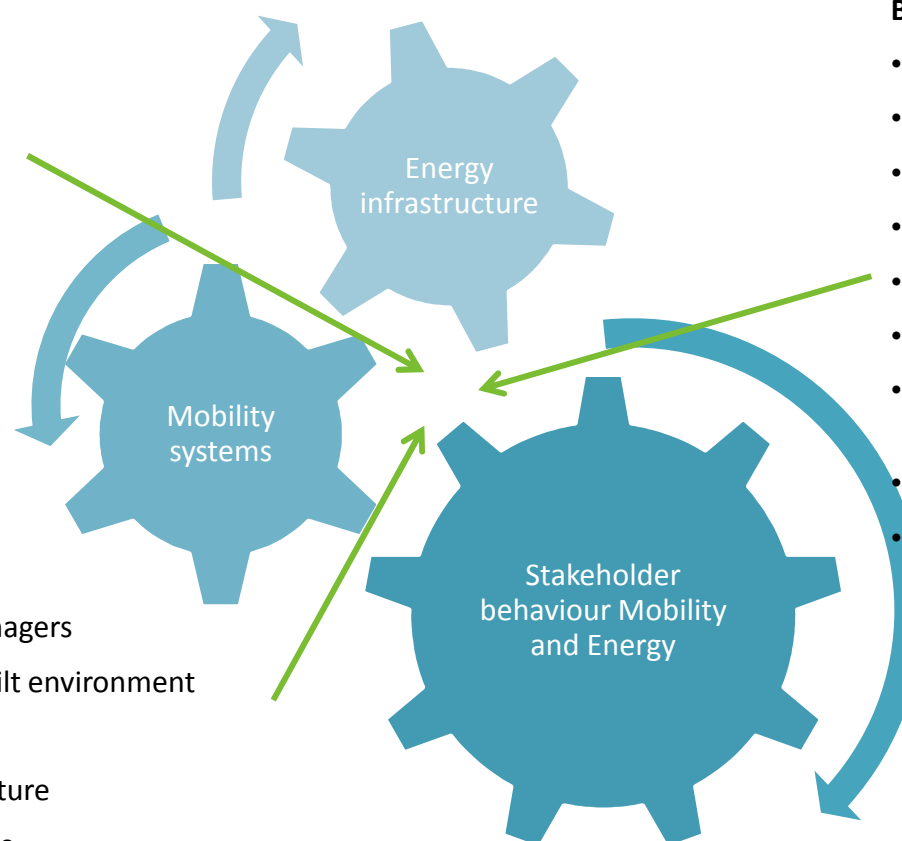
# Future Transport Systems

## Connecting systems

- EV charging
- Vehicle 2 Grid (mobile storage)
- Energy storage (static storage)
- Energy management system integration
- Grid support – micro & macro
- Intelligent, integrated mobility management

## Behavioural influence

- Vehicle purchasers
- Drivers and fleet managers
- Inhabitants of the built environment
- Facilities managers
- The role of infrastructure
- The role of experience
- Interaction, knowledge, communication



## Business models

- Managed charging
- Demand response
- Electricity trading
- Time of Use tariffs
- Local network management
- Multi-stakeholder value streams
- Fleet management – facilities management
- Car clubs
- Multi-modal mobility

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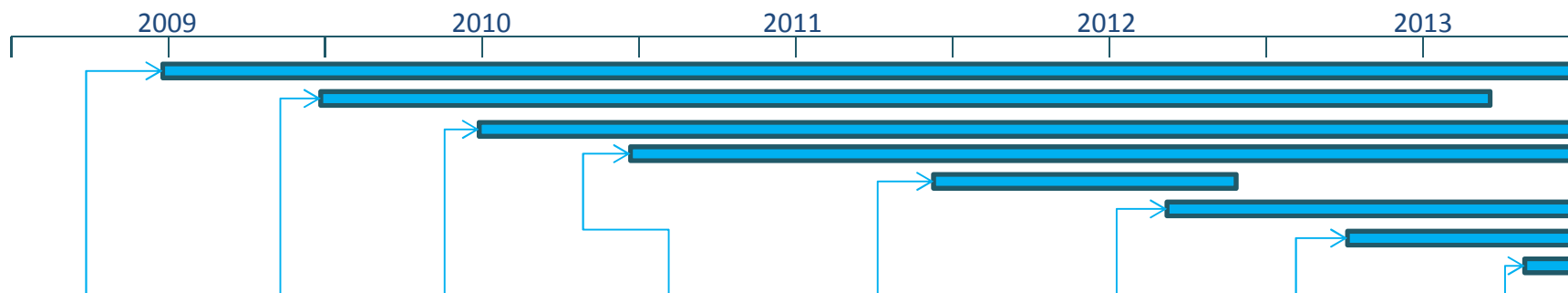


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## Typical projects



Name	Regional strategies	SWITCH EV (TSB)	ENEVATE (EU Interreg)	EVALU8 (OLEV – PiP)	Infras'ture partnership	V2G	Managed Charging	Everest (DECC)
Partners/clients	Various UK regions	Nissan, SEV, Peugeot, Newcastle Uni, AVID	Partners in UK, NL, GR, B, IR, F	Herts Uni	Major Industrial Blue Chip	4 UK Distribution network operators	Major global energy company	Automotive supply chain
Value	£250k	£10m	€5m	£7.5m	£100k	£2.5m	Confidential	£3.6m
Objective	Develop EV charging network & e-mobility strategies	Flagship TSB vehicle trial 43 vehicles, 24 months	Researching EU EV infrastructure landscape, developing tool kit	East of England Plugged in places EV charging network	Commercial partnership to develop and operate EV charging network	Develop V2G conversion feasibility and trial	Create sophisticated managed charging trial within UK, US and Germany	Develop and trial unique energy storage concept

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## Why develop the ENEVATE Tool Kit?

- Many EV infrastructure and e-mobility pilot projects
- Little sharing of knowledge
- E-mobility is still in the R&D phase we need to work together
- A big knowledge differential



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## The development process

- Insights from parties climbing the learning curve
- Borrowed their tools
- Combined their experience
- Created a Tool Kit guidance document
- Passed it on
- Trialled on several projects



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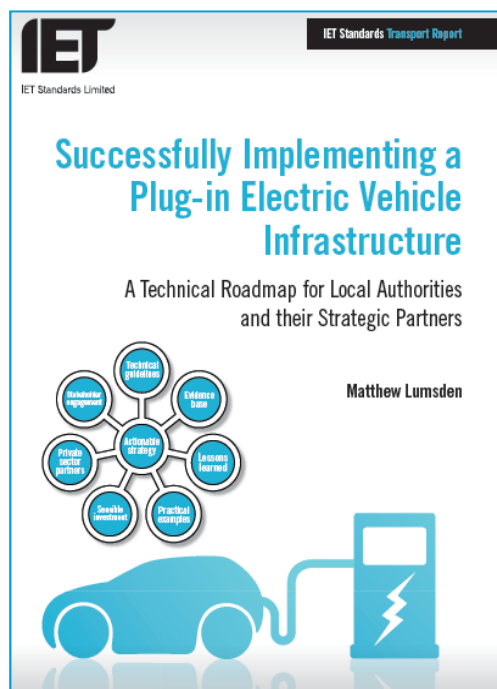
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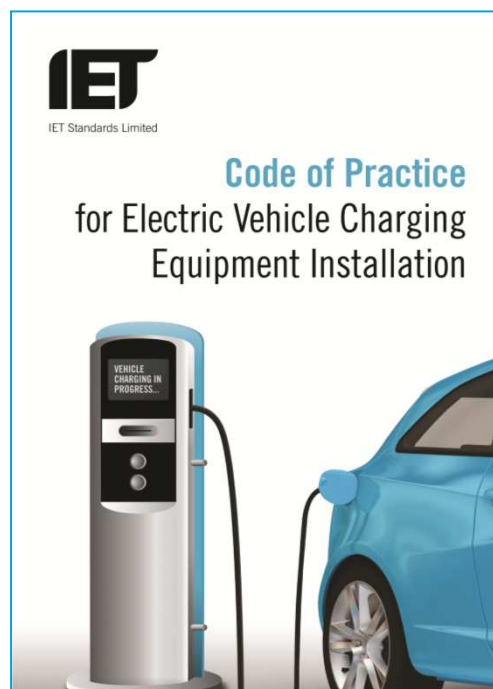
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## Part of a set of documents

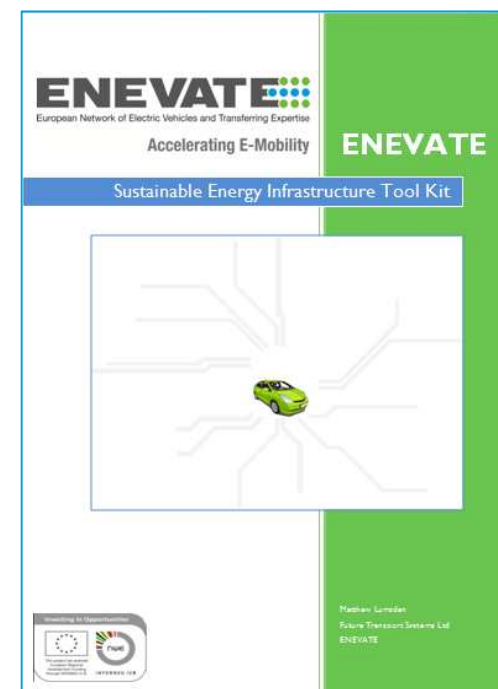
Technical & strategic  
background information



Detailed technical guidance on  
charge point installation



Key components of the development and  
implementation process



Bespoke workshops

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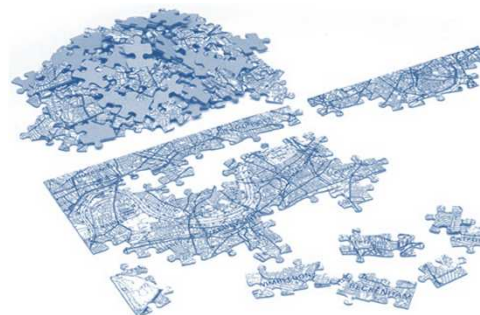
## Structure



Strategy & design



Planning



Implementation



Operation

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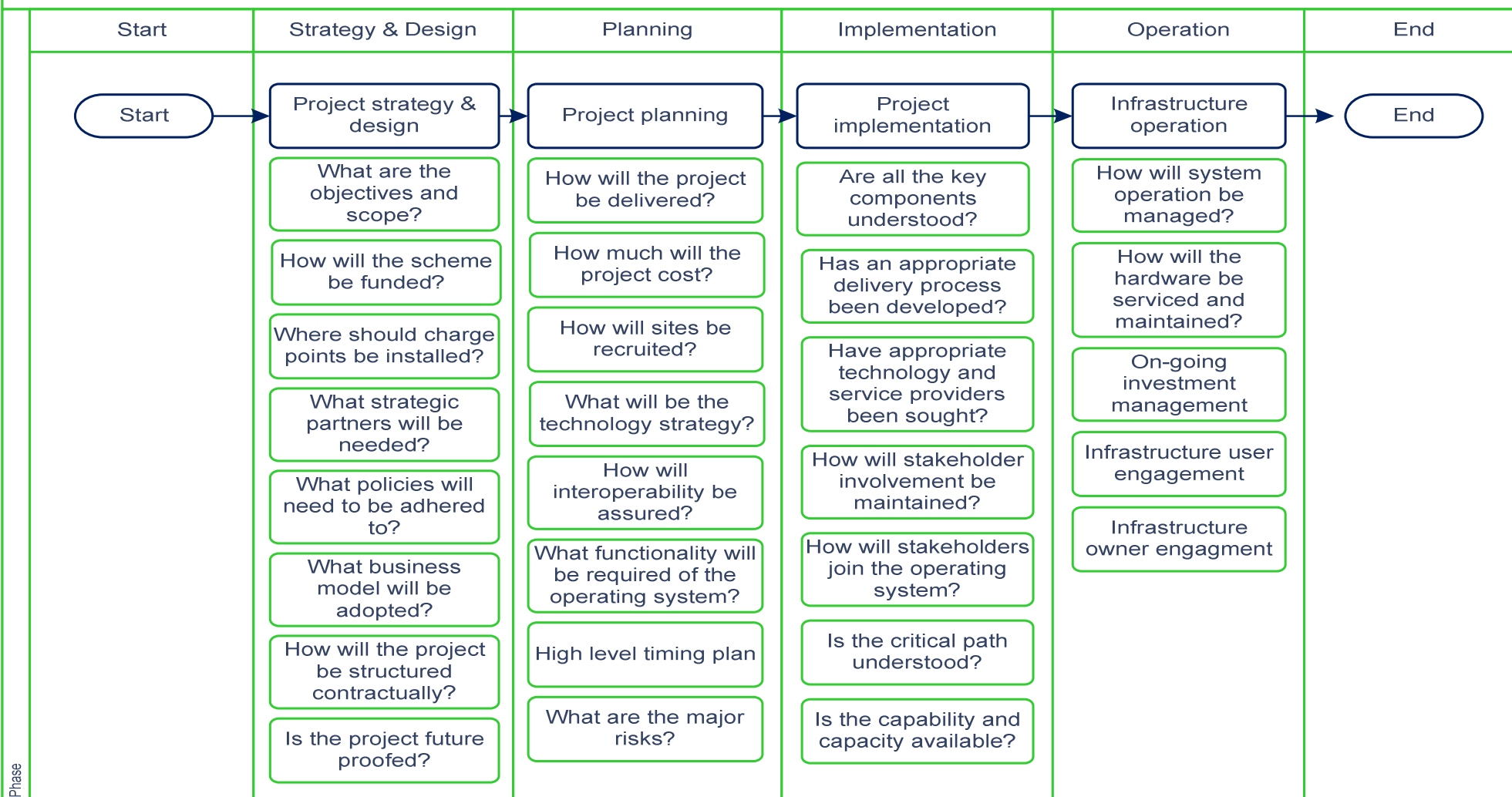
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# Tool Kit Structure

Tool Kit Structure





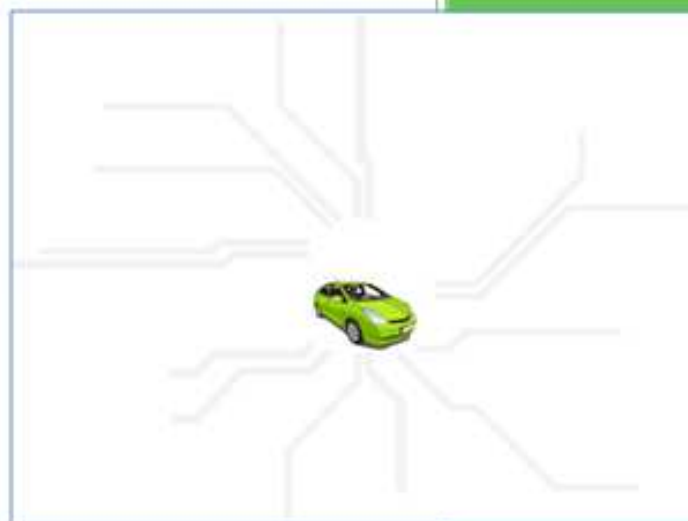
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## ENEVATE

### Sustainable Energy Infrastructure Tool Kit



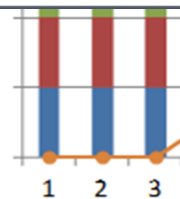
Work Package 2 working document -



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- 5.1 Applicable standards
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  - IEC 60309-2:2009 - 12 A, 16 A, 32 A, 63 A, 125 A, 250 A and 630 A fused circuit-breakers
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  - IEC 60309-92:2009 - 12 A, 16 A, 32 A, 63 A, 125 A, 250 A and 630 A fused circuit-breakers
  - IEC 60309-93:2009 - 12 A, 16 A, 32 A, 63 A, 125 A, 250 A and 630 A fused circuit-breakers
  - IEC 60309-94:2009 - 12 A, 16 A, 32 A, 63 A, 125 A, 250 A and 630 A fused circuit-breakers
  - IEC 60309-95:2009 - 12 A, 16 A, 32 A, 63 A, 125 A, 250 A and 630 A fused circuit-breakers
  - IEC 60309-96:2009 - 12 A, 16 A, 32 A, 63 A, 125 A, 250 A and 630 A fused circuit-breakers
  - IEC 60309-97:2009 - 12 A, 16 A, 32 A, 63 A, 125 A, 250 A and 630 A fused circuit-breakers
  - IEC 60309-98:2009 - 12 A, 16 A, 32 A, 63 A, 125 A, 250 A and 630 A fused circuit-breakers
  - IEC 60309-99:2009 - 12 A, 16 A, 32 A, 63 A, 125 A, 250 A and 630 A fused circuit-breakers
  - IEC 60309-100:2009 - 12 A, 16 A, 32 A, 63 A, 125 A, 250 A and 630 A fused circuit-breakers

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...ective conductor level is not verified and should a damaged cable or extension be used, an earth fault in a vehicle will not be detected and could cause injury or death to the user coming into contact with the vehicle bodywork. Thus, it is extremely important that users of this system ensure that their installations are checked and brought up to the latest standards and that cables are correctly maintained and regularly checked.

The main advantage of this approach is its inherent safety, low cost and the ability to use existing infrastructure.

The main disadvantages are the potential for undetected faults with damaged cables etc. the intermediate space to dust and sockets that can be caused by users unsuitable a vehicle when their charging and plug, (i.e. of any means to prevent hazardous use of extension cables).

Mode 2 charging (see 5.1 in Figure 1 above)

Connection of the electric vehicle to the AC supply network (mainly utilizing standardised socket-outlets, cable-sockets or three-phase and utilizing phase(s), (s) and/or earth conductors together with a metal alloy conductor between the electric vehicle and the plug or in-vehicle control box. The intermediate metal box is usually located close to the standard socket-outlet so as to minimise the length of unprotected cable.

The main advantage of this mode over mode 1 is that the intermediate box contains an RCD unit in line with communications with the vehicle to verify the integrity of the protective conductor and it also tells the vehicle a maximum current can draw. A number of vehicle manufacturers have limited the maximum current to 16A. In recognition of the fact that operating a 16A socket-outlet and cable acts as a rated current for long periods can lead to overheating in some circumstances.

Disadvantage of this mode of charging is that there is still risk to prevent users from plugging the socket-outlet to a conventional extension cable. Also the reduced power capacity will result in longer charge times.

Mode 2 charging (see 5.1 & 5.2 in Figure 1 above)

Direct connection of the electric vehicle to the AC supply network (mainly utilizing standardised socket-outlets, cable-sockets or three-phase and utilizing phase(s), (s) and/or earth conductors together with a metal alloy conductor between the electric vehicle and the plug or in-vehicle control box. In this mode, there is a dedicated cable with over-voltage communications device between the EVSE and the vehicle can be established. In this mode, the current capacity of the equipment is then, typically up to 32A per phase.

The main advantage of this mode is that the integrity of the protective conductor is monitored. Communications with the vehicle must be established before any power will be delivered from the EVSE, the conductor of the intermediate cable can be verified and the amount of power limited to ensure that the electric equipment is not overloaded during operation.

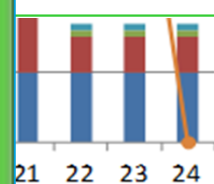
The main disadvantage is the increased complexity and cost.

Mode 4 charging

Direct connection of the electric vehicle to the AC supply network (mainly utilizing an off-board charger where the control cable conductor extends to equipment permanently connected to the AC supply).

This mode is essentially only applicable to DC Quick chargers and in the UK these are currently all CHAdeMO compatible units for Mitsubishi, Nissan, Renault and Toyota vehicles. Project developers wishing to test such equipment will need to make themselves of the communications of the standard in particular the capability of the American companies Ford and GM, who appear to be adopting a different approach.

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