CHARGE

Refuelling Tomorrow's Electrified Transport

What Do Mobility Patterns Tell Us About the Requirement for Public EV Charging?

March 2022

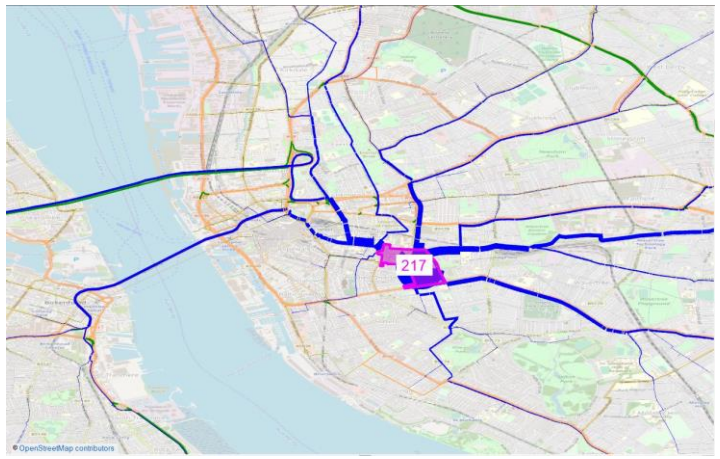
Dr Laurence Chittock – Project Lead for Charge Project, PTV UK

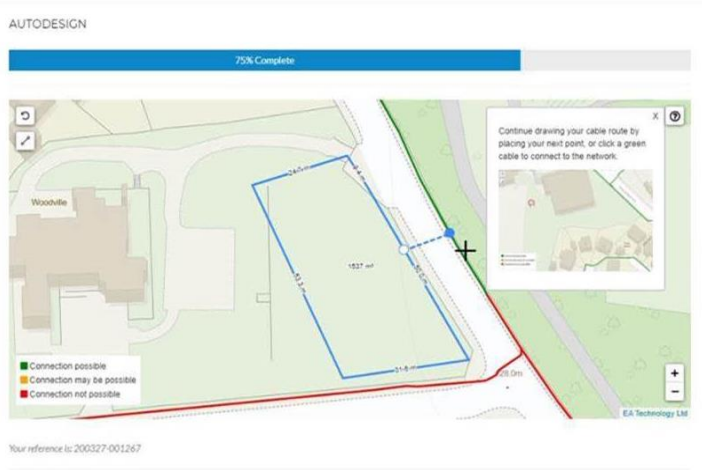
PTV GROUP

Charge Project Background

Accelerate the connection of EV charging infrastructure across SPM by:

- Combining Transport Planning and Network Planning to maximise available network capacity
- Developing and trialling innovative connection solutions for destination and en-route charging
- Developing a connections tool to support mass deployment of EV chargers





Charge Project website

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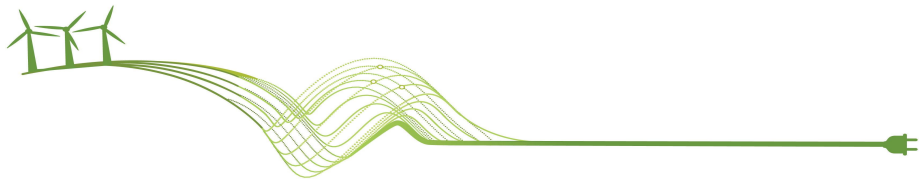
Agenda

- Project background – Geoff Murphy, SP Energy Networks
- What is a transport model and how can it be used to estimate EV charging needs?
- Slido Poll
- ConnectMore demo – Tim Butler, EA Technology
- Break / chance to test ConnectMore (11:50)
- Insights from the transport model
- Q&A and close



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In the News

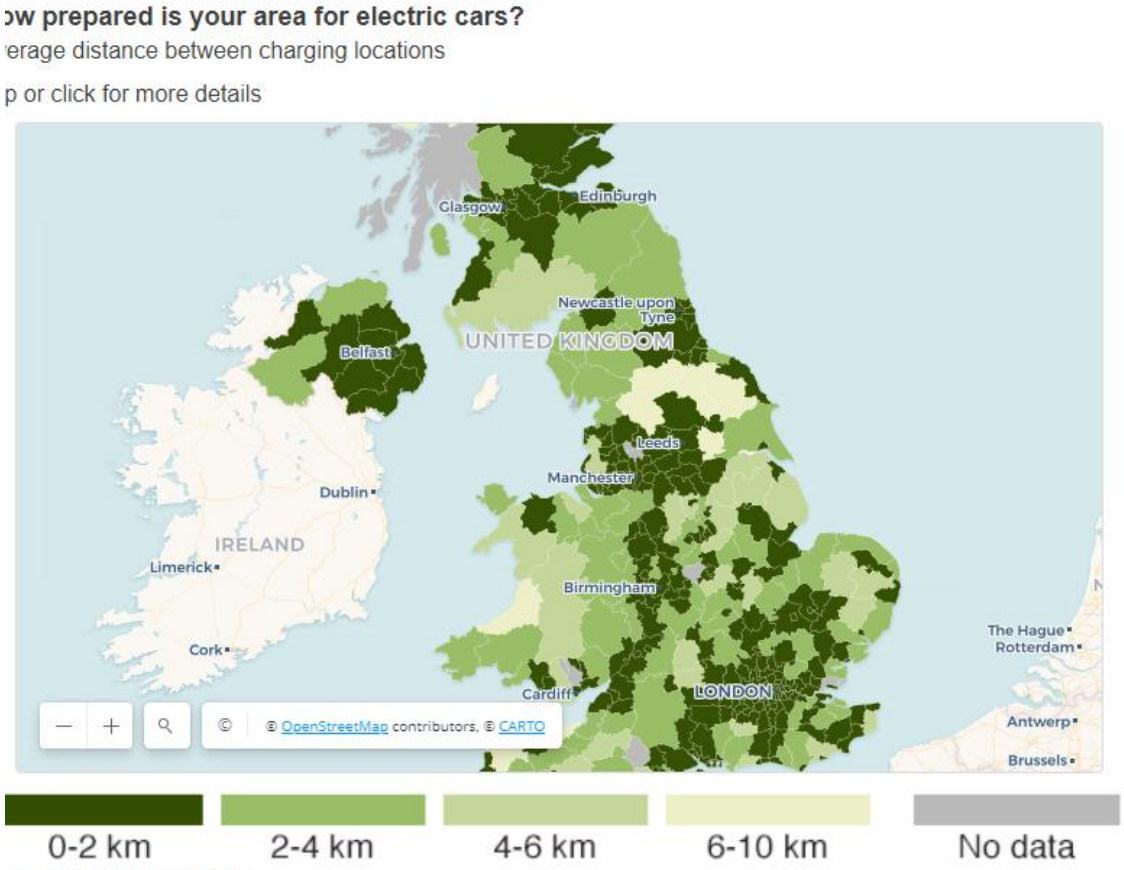
Charging Up

Policy Exchange

Policies to deliver a comprehensive network of public EV chargepoints.

400,000 public charging points required by 2030

Source: Department for Business, Energy & Industrial Strategy



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Why EV Demand Forecasting Matters to Grid Operators

Can the grid cope with the extra demand from electric cars?

- Transport is a **new load** for electricity grids
- Cars are not fixed assets, so understanding travel patterns **can inform load forecasting and management**
- At the distribution level, **capacity constraints** could limit infrastructure rollout
- Network operators can **help enable an EV future** by working with governments and private sector

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Why EV Demand Forecasting Matters to City Planners

How many charging points are needed and where?

- Charging infrastructure is necessary to **enable EV usage** and encourage uptake
- **Understanding the scale of need** can help planners prioritise intervention
- Knowing where charge points are needed can help identify **gaps in supply**
- Understanding population segmentation highlights **which drivers will rely on public infrastructure**

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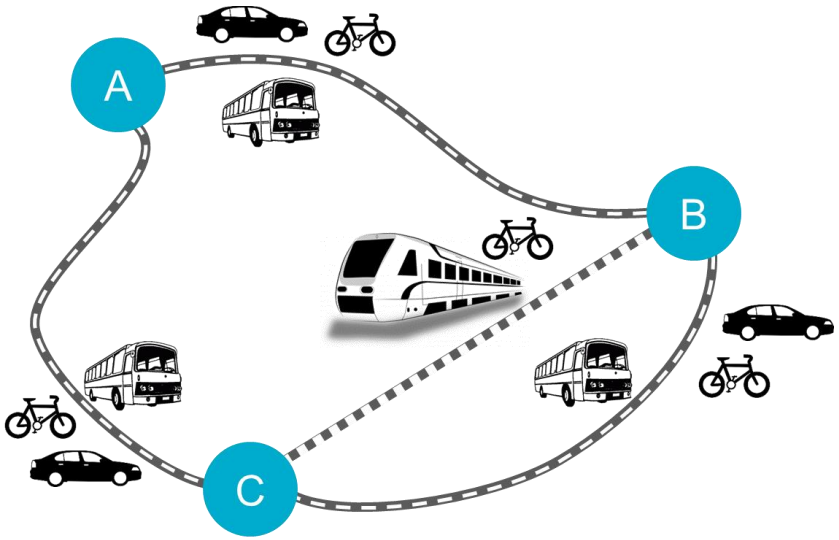
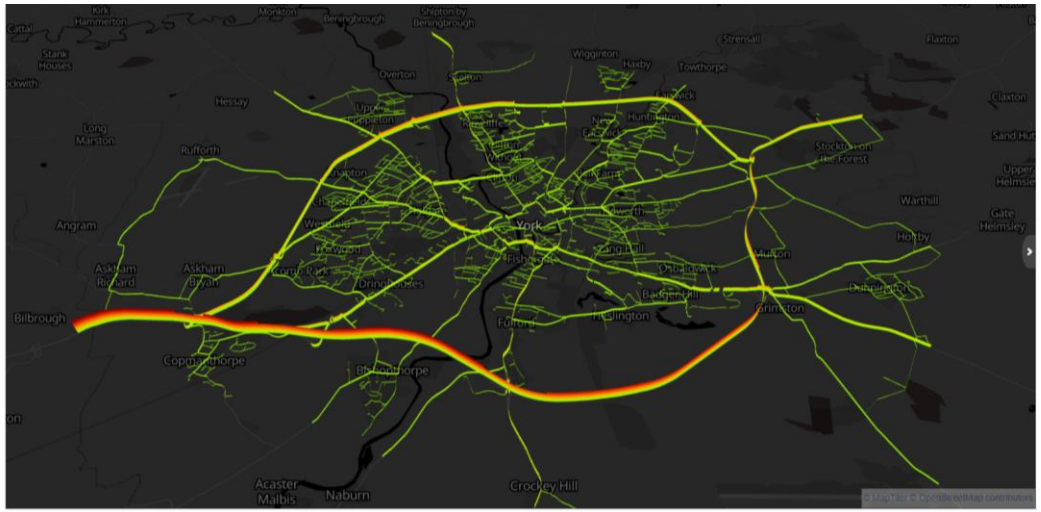
Understanding Mobility Patterns





Department for Transport

national highways

SP ENERGY NETWORKS

TRAFNIDIAETH CYMRU
TRANSPORT FOR WALES

Transport for West Midlands

WEST OF ENGLAND Combined Authority

Transport for London

CITY OF YORK COUNCIL

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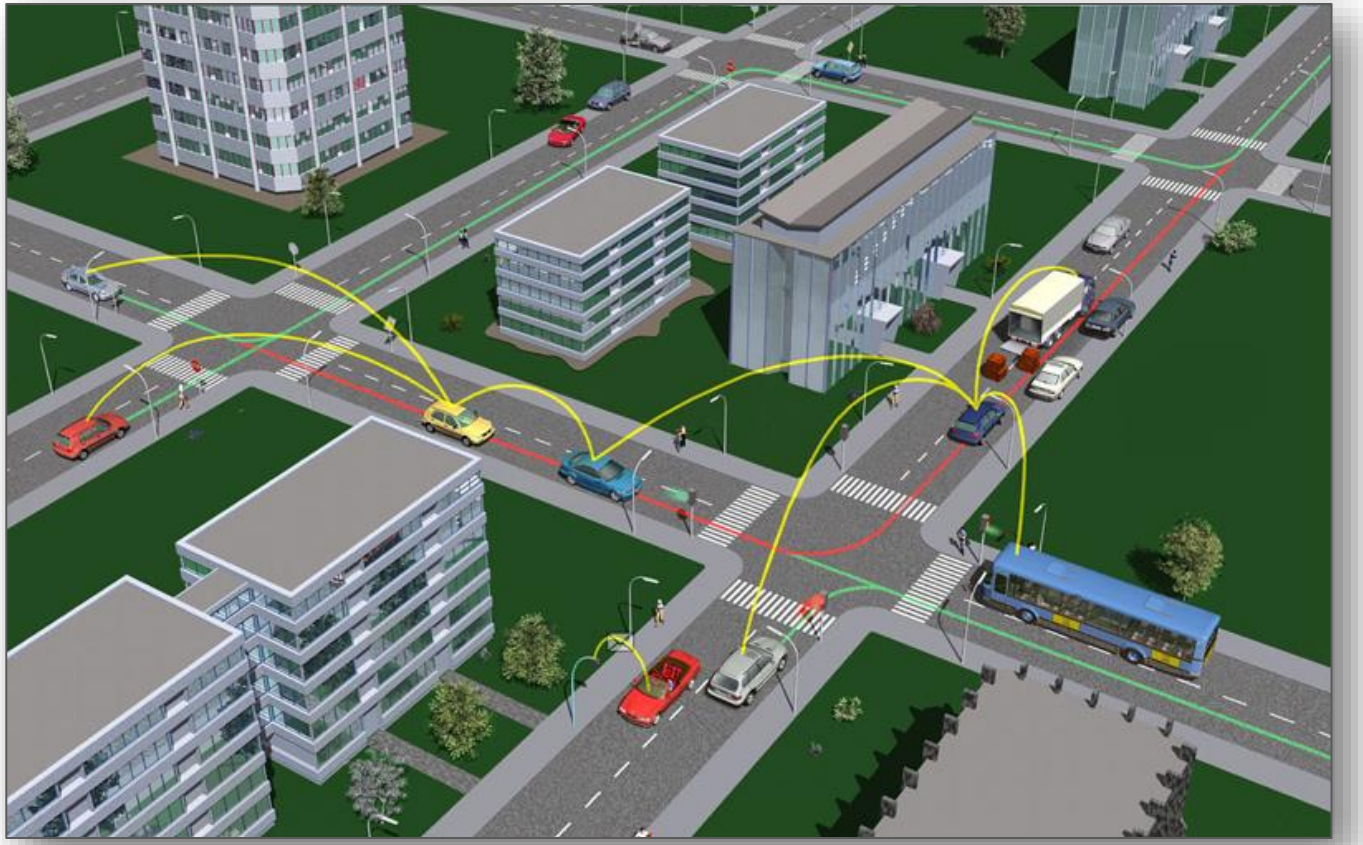
Why Use a Transport Model?

Set-up a virtual world

Build bespoke evaluation

Test and compare scenarios

Predict EV uptake and energy requirements



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Model Specification

1. Strategic or Targeted?
   - Region-wide or site assessment?
2. Represent EV uptake
   - In which neighbourhoods is EV uptake likely to be higher?
3. Understand energy requirements
   - How much electricity based on distance travelled and battery size?
4. Represent different charging options
   - Where do vehicles travel where they could feasibly recharge?
5. Infrastructure Requirement
   - How many points might be needed, and of what type?
6. Be flexible
   - Handle various scenario inputs

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The Charge Transport Model

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SP ENERGY NETWORKS

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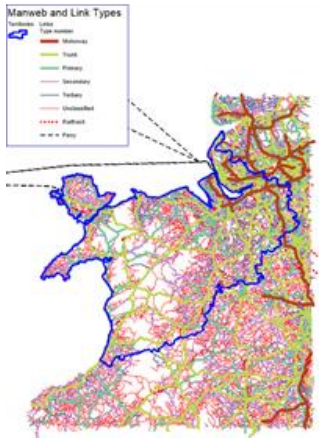
smarter grid solutions

ea technology

Inputs

Road networks



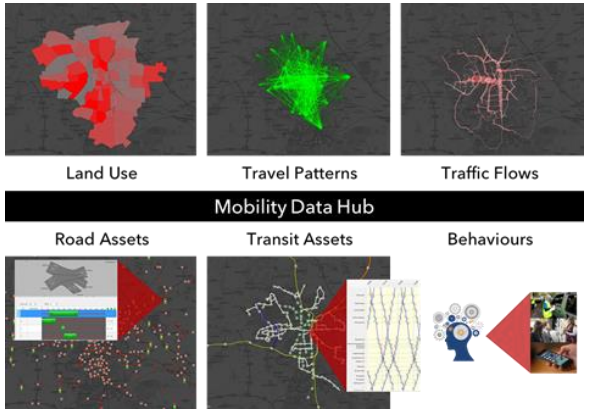
Census and OSM data

National Travel Survey

Model

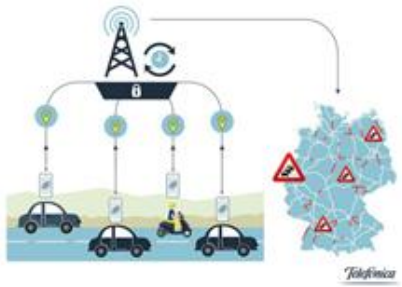
PTV VISUM

Tour-based demand model



Cal / Val

Movements data



Traffic count data

LIVERPOOL CITY REGION COMBINED AUTHORITY

Household Travel Survey & Model

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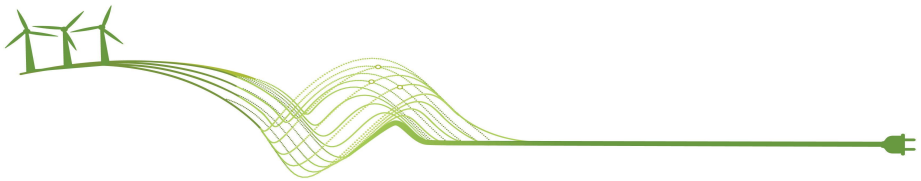
EV Future Scenarios

- EV Future Scenarios
- Scenarios applied to anticipate demand from 2025 – 2050 & consistent with dFES.
- Scenarios define:
  - Number of EVs and who is likely to buy them
  - Vehicle technologies, including future battery ranges
  - The outlook of public infrastructure



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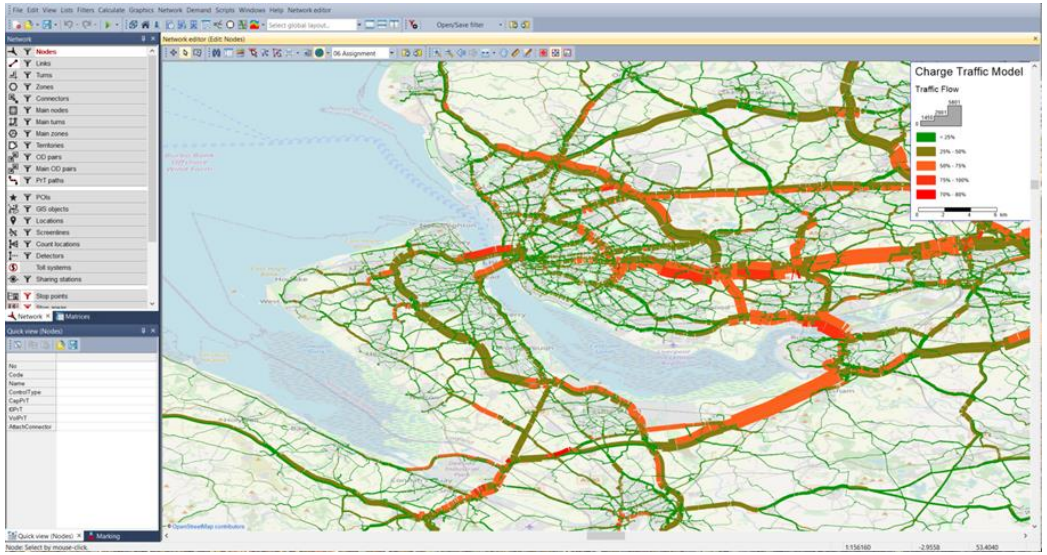
EV Modelling

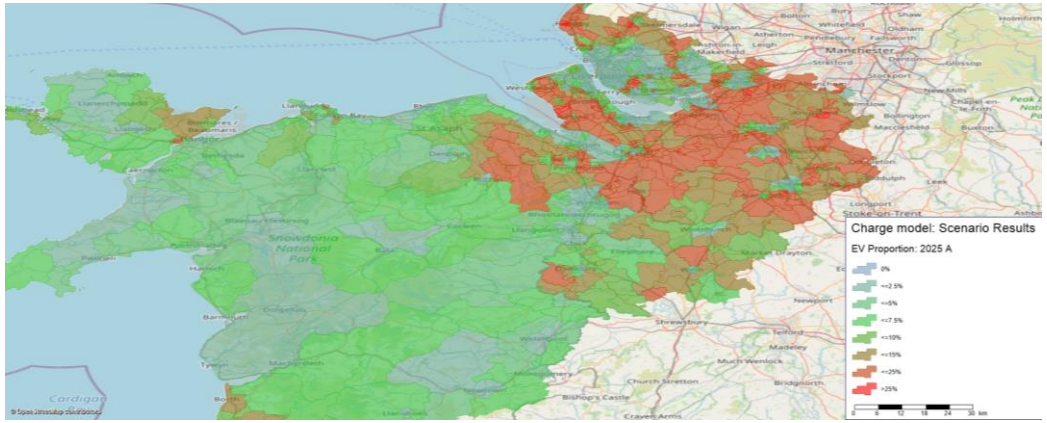
EV uptake defined by:

- Income
- Car ownership
- Off-street parking
- Scenario inputs

Travel patterns and activity sequences combined with EV uptake to determine:

- **Where** EVs are likely to be driven and for what purpose
- **How far** they travel & energy consumed
- **When** and where they might require charging
- **How long** the car is parked and the electricity required to charge





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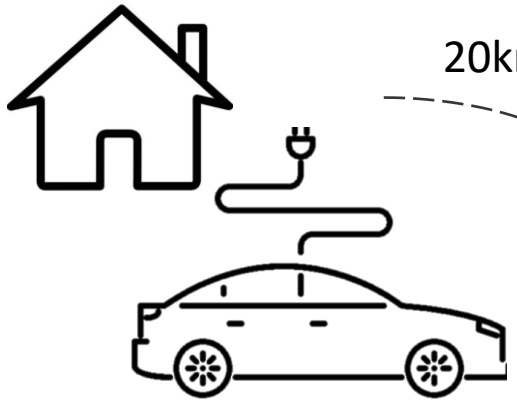
Modelling EV patterns



20kms = 4kWh

5kms = 1kWh

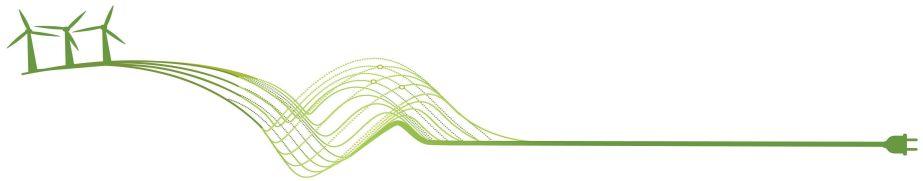
20kms = 4kWh

EV with 40kW battery
~200km range

50kms = 10kWh

50kms = 10kWh

100kms = 20kWh



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Charge Transport Model Report

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Transport Model Final Report

Method, Findings and Conclusions

Table 1: Model Requirement

Model Aspect	DNO Consideration
Area	The model area should include the network licence area, plus sufficient coverage to capture most travel into and out of the network licence area.
Zoning System	A zoning system provides a means to attribute travel demand at an aggregate level across a spatial area. Consider pros and cons of population-based zones or evenly sized zones.
Population Segmentation	Segmenting the population allows differing behaviours to be modelled. Consider what attributes will influence EV uptake and usage (car drivers, income, household type, etc).
Population Activities	A transport model determines the number and location of trips based on activity purpose, such as work or shopping. Consider how these activities tie in with charging types and locations.
Travel Modes	Private car is essential, but other modes may be useful or necessary to determine a representative split of travel options.

Charge Transport Model Report

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Slido Poll

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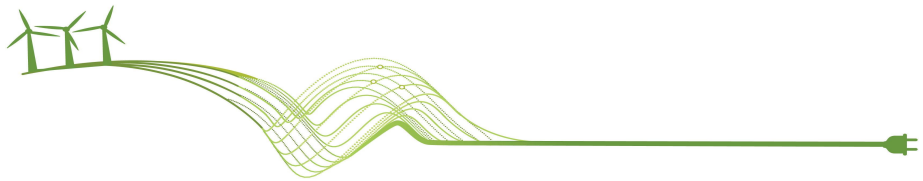
Enter the code: #PTV1603



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Charge Project: ConnectMore

Tim Butler (Senior Consultant, Project Manager)

ea technology

16th March 2022

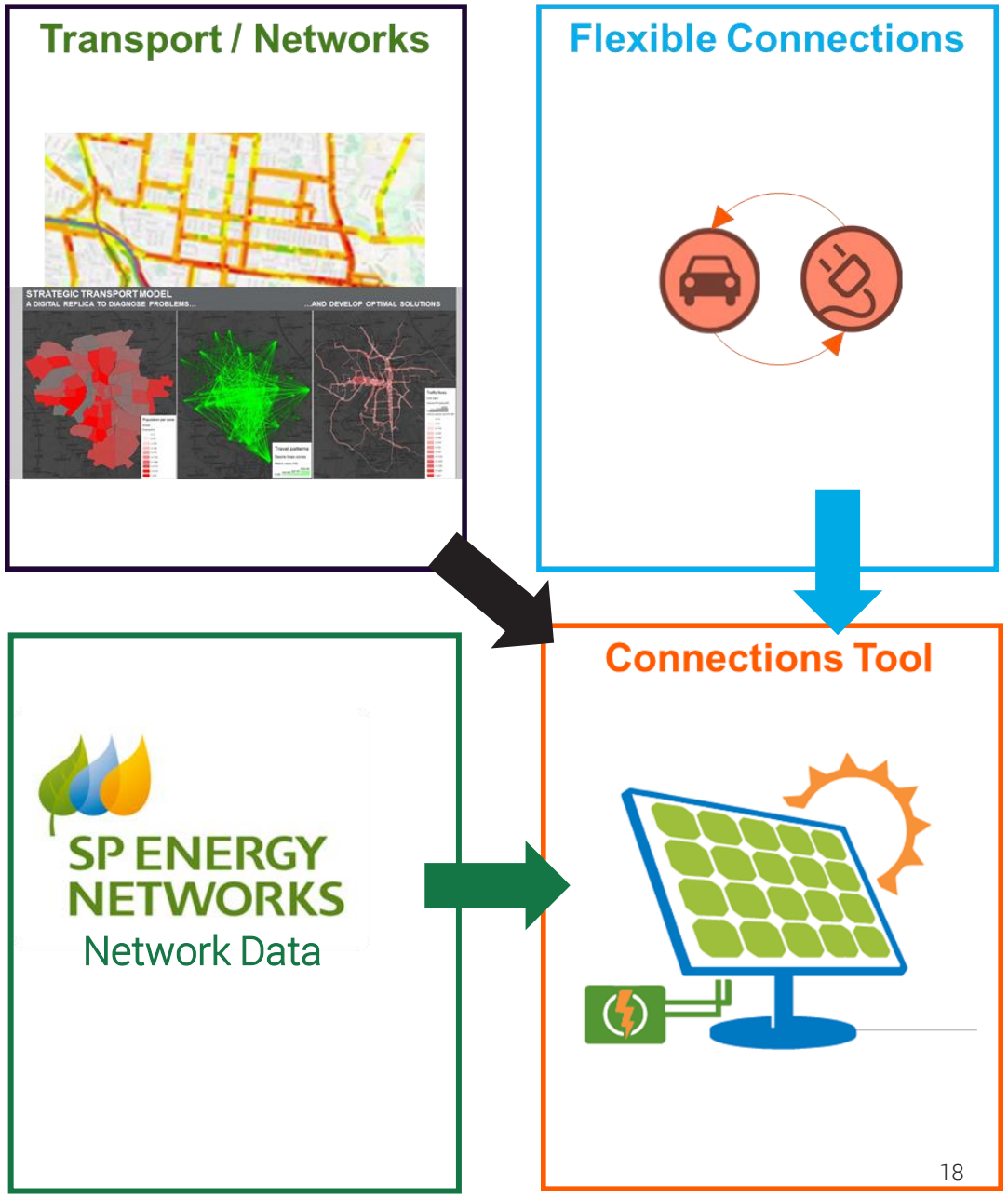
Overview of the ConnectMore Tool

The ConnectMore Tool

What is it?

The ConnectMore Tool is being developed as the method by which the Charge Project benefits are made available to customers:

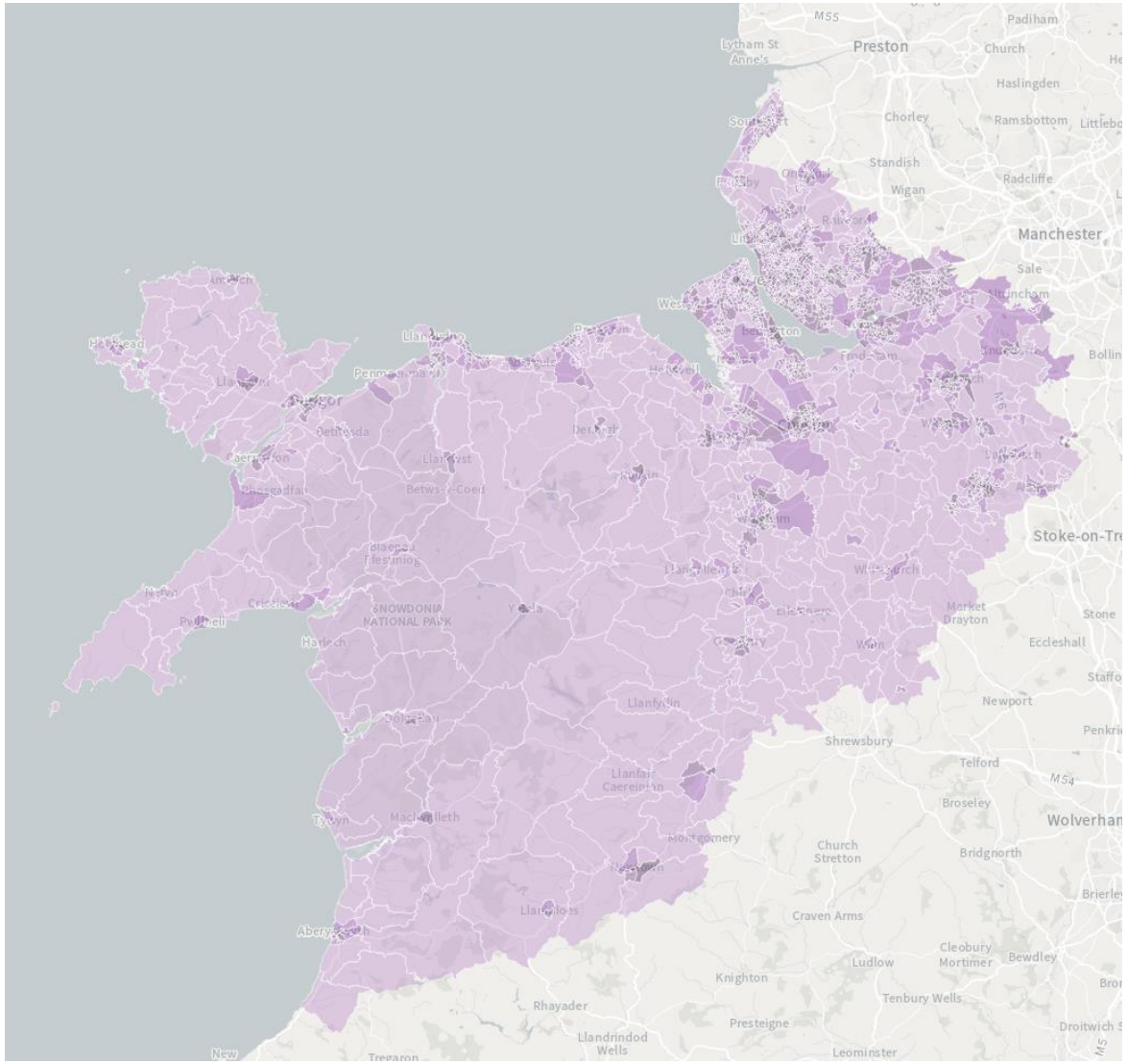
- Give charge point installers the insight to install charge points where they will be most beneficial.
- Provide them visibility of where the network can accommodate the demand.
- Identify whether flexible connection agreements can be used.
- Make network maps and cost estimations available to the public.
- Reduce the volume of speculative quotations for any type of new connection.



The Charge Project

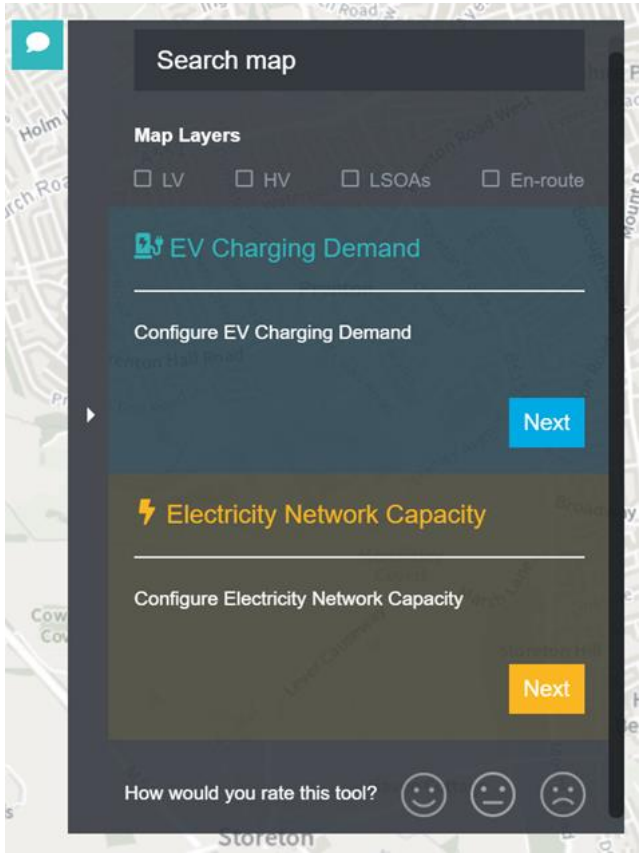
Where is the project focused?

- The project is limited to the MANWEB license area so the EV charging demand data, ConnectMore Tool and the Cost Estimator have only been developed to cover:
  - Merseyside
  - Cheshire
  - North Shropshire and
  - North and Mid-Wales.



ConnectMore

- There are lots of big data sets in ConnectMore. To try to make it easier to use, it is sorted into layers.
- Once you have selected the data you want to look at, you can turn layers on and off using the tick boxes at the top of the right hand menu.
- You will also see the speech bubble where you can leave feedback.



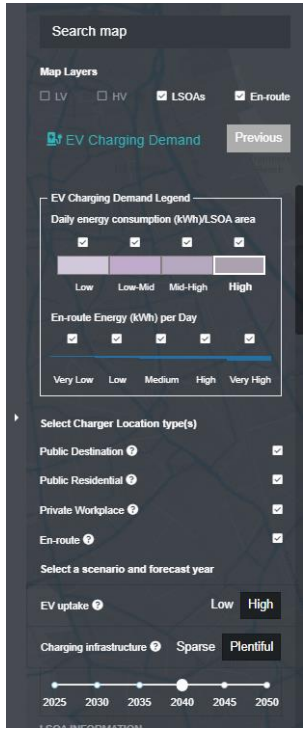
- Project Home Page
  - https://www.spenergynetworks.co.uk/pages/charge.aspx
- Full screen Tool
  - https://connectmore-heatmap.azurewebsites.net/

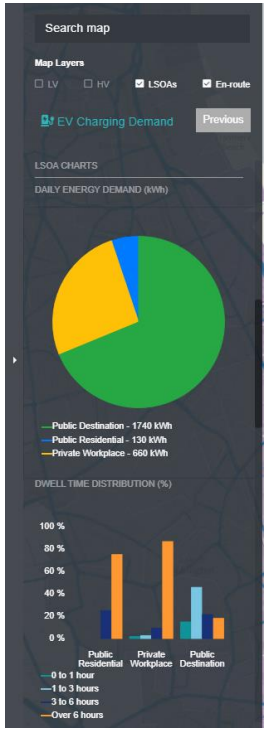
Transport Layers

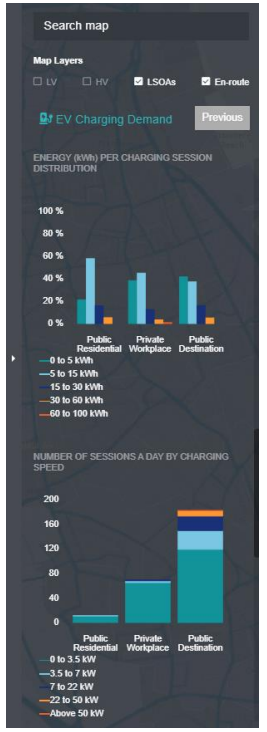
- Under the “EV Charging Demand” section…
  - Select which charger type you’re interested in:
    - Public Destination
    - Public Residential
    - Private Workplace
    - En-route
  - Select the Scenario…
    - EV Update: Low / High
    - Charging Infrastructure: Sparse / Plentiful
    - …and the year of interest out to 2050
  - The LSOA’s will be populated and can be selected for details on forecast charging requirements.

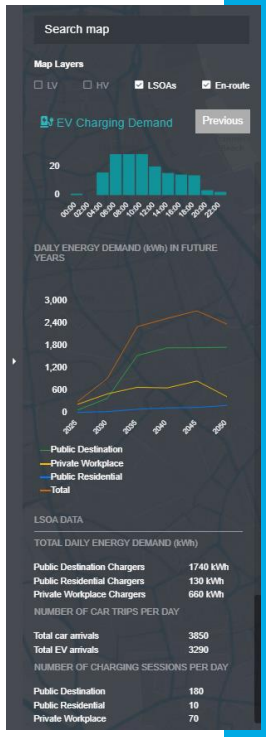
EV Charging Energy Requirements

- Transport Layer built from analysis undertaken by PTV.
- Used to identify the EV charging energy requirement by LSOA.
- Detailed information available for each LSOA covering:
  - Anticipated number of vehicles
  - Charging events (by duration and energy requirement)
  - Total energy requirement over a 24hr period
  - Breakdown of charging location type (Public Destination, Public Residential and Private Workplace)



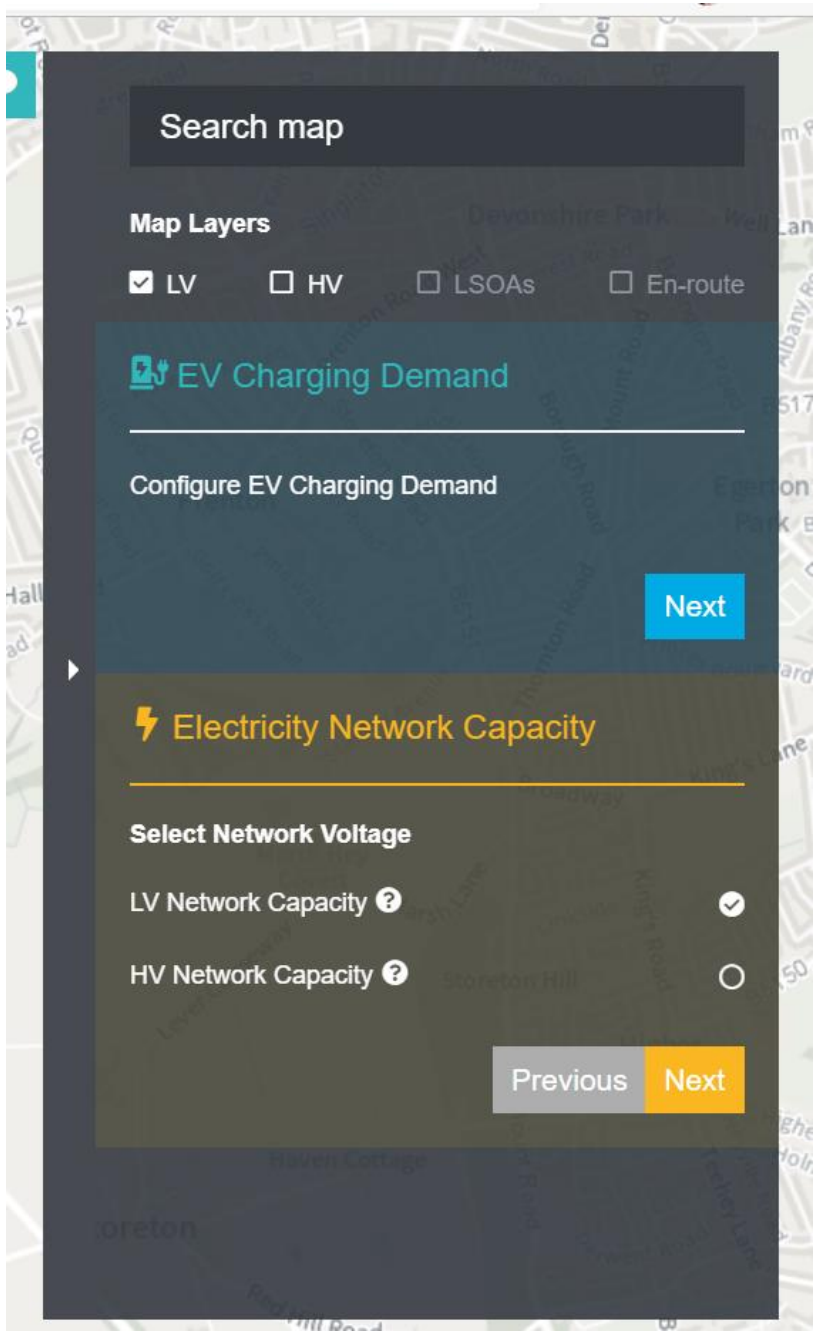






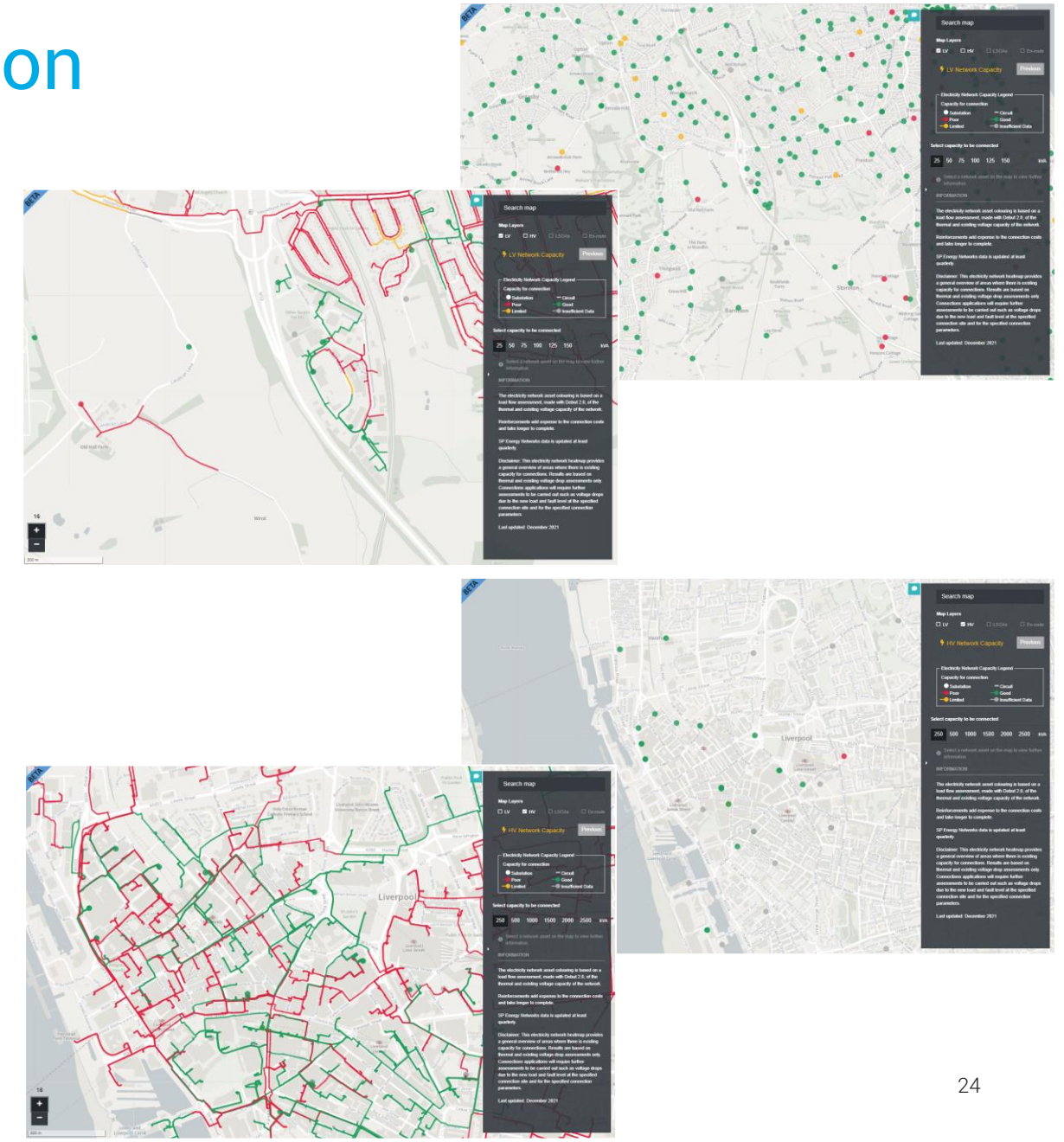
Network Data

- ConnectMore contains LV and HV network Maps
- Once you have selected the geographic you want to look at, you can turn layers on and off using the tick boxes at the top of the right hand menu
- To navigate to the network data navigate to this screen and select LV or HV
- You can only see LV or HV at any time



Network Capacity Visualisation

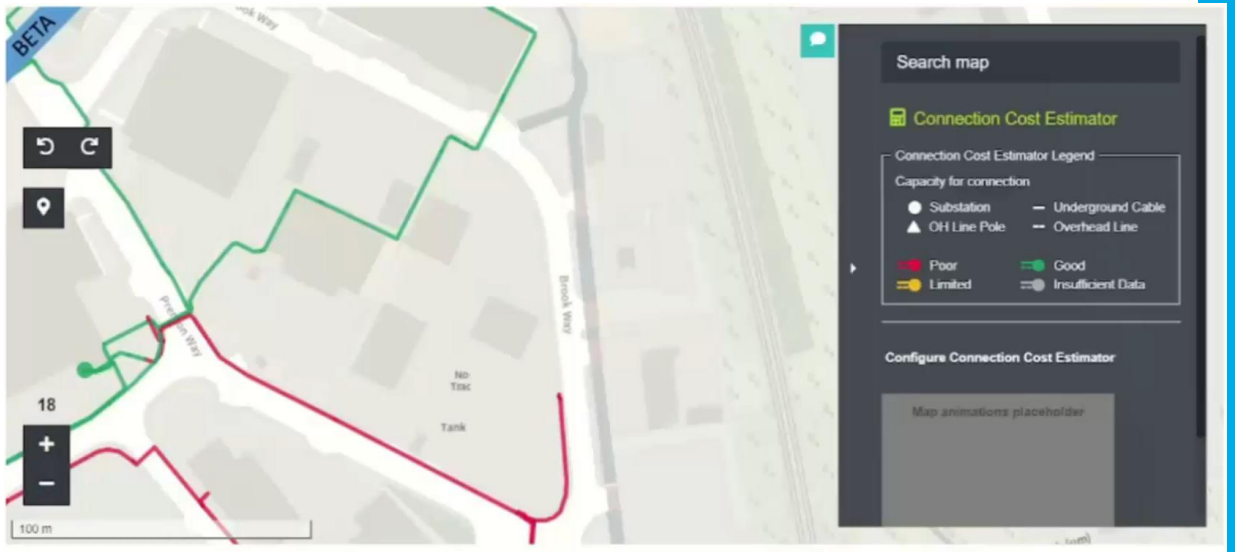
- Network Capacity Layer details both HV and LV assets.
- Loading is modelled within the ConnectMore Tool, using SPEN data on assets and connected customers.
- Red-Amber-Green status is assigned to assets based on the existing (modelled) load, and the desired additional load to be added to the network.
- RAG status dynamically updates as the desired new connection value is changed.



Cost Estimator Tool

Generates budgetary estimates for LV & HV Networks.

- Determines the distance and ground types of the new connection route.
- Will calculate the reinforcement costs (if necessary).
- Warns against unsuitable ground types (railway, river, existing building).
- Outputs a total (budgetary estimate) cost for all work.
  - Customer receives a final price and outline route map.
  - Details of the estimate calculation are stored within the tool for later access if required.
- The tool is in final development stages, and not yet deployed in the ‘live system’.

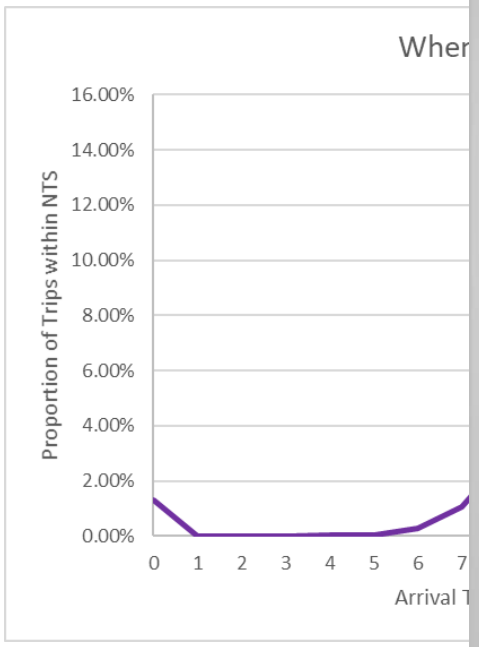


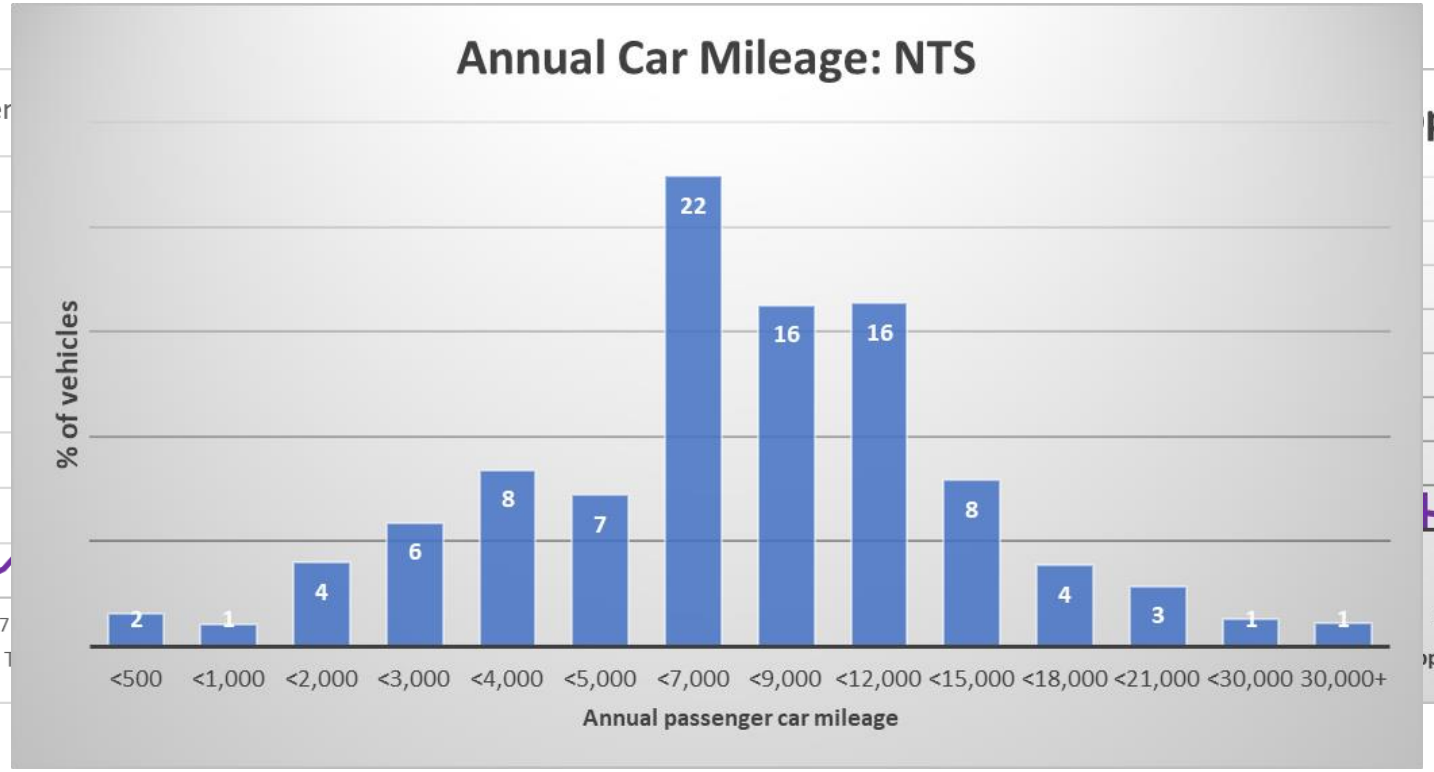
Cost Breakdown (LV Unconstrained)

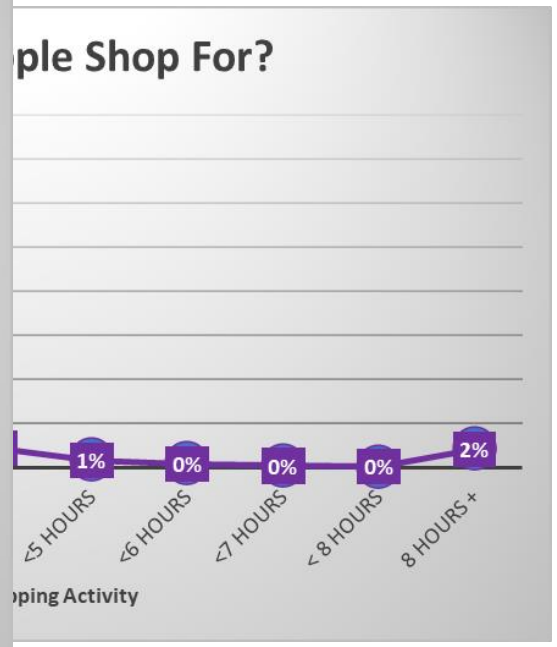
Group	Description	CUs	Qty
Project Management	Project Management EN4 (per hour)	140000310	8
Ducting Costs	Contract supply only 150mm class 2 ducts	140000802	9
Ducting Costs	Contract install ducts Class2 100/150mm	140000804	13
Service Cable	1 LV in trch-F/P B/T orRigid 35mm2 1ph	140000564	15
Mains Cable	1 LV in trch - F/P B/T orRigid inc 95WF 3C	140000595	89
Mains Cable	1 LV in trch - Road Type 3/4 inc 95WF 3C	140000599	13
JPEs	Breech JT 300WF 3/4C to 185-300 4C PILC	140000990	1
JPEs	JBay LV Breech Joint - F/P B/T orRigid	140000691	2
JPEs	LV Pot end 95WF	140000353	1
JPEs	SERV BR JT upto 35mm 3ph to 0.2PILC	140001078	1
JPEs	JBay LV Service - F/P B/T orRigid	140000679	1
Terms	100A 1ph Cut Out	140000348	1

Sub Total	£9007
Postcode Uplift @ 13%	£1171
Total Cost Excluding VAT (rounded up to nearest £100)	£10200
Total Cost Including VAT	£12240

What Do Mobility Patterns Tell Us?







Source: National Travel Survey 2015 - 17

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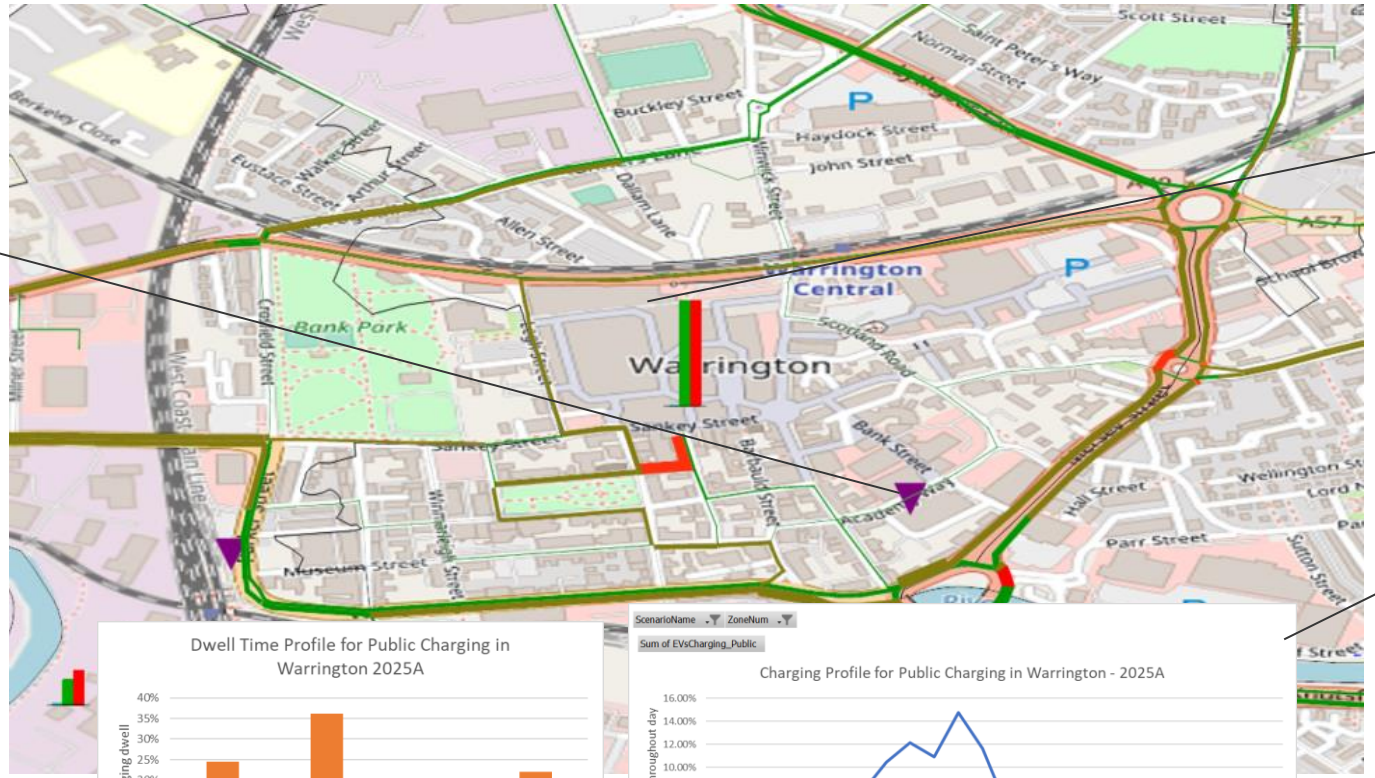
Transport Model Use Case

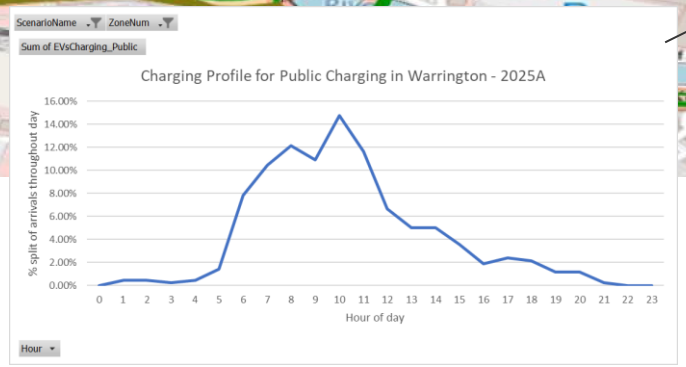
- Provides targeted justification for network **investment** ahead of need

Current infrastructure:

30 x 2
7kW chargers

Is there enough capacity to enable connection growth?





Based on ~10% EV uptake in 2025, ~90-110 EVs arrive into this zone per day and want to charge

Equivalent to daily kWh:
580 – 780kWh

Daily profile and dwell times suggest:

40 – 60 22kW chargers &
5-10 50kW+ chargers
/ ~1,800kVA
required

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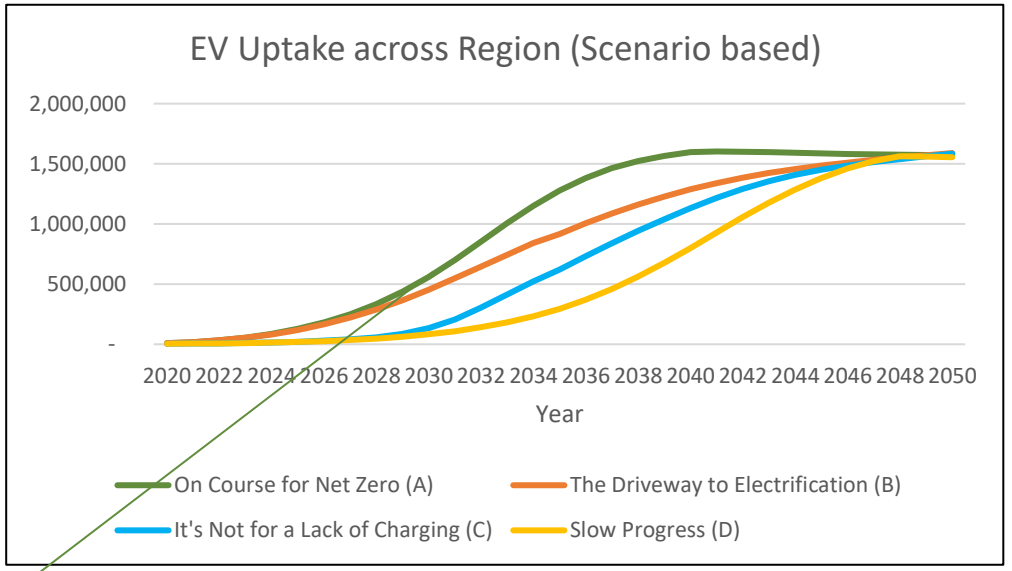
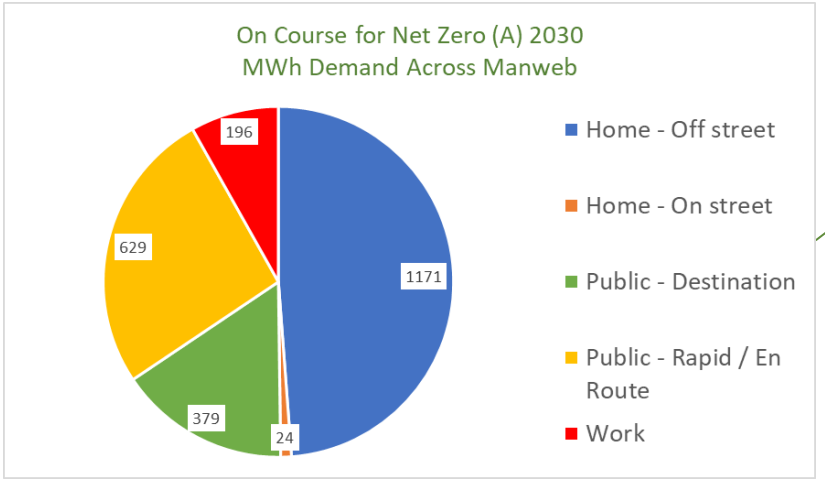
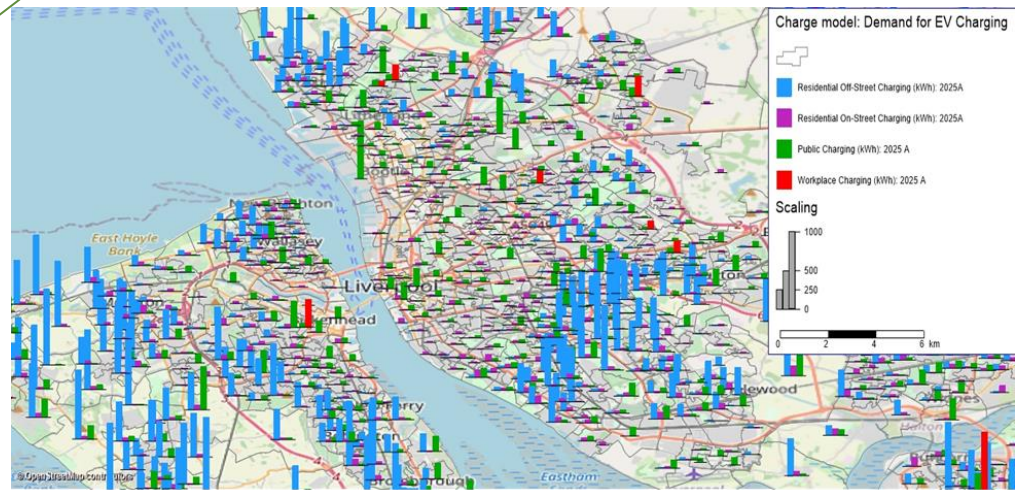
Transport Model Insights

- Electricity networks and infrastructure planners should be prepared for **significant growth in demand**
- Modelling highlights that networks likely to need **reinforcing** in places, but **flexibility** will be key.







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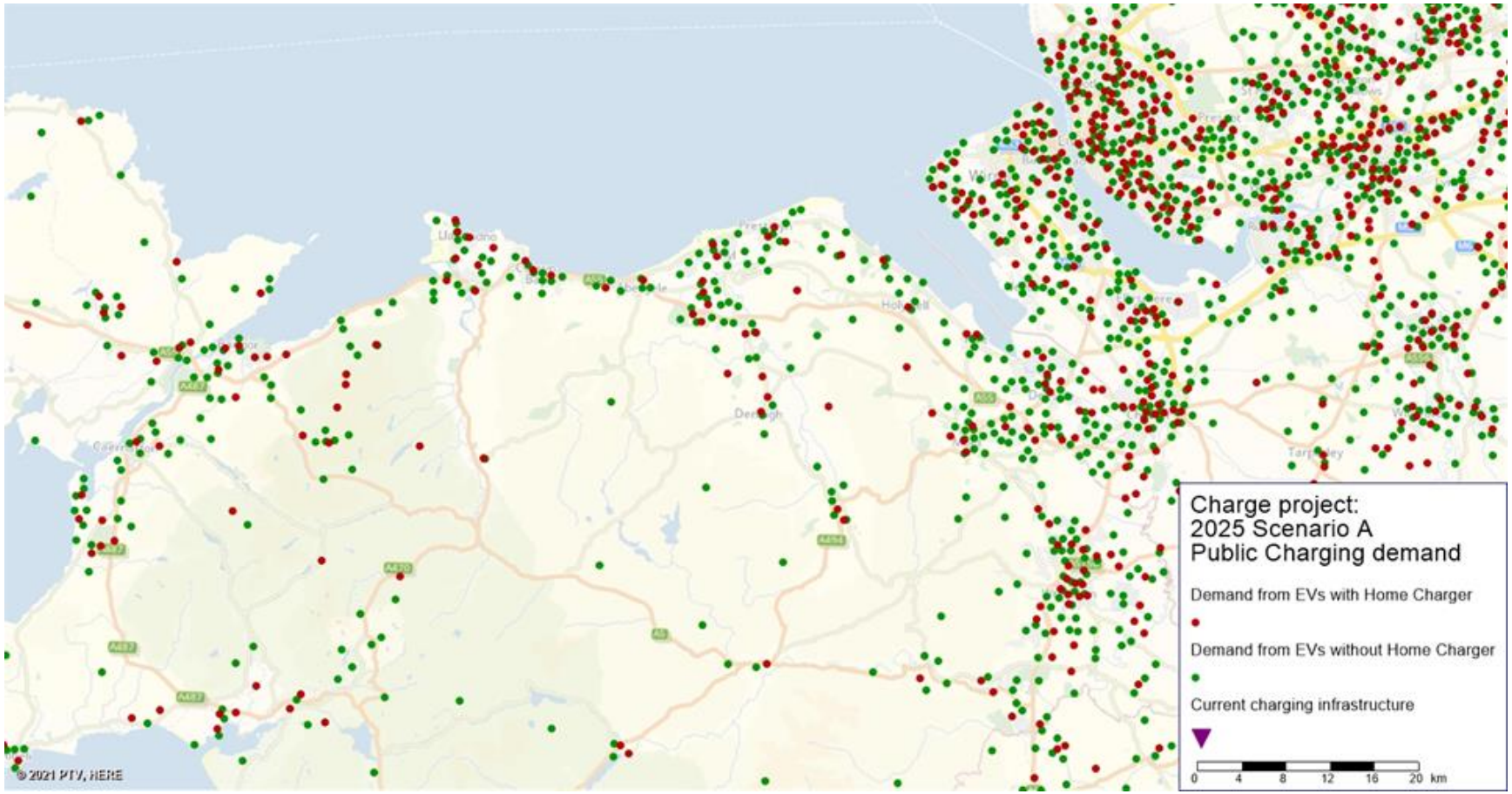
Transport Model Insights

Understanding impacts of infrastructure decisions on different **customer groups**



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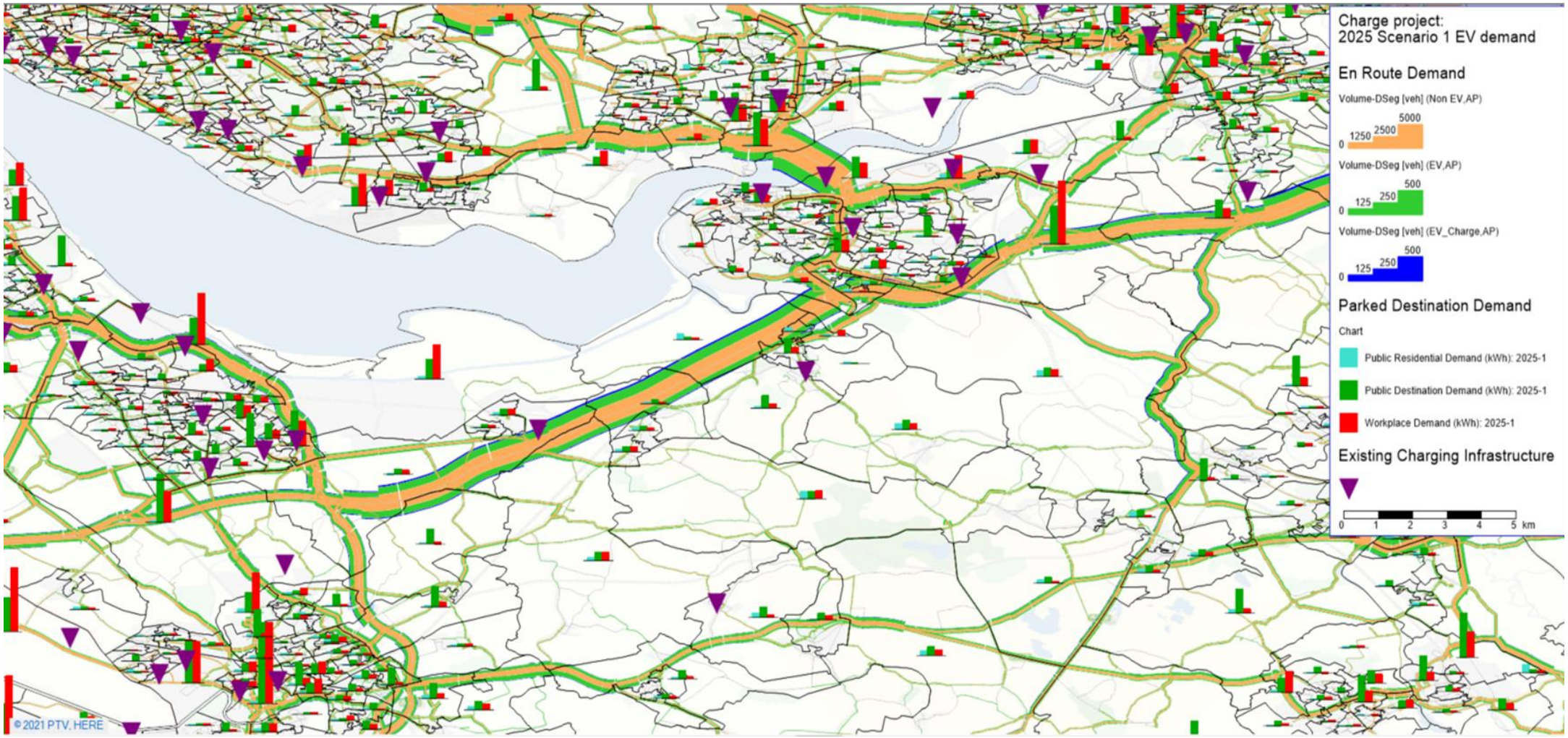
Location Optimisers



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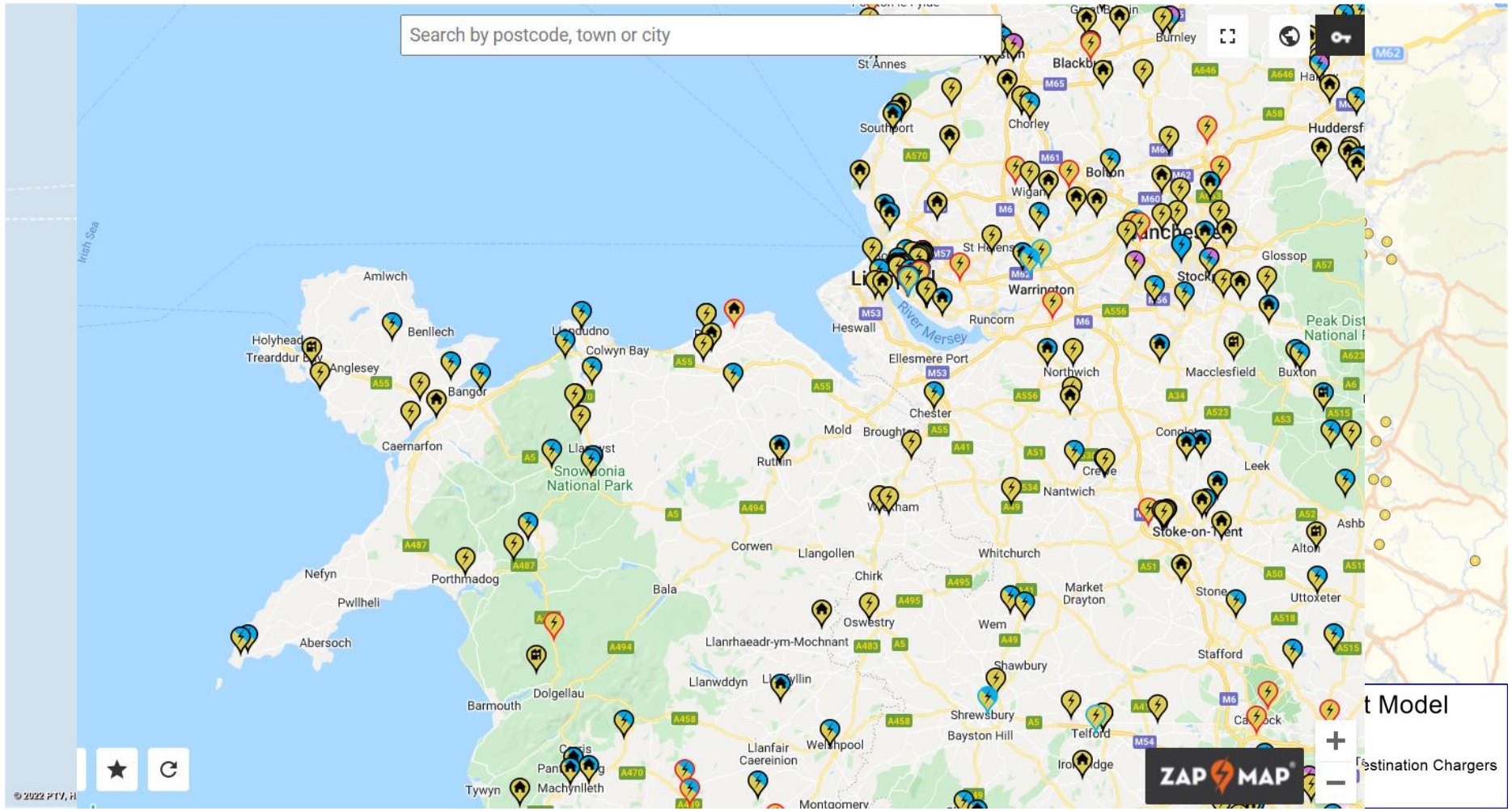
Public Charging Requirement?



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EV kWh Demand Split by Location Type
Scenario / Year as per table

Charging Up

Policy Exchange

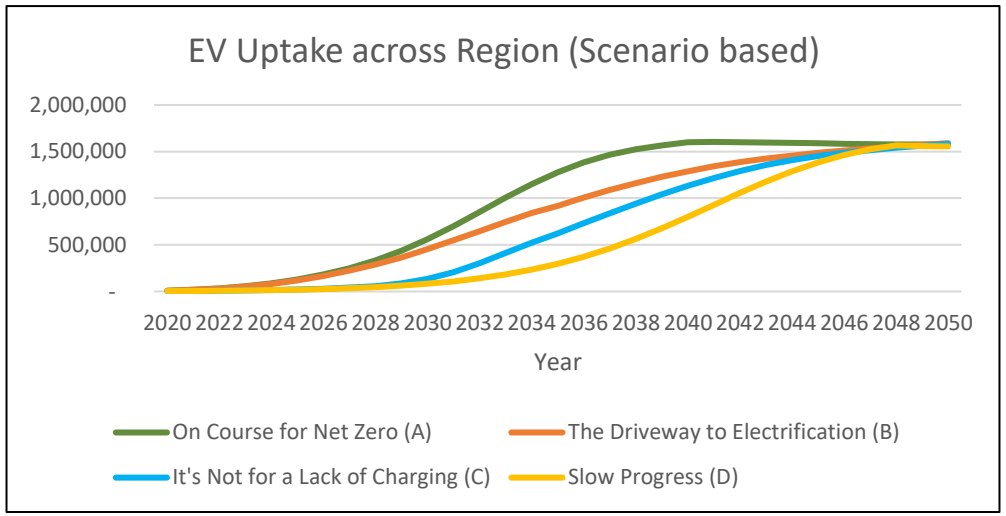
Policies to deliver a comprehensive network of public EV chargepoints.

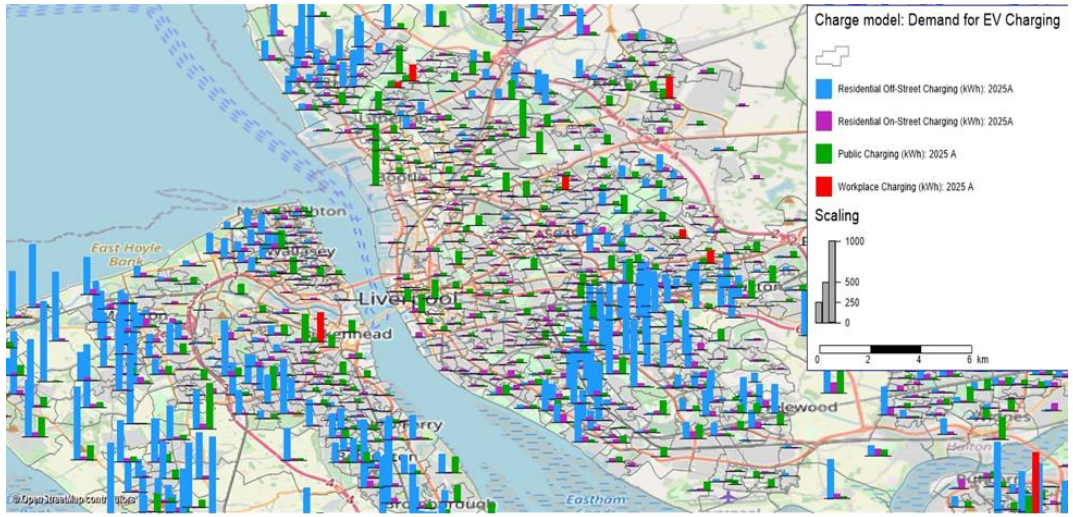
400,000 public charging points required by 2030

Net Zero Scenario 2030

What Does the Transport Model Tell Us?

- What is the scale of requirement for EV infrastructure?
- How are infrastructure needs likely to differ by area?
- What is the likely use case for infrastructure if it is installed in a certain location?
- What affect might EV charging demand have on the electricity network?
- What sort of future is desired and how can be build towards that future?





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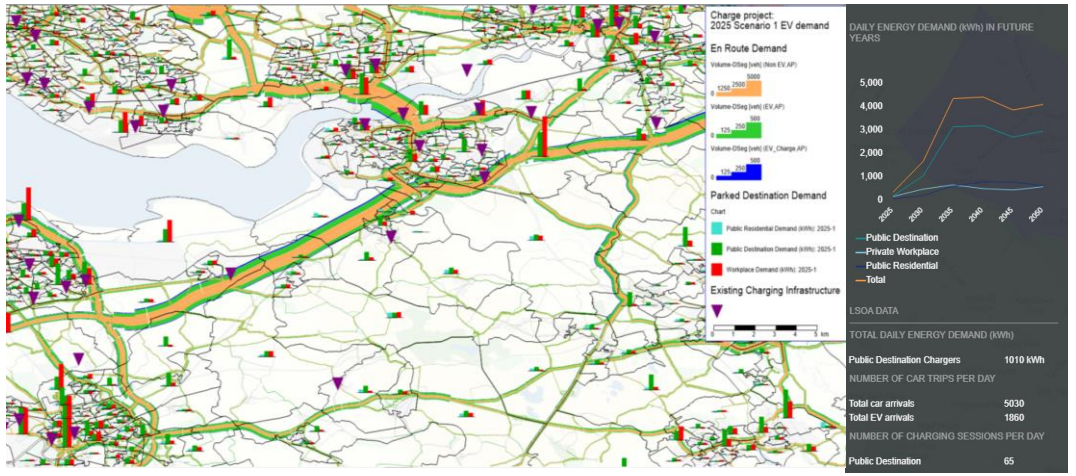
Summary

- **Understanding travel patterns is crucial** to assessing the requirement for charging.
- Transport Model tools exist to estimate this requirement and **test different scenarios**
- **Customer segmentation** in a transport model can help understand charging behaviours and needs
- Overlaying charging demand with electricity network supply helps **identify hotspots** for rollout.



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Final Q&A

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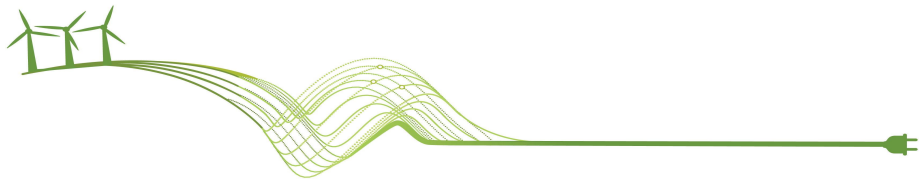

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Please get in touch for more info

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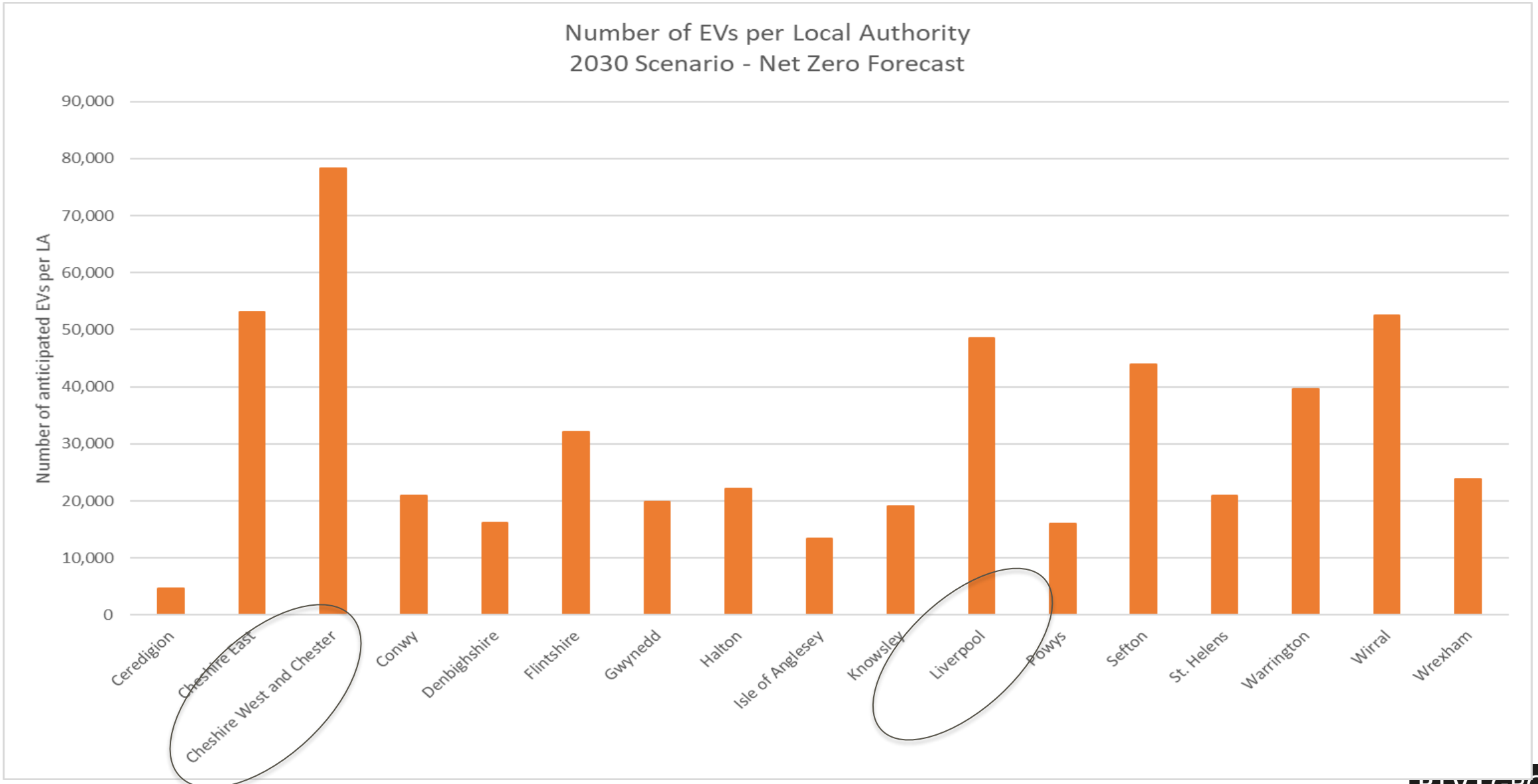
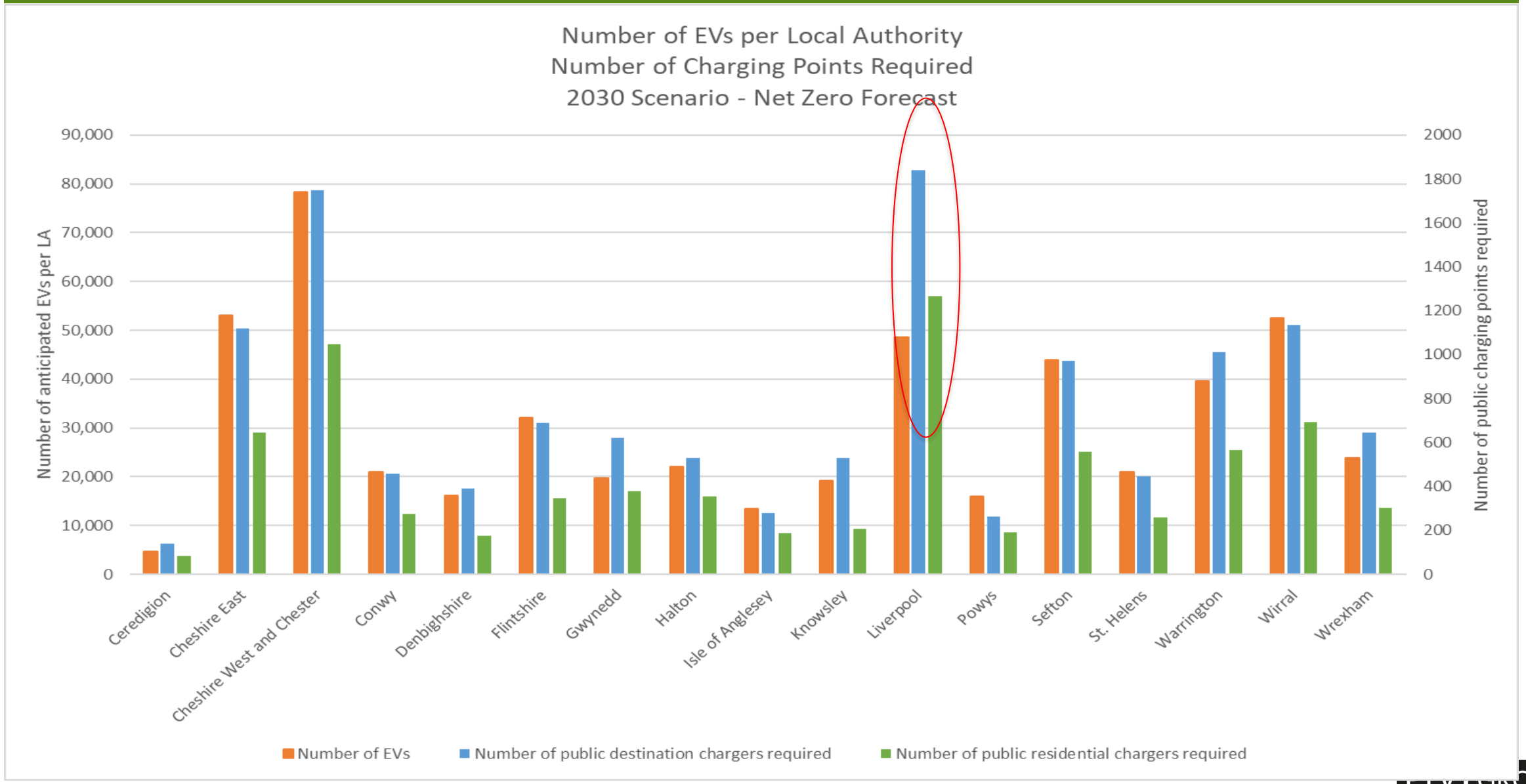
Laurence.chittock@ptvgroup.com

Transport Model Insights – EV Uptake

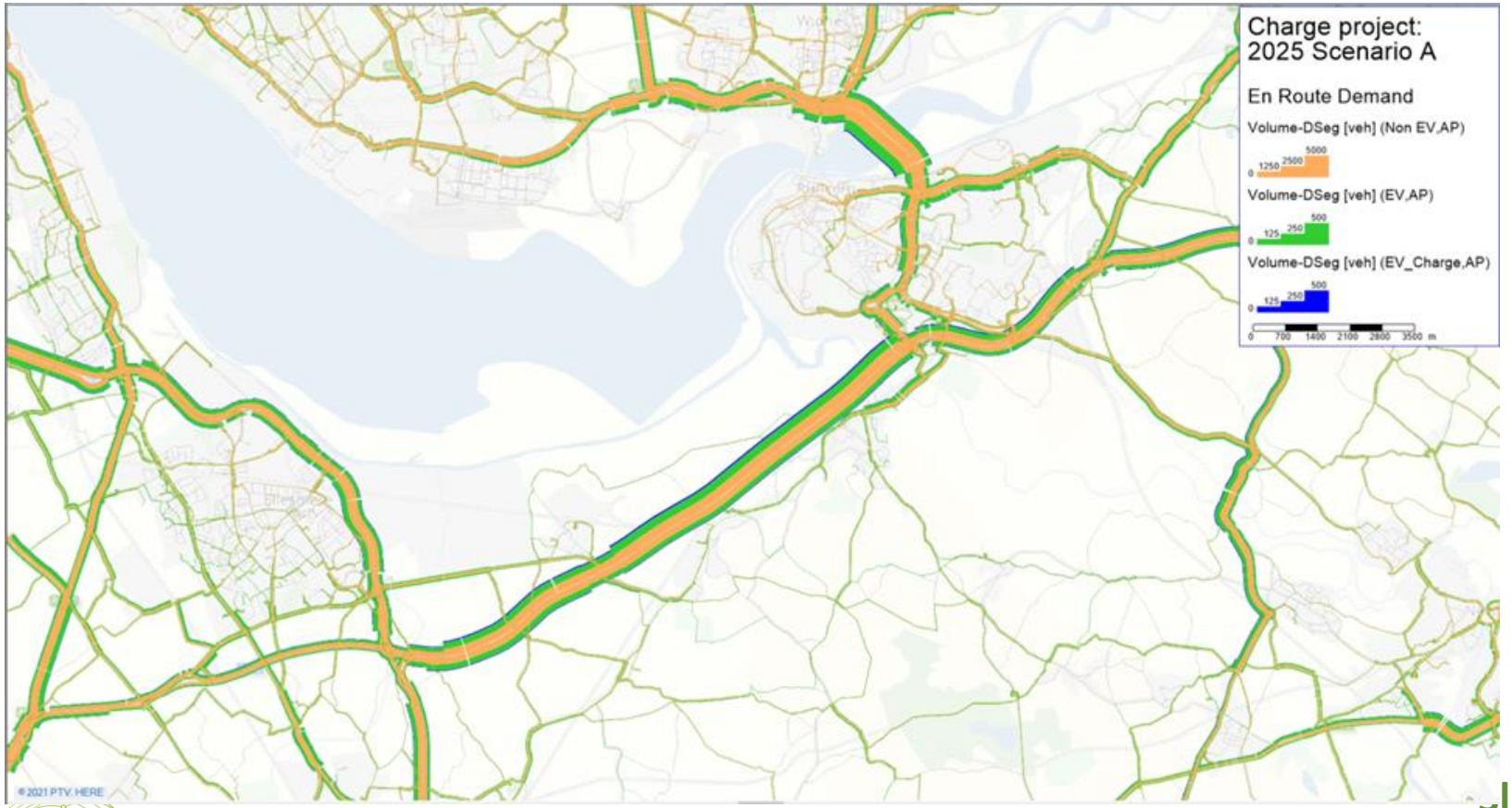


Transport Model Insights – Requirement for Public Charging



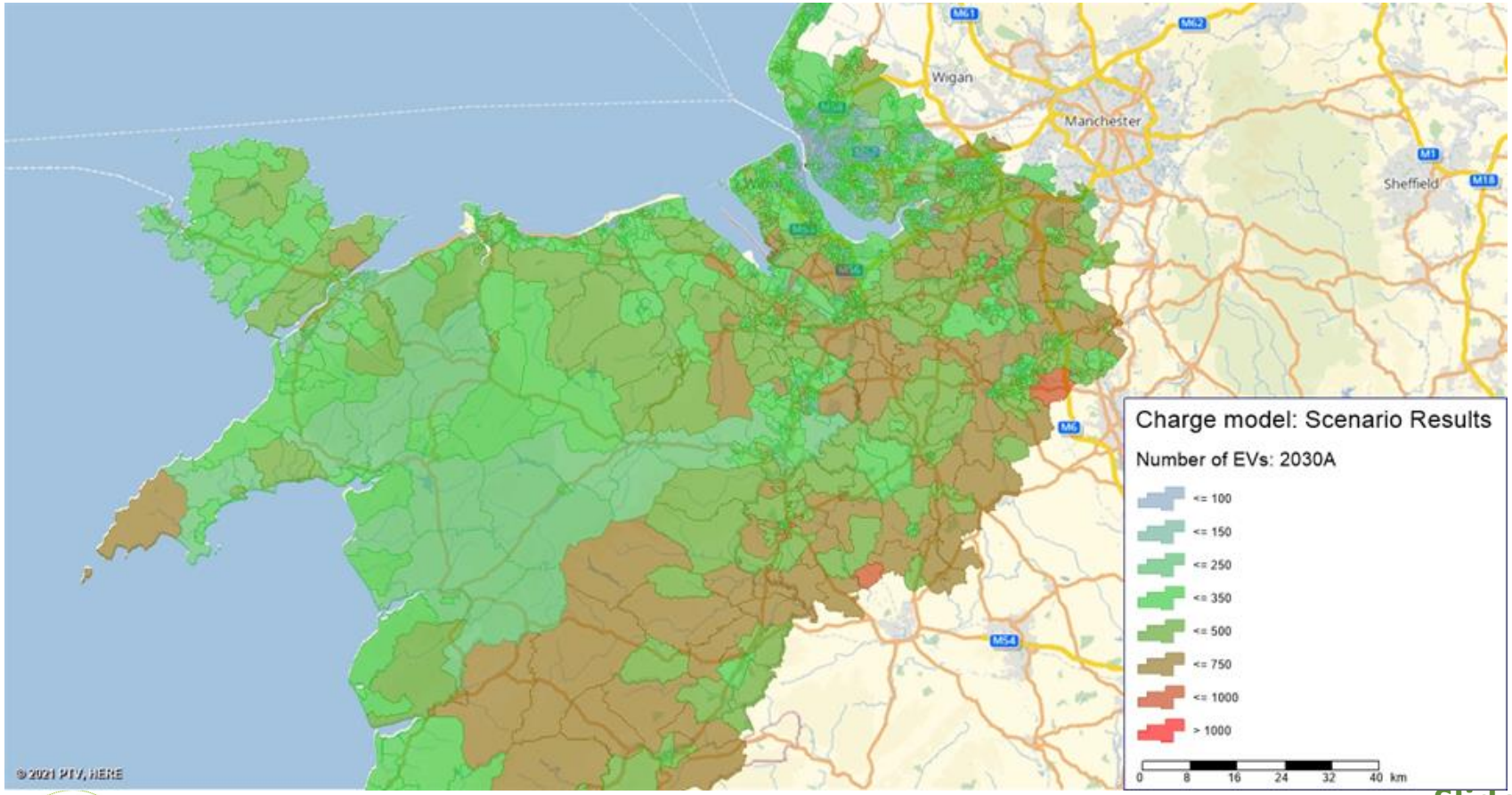
Transport Model Outputs

EV assignment – showing levels of anticipated EV traffic, and proportion of demand for en-route / rapid charging



Transport Model Outputs

Scenario-based EV uptake plotted in model



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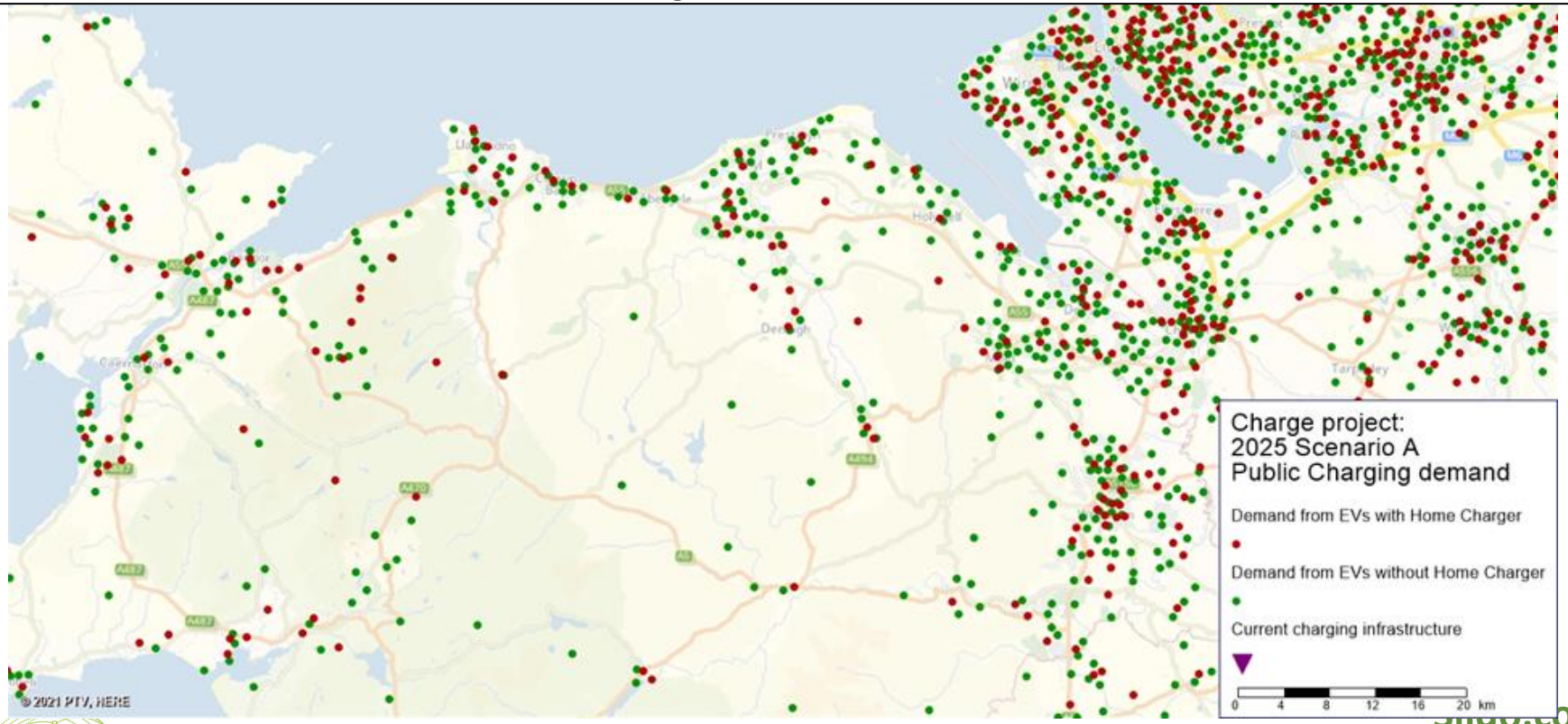
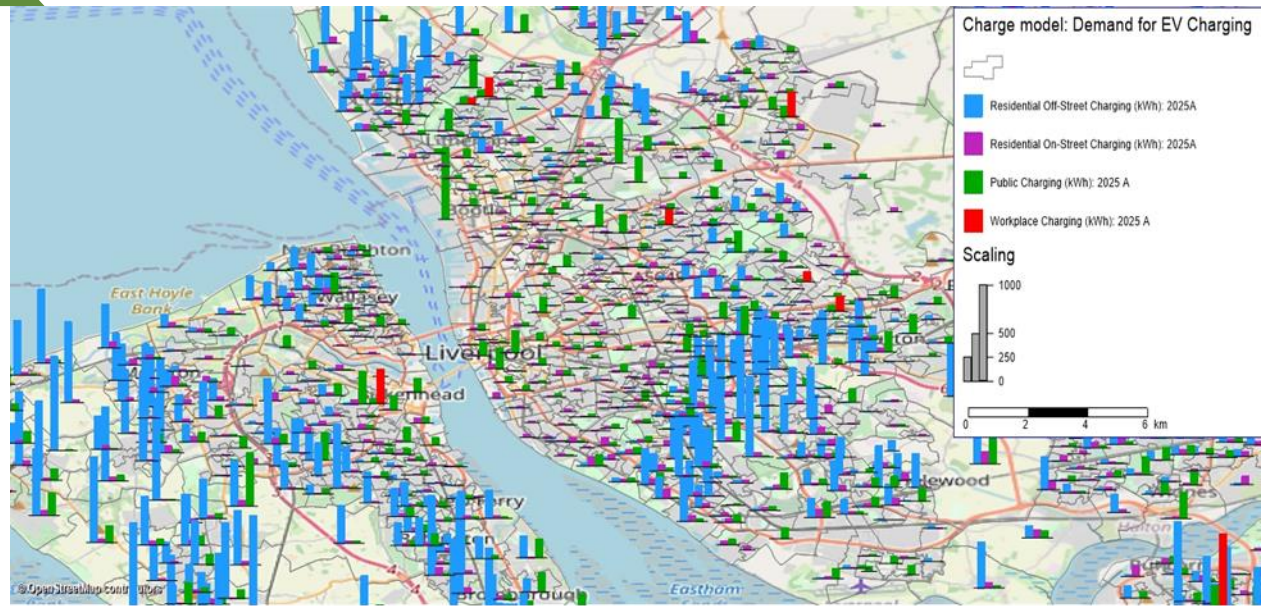
Transport Model Outputs

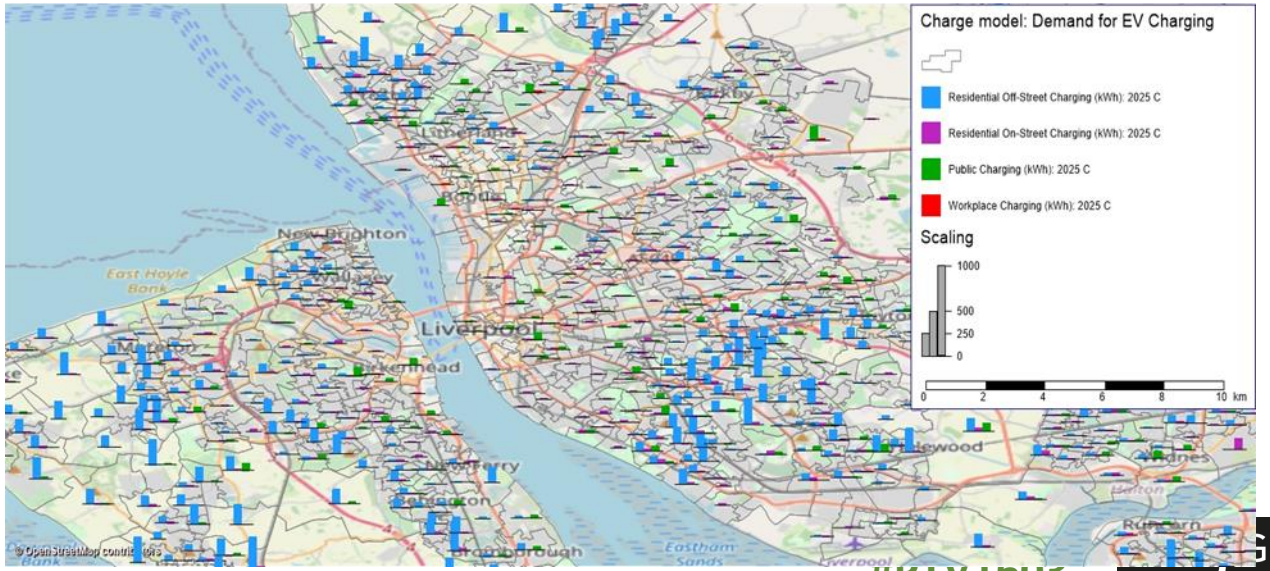
Demand for public charging, displayed as dots to represent number of anticipated charging sessions per area. Dots coloured based on whether EV drivers likely to have home charger (red) or not (green). In this scenario, 85% of EVs can charge at home, but 60% of public charging demand is from those without a home charger.



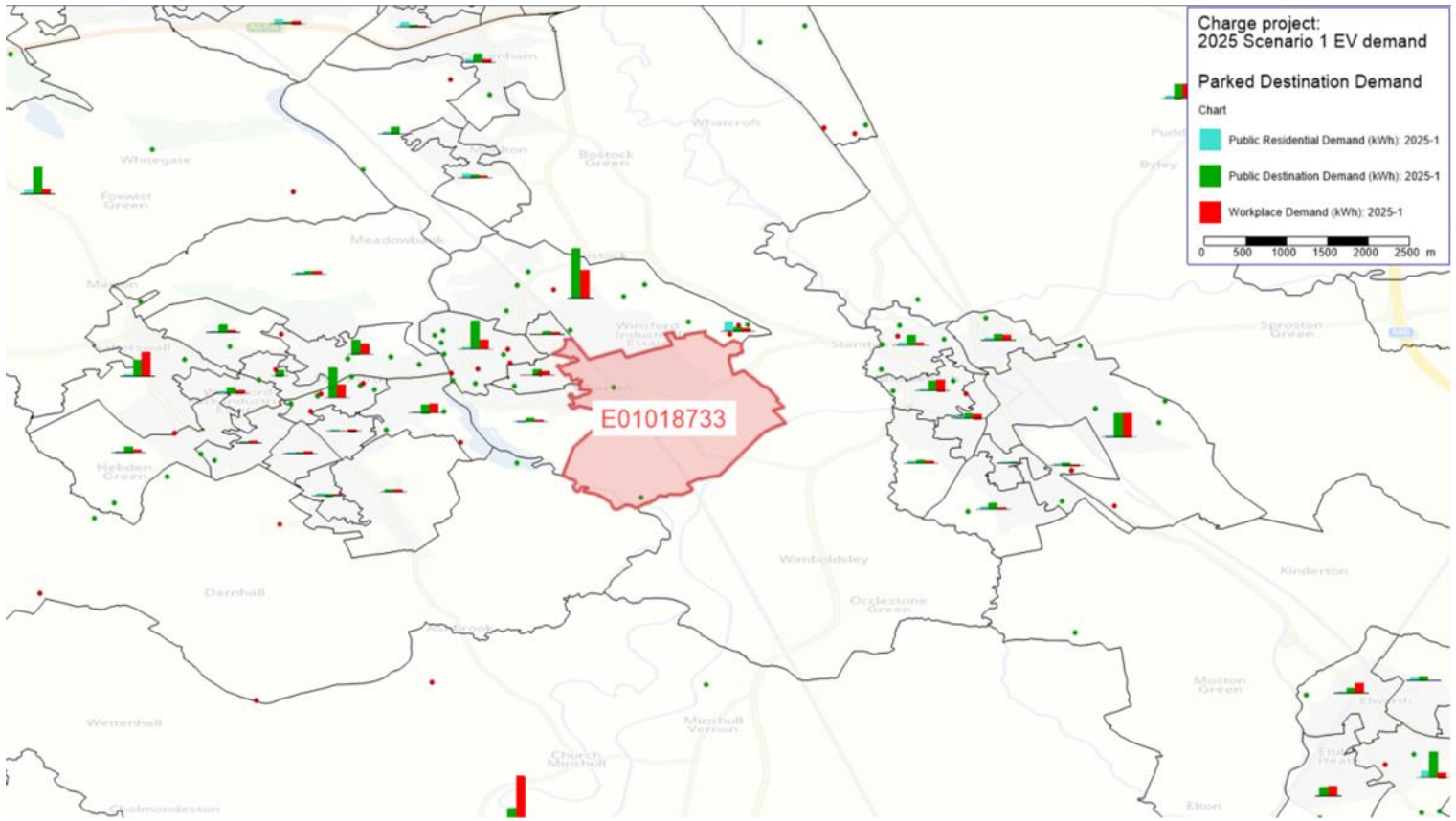
Transport Model Outputs

Alternative way of displaying demand for charging in model.
Columns representing demand for energy by different types of charging





Transport Model Outputs



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