WESTERN POWER DISTRIBUTION

INNOVATION

NEXT GENERATION NETWORKS

Network Assessment Tool: Interim Development Report

Electric Nation

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Table of Contents

Glossary

Abbreviation	Term
Adjacency Model	Pathfinding, redistricting, allocation
BaU	Business as Usual
BSP	Bulk Supply Point
C#	.NET framework based object-oriented coding language
Coincidence Model	Topological overlay, intersection analysis
Convex Hull	Geometrical spatial analysis method
ERD	Entity Relationship Diagram
ESA	Energy Supply Area
EV	Electric Vehicle
Feeder	A circuit which feeds electrical energy from a substation
Geometric Model	Distances between points, buffers and perimeters
GIS	Geographical Information System
MPAN	Meter Point Administration Number
MSOA	Middle Layer Super Output Area
NOP	Normally Open Point
NCP	Normally Closed Point
WPD	Western Power Distribution
NAT	Network Assessment Tool
Raster Data Model	Matrix of pixels (i.e. image based)
REC	Regional Electricity Board
SQL	Structured Query Language
SSIS	SQL Server Integration Services
UI	User Interface
Vector Data Model	Data stored as co-ordinates
WMS	Web Mapping Server

1 Executive Summary

The ongoing development of the prototype Network Assessment Tool (working title) described in this report is being developed by EA Technology as part of the Electric Nation project. This report describes the progress and developments to date from the previous report in April 2018.

EA Technology has continued the development activities as per the previously stipulated developmental timelines to complete the implementation of the initial EV analysis toolset. Work has been undertaken to design the extended functionalities which will further accommodate the user to review custom EV penetration levels at a local level.

In parallel with this development, the development methodology and framework has been migrated over to an agile format. This allows for enhanced project management and developmental progression and testing through the next stages which contain developmentally smaller functionalities which the user will interact with. To further support the agile framework, detailed internal workshops have been held to gather all requirements necessary to conceptualise and design the necessary mechanisms. These are collated into a prioritised backlog to facilitate the planning of each development sprint.

The agile framework has also unlocked the capability to provide a demonstration platform which is being made available to WPD to review and feedback into subsequent design and development stages. This is being setup to work through Microsoft Azure along with some security configurations to ensure access can only be granted to WPD while also removing any customer data entirely as a second line preventative measure.

Some smaller items have also been cleared up which had been noted from previous review stages, such as; a correction to the line and load estimation which provides a network approximation where there is either invalid or no network data available, substation ratings have been mapped in from the source data and the network calculations rerun for all areas and colour coding of substations has been tweaked to indicate where the network translation hasn’t been successful.

2 Introduction

This report details the ongoing development of the Network Assessment Tool (working title) since the last progress report (April 2018). The tool aims to provide LV network planners with a new platform to view and assess LV networks under future Electric Vehicle (EV) market scenarios and assess the potential benefit of using smart charging as a method to delay or avoid the need to reinforce networks overloaded by EV charging loads.

The tool is currently under development; development has been phased into three distinct workstreams; data transformation and pre-processing; the user interface and the calculation engine. A full development update on the progress to date is provided within this report alongside a status update for each development path.

2.1 The Electric Nation Project

Electric Nation is the customer-facing brand of CarConnect, a Western Power Distribution (WPD) and Network Innovation Allowance (NIA) funded project. WPD's collaboration partners in the project are EA Technology (the authors of this report), DriveElectric, Lucy Electric GridKey and TRL.

Electric Nation, the world's largest domestic electric vehicle (EV) trial, is revolutionising domestic plug-in vehicle charging. By engaging 673 plug-in vehicle drivers in trials, the project is answering the challenge that when local electricity networks have 40% - 70% of households with electric vehicles, it is estimated that at least 32% of these networks across Britain will require intervention.

A parallel activity as part of the project is the development of a Network Assessment Tool, this aims to enable a LV planner to assess smart charge solutions to support plug-in vehicle uptake on local electricity networks. A key outcome will be an analysis specifically tailored for highlighting plug-in vehicle related stress issues on networks and identifies the best economic solution where appropriate. This 'sliding scale' of interventions will range from doing nothing to smart demand control, from taking energy from vehicles and putting it back into the grid, to traditional reinforcement of the local electricity network where there is no viable smart solution.

The immediate challenge to such a tool is the prevalence of poor data quality historically present for LV networks in comparison to the vast and accessible datasets available at HV levels. As such, the tool under development will be of great interest country-wide as the next step to high visibility of LV network data at the planning stages. The outcomes of this project will be communicated to central government and the GB energy and utility communities.

This report focuses on the developments undertaken since the previous reporting cycle. Namely this is focussing on the initial targeted EV analysis user interface additions and transition to an agile development framework.

3 Summary of Previous Progress

In the span covered by the previous report (January 2018 – April 2018), developmental focus was aimed towards the bulk data upload, reprocessing and analysis of success rates in terms of network data translation and infilling. Success reviews were actioned using a failure mode effects analysis and the results found were proving to be a positive step.

The development stages remaining from the previous reports were:

- Targeted EV analysis and User Interface additions
- Refinements to the estimation of line and load for failed network translations
- Wider-scale EV analysis

The following sections will detail the tasks performed in the last quarter period since the previous report. Following on is a short section to give an overview as to the ongoing and anticipated next stages of development.

4 Overview of the Latest Progress

The primary developmental focus on the Network Assessment Tool (the tool) through to July 2018 has been on realising the plans described in the previous report. Since April 2018, development work has primarily been around the EV analysis mechanisms whilst also migrating to an agile development framework.

As further discussed in this report, EA Technology has migrated development to an agile framework to facilitate development of the remaining tasks which are incremental and front-end focussed. The agile framework allows for isolated development items to be checked off and tested one-by-one in a developmentally focussed timeline which further aids better management of development timeframes and deliverable progress.

In this theme, the initial developmental focus for the first stage was to design and implement a sidebar element which will allow the user to view the EV uptake at a local level and what the impact is on the network. This has now unlocked the next phase to implement the EV analysis mechanism and review stages which will be commencing as the next phase.

In parallel, a platform has been setup to be imminently released to Western Power Distribution to demonstrate the latest progress of development of the tool. This will be internally available for review and testing purposes of each completed development item. This completes the development to the agile framework and allows for the immediate review and feedback into the forthcoming development items.

4.1 Agile Development Framework

Developments up until this point have predominantly been focussed on network translation and connectivity algorithms. For this work a traditional research and development strategy was employed which was lighter on developmental project management as these tasks were very focussed and iterative. However, it was identified that for the remaining areas of development which consist of multiple smaller development strands, an agile framework would be much better suited. An agile development strategy ensures regular reviews of both undergoing and the upcoming development work required. In turn this enables better tracking and flexible re-prioritisation. Figure 1 illustrates the agile methodology of development.

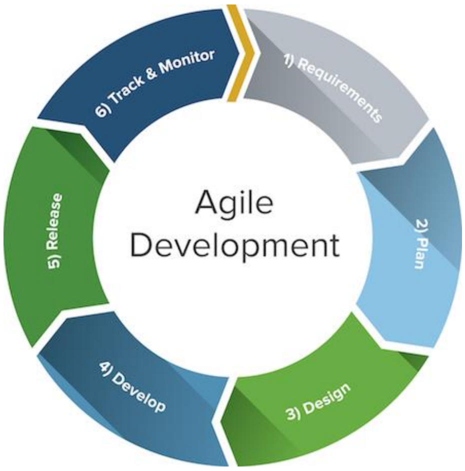

Figure 1: Agile Development Methodology

4.1.1 Initial Implementation of the agile framework

As a first step, all user considerations were gathered to create a consolidated list of 'user stories'. Each user story subsequently forms an isolated functional requirement. Several internal workshops have been completed to define these in a consistent manner.

Secondly, the month's 'sprint plan' which is the upcoming month's developmental focus, is decided upon and which sub-tasks will be completed. The user story which was the first focal point was, "as an LV Designer, I want to view substation metrics by year. As I change the year I want to view instant updates onscreen so that I can understand when and where the network breaks". Subsequently for the design stage, a planning meeting to scope the months sprint was held to decide upon the conceptual front-end UI design and the user journey. From these decision points, the pre-requisite sub-tasks and estimate times are also split out to ensure a suitable month's sprint was defined with a deliverable result.

Finally following completion of the sprint tasks, there is a review and signoff session to go through each item in turn. To supplement and support this is a parallel test bed to ensure there is agreement of when each item has been successfully implemented as per the original scope. This testbed is also being made visible to WPD as further discussed in the next section.

4.1.2 Product Backlog

As the user journey through the tool can be imagined, the requirements can be defined and stipulated. Capturing all the end user requirements is an extensive process and requires exploration of ideas through discussion with various stakeholders, designers and developers. As these are captured, they are recorded in a product backlog to form a collation of all required user stories, these can also be grouped into themes and initiatives as illustrated below in Figure 2.

The backlog is periodically prioritised to the high-level development plan and this can then provide an effective reference during the sprint planning meeting to decide the next set of focussed developments.

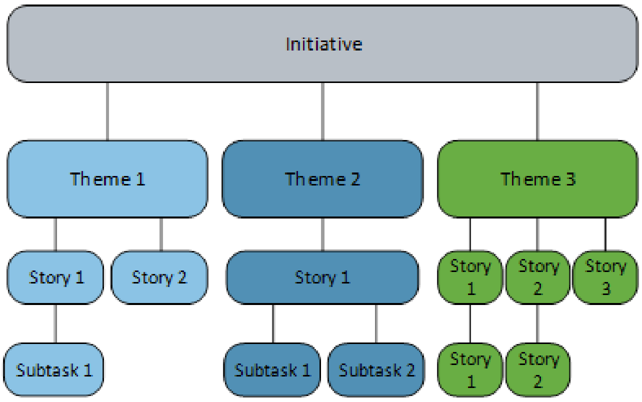

Figure 2: Organising the backlog subtasks/stories/themes

4.2 Western Power Distribution demonstration platform

EA Technology has engaged with WPD to put in place a demonstration platform to provide an instantaneous link to all developments. This will allow for increased visibility and feedback possibilities in line with the agile development methodology, as discussed in the previous section. It has been decided that a testbed platform utilising Microsoft Azure, as the cloud base platform, which the development team can continue to provide incremental releases after each completed functionality addition. Figure 3 below illustrates the feedback loop this provides to the project.

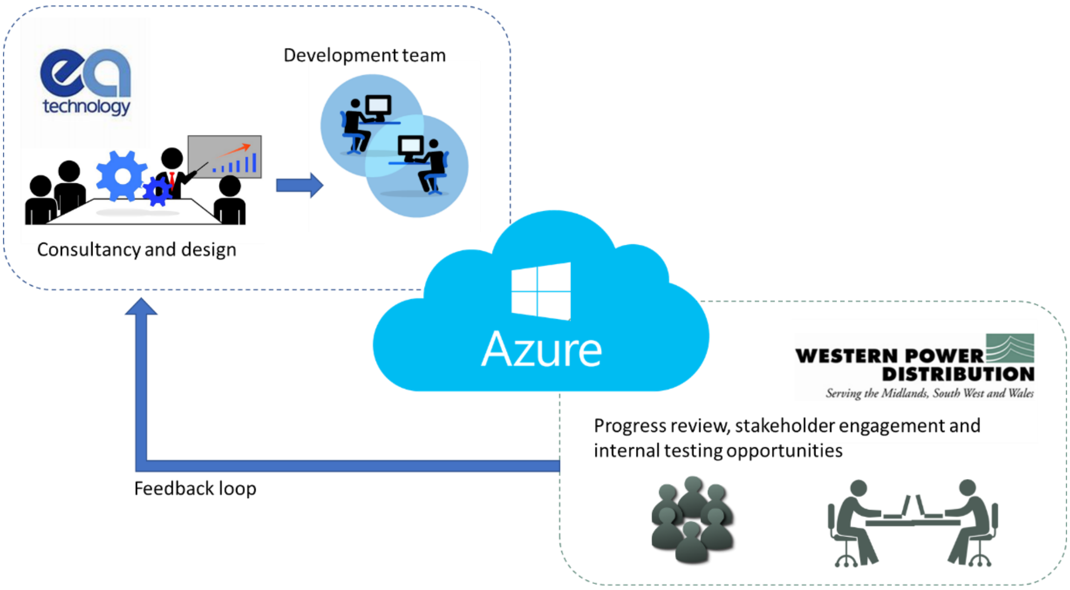

Figure 3: Development and demonstration platform

The initial platform has been successfully setup and tested internally. Additional security measures are being put into place to ensure that access can only be granted to WPD and as a backstop all customer data has been removed entirely from this platform. EA Technology will be able to release this at the end of July and are awaiting some final configuration pre-requisites from WPD before it can go live.

4.3 EV Analysis User Interface

4.3.1 Sidebar concept and implementation

The basic User Interface concept to interact with the EV analysis mechanism was defined as follows; a user will select a substation with a single right click and a sidebar pane will be displayed, the objects contained in the sidebar and their dynamics are detailed below;

1. Substation name and unique identifier are to be displayed as a title
2. A graph at the top of the pane will be embedded to display electric vehicle uptake;
    - The y-axis expressed in the percentage penetration of electric vehicles (EV).
    - The x-axis expressed as years going forward to 2030.
    - Separate colour coded series to display hybrid and full electric variants while also containing one for the total number of EVs.
    - A slider element to allow the user to skip through the future years to update the results onscreen for comparison on the effects of the additional EVs connecting onto the network.
    - A dynamic legend to identify the colour coded series, a number aside will give the selected years values of the underlying values on the graph.
3. A table below the graph to list the substation and feeder level results for both today and for the selected future year (via the slider stipulated in item 2) to judge the impact of the additional EVs;
    - The columns contain; Maximum Utilisation % and Maximum Voltage Drop %.
    - A row is displayed for the substation and each outgoing feeder.
    - Conditional formatting will highlight the constraint health, amber for nearing a constraint breach and red for exceeding a constraint. The values to define these will be configurable items within the backend.

A mock wireframe design was sketched out to guide the development team as shown in the following figure. The items in red are user actionable objects.

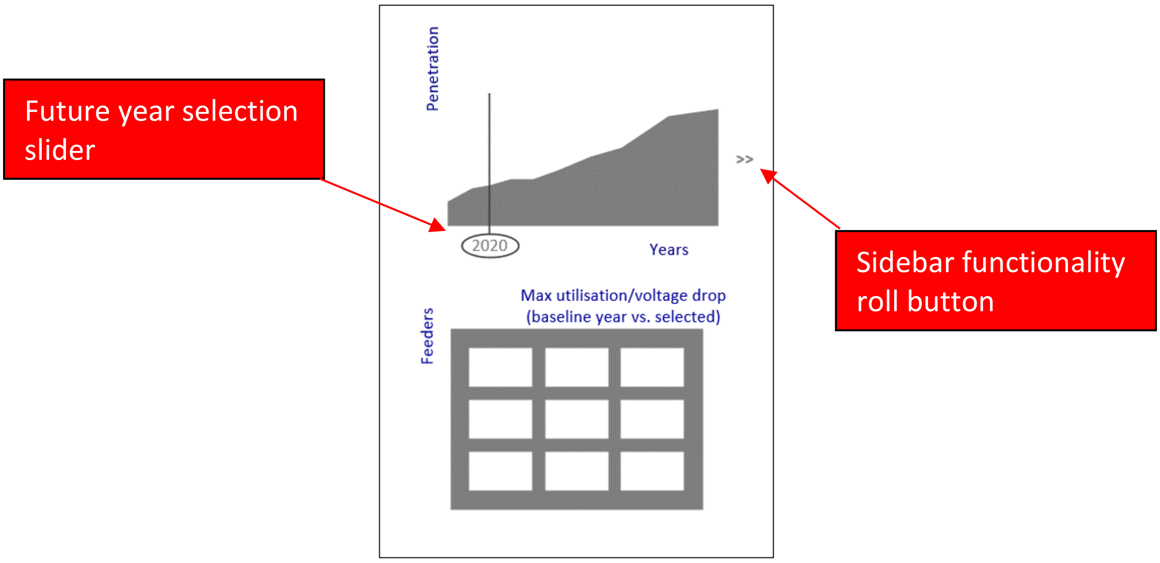

Figure 4: Initial sidebar design

As the user interacts with the sidebar, the mapping elements will also be updated to align with the selected year. Primarily, segments outgoing from the selected substation which are over-utilised will be highlighted and voltages out of bounds will be indicated for quick visual identification.

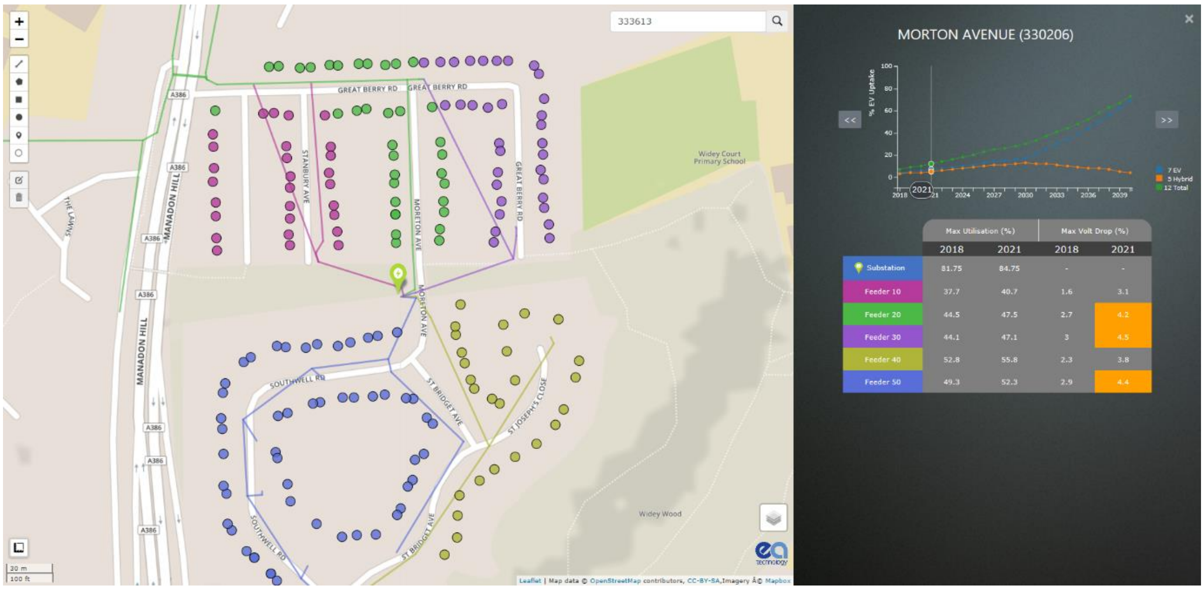

Figure 5: New sidebar to facilitate EV analysis using projected demands (2021 selected)

Figure 5 and Figure 6 illustrate the initial development of the sidebar in place and it is populated with baseline data again mocked up future projections.

In these illustrations a user has first selected a substation to enter the targeted analysis mode, this mode brings the sidebar pane into view. The user has then selected a future year (2021 and then 2023 in the figures provided) by sliding the selector line on the graph. This in turn updates the table to give comparative views against the 2018 baseline. Where the outputs of the network demands nears and reaches constraint points the table cells will be highlighted amber and red to provide a clear indication to the user.

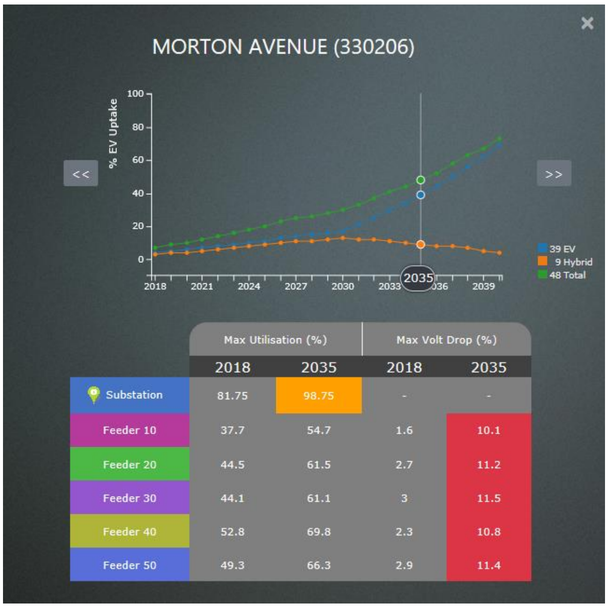

Figure 6: Closer view of the sidebar projecting future years network status (2023 selected)

Remaining tasks for the sidebar are; a display area for the substations key data fields (Tx rating, total customers etc.) and incorporating a method to adjust and re-calculate for a user defined EV uptake combination.

In addition to the sidebar, the main mapping elements will also be updated to provide clear indications of which network segments are being constrained. Separate indicators will be provided for voltage and thermal constraints, again for quick identification of what the issue is and where it is affecting the network. This aspect is still in development at the time of writing however it is expected to be contained in the initial release, again using mock up data to prove the preliminary user interface functionality.

4.3.2 Extending the sidebar functionality further

Following on from the base sidebar design, additional user interaction is required to manipulate the uptake penetration to a custom setting that isn't on the preloaded graph and view the network impacts. An initial concept is under consideration at present which has been laid out in the following draft wireframe.

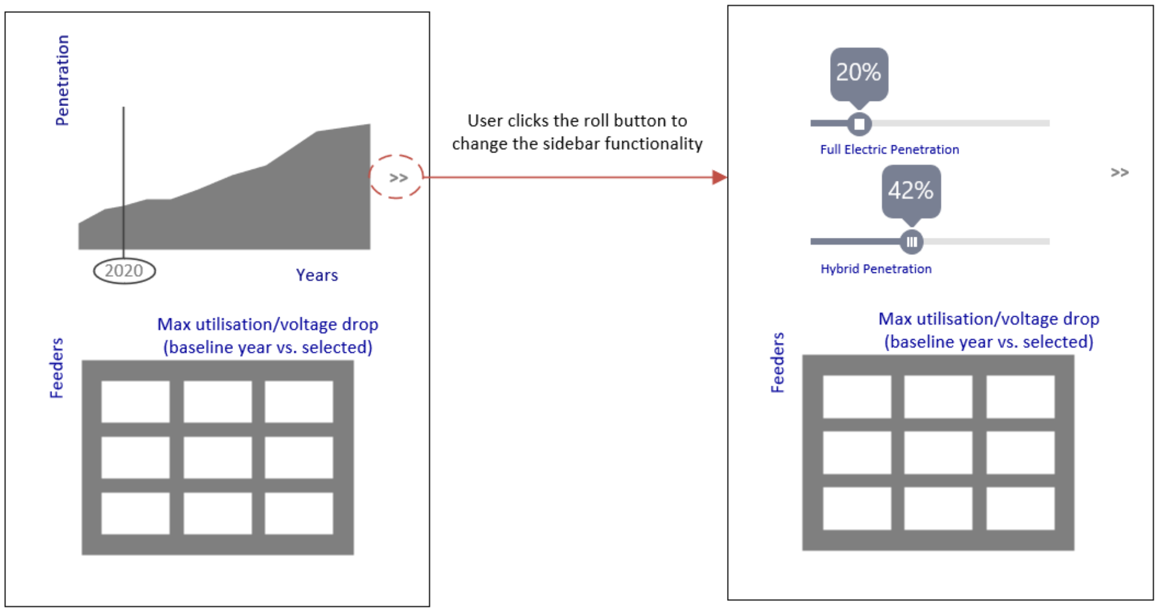

Figure 7: Extending sidebar functionalities

As illustrated in Figure 7 above, the user could roll the graph over to present a set of sliders which would allow the user to select any penetration and pure battery/hybrid EV combination to assess the given local network.

4.4 Development of Method for Distributing EV Uptake within ESAs

4.4.1 Existing Data Regarding EV Uptake Growth

WPD has provided Electric Nation with EV growth forecasts for all four WPD license areas developed by Regen. These forecasts were developed in June 2017 (See https://www.westernpower.co.uk/docs/About-us/Our-business/Our-network/Strategic-network-investment/East-Midlands/DG-and-demand-growth-scenarios-East-Midlands-2017.aspx for further information).

The EV growth forecasts are reported annually to 2030 for Energy Supply Areas (ESAs), these are defined as geographic areas served by the same upstream network infrastructure to a Bulk Supply Point or Primary substation. These ESAs were developed through GIS analysis by Regen and WPD.

In addition, these EV growth forecasts are split into the four scenarios developed by National Grid in their Future Energy Scenarios work:

Figure 8: National Grid - Future Energy Scenarios

So, for each ESA there are four corresponding growth forecasts for each year to 2030. Further, Regen allocated EV growth by ESA in each WPD license area recognising that household wealth is and is likely to remain for the decade to 2030 a primary driver of EV uptake, resulting in uneven uptake patterns. For example, in the East Midlands area the following four scenarios were produced:

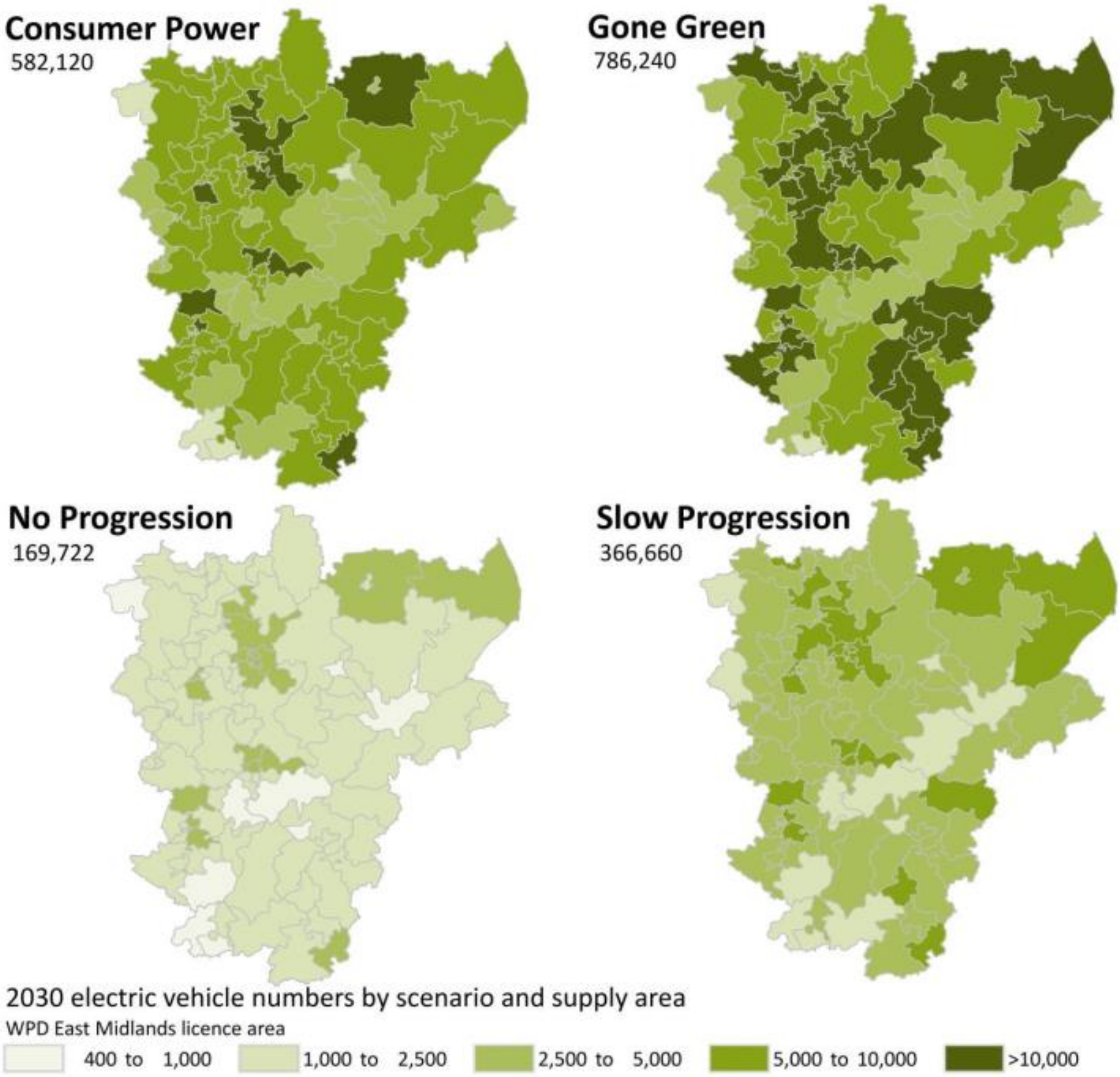

Figure 9: Regen EV growth forecasts illustration

These EV growth forecasts take the form of a spreadsheet provided by Regen.

4.4.2 Incorporation of EV Growth Forecasts into the NAT

For the purpose of generating DEBUT analysis of the impact of EV uptake on LV networks the Regen EV growth forecasts need to be split and apportioned to LV substations servicing domestic supplies within each ESA. However, it is recognised that household wealth is unlikely to be evenly spread across all households within an ESA. So, a method for apportioning the gross ESA EV forecast is required.

It is agreed that household wealth is likely to be and remain to 2030 a primary driver of EV uptake – currently EVs are more expensive than internal combustion engine vehicles, though this price differential is forecast to reduce dramatically or even disappear by the early 2020s. Further, wealthier households are more likely to purchase (or lease) new vehicles.

Further, car ownership patterns are likely to remain the same over this period, though there is a trend towards reduced car ownership across the country: households who do not own cars are likely to remain so, whether because of low wealth or because of geography (city centre dwellers tend to rely on public transport rather than own cars. This is very apparent in London.

In addition, a current major barrier to EV ownership is the challenge of on-street parking charging – or more to the point the lack of off-street parking for homes, having a driveway makes installation of an EV charger easy and so ownership of EVs more attractive. So, EV uptake is likely to be lower in areas with relatively high levels of terraced housing or flats than areas with relatively higher levels of detached or semi-detached homes.

Finally, it could also be argued that growth of EV uptake in homes in relatively remote rural areas are likely to be slower than in areas with significant conurbations where EV charging infrastructure (workplace, destination and en-route chargers) is bound to grow faster.

EA Technology have developed a method to take these factors into account to enable apportionment of Regen's ESA EV growth forecasts to substation level using data available from the 2011 Census.

4.4.3 2011 Census data

While the 2011 Census data is now seven years old it is the best available data of its type that is publicly available and significant social/economic change in discrete locations since 2011 is unlikely.

The census data provides three useful sets of data that can be utilised by the NAT:

- Household type – e.g. numbers of detached/semi-detached houses and bungalows, terraced housing and flats/maisonettes
- Net household income after housing costs – a measure of wealth of households
- Household car/van ownership – in particular the number of households that do not own a car/van

These national data can be split up into Middle Layer Super Output Areas (MSOA) - Middle Layer Super Output Areas are a geographic hierarchy designed to improve the reporting of small area statistics in England and Wales. Middle Layer Super Output Areas are built from groups of contiguous Lower Layer Super Output Areas. The minimum population is 5,000 and the mean is 7,200 (which translates to a minimum of 2,570, maximum 4,600 and mean 3,550 households).

A further useful set of data is available by MSOA, which is a categorisation of the Urban/Rural characteristics of the MSOA:

- Urban major conurbation
- Urban city and town
- Urban city and town in a sparse setting
- Urban minor conurbation
- Rural town and fringe
- Rural town and fringe in a sparse setting
- Rural village and dispersed

- Rural village and dispersed in a sparse setting

4.4.4 Using the Census data to produce an "EV-uptake factor" for an MSOA

The proposed method for developing an "EV Uptake Factor" (F) for substations within an MSOA is to use the following data from the 2011 census.

I = [Net Household Income after housing costs Quintile] – by assigning MSOA to the national Net Household Income after housing costs quintile (excluding London) – i.e. 5 (most wealthy), 4, 3, 2, 1 (less wealthy)

O = [percent of homes detached/semi-detached] – i.e. with higher likelihood of having off-road parking for EV charging

C = [percent of homes owning 1 or more cars/vans]

R = [Rural/Urban] – scoring on the basis X/5, where X is factor according to MSOA character is:

Urban major conurbation	5
Urban city and town	5
Urban city and town in a sparse setting	4
Urban minor conurbation	4
Rural town and fringe	3
Rural town and fringe in a sparse setting	1
Rural village and dispersed	2
Rural village and dispersed in a sparse setting	1

F= [EV Uptake Factor] = I x O x C x R (F can be calculated for each MSOA)

The spread of [EV Uptake Factor], F, for each MSOA for the whole of England and Wales (excluding London) categorised by [Net Household Income after housing costs] is illustrated below in Figure 10.

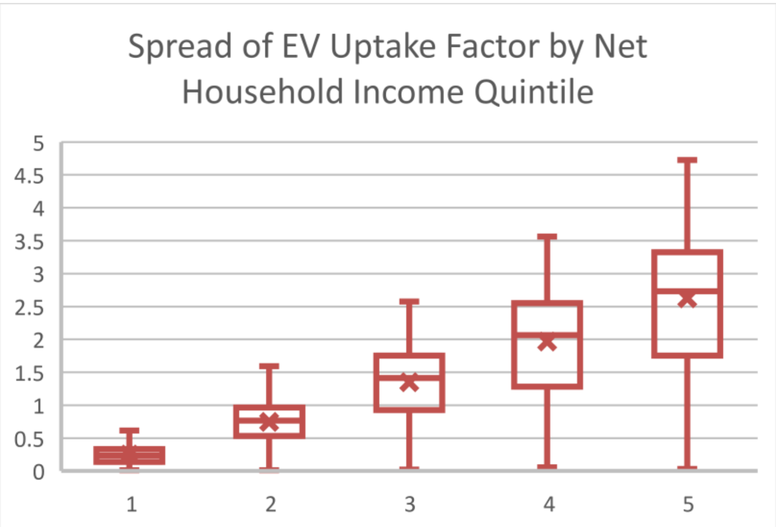

Figure 10: Spread of EV Uptake Factor by Net Household Income Quintile

This whisker and box chart shows the range of each quartile of data points in the sets defined by the primary EV uptake factor of net household income after housing costs, x marks the median value of each set. This clearly shows that using this factor would enable differential apportionment of EV growth forecasts to LV substations where an ESA covers more than one MSOA.

Note that in each net household income data set it is possible for the factor to be low owing to the influence of a combination of relatively low detached/semi-detached housing, high "no car ownership" and (sparse) rural setting.

If the EV uptake factor is simplified by ignoring the rural/urban factor to produce

F* = [EV Uptake Factor] = I x O x C, then the lower bound of the lower quartile of the data sets is not so low for income quintiles 4 and 5, see below Figure 11.

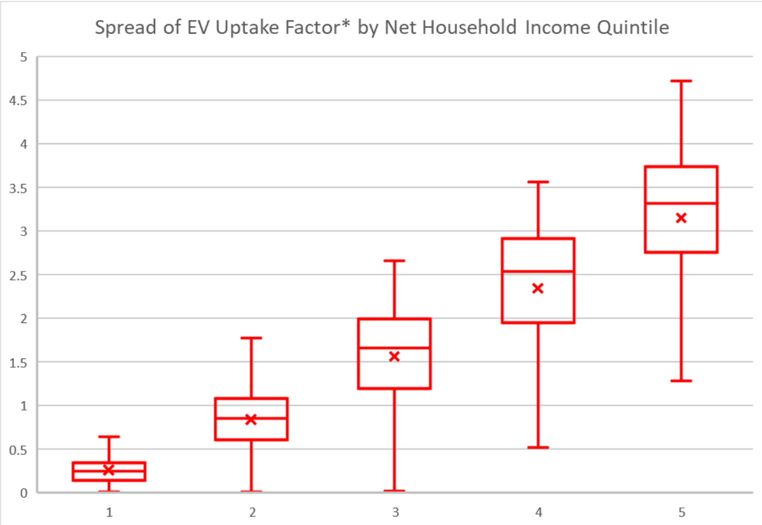

Figure 11: Spread of EV Uptake Factor by Net Household Income Quintile*

Practical testing of F and F* will be undertaken to evaluate the impact of these two approaches on EV apportionment to LV substations with ESAs.

4.4.5 Approach to apportioning EV Growth to ESAs

GIS mapping of ESA and MSOA boundaries shows that these boundaries do not correlate – i.e. very few ESAs are within a single MSOA and many ESAs cover more than one MSOA. For example, looking at the Bristol area below.

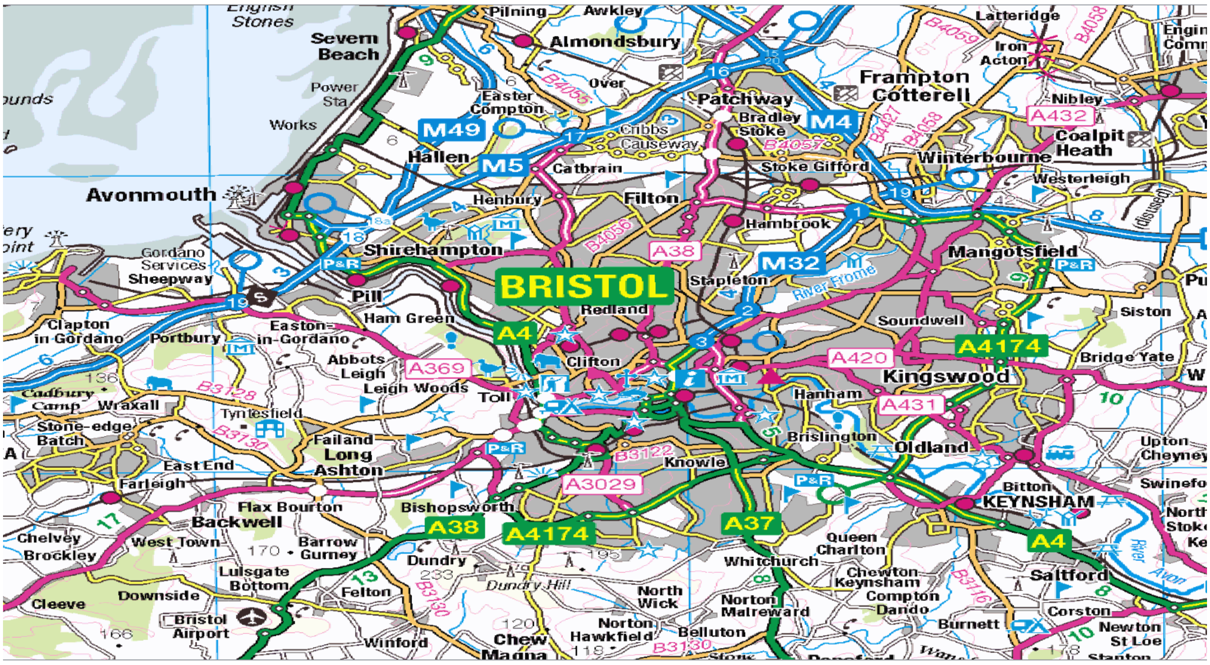

Figure 12: Map of the Bristol area

Overlaying MSOA areas (in this example, for simplicity, colour coded by Net Income after housing costs quintile – the darker the MSOA the higher the quintile value):

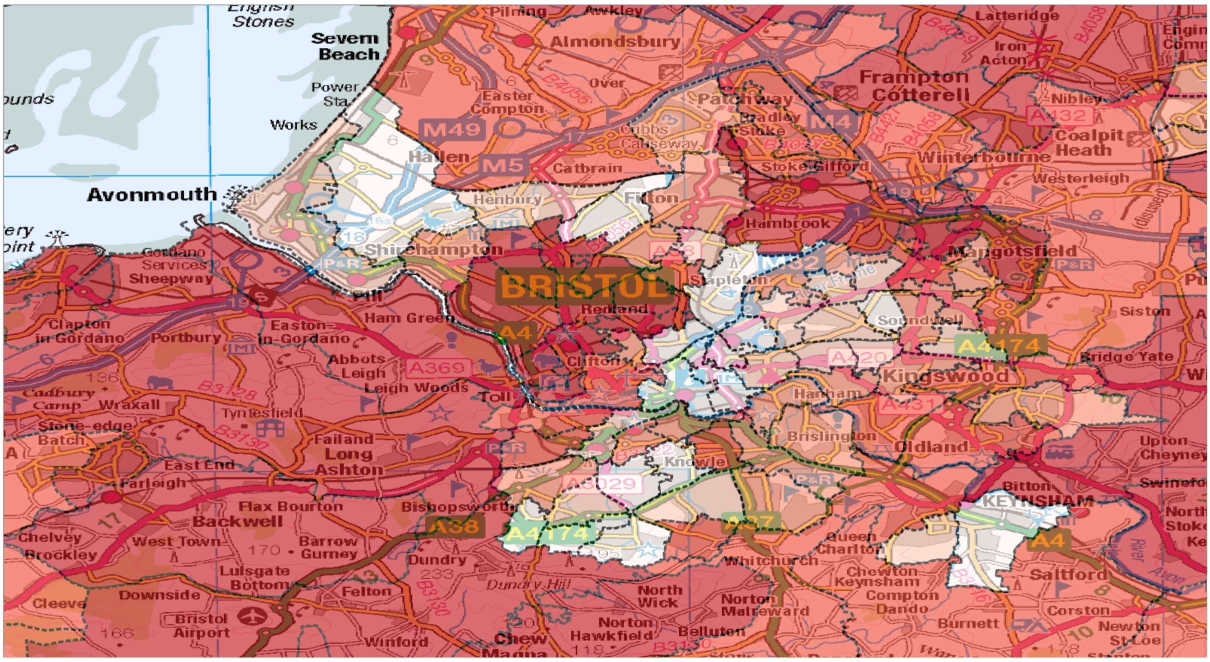
Figure 13: Bristol area overlaid with MSOA areas shaded by the 'Net Income after housing costs' quintiles

Removing the map layer for clarity:

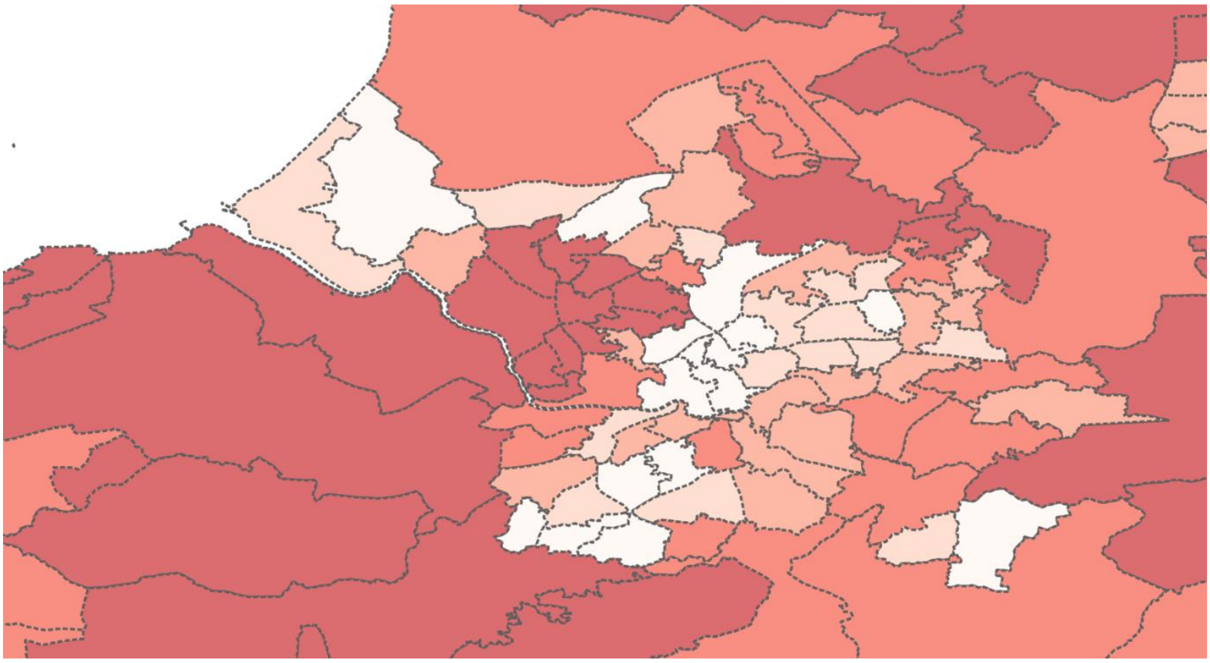

Figure 14: MSOA areas repeated with the Bristol map removed for clarity

And then overlaying ESA boundaries (blue lines) the issue of ESAs covering more than one MSOA can be seen and the relative wealth of each MSOA varies considerably as would the EV uptake factor for each:

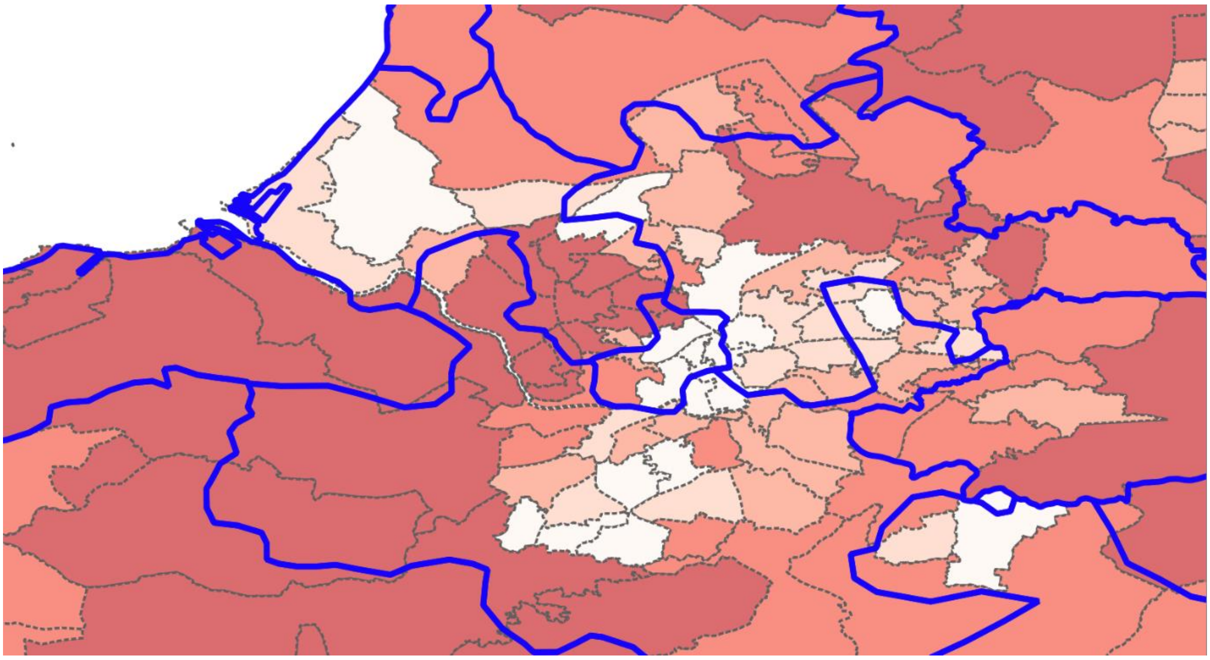

Figure 15: MSOA areas overlaid with ESA boundaries

Focusing on the Avonmouth BSP area, highlighted in red below:

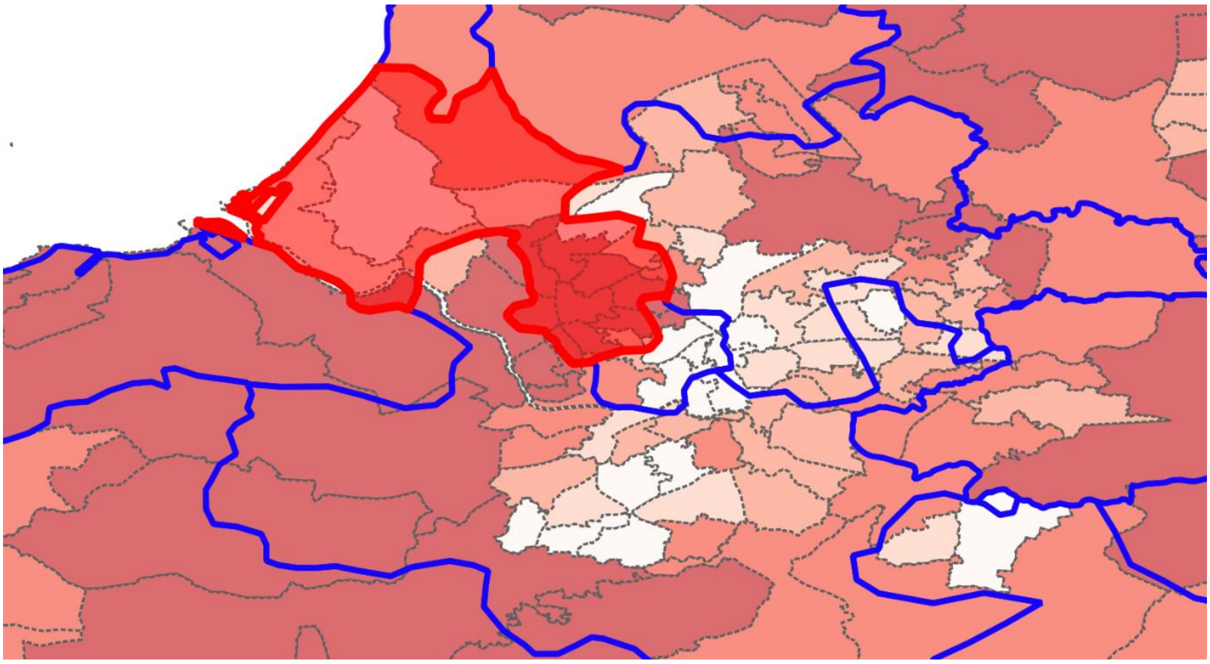

Figure 16: Focussed on the Avonmouth ESA for an example

Zooming in:

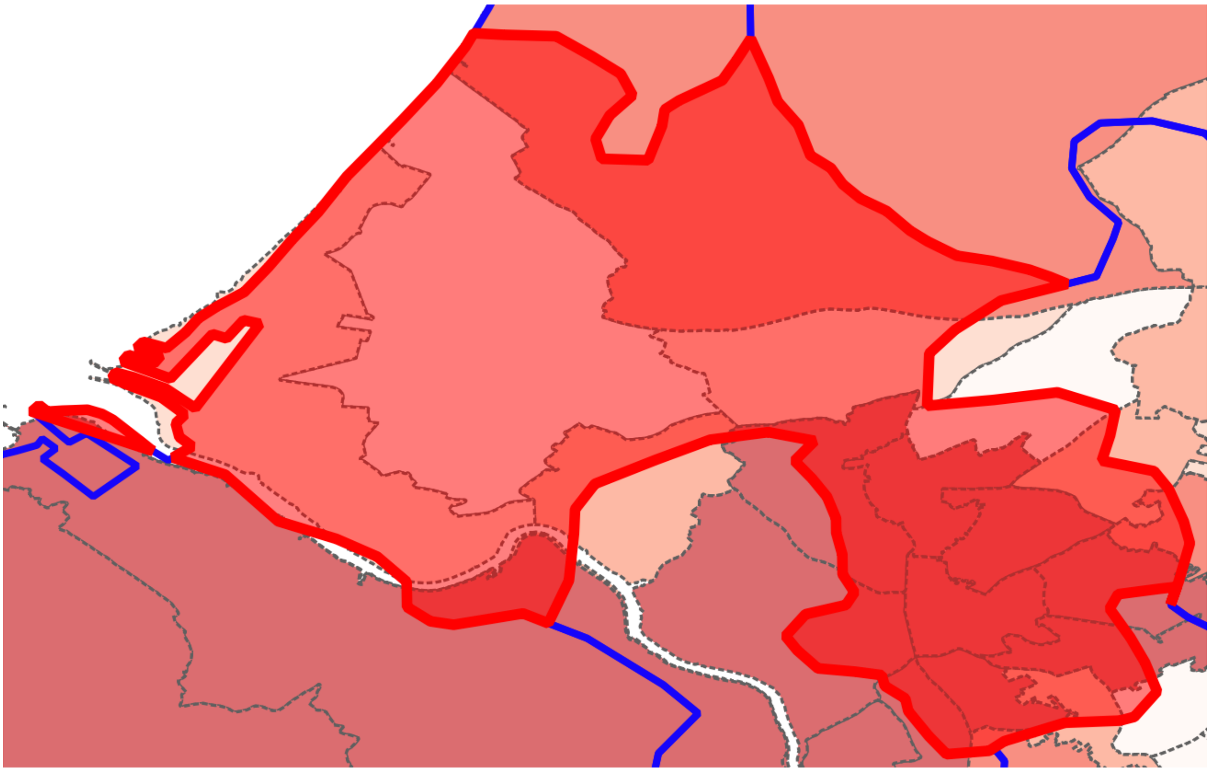

Figure 17: Zoomed in on the focused Avonmouth ESA example

This ESA covers some twenty MSOAs, all but four only partially and these MSOAs will all have different EV Uptake Factors.

Clearly, the apportionment of EV growth across this ESA using the forecast provided by Regen for each ESA requires a method. The proposed approach is as follows;

1. Assign each LV substation with 1 or more domestic customers to an MSOA and so allocate an EV uptake factor to that substation and its associated group of domestic customers
2. Multiply the number of substations assigned to each MSOA by its allocated EV uptake factor = P
3. Use this number, P, to allocate EV uptake forecast across all MSOAs, e.g.

$$\text{MSOA Allocation for MSOA 1} = Q_1 = P_1/\text{sum}(P) \times \text{EV Forecast for ESA}$$

4. Where S = Q/No. subs in MSOA is less than 1 EV, make it zero or >1 (T)
5. Recalculate F x No. Subs (=U) where T>1
6. Reallocate EVs to MSOA (=V) based on U, e.g.

$$\text{MSOA Allocation for MSOA 1} = V_1 = U_1/\text{sum}(U) \times \text{EV Forecast for ESA}$$

Table 1 below shows an example calculation for a fictitious ESA.

ESA	50,000	**customers**									
	500	**LV substations**									
	10,000	**EV uptake forecast by 2030**									
	10	**MSOAs intercepting ESA**									
		2.4									
MSOA No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Totals**
EV uptake factor = F	0.05	2.5	1.2	0.01	0.2	4.7	3	4.3	3.3	2.5	
No. Subs	35	25	40	51	30	45	56	27	68	123	500
P = F x No. Subs	2	63	48	1	6	212	168	116	224	308	1146
Q = EV allocation to MSOA	15	545	419	4	52	1,845	1,466	1,013	1,958	2,683	10,000
S= EV/sub	0.4	21.8	10.5	0.1	1.7	41.0	26.2	37.5	28.8	21.8	
T = Rationalised EV/sub average	-	>1	>1	-	>1	>1	>1	>1	>1	>1	
U = RationlisedF x No. Subs	-	63	48	-	6	212	168	116	224	308	1,144
V= Rationalised EV Allocation to MSOA	-	546	420	-	52	1,849	1,469	1,015	1,962	2,688	10,000

Table 1: EV apportionment to a substation from an ESA level via MSOA boundaries

These EV allocations by MSOA then need to be allocated to each substation, the proposed approach is;

1. For each substation in MSOA identify number of domestic customers associated with substation = A
2. Apportion MSOA allocation to each substation as a proportion of the total domestic population of all substations assigned to that MSOA = B, e.g.

For substation X $B_x = A_x/\text{sum}(A) \times$ MSOA allocation (V)

Table 2 below shows an example calculation for MSOA 2 in the fictitious ESA example above.

EV Allocation	546	
Sub No.	**A = No. Customers**	**B = Allocation**
1	100	36
2	102	36
3	17	6
4	67	24
5	98	35
6	6	2
7	89	32
8	15	5
9	95	34
10	42	15
11	85	30
12	2	1
13	109	39
14	52	19
15	94	33
16	91	32
17	30	11
18	68	24
19	8	3
20	27	10
21	96	34
22	42	15
23	88	31
24	22	8
25	89	32
Totals	**1534**	**547**

Table 2: Continued example, MSOA 2 calculated for a fictitious ESA

A special case may need to be made where a substation has very few customers associated with it (e.g. small pole-mounted transformers), where the method above may result in zero EV allocation despite F being high for the MSOA. In this case a default of 1 EV should be assigned to such substations. This will be investigated as the above methodology is implemented in the NAT and example results analysed.

4.5 Refinements to the estimation of line and load for failed network translations

To recap, fundamentally, the line and load estimation is the fall-back position where the network data translation fails due to incomplete data or other unexpected errors in processing. As discussed in the previous report, the initial implementation of the estimation routine was found to have a small error in the implementation.

The mechanism has been successfully modified to align correctly with the original design and the function has been re-executed to update the results.

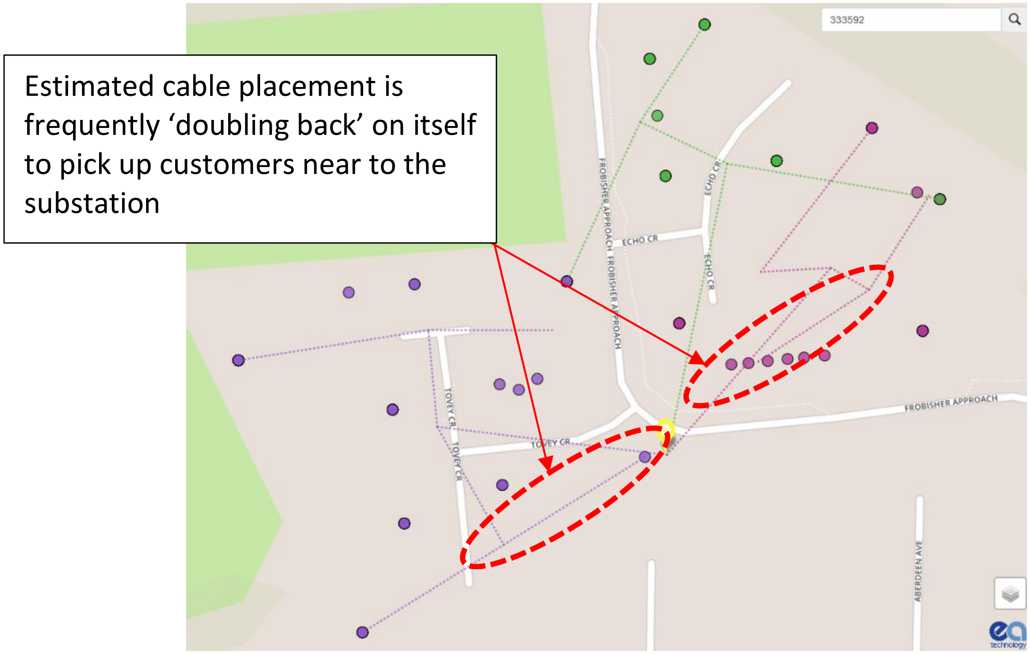

Figure 18: Line and load estimation based on absent network data illustrating the original issue

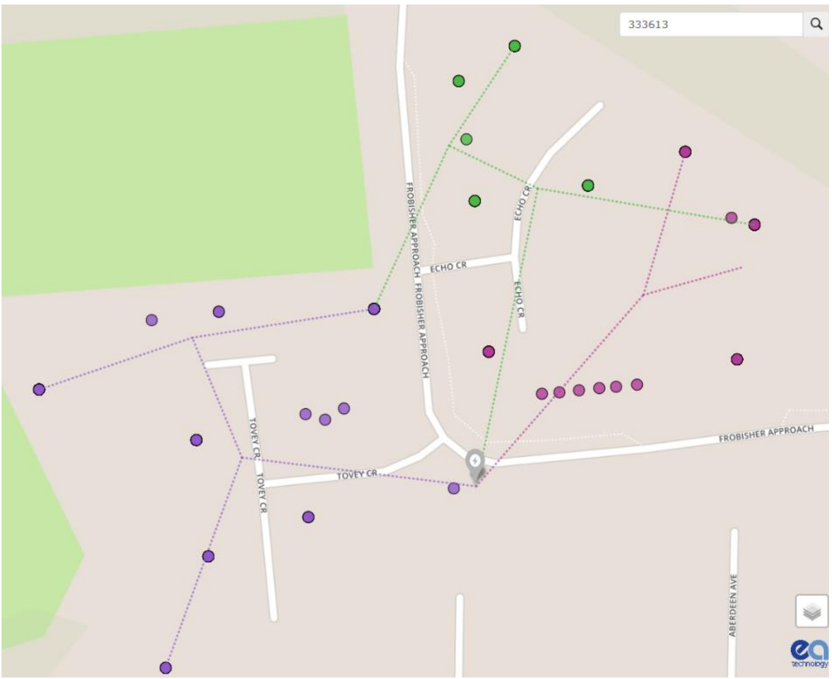

Figure 19: Line and load estimation with the corrected implementation and no 'doubling back' effect

5 Ongoing Development Path

This section discusses the ongoing developments which are required to provide a functional network assessment tool which are anticipated to be progressed in the next months.

5.1 Remaining Development Paths

The following immediate development paths are still either in progress or awaiting a pre-requisite task before development can progress;

- Implementing the confidence metrics to score each substation network translation based on the available data
- Methodology for wider scale EV analysis is still to be decided upon, currently this is awaiting further analysis to be carried out on the processing optimisations made and the time ramifications for wide scale network calculations
- User interface additions for EV analysis at a wider-area level
- Implementation of targeted EV uptake analysis mechanism, which has been designed as reported in section 4
- Further user interface additions to accommodate user interaction and the modification of the EV penetration level to assess on a local network
- Options assessment module – which will enable assessment of smart charging as a mitigation method (vs reinforcement) for networks overloaded by forecast EV loads.

5.1.1 Confidence metric

As discussed in the previous report, the underlying concept has been established. Additional research and design work is still required to ensure the additional processing burdens are acceptable and establish the reference values and initial weightings before this is ready to be fed into the development timeline at an appropriate point.

5.1.2 Wider-scale EV methodology and User Interface considerations

The design for wider-scale analysis methodologies will be decided upon post implementation of the targeted analysis. This will allow for processing speed implications to be further ratified before committing to further design and development work.

5.1.3 Further targeted EV analysis and User Interface additions

The next stages for this section are twofold, the method as discussed in the previous report, is to be implemented and tested across real networks to verify its fitness functionalities required to modify the penetrations. However, the new sidebar functionality is enough of a platform to begin this implementation now.

5.1.4 Options assessment

Some thought has been done in this area of the tool and early prototype ideas are in progress. Development of wireframe user journeys to provide the necessary user interaction, user interface and internal mechanisms required have begun and are in the early stages. Initial considerations are being undertaken in parallel with targeted network analysis, however further detail is still required to further this design work. In a similar vein to the wider-scale EV analysis, the processing implications are going to influence the feasibility of certain design aspects. As such further work in this area is also pending the initial implementation of the targeted EV analysis.