eSmart networks

Electric Vehicle Charging Infrastructure in Northern Ireland

A Summary Review of Grid Connection Challenges and Underlying Network Regulation

On behalf of the Electric Vehicle Association Northern Ireland
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EVA NI

Contents

Who we are

eSmart Networks are a leading provider of EV charging infrastructure, including the Grid infrastructure required to enable it, across the UK. We are enabling the energy transition by designing and building the electrical infrastructure needed to enable EV infrastructure, Renewable Energy, Battery Storage and Industrial Electrification. Our highly skilled teams design and build projects ranging from LV up to 132kV.

Given our leading position as a UK wide 'one-stop shop' for the roll-out of energy transition electrical infrastructure, with a particular focus on Grid infrastructure, eSmart Networks also provides Grid Consultancy Services and expertise to assist our partners in the energy transition. To date we have provided these services on multiple thousands of MWs of projects across every UK region. These services are primarily delivered via our Grid Connection Management team which comprises some of the most experienced and innovative Electrical & Power Systems engineers across the UK; when it comes to integrating EV charging, Renewables, Battery Storage and Industrial Electrification onto the UK Power System. Our Grid Connection Management team are at the forefront of UK Grid Connection Policy, Technical Innovation and Grid Capacity Analysis.

As part of sharing our expertise to assist with the energy transition, we regularly produce a free podcast called 'The Grid' which covers all aspects of the Electricity Grid, its centrality to the energy transition and the challenges it faces. Further information can be found at the following links:

YouTube: https://www.youtube.com/channel/UCm1xJpPsmcC2zrqg-6Qn-XQ
Spotify: https://open.spotify.com/show/56iL31Ttt2AgFixv2CE7CX
Apple Podcasts: https://apple.co/3Ly4LwU

Background

The Chair of the Electric Vehicle Association Northern Ireland (EVANI) sat down with the eSmart Networks team early in the summer of 2022 to discuss EV charging infrastructure in Northern Ireland (NI), with a particular focus on grid related challenges.[1]
The frustrations of EV drivers, with regards to EV charging infrastructure in Northern Ireland, are well documented, largely through the work of EVANI as well as various statistics published by relevant public bodies and statutory agencies.
The discussions on the grid related challenges facing EV charging infrastructure development in NI led to the request from EVANI to have some of the key information, along with further detail, compiled into this short summary paper.

This paper is provided free of charge, motivated by our teams' personal motivations to see improvements in their local infrastructure, alongside eSmart Networks' corporate level commitments to helping improve the local green infrastructure in the communities and areas in which we live and work.

Introduction

The issues faced by the growing number of EV drivers in NI, with respect to lack of EV charging infrastructure, are well documented and don't require to be rehearsed in this paper. We would however highlight two glaring statistics that summarise the growing problem faced by Northern Ireland:

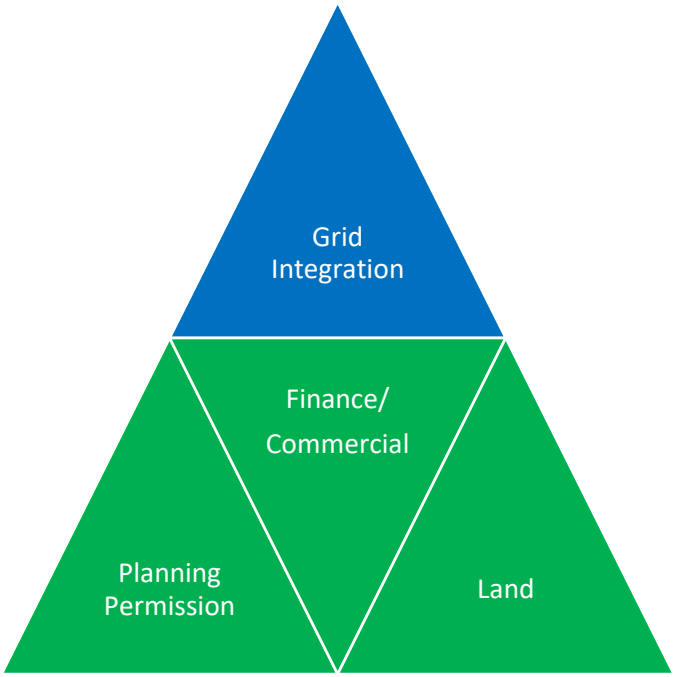
1. The exponential growth of EV drivers in Northern Ireland[2] alongside wider UK statistics which show EV uptake occurring much faster than previous estimates.
2. The significant lack of EV chargers per capita in NI, in comparison to our closest neighbours. The latest statistics on the UK government website from July 2022 indicate 1.1 rapid charger per 100,000 population in NI, vs between 6.7 - 14.2 rapid chargers per 100,000 population in all other UK regions[3].

Anecdotally, as a leading organisation in the rollout of EV charging infrastructure across the UK, we can attest to the significant difference in roll out rates across GB compared with NI (where the rollout rate of AC charging could be described as a 'minor trickle' and the roll out of high powered charge points in NI is at virtually zero with no high powered chargers anywhere in the region).

[1] eSmart Networks and EVANI discuss EV charging infrastructure in Northern Ireland on 'The Grid' Podcast, published 14/07/22: https://www.youtube.com/watch?v=eQVCfI2dJyI
[2] EVANI publication of DfT statistic, last accessed 24/08/22: https://evani.uk/year-on-year-ev-sales-in-ni-more-than-doubled-in-2021/
[3] EV Charging Statistics, UK Government Website, last accessed 25/08/22: https://www.gov.uk/government/statistics/electric-vehicle-charging-device-statistics-july-2022/electric-vehicle-charging-device-statistics-july-2022

The EV Charging Development Triangle:

The development triangle summarises the three key elements, underpinned by finance/commercial aspects, required to facilitate development of EV charging infrastructure. Each corner of the triangle is required for progress to be made.



The activity and interest in the EV charging market from Charge Point Operators (CPOs), alongside rapid rollout rates in GB, would indicate that the relevant enablers are in place with regards to the finance/commercial and Land aspects of EV Charging Development.

With regard to the planning permission element, it does not appear to be a significant blocker at present, but this may yet to be tested as many projects are unlikely to have progressed to the planning stage.

This summary paper focuses on the 'Grid Integration' element of the development triangle. With a particular focus on comparing aspects of Regulation & Policies that exist in NI, with those of our closest neighbours across GB. We have focused on GB rather than ROI because Electricity Regulation in NI is founded on a similar legislative basis to GB and is substantially different to the legislative and regulatory framework in ROI. We would however note that ROI does also have regulatory mechanisms which make EV charging development conditions more favourable than in NI.
We examine how the divergence in these policies and regulation undermines the commercial and/or technical feasibility of EV charging development in NI, in comparison to GB.

Grid Capacity in NI: A High-Level Overview

This section outlines a quick summary of grid capacity in Northern Ireland based on NIE Networks published capacity map, accessed 24th August 2022: https://www.nienetworks.co.uk/connections/capacity-map

A quick analysis of the data set extracted from the map data, specifically tab 'Primary+Dual-Primary' and 'BSP-Primary-combined', and is summarised below:

Description	No. of sites	Percentage of Total sites (%)	Cumulative Total (%)
Substations with <1MVA capacity	46	21%	21%
Substations with 1-3MVA capacity	32	15%	36%
Substations with 3-5MVA capacity	39	18%	54%
Substations with >5MVA capacity	98	46%	100%
Total Primary Substations listed	*215*	*100%*	*100%*

Table 1: Review of NIE Networks Capacity Map Data

The table below illustrates the capacity required by different types of EV charging installation:

Description	No. of chargers	Descriptor	Typical Grid Capacity Required	Typical Timeline for Delivery
Rapid Charging Site	1-5 Rapid Chargers (50kW each)	Small site with limited number of rapid chargers. Suitable for 'destination charging' where drivers are likely to dwell for 30min-1hr (e.g. shops, cafes etc).	50kVA-250kVA	6 months
High Powered Charging (HPC) Hub	4-12 HPC (150kW-300kW each)	Seen as the next essential step in the transition to EV, mass rollout now taking place in GB following years of project development. Small hub of HPCs that can provide significant charge in under 30min.	Typically 1MVA – 3MVA (with some smaller 500kVA installations.)	12-24 months
EV Charging Forecourt	20-30 HPC (150kW-300kW each)	Seen as the future of EV charging, will increasingly be required as EV uptake increases.	3MVA – 10MVA	18-36 months

Table 2: Illustration of Different Types of EV Charging Installation

NI Network Capacity Considerations and Discussion Points:

- The capacity data suggests that large portions of NI's electricity grid are likely to be unfeasible for connecting EV charging hubs, before downstream constraints are even factored in.
- If downstream capacity were to be factored into a more comprehensive analysis, we would expect the 'unfeasibility rate' to rise significantly due to the prevalence of relatively low capacity, rural, overhead line network in NI.
- We would note that the remaining capacity on the network will not solely be used by EV charging and is required for electrification & decarbonisation of other areas such as heating, economic development, new factories & business and other critical infrastructure such as hospitals, water pumping stations etc. Therefore, there will likely be less capacity than shown in the table for EV charging.
    - To illustrate, 21% of substations are likely to provide no significant capacity for EV charging hubs at all, while the 15% of sites with 1-3MVA could be 'filled up' by the connection of a single factory or other large energy user.
- For a quick comparison, we looked at the East Midlands region of GB (a relatively rural network with a few large towns/cities such as Leicester & Northampton). Approximately 9% of distribution substations had less than 3MVA of capacity[4] compared with 36% in NI as per the table above. 18% of substations had less than 5MVA compared with 54% in NI.
- It should be noted that NIE Networks have been highlighting these issues to stakeholders[5].
- Uneven access to grid capacity across different regions in NI poses a significant social issue in the decarbonisation transition, where access to increasingly essential amenities such as electrical heating and EV charging becomes a 'postcode lottery'.

This high-level analysis therefore illustrates a relatively bleak picture in comparison to networks in GB. We would also note that network capacity issues typically do not have 'quick fixes' with typical timescales to upgrade distribution substations ranging from 2-5 years. We note that the capacity issues facing many of these substations are also more significant than a single localised constraint, where even if the local substation were to be upgraded, the capacity would not be available without further upstream reinforcement. These timescales are likely to prove extremely challenging as we approach the end of 2022, facing a ban on the sale of new combustion engine vehicles by 2030.
We would also note that there has been significant progress and momentum in GB at various levels to address growing concerns over network capacity issues; some of the main initiatives which commenced in 2018 are outlined in further detail in this paper and compared with the equivalent policies in NI. NI would have to adopt such measures much faster than GB in order to begin to catch up.

Technical Footnotes regarding this high-level analysis:

- *This analysis considers the capacity constraints at each substation, upstream 33kV constraints and upstream Bulk Supply Point constraints. There may be further upstream constraints on the Transmission Network which are not considered in this data set.*

[4] WPD Long Term Development Statement, published November 2021, updated May 2022. Note that 33kV network constraints are not considered within the WPD data set, however this is unlikely to have a significant impact on the headline figures based on our experience in modelling GB networks.
[5] NIE Networks, Networks for Net Zero, last accessed 24/08/22: https://www.nienetworks.co.uk/documents/future-networks/networks-for-zero-net.aspx

- *Note that some of the capacity available on certain substations is shared with others, therefore a connection at one substation may use up any available capacity at several others.*
- *This data set does not consider constraints on downstream capacity of 11kV cables and overhead lines. We would expect further significant capacity constraints on the downstream network that would make EV charging installations unfeasible.*
- *We note that NIE Networks' capacity map colour coding key designates any substation with greater than 1MVA capacity as 'green'. Moving forwards in the context of the energy transition and significant electrification ahead, we would deem it more appropriate for a threshold of 5MVA, or above, to be used for 'green' and 2-3MVA to be used as 'amber' to help better inform stakeholders of the capacity issues.*

Comparison of NI Governance & Regulation vs GB

Introduction

The following key areas where a different approach to governance & regulation currently helps facilitate EV charging in GB are summarised in this section.

a) **Connections Charging Regulation & Methodology**
b) **Independent Distribution Network Operators and Asset Value provision**
c) **Green Recovery Funding**
d) **Timescales to obtain connection offers**

The above areas are ranked by perceived importance & impact, with Connections Charging Methodology being undoubtedly the most impactful difference in network regulation.
We have described each of the above at a very high level and would refer readers to the reference material in the footnotes for further detailed information.

Connections Charging Regulation & Methodology

This is the most significant difference between Grid Connection in GB vs Grid Connection in NI.
Costs levied on connecting customers in GB are governed by a set of rules called the Common Connections Charging Methodology[6] (CCCM).
The current rules in GB mean that connecting customers pay the full cost of any new line or cable needed to connect from their site to the nearest existing piece of network and then pay a share of any upgrade costs required on the existing network. The sharing mechanism is based on the capacity that the customer uses as a fraction of the total capacity of the upgraded network.
The equivalent rule in NI requires the connecting customer to fund the full costs of any network upgrades. This is a particular issue, since as highlighted in the earlier section of this report, Grid Capacity in NI: A High-Level Overview, there is limited capacity left on the network in NI. With network capacity continuing to degrade, it is totally unfeasible to expect single customers to pay to upgrade and create capacity on the wider network.

Therefore, a much higher percentage of new connections for major load installations, such as EV charging, do not proceed in NI because the Connection Charging Regulation & Methodology makes them unfeasible and any consequential network upgrades to create further capacity do not happen either. This results in capacity stagnation which greatly limits the numbers of feasible projects that are required for the Energy Transition or other economic development.

In parallel to the NI regime, the GB networks have benefited from the CCCM for a significant period of time (>10 years), which has allowed a continual uptake of new connections to the network, which have paid their share of wider network development and in turn created additional capacity on those networks that can be availed of for EV charging and other energy transition projects today.

[6] DCUSA, Schedule 22, last accessed 25/08/22: https://www.dcusa.co.uk/dcusa-digital-document/index.html#t=DCUSA%2FDCUSA_Schedule_22%2FDCUSA_Schedule_22.htm

In further contrast to the NI charging regime, Ofgem began a review process of the CCCM in 2018[7] (Access and Forward-Looking Charges Significant Code Review, 'SCR') as they believed that the CCCM did not go far enough to enable the energy transition.
Ofgem's objective of the Access SCR is to ensure that electricity networks are used efficiently and flexibly, reflecting users' needs and allowing consumers to benefit from new technologies and services while avoiding unnecessary costs on energy bills in general."

The outcome of the SCR was a decision to completely remove any network reinforcement costs from being levied on connecting demand customers (subject to a few minor exclusions). This creates an even larger disparity between Connections Charging Regulation & Methodology in NI vs GB, which creates an even wider gap in the feasibility of EV Charging Infrastructure between the two jurisdictions.

Ofgem's rationale for this change to regulation was to address the social challenges posed by EV charging (and other necessary electrification) only being available in areas where grid capacity already exists, alongside generally enabling the EV infrastructure (and other green infrastructure) required to facilitate the energy transition.

Illustrative example:
The table below illustrates an approximate difference in cost to connect a typical 2MVA EV charging hub in GB compared with NI. This assumes a connection at 11kV and is downstream of a primary substation that does not have 2MVA of remaining capacity (i.e. this could be in any of the 41 primary substations in NI that have less that 2MVA of local capacity). For illustrative purposes we've assumed a cost of £2M to upgrade a typical primary substation to 2x 20MVA 33/11kV transformers, a £1M cost to upgrade the 11kV network between the Substation and new site to 5MVA capacity and a cost of £200k for the new dedicated infrastructure required at the EV charging site.

Scenario	Total cost of Primary Substation Upgrade + 11kV Network upgrade	Approx cost of Primary Substation Upgrade to customer	Approx costs of 11kV network upgrade to customer	Approx cost of dedicated connection (e.g. 500m 11kV cable & new customer substation)	Total cost customer has to pay to connect
NI	£2M + £1M	£2M	£1M	£200k	£3.2M
GB (current regulations)	£2M + £1M	£200k (2/20 x £2M)	£400k (2/5 x £1M)	£200k	£800k
GB (from March 2023)	£2M + £1M	£0	£0	£200k	£200k

Table 3: Illustrative example of GB connection costs vs NI

It should be noted that the network upgrade costs must be paid for from elsewhere, if not the connecting customer. GB regulations put more of the cost onto bill payers via DUoS charges. However, this is offset by

[7] Ofgem, Access and Forward-Looking Charges Significant Code review, last accessed 25/08/22: https://www.ofgem.gov.uk/publications/access-and-forward-looking-charges-significant-code-review-decision-and-direction

the fact that EV Charging and other new connections increase the amount of electricity used and therefore create more units of electricity across which DUoS charges can be spread. Ofgem have completed a cost benefit analysis of the SCR changes and have concluded that their decision is in line with their obligations to protect consumers. Ofgem have also included a 'High Cost Cap' mechanism which limits the cost exposure to the wider customer base.

Longer term issues for the energy transition:

Aside from the immediate disparity of upfront connection costs, the divergence of regulation between the two jurisdictions is also likely to impact on many other areas of innovation and network development required for the energy transition. We would point to the emergence of flexibility markets as just one example of a new emerging tool in development that will be needed for the energy transition. Regulation on network connections will have a significant interplay with these new flexibility markets. If connection regulation in NI is fundamentally different to that of GB, then the opportunities for flexibility markets will be fundamentally different.

Where such divergence exists, it is then likely to be more costly, time-consuming and difficult for a small region such as NI to 'go it alone' in creating and developing such large and bespoke solutions for the energy transition (this is also at odds with the 'fast-follower' approach that is typically promoted in NI grid regulation). This is only one example and there will be many others, where fundamentally different technical, regulatory or process solutions will be required if NI continues with fundamentally different Connections Charging Regulation & Methodology.

Independent Distribution Network Operators and Asset Value provision

The presence of Independent Distribution Network Operators (IDNO) in GB and their ability to provide connecting customers, such as EV CPOs, with a contribution towards connection costs (called an Asset Value) reduces the network connection cost and therefore overall development cost of an EV Charging site. This is facilitated by the existence of a competitive market for the adoption of the network connection infrastructure, which also drives technical innovation that can further reduce connection cost and timescales.

There is no regulatory framework in NI for IDNOs or for other mechanisms that would create similar outcomes. This makes EV charging development in NI more costly and time consuming, which in turn reduces the feasibility of EV charging development.

Green Recovery Funding

In response to the COVID-19 pandemic, Ofgem launched a 'Green Recovery' mechanism in GB which targeted network funding to shovel ready projects that were part of the energy transition. This has resulted in many previously unfeasible EV charging developments now proceeding across key areas such as bus depots and motorway service stations. This short-term funding mechanism could be seen as an initial initiative to promote such projects until March/April 2023, when the new Connections Charging Regulation & Methodology takes effect.
NIE Networks have made proposals for a similar funding mechanism in NI but it does not appear to have reached either a public consultation or regulatory decision stage at this point.

Timescales to obtain connection offers

Regulation for GB Network operators sets out much faster timescales for Network companies to issue Connection Offer to customers, particularly for connections in the 1-2MVA capacity bracket (such as HPC sites). A typical timescale for connection offer for a 1MVA EV HPC site in GB is 4 weeks[8], compared with 3 months[9] in NI.
This variance is regulation therefore creates a typical 2-month timescale variation in delivery of EV charging sites.

[8] Refer to any GB DNO Statement of Connection Charges, available on all GB DNO websites
[9] UREGNI, NIE Networks Distribution Licence, last accessed 25/08/22: https://www.uregni.gov.uk/files/uregni/documents/2021-08/nie-distribution-licence-effective-16-08-2021.pdf

Summary & look ahead

- Network capacity issues in NI will continue to be a significant blocker to the development of EV charging infrastructure (and other energy transition electrification as well as general economic development) unless the challenges identified are addressed. EV charging infrastructure is likely to only progress in the limited areas where capacity is currently available or where significant public funding is available to make network upgrades commercially viable.

- Connections Charging Regulation & Methodology has been identified as one of the key areas of divergence in regulation that has contributed to the lack of capacity and continues to be a blocker to new EV charging infrastructure development.

- There will be no 'quick fixes' to the network capacity issues. Even if regulations were aligned with GB today, the build out timelines for network upgrades are likely to take 2-5 years per upgrade project. It is therefore imperative that the initial blocker of divergence in regulation is resolved as soon as possible to allow infrastructure providers to commence work on the EV charging infrastructure that is increasingly required by NI.

- Should regulatory divergence issues be resolved, there will then be a significant programme of implementation work required by various stakeholders before the relevant policies and procedures would be in place to enable progress on the ground. This paper does not cover any of the further technical aspects or policies that exist in GB in the context of differing underlying regulation. Following resolution on the initial regulatory hurdles, it will then be a task for various industry stakeholders to put in the place the next level of policy and procedure to implement the various changes required.

- Below is an outline indicative timeline, should the relevant decision makers act now on key policy and regulatory decisions. We anticipate that EV drivers will not welcome these anticipated timescales, as it illustrates that NI is going to be lagging behind in our EV infrastructure requirements and our neighbouring jurisdictions for quite some time, before real improvements are seen by EV drivers.

    - **Year 1**: UREGNI consultation and implementation (to include relevant licence changes etc. Note that Ofgem began this process in GB in 2018 and issued a decision in 2022, therefore a fast-follower approach would be required to compress this to 1 year, through adoption of much of the good work already completed by Ofgem)
    - **Year 2**: Industry stakeholder development of implementation plan and relevant policies
    - **Year 3**: Connection Offers begin to be issued under the new regime
    - **Year 4**: First EV hub connected under new regime
    - **Years 4-9**: Network upgrade works to enable widespread EV charging infrastructure roll-out, in parallel with roll-out in areas with capacity