Marches Network Monitoring Project

Report

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Executive Summary

The Marches Network Monitoring Project is an initiative supporting the rollout of Low Voltage electricity network monitoring across the Marches region, covering Shropshire, Telford & Wrekin and Herefordshire. National Grid Electricity Distribution, the distribution network operator for the region, have contracted EA Technology to manage the introduction of the monitoring devices to targeted locations and report on what opportunities can be unlocked through greater network visibility.

The Marches LEP has provided funding to National Gird Electricity Distribution to increase the number of monitoring units being installed in the region, allowing for greater coverage of the network, and to investigate the benefit of system visibility for energy projects. The project will be actively managed for 3 years, during which EA Technology will report on lessons that have been learned through ongoing project activities and provide future pathways for network monitoring installations projects. Local energy projects, industrial parks and local authorities will be engaged to understand the key areas that could benefit from having more information about the parts of the electricity network to which they are connected.

The objective of the project is to understand how the transition to low carbon technologies can be supported at a local level by providing network data, empowering the communities to join in with the goal of reaching Net Zero by 2050.

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1 Background and Introduction

National Grid Electricity Distribution (NGED) has outlined plans to increase Low Voltage (LV) monitoring in their network area during RIIO-ED2, the next Ofgem regulatory period for Electricity Distribution Network Operators (DNOs). To improve the efficiency and effectiveness of the rollout of the LV Monitors, NGED have successfully received funding from the Marches Local Enterprise Partnership (LEP) to increase the number of monitors in the Marches Region and research the effects of a specific and targeted installation process. EA Technology are supplying the VisNet® Hub monitors[1] and are managing the analysing and reporting the outcomes of the project. NGED has previously used VisNets in their various operational areas and EA Technology has previous experience managing innovation projects regarding LV monitoring.

Grid monitoring is a powerful enabler in supporting other programmes and projects. It is nondisruptive during installation, and once in place, can quickly provide support to a wide range of businesses and residents. It aligns strongly to national (and international) policies in the transition from fossil fuels to low and zero carbon electricity. This has been recognised by the electricity network operators and the energy regulator, Ofgem, with plans to deploy LV monitoring in far greater numbers over the course of the 2023-28 (RIIO-ED2) price control period. Deployments can be aligned to local needs, driven either by individual business/communities or strategically by the LEP.

While monitoring is standard practice on the high voltage network, the LV network has historically been under monitored as transformers were generally planned to exceed required capacity and there was little expectation of bi-directional power flows. This has changed in recent years, particularly with the increase of solar generation installations in domestic properties, and DNOs need to ensure their assets on the network are fit for purpose.

Instead of NGED's previously allocated 50 VisNet® units for the region, this project will oversee the installation of 200 VisNets as well as monitoring the outcomes of having increased network visibility on communities, businesses and local authorities. The VisNets will be strategically located to substations that have associated "Net Zero Projects" such as local energy projects, electric vehicle (EV) charge point installations, planned renewable generation and other low carbon energy projects of interest in the region.

At the outset of the project no exact locations for monitoring had been identified but both the Marches LEP and NGED had a number of locations they believed could benefit from monitoring. These lists were considered when the monitored substations were chosen.

It is important to note that NGED has planned business-as-usual (BaU) initiatives surrounding the generation and publication of LV monitoring information and this project will utilise the outputs of some of them. It is anticipated that the Marches network monitoring project will be able to provide some insights into the best way to continue this rollout, some of which may be implemented during the course of the project.

[1] VisNet® Hub Website.

1 Background and Introduction

1.1 Scope and Objectives

The scope of the project is to install monitoring equipment into 200 NGED LV substations within the Marches LEP area and provide support in utilising the data. The rollout is targeted to focus on areas of community interest and/or areas prioritised for inward investment. Once in place, the project will share data to:

- Locate spatial and temporal capacity constraints, to inform energy generation and storage investors.
- Support energy consumers, including those in fuel poverty, on opportunities for providing demand side measures, e.g. reduced EV charging or deferred space heating.
- Facilitate the creation of a local energy markets for trading variable loads with variable generation within the agreed area.
- Understand the effectiveness of different approaches to targeting LV monitoring for a BaU rollout.

This project seeks to achieve these objectives by doing the following:

- Engage with >20 communities and businesses to target monitoring to support their projects.
- Deploy monitoring to 200 secondary substations.
- Share the substation data through an NGED data portal for stakeholders to access, use and build upon.
- Promote best in class practice to allow others to follow in the footsteps of the trailblazers.

12 Project Timeline

The project will run for an initial three-year period, during which EA Technology will actively promote and manage the project, reporting successful uses of the monitoring data and providing technical support with regards to the monitoring. This includes publicising these successes and supporting NGED with possible best practice implementations of monitoring during BaU.

After three years, EA Technology will provide bi-annual reports evaluating the project for a further two years until project closedown at the end of year five. The VisNets will remain in situ post project until NGED chooses to remove them.

2 Definitions

BaU	Business-As-Usual
DNO	Distribution Network Operator
LCT	Low Carbon Technology
LV	Low Voltage – Distribution Network
LV-CAP®	Low Voltage Common Application Platform
Marches LEP	Marches Local Enterprise Partnership
NGED	National Grid Electricity Distribution
RIIO-ED2	Revenues using Incentives to deliver Innovation and Outputs – Electricity Distribution
UI	User Interface

Table 1: Definitions.

3 Project Set Up

The project is being managed by EA Technology, who are responsible for locating VisNets in areas of interest for the objectives of the project and co-ordination of monitoring outputs from the project. NGED are responsible for the installation and data collection from the monitors. This approach is the standard for installing VisNets in the region and avoids the requirements for any additional training or process. The project also utilises other efficiencies from EA Technology products such as a self-serve data portal for stakeholders that has been previously developed for NGED.

This section provides some background on the EA Technology VisNet® Hub and LV Insights platform utilised during this project.

3.1 Overview of VisNet® Hub Capabilities

The VisNet® Hub is designed to provide visibility of voltage and current on LV distribution substations. The Hub monitors the outgoing ways of a LV board providing insight about load, faults, and condition across the network. It can measure three phase currents, plus neutral, for up to six low voltage circuits and the busbar voltage. Each of the current sensors (Rogowski coils) are fitted by wrapping them around the individual phases of the outgoing LV circuits and the voltage connections are made with shielded plugs into the busbar. *Figure 1* shows the VisNet® Hub installed in a substation.

The three phase voltage connections can be seen protruding from the LV board in *Figure 1*. The device is installed without supply interruption by a DNO engineer trained by EA Technology and the install can be completed in under an hour depending on the set up of the substation. This allows for a quick rollout of devices, especially in areas where multiple devices will be installed in close proximity.

Figure 1: VisNet® Hub installed in a substation in the Marches region.

The VisNet® Hub utilises EA Technology's Low Voltage Common Application Platform (LV-CAP®) operating system, which allows a range of Applications (Apps) to be deployed at the distribution substation to expand the functionality of the unit beyond simple measurement.

Both the raw data and insights gained from onboard calculations are transmitted to EA Technology wirelessly, where they are stored and processed ahead of display. Substation 360 is EA Technology's custom data platform that, through a collection of micro-services and back-end databases, can ingest data from multiple sources. Data is aggregated, analysed, and modelled before being presented as information to the client via a dedicated user interface. In this project the user interface is the NGED LV Insights Platform.

3.2 NGED LV Insights Platform

As part of EA Technology's ongoing work with NGED to provide LV network monitoring solutions, a custom portal for NGED customers to use when viewing the data associated with their local substation has been developed. This platform was built separately from this project in anticipation for NGED sharing monitoring data as part of their Regulatory commitment but users in the Marches region will be among the first to utilise its features for a specific purpose.

The platform is publicly available at lvnetworkinsights.nationalgrid.co.uk and can be accessed without any sign up. This will allow it to be linked in any publication by the project so interested parties can immediately check if their area is monitored, improving the likelihood of a user becoming involved in the project.

The User Interface (UI) allows users to search for substations based on their postcode, DNO licence area or county. Other layers can be added to show the electricity network connections beyond their distribution substation, which could be useful for projects in development that have been unable to connect due to network constraints. They could choose to move to a different, less constrained area in the region if their project is too large to connect to a substation on one feeder.

With the UI being a map, it is possible for users to navigate to their substation manually. When a user clicks on a substation they can choose to show the area that substation supplies, allowing them to double check that it is the correct substation they want to know more about. Then they can click through to see more information about the substation.

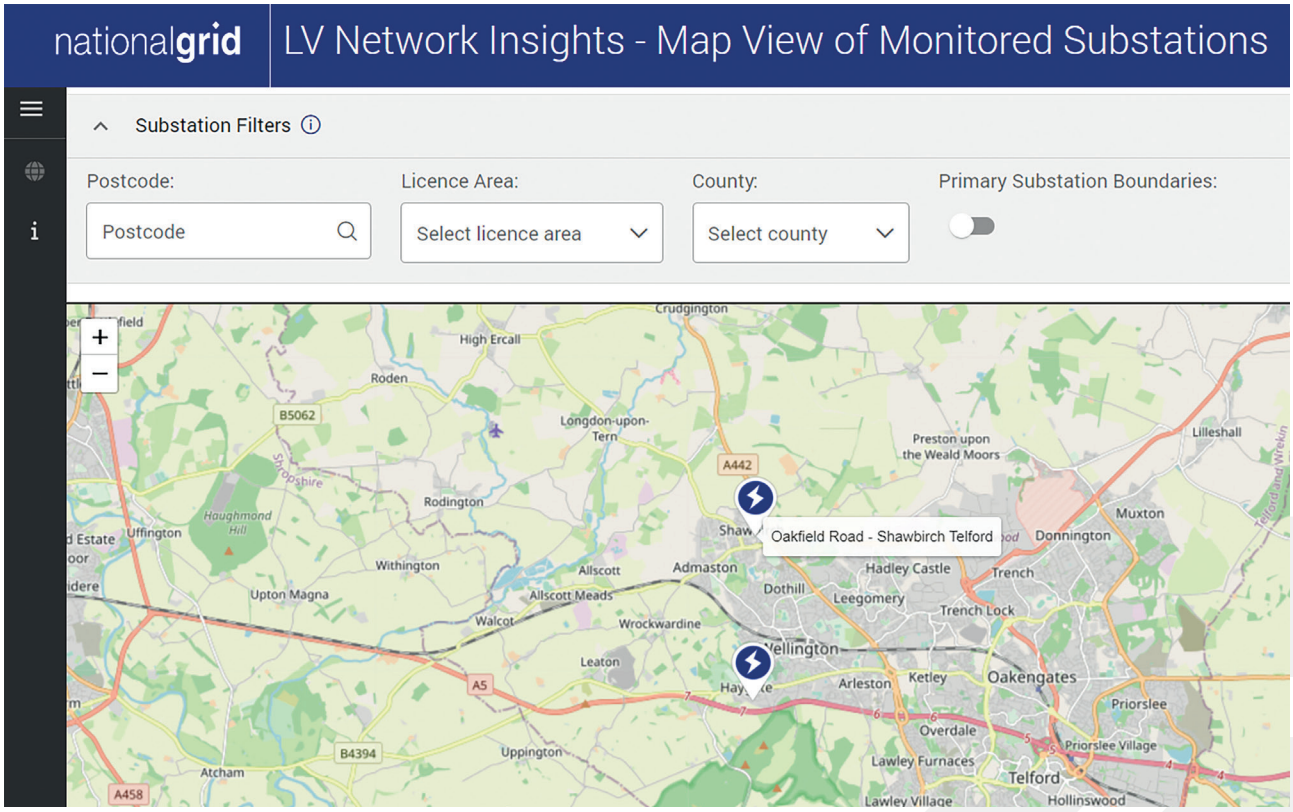

Figure 2: Map View of Monitored Substations.

To give a brief overview of the information that is most pertinent for this project, the Network Capacity data will allow projects to understand how much more demand can be connected to a substation. It is important to note that the maximums are calculated from the data that has been recorded by the monitor while it has been installed, which is a limited data set. A monitor must have been in a substation throughout the winter period for these maximums to accurately reflect the peak demand at a substation, this is due to typical electricity demand peaks occurring in winter. Maximum Demand measurements do not accurately indicate the available future capacity of the substation, because they do not reflect future connections that NGED may be considering. The available future capacity would be determined when NGED receives a connection application.

Over the course of this project the monitors will be in locations for at minimum 5 years and after the first year of monitoring a general understanding of the generation and demand at each substation should be gained. This will allow decisions to be made quicker and NGED will be able to confirm the information instead of beginning the analysis upon receiving the connection request.

The information set also includes the number of connected customers[2], LCTs connected to the substation and any generators connected to the substation. In many cases it is required that these types of devices are registered with the DNO[3], unless the installation is very small, so NGED will have up to date knowledge of these and it will be reflected here. For example, all EV charge points installed must either be registered within 28 days of installation or receive DNO permission prior to installation, depending on the rating and number of chargers[4].

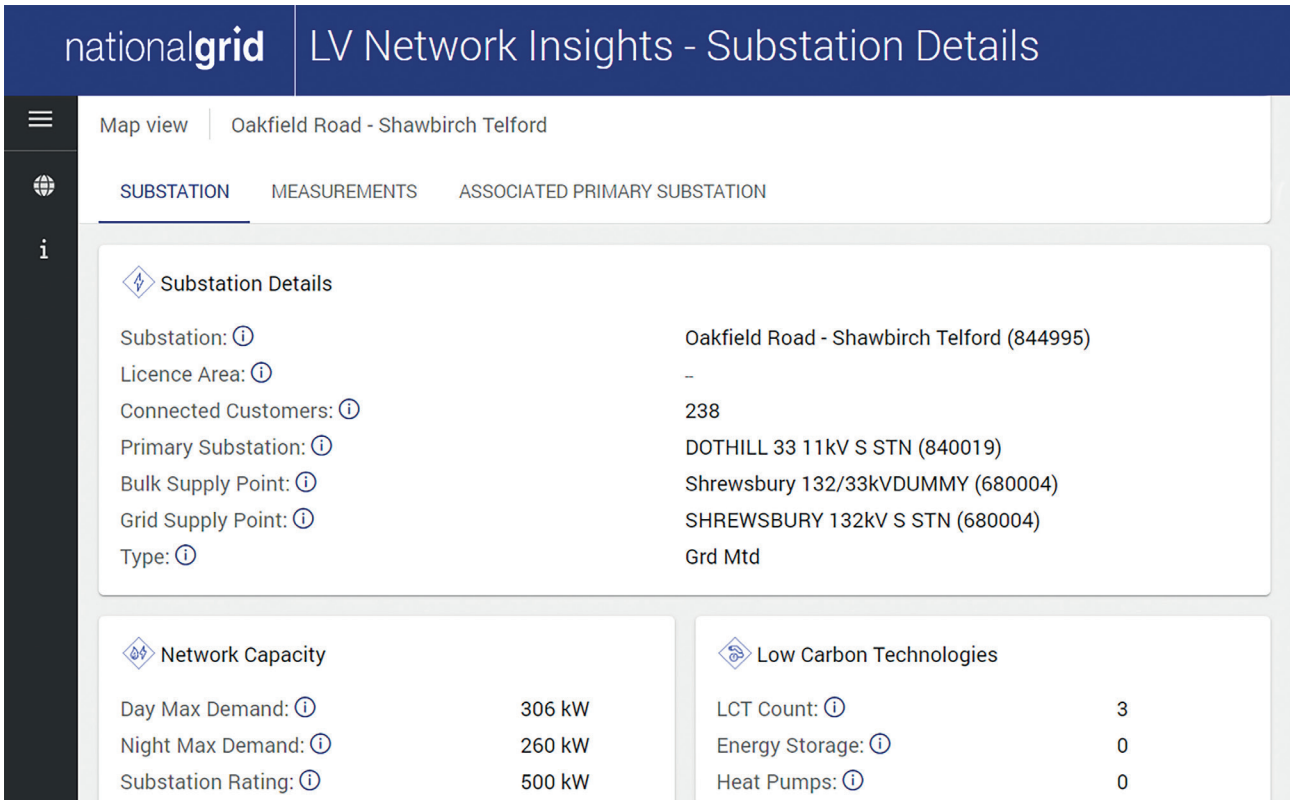

Figure 3: Substation Details.

[2] For substations with less than 6 customers not all data will be available to the public to comply with GDPR and reduce the opportunity for information to become publicly identifiable.

[3] The Energy Networks Association has issued three Engineering Recommendations G98, G99 and G100 that cover various technical requirements for connecting generation at LV. DNOs have a legal obligation to disallow the connection of micro-generation that does not comply with these Engineering Recommendations, the Distribution Code and the Electricity Safety, Quality and Continuity Regulations.

[4] NGED Domestic EV Charge Point Installation Notification Portal.

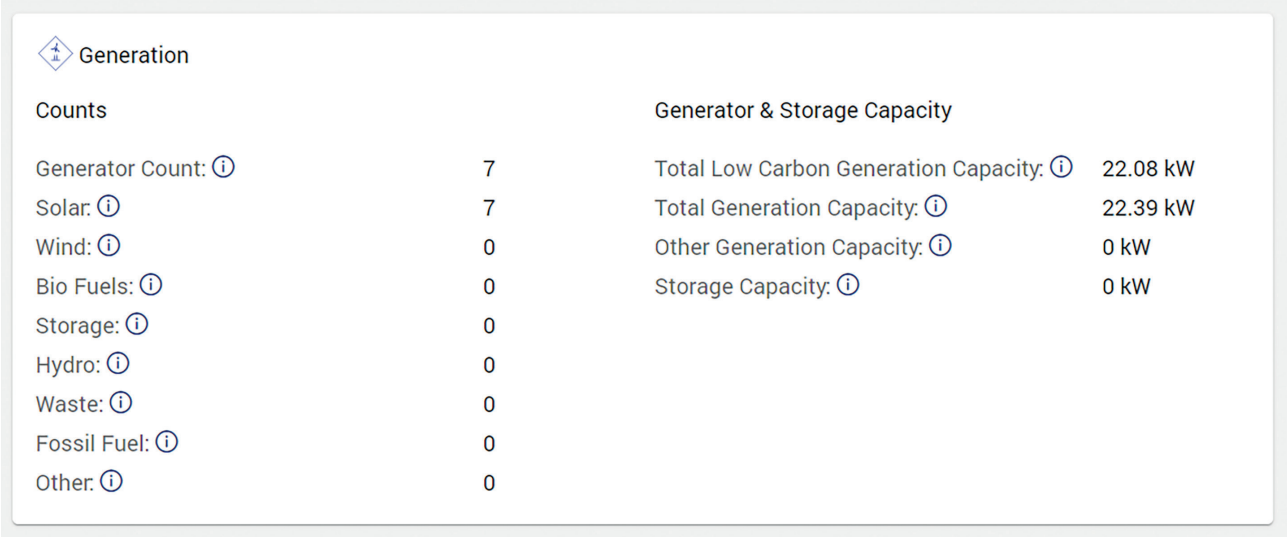

Figure 4: Substation Generation Count.

Users can also see the generation capacity connected to their substation, transformers can often have a lower limit for generation (known as reverse power flow limits) and so this is worth considering including generation in a development.

3.3 Case for Improving LV Monitoring in Marches Region

The Marches LEP supports the growth of business, industry, and communities in the region, providing purposeful investment to drive further development. It is clear that by enabling more connections of renewable generation and sustainable uses of energy there can be great economic benefit. Grid monitoring is a critical enabler in the transition to decarbonised energy, particularly as more energy vectors (heat and transport) switch over from fossil fuels to electricity.

Many local authorities in the region have their own Net Zero targets and to achieve them there must be collaboration between the energy industry, local planning departments and the project developers.

With LV monitoring in place, grid connections can be more accurately sized for the time dependant available capacity of the transformer and this can be done quicker using historical data. For example, feedback from the local authorities identified multiple locations where they intend to install public EV charging stations that will benefit communities in the region with increased tourism and business, as well as providing more access to EVs for locals.

This project will also help to investigate the correct density of grid monitoring deployment: is it more beneficial to target singular substations for a known project or should all substations in a given area be monitored? The approach might differ based on the planning stage a development is in at the time of the connection request, but this project should identify pathways to choose the correct method of monitoring.

4 Monitoring Locations Chosen

The correct placement of VisNets is key to getting outputs from this project that can be used to inform future uses of LV monitoring equipment in NGED operational areas. As the purpose of this project is to investigate how communities utilise data for project planning purposes it was beneficial to identify existing energy projects in the region as a starting point. Both the Marches LEP and NGED were consulted early in the project and further research was conducted on the social, economic, and technical backgrounds in the area to ensure local challenges were broached.

4.1 Background to Location Decisions

Reasons for a location being monitored for this project include but are not limited to:

- Having existing and active community energy projects.
- Business parks looking to connect LCTs.
- Local authorities planning public energy projects.
- Individual users.

The first three reasons make up the majority of "user cases" envisaged for this project, when reporting project successes it is likely that they will mainly come from these groups. Both NGED and the Marches LEP have targets to support these users and many will have existing relationships with either the DNO or the LEP. The last reason, the individuals, are difficult to target at the beginning of the project but will utilise the data supplied for their own projects.

Community energy projects

Community energy projects are common in the UK and come in various forms and sizes. For this project the community must be contained within one area to ensure that a suitable number of substations can be monitored to support the energy project's goals. An active community is required to raise the likelihood that the data will be used and acted upon within the first three years of the monitoring being in place, this is to ensure it can be reported on. Communities may not have the ability to cost for large projects so small efficiency wins and providing them with easy to parse LV monitoring information will allow them to have more productive discussions with the DNO. A previous example of a community energy project in the NGED network area would be the Open LV project which trialled and demonstrated an open, flexible platform that could ultimately be deployed to every LV substation in Great Britain[5]. Projects that seek to utilise data in new and innovative ways could be the blueprint for new ways of distribution network operation across the GB network.

Business parks looking to connect LCTs

In contrast to the community energy projects, each of which has one focus in a small, concentrated area, business and industrial parks typically have a number of substations, each connecting a few customers. These customers share similar energy challenges, generally consuming more energy than a domestic customer, this makes connecting renewable generation a priority for these sites. They will also be interested in connecting multiple EV chargers on their sites to support businesses looking to decarbonise fleets or providing EVs on company plans. Business parks will generally have a company to manage the external utility connections to the site. This includes upgrading the facilities on site as well as planning for future expansions to increase the footprint, and therefore the energy demands, of the site. Having LV monitoring covering various substations in the area will allow business parks to capitalise on LCTs quicker and lead to further investment in the Marches region.

Local authorities planning public energy projects

Covering a larger scope than the previous two user cases, local authorities have the responsibility of planning for the future of their constituent area. Many have departments dedicated to the challenges of decarbonising, including providing information and support to people in their area. Local authorities can benefit from LV monitoring when creating future energy plans and it allows them greater visibility of the locations they can focus investment on, with more spare capacity enabling larger developments to be constructed.

[5] NGED Open LV project page.

Individual user

The fourth and final user case is that of the individual user who utilises the data to plan their own individual energy project. At the early stage of the project it is difficult to target this user case for specific monitoring, however they will likely be opportunistic members of the public who are "early adopters" of technology. They are people who will actively engage in processes to decarbonise their homes, whether to become more self sufficient, reduce costs or reduce their own carbon footprint. This will be a useful demographic to understand how they use the data but are unlikely to become the target of an LV monitoring roll out.

There are over 26,000 NGED LV distribution substations in the Marches region. It is unfortunately not feasible to monitor all these locations, even outside this project, which is why understanding how to efficiently roll out this technology is important.

4.2 Location Choice Process

Following the initial recommendation of 12 prospective community energy projects by the Marches LEP a number of VisNets were earmarked to be located in and around these areas. This list of monitoring sites was checked by NGED network planners for suitability and they provided some sites that had prior LCT connections from local authorities that filled similar roles to the suggested projects.

Then two meetings took place between EA Technology and NGED network planners to provide insight into what other areas may benefit from additional monitoring. It was key to ensure that these new locations were not being monitored solely for constraint reasons but to understand transformer capacity where there have been previous connection requests alongside known energy projects in development. Network planners from all areas in the region were consulted to ensure a balanced spread of VisNets across the whole Marches region. However, as can be seen in *Figure 5*, the sites of interest tend to cluster in the more populated towns due to the larger number of substations in those areas. More customers connected to a substation also tends to correlate with more connection requests, which will have raised their profile for the network planners.

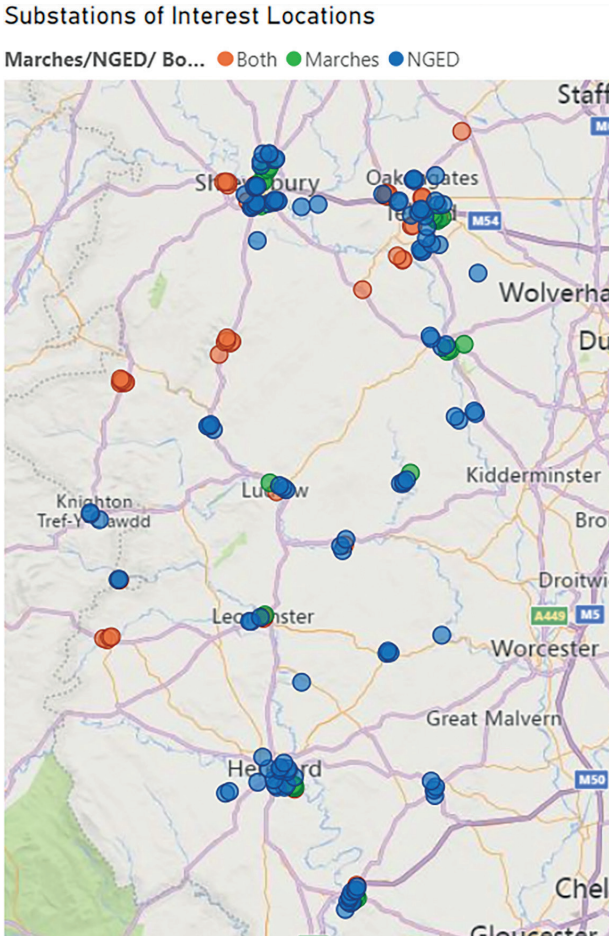

Figure 5: Substations chosen for monitoring in the Marches region.

Appendix 1 provides the full list of substations chosen for this project and *Appendix 2* provides a list of additional substations in the region that have had VisNets installed that were not targeted for the Marches network monitoring project.

4.3 Non-project VisNets in the Marches Region

NGED is already deploying LV monitoring across there substations as part of their RIIO ED2, BaU initiatives. As a result, some additional devices are being seen on the NGED LV Insights platform alongside the VisNets allocated to sites of interest for the Marches Network Monitoring project. As there is no distinction between a VisNet® installed for general monitoring and a VisNet® installed for this project there is no way to filter them out and there is no need to filter them out. To avoid any confusion from stakeholders that may be interested in using the data, NGED have agreed that their BaU VisNets will release the data in the same way so that they can be used to provide valuable learning for this project.

There is no reason not to include them in the analysis if interested parties use the data for their own purposes similar to the stakeholders that will be discussed in this report. Some of these devices may provide further insights into the optimal method of siting LV monitoring on the network that were not considered or not possible at the outset of this project.

5 Installation Progress

This workstream of the project is within NGED's purview, they have the VisNets in stock and the trained engineers to install the monitors. The four network areas of Shrewsbury, Telford, Ludlow and Herefordshire will install the devices alongside the BaU devices to bring the total number of monitors in the region to above 200. At this point more non-project VisNets have been installed however this includes VisNets that were installed prior to the project being initiated.

Marches Project VisNet®	No. of Installed VisNets
N	23
Y	15

Table 2: VisNet® Installation Progress.

With the publication of this document the installation progress is not at the milestone initially forecast for this project. The current progress of installs is shown in *Figure 6*.

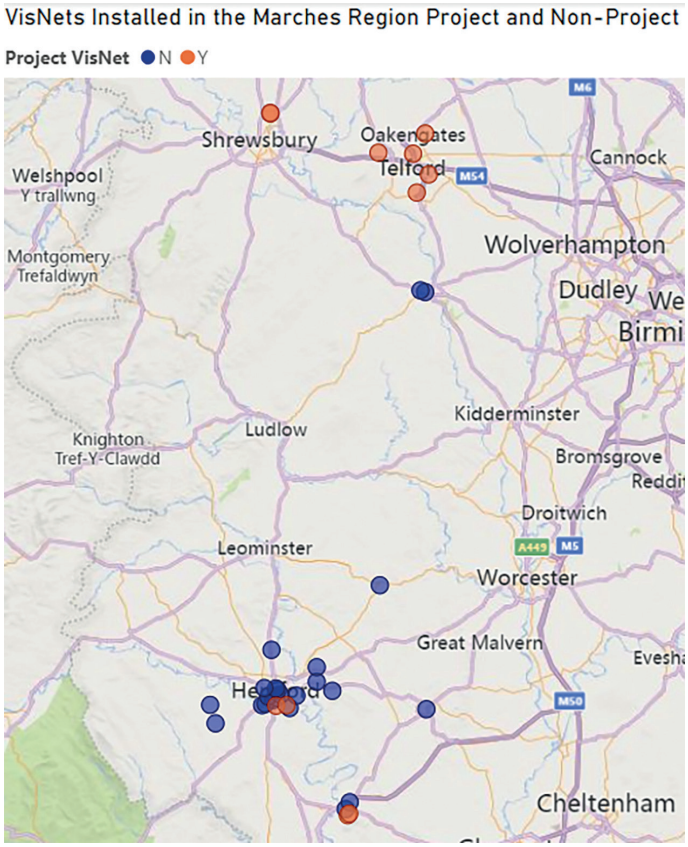

Figure 6: VisNets installed in the region.

As can be seen on the map, the dark blue dots represent non-project installs, meaning the majority of VisNets in the region are not part of the targeted rollout. At the time of writing, multiple devices have been installed in the region but not yet been fully commissioned to begin supplying measurements back to EA Technology's portal. These devices are being investigated to ensure they are correctly recorded on the system.

NGED are currently reviewing their installation and commissioning process to increase the rate of installation and ensure the project stays on track. Further discussions with NGED around this workstream are happening to support the installation and commissioning of the devices required for this project.

6 Stakeholders Contacted

This section provides examples of the types of stakeholders the project aims to reach, it is not an exhaustive list of contacts but context for the needs and opportunities of different user bases.

6.1 Local Authorities

The Marches region covers three Local authorities: Telford & Wrekin, Shropshire and Herefordshire. In the early stages of deciding monitoring locations all three were consulted for better local knowledge of constraints and existing pain points on the network. In general, the contacted parties were sat within the Sustainability, Climate Change or Net Zero team in their respective councils, making them well placed to provide input on initiatives in their area alongside developing an early working relationship for future questions.

These conversations have led to other opportunities for monitoring locations to be established, allowing for deployment of devices to projects that could show benefits from having more available data at the planning stage. All councils will be kept informed of outputs from the project and will likely be able to provide further locations for monitoring to NGED depending on a development's planning needs.

6.2 Business Parks

From an early stage of the project, the Marches LEP identified multiple business parks that would benefit from improved network visibility when discussing future plans for both improvement of existing services and expansion of their developments.

6.2.1 Stafford Park

Situated in Telford, Stafford Park is a key enterprise area in the region. It was highlighted by the Marches LEP as an area of economic interest and contains numerous substations. Monitoring locations were chosen based on previous NGED experience in the area regarding requests and capacity however not all substations could be monitored so further work may be needed in the area if more parties want access to monitoring information.

6.2.2 Skylon Park

Skylon Park is a business park in Herefordshire that aims to provide plots that are ready for businesses to move in a simplified process to enable investment in the area. As part of this they are keen to understand the electricity network in their area to provide more services like solar generation and EV chargers on the site.

6.2.3 Industrial Areas

Alongside the two parks discussed, other industrial areas identified in the region were Ashburton Industrial Estate in Ross-On-Wye and the Bridgnorth Industrial Cluster, both of which have been targeted for monitoring.

6.3 Community Energy Groups

In a similar vein to the business parks, the Marches LEP was aware of community energy projects in their region and gave some initial contacts to open discussions. There are likely to be other community energy projects in the region that it is hoped the media outreach campaign will create avenues of contact with.

6.3.1 Bishop's Castle

EA Technology spoke directly to representatives from Bishop's Castle and the Share Energy Co-Operative that the residents are working with. This is a community of engaged people that want to tackle emissions problems and look for less expensive options for heating their town.

Bishop's Castle faces many of the typical blockers to decarbonisation that other towns and villages across the country have. In particular there are issues with installing heat pumps, including the required installation of suitable insulation and windows, in a village containing many older properties that have solid stone walls and limited space. Residents have expressed concern over the future heating options available to them, along with an interest in decarbonising their energy consumption where possible.

6.3.2 Church Stretton

Church Stretton is a community in Shropshire that has developed its own Community Led Plan that includes plans to reduce carbon emissions in their town and has formed the Stretton Climate Care organisation[6]. They believe strongly in taking practical actions to ensure the town is coordinating its efforts collectively rather than on an individual basis. This group is clearly engaged and active so it will be interesting to follow how the monitoring data that is provided by the six VisNets in their area will support their plans.

[6] Church Stretton Community Led Plan.

7 Media Outreach

To improve the chances of project success EA Technology has onboarded a PR agency that will be co ordinating the campaign to improve public and industry awareness of the project. Initial discussions have taken place between NGED, the Marches LEP and EA Technology to understand the requirements of the project, the messaging surrounding the early stages and the desired objectives for the project.

Project informational materials will be placed in industry publications, local news organisations, other Marches LEP and local authority publications and NGED community outreach events. The fourth user case "The Individual" is unlikely to be reached through the same means as the other anticipated users, so finding methods of engaging them and understanding their needs will require further work. It is hoped that this approach will reach some of them, alongside further word of mouth from participants in community energy projects and some of the business parks. The most successful methods of engaging with the individual users will be captured to provide recommendations to future projects as they are still likely to be the most difficult to contact group.

The next 6-month report will detail the scope of the publicity campaign and give some early indications of its successes and where more focus will be placed going forward.

8 Conclusions and Next Steps

The Marches Network Monitoring project has successfully engaged with communities across the region to begin understanding of what monitoring can do for them and how it can be effectively implemented. The increase in the number of monitors that will be deployed in the region will support the social, economic, and environmental targets the Marches LEP are looking to achieve. The project has benefited from successful early communication between all parties to ensure a range of energy projects have been engaged in areas that may require more network visibility.

Provided the remaining project VisNets are rolled out within a reasonable time, the overall progress of the project should not be affected largely due to the substation maximum demand typically occurring in winter. The installation of all allocated project VisNets is fundamental to the progress of the project however the delay in the planned installation timeline is not expected to have a significant impact on project progress due to the overall length of the project.

Over the next 6 months of the project there are three headline objectives that need to be completed to ensure the early engagement of parties in the region and enable future success of the project. Gaining a wide outreach will be key to having participants in the project that were not part of the initial consultations on the project.

The three key objectives to be completed over the next six months are:

- Installation of all VisNet® units.
- Project media launch.
- Active involvement in at least one project currently in development.

The sooner substations are monitored the earlier stakeholders can be engaged and the project media can be fully launched. Launching without a considerable number of units in place will jeopardise the effectiveness of the launch as people will not be able to immediately ascertain if they will be able to get involved with the project.

Once the project has a more public presence it is likely that there will be early front runner projects who will agree to be followed more closely to provide a case study on their use of the data. It is anticipated that more than one development will be followed but even in six months it is unlikely that sufficient data will be available to facilitate final project decisions.

Appendix I - Sites Chosen for Monitoring

The following substations were initially chosen for monitoring for this project. Some sites may have more than one VisNet® allocated as they have more than six feeders to monitor.

This list is complete at time of publication but until the full course of installs has been completed by NGED it will not be known if all these substations are suitable and therefore the list is subject to amendment. If a site is not suitable for a VisNet® installation then another site in the Marches region will be chosen.

Substation Name	Substation Number	Region
Queen Street - Castlefields	844958	Shropshire
Castlefields - Shrewsbury	843553	Shropshire
Whitchurch Road No. 1 - Harlescott	845118	Shropshire
Sundorne Road - Harlescott	845119	Shropshire
Sandford Close - Harlescott	842979	Shropshire
Old Heath Lane - Harlescott	844246	Shropshire
Albert Road - Harlescott	844569	Shropshire
Thrower Road	845756	Shropshire
Stump Jumper	840822	Shropshire
Grainger And Worral No. 4	745368	Telford
Star Aluminium Local - Bridgnorth	776643	Telford
Stourbridge Road - Bridgnorth	776645	Telford
Chartwell Bus Park	779165	Telford
Bromfield Road - Ludlow	744260	Ludlow
Rotherwas Industrial	751105	Hereford
Munitions Way	756473	Hereford
Wpd Depot	755510	Hereford
Beech La	756494	Hereford
Fir Tree Lane - Rotherwas	751107	Hereford
Campwood Road - Hereford	751106	Hereford
Stella Way - Rmu	751101	Hereford
Thorn	751081	Hereford
Smokey - Rmu	751100	Hereford
Gooders - Rmu	751103	Hereford
Whites Corner	756562	Hereford
Alton Road - Ross	755009	Hereford
Ashburton Road - Ross	755017	Hereford
Woodside - Ross On Wye	754787	Hereford
Alton Park Industrial Estate - Ross	755007	Hereford
Alton Road Units - Ross On Wye	754026	Hereford
Stafford Park 1 - Stafford Park Telford	841942	Telford
Stafford Park 4 East - Telford	841914	Telford

Table AI.1: Sites chosen for monitoring.

Substation Name	Substation Number	Region
Stafford Park 11 - Stafford Park Telford	841417	Telford
Stafford Park 15 West - Stafford Park	841266	Telford
Stafford Park 15 East - Stafford Park	841258	Telford
Stafford Park 17 - Stafford Park	840395	Telford
Stafford Park 17, Workshops	840396	Telford
Stafford Park 128 - Stafford Park Telford	840962	Telford
Stafford Park 12 - Stafford Park Telford	841910	Telford
Dales - Leominster	742801	Ludlow
Brookvale Rd - Rmu	842918	Telford
Oakengates - Oakengates	844742	Telford
Tan Bank - Wellington	842959	Telford
Victoria Avenue - Wellington	843620	Telford
Market Hall - Newport	844627	Telford
Dawley	844739	Telford
St Mary's Road - Much Wenlock	841691	Telford
Hortonwood 3 - Telford	842528	Telford
Park Industrial - Rmu	842530	Telford
Haldane Road 4 Halesfield - Halesfield	840354	Telford
Glenwarren - Donnington	842667	Telford
The Coppice Randlay - Telford	841898	Telford
St Helliers Drive - Lawley	843150	Telford
Ryton Road - Beckbury Shifnal	841897	Telford
Woodhouse Fm Telford - Off Collett Way	843094	Telford
Priorslee Area H - Priorslea	844003	Telford
Hortonwood 1 - Hortonwood Telford	842533	Telford
Reliance 194 - Rmu	840739	Telford
Retail Park - Telford Town Centre	842892	Telford
Telford Forge No. 1 - Telford	843889	Telford
Rampart Way	845510	Telford
Oxford Street - Oakengates	842952	Telford
The Limes - Oakengates	842951	Telford
The Parade - Wellington	843619	Telford
Bridge Road - Wellington	844603	Telford
Hazeldine House - Lawley/Wellington.	840956	Telford
Ketley Retail Park - Ketley	842218	Telford
E/F1 & F2 Wrekin Retail Park	845176	Telford

Table AI.1: Sites chosen for monitoring (continued).

Substation Name	Substation Number	Region
Blewshill - Dawley	844738	Telford
Madeley Court	840249	Telford
Park Avenue - Madeley	843503	Telford
Madeley Town Centre - Madeley	843504	Telford
Ironbridge Station - Ironbridge	842348	Telford
Ironbridge - Ironbridge	843049	Telford
Severn Foundry - Coalbrookdale	842349	Telford
Brookside Local Centre - Brookside	840746	Telford
The Hook - Bridgnorth	776826	Ludlow
Lodge Lane - Bridgnorth	777060	Ludlow
Ash Road - Bridgnorth	776649	Ludlow
Well Meadow - Bridgnorth	776594	Ludlow
Greenhill Close - Tenbury Wells	742808	Ludlow
Wheeler Orchard - Tenbury Wells	740954	Ludlow
Orchard Court - Tenbury Wells	742706	Ludlow
Foresters Road - Tenbury Wells	740976	Ludlow
Buckfield Road - Leominster	742668	Ludlow
Gasworks - Leominster	742636	Ludlow
The Meadows	742670	Ludlow
West Gate - Leominster	742186	Ludlow
Central Car Park - Leominster	741959	Ludlow
Kington	742667	Ludlow
Kington Industrial Estate - Kington	741998	Ludlow
Kington Station - Kington	740163	Ludlow
Crooked Well - Kington	742792	Ludlow
Clee View - Ludlow	743574	Ludlow
Hayton View - Ludlow	744030	Ludlow
Parys Road - Ludlow	740780	Ludlow
Portcullis Lane - Ludlow	744026	Ludlow
Ludlow Road - Cleobury Mortimer	744835	Ludlow
St Marys Place - Cleo Mortimer	744492	Ludlow
Furlongs Close - Cleo Mortimer	742901	Ludlow
Cleobury Mortimer - Cleobury Mortimer	744334	Ludlow
Newton Street	740389	Ludlow
Farmore - Craven Arms	740398	Ludlow
Greenfields Road - Craven Arms	744283	Ludlow

Table AI.1: Sites chosen for monitoring (continued).

Substation Name	Substation Number	Region
Brooklands Park - Craven Arms	744284	Ludlow
The Dingle - Knighton	744828	Ludlow
Radnor Drive - Knighton	744751	Ludlow
Laurels Meadow	744464	Ludlow
Silverdale Terrace - Highley	776718	Ludlow
Ashleigh Gardens - Highley	776899	Ludlow
Arden Way - Alveley	777216	Ludlow
Alveley - Alveley	776454	Ludlow
Presteigne Industrial Estate	740314	Ludlow
Townend Field - Presteigne	742594	Ludlow
Presteigne Comprehensive School - Presteigne	742593	Ludlow
Clive Avenue - Church Stretton	841341	Shropshire
Hazler Crescent - Church Stretton	841342	Shropshire
Corporation Street - Bishops Castle	841150	Shropshire
Meole Brace School - Meole Brace	844009	Shropshire
London Retail Park - Meole Brace	844022	Shropshire
Rothley Close Radbrook - Shrewsbury	844551	Shropshire
Barker Street - Shrewsbury	842988	Shropshire
Crown - Shrewsbury	842970	Shropshire
Harley Road - Condover	843726	Shropshire
Vanguard	842734	Shropshire
Food Enterprise Park	842730	Shropshire
Easthope Road New	845208	Shropshire
Ludlow Road - Church Stretton	840847	Shropshire
Lutwyche Road - Church Stretton	840846	Shropshire
Little Stretton - Little Stretton	841008	Shropshire
Cosira - Bishops Castle	840261	Shropshire
Love Lane Bishops Castle- Bishops Castle	840257	Shropshire
New Street - Bishops Castle	840403	Shropshire
Kerry Gate	840258	Shropshire
Oak Meadow - Bishop Castle	840054	Shropshire
Weeping Cross Business Park	840944	Shropshire
Emstrey Business Park - Shrewsbury	842311	Shropshire
Salcombe Drive - Springfields	843570	Shropshire
Kingston Drive - Springfield	842315	Shropshire
Rowton Road - Sutton Farm	845138	Shropshire

Table AI.1: Sites chosen for monitoring (continued).

Substation Name	Substation Number	Region
Enterprise Park No. 2 - Harlescott Shrews	842745	Shropshire
Atcham Storage - Atcham	842598	Shropshire
Meole Island	840994	Shropshire
Do It All - Meole Brace	844021	Shropshire
Shomere Crescent - Meole Brace	842808	Shropshire
Mary Webb Road - Meole Brace	842294	Shropshire
Arlington Way - Sundorne Shrewsbury	844255	Shropshire
Shrewsbury Industrial Park	843984	Shropshire
Lydham Road - Shrewsbury	845146	Shropshire
Attingham Hall - Atcham	843144	Shropshire
Boscobel Drive - Shrewsbury	845136	Shropshire
Princess House - Shrewsbury	842989	Shropshire
Shoplatch - Shrewsbury	842991	Shropshire
Riverside - Shrewsbury	843551	Shropshire
Raven Meadows - Shrewsbury	843552	Shropshire
Coach Road - Gains Park Bicton Heath	844954	Shropshire
Corner Lane Gains Park Bicton - Shrews	843817	Shropshire
Oaklands - Gains Park	844012	Shropshire
Penfold - Gains Park	843050	Shropshire
Sitka Drive	842312	Shropshire
Ashfield Crescent - Ross On Wye	755178	Hereford
Barneys Lane	756610	Hereford
Bricknell Close - Hereford	750893	Hereford
Bryn View	756609	Hereford
Bullingham Site B - Hereford	750942	Hereford
Clifton Road - Hereford	750906	Hereford
Court Road - Ross	754155	Hereford
Deer Park West - Ledbury	754174	Hereford
Dorchester Way -Belmont Hfd.	752025	Hereford
Englands Gate - Bodenham	752773	Hereford
Gatehouse Road	750165	Hereford
Gloucester Road - Ross On Wye	755061	Hereford
Goodwin Way - Lower Bullingham	751683	Hereford
Gosmore Rd	756571	Hereford
Grandstand Road - Hereford	753581	Hereford
High Street - Ledbury	755077	Hereford

Table AI.1: Sites chosen for monitoring (continued).

Substation Name	Substation Number	Region
KFC Ross	755430	Hereford
Kyrle Street Masons	755373	Hereford
Landimore Clehonger - Rmu	755856	Hereford
Ledbury Road - Hereford	750280	Hereford
Lower Bullingham - Hereford	751215	Hereford
Meadow Green - Whitbourne Bromyard	740997	Hereford
Merrivale - Ross On Wye	755006	Hereford
Mount Pleasant - Ross	754671	Hereford
Maltings Supermarket - Ross	755235	Hereford
New Mills - Ledbury	754780	Hereford
Nimrod Drive - Hereford	751721	Hereford
Old Road - Bromyard	742709	Hereford
Penyard Lane - Ross On Wye	755004	Hereford
Quarry Meadow - Bromyard	740688	Hereford
Ross Road - Hereford	751636	Hereford
Russell Close - Hereford	750295	Hereford
Saxon Gate - Hereford	751350	Hereford
Sheep Street - Bromyard	740977	Hereford
Station Approach - Hereford	751360	Hereford
Vine Tree Farm	755226	Hereford
Woodleigh Road - Ledbury	755300	Hereford

Table AI.1: Sites chosen for monitoring (continued).

Appendix II - VisNet® Installation Locations

NGED is delivering a BaU rollout of LV monitors as part of their RIIO ED2 business plan commitment. As a result, some additional devices are being seen on the NGED LV Insights platform alongside the VisNet® allocated to sites of interest for the Marches Network Monitoring project. All installed VisNets in the Marches Region are included in this table.

The following list is complete at the time of publication but other devices may be installed in the region during the course of the project. NGED have decided to make the data available so they can be utilised by interested parties and considered as part of this projects learning.

Substation Name	Substation Number	Target Substation	Local Authority Area
Whitecross - Hereford	753635	N	Hereford
St. Katherines	755765	N	Hereford
Brookend Street - Ross	755002	N	Hereford
St. Owens Street - Hereford	750057	N	Hereford
New Baths - Hereford	751351	N	Hereford
Whitefriars Road - Hereford	753588	N	Hereford
Belmont Rd	751055	N	Hereford
The Baths - Edgar Street Hereford	751210	N	Hereford
Netherwood Road - Rotherwas	751078	N	Hereford
Food Enterprise Park	842730	Y	Shropshire
Oldbury Wells - Bridgnorth	776651	N	Telford
The Wheatlands	776708	N	Telford
Hereford Road - Bromyard	742802	N	Hereford
Overross - Ledbury Road Ross	755019	N	Hereford
Alton Park Industrial Estate - Ross	755007	Y	Hereford
Dean Pool - Kingstone	753039	N	Hereford
Church Croft - Madley	753502	N	Hereford
Stanbrook Rd - Belmont	753603	N	Hereford
Linden Lea - Hereford	751733	N	Hereford
Broomy Hill - Hereford	751606	N	Hereford
Dormington Court - Dormington	750259	N	Hereford
Hagley Hall - Bartestree	750753	N	Hereford
Veldo Lane - Withington	752407	N	Hereford
Widemarsh Street Car Park - Hereford	750054	N	Hereford
Vanguard	842734	Y	Shropshire
St. Andrews Close - Moreton On Lugg	751661	N	Hereford
Saxon Gate - Hereford	751350	Y	Hereford
Penyard Lane - Ross On Wye	755004	Y	Hereford

Table AII.1: VisNets installed in region.

Substation Name	Substation Number	Target Substation	Local Authority Area
Goodwin Way - Lower Bullingham	751683	Y	Hereford
Oakengates - Oakengates	844742	Y	Telford
Stafford Park 12 - Stafford Park Telford	841910	Y	Telford
Glenwarren - Donnington	842667	Y	Telford
Brookside Local Centre - Brookside	840746	Y	Telford
Tan Bank - Wellington	842959	Y	Telford

Table AII.1: VisNets installed in region (continued).

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