Energy Networks Innovation Process Project Closedown Report Document

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Project Title (*This cannot be changed once registered*)	Project Reference
E Tourism	NIA_SSEN_0038
Funding Licensee(s)	**Project Start Date**
SSEN - Scottish Hydro Electric Power Distribution & Southern Electric Power Distribution	July 2019
Project Duration	**Year**
38 months	2023
Nominated Project Contact(s)	
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1. Scope

The scope of the project is to carry out traffic flow and network modelling to understand the impact of EV charging. It will also design and develop a trial of specific network and local flexibility solutions to assist with security of electric supply to EV charging hubs to deal with highly seasonal charging peaks in the tourist season.

The geographical scope of the project will be a 'tourist route' suitably representative of the primary tourist routes. The output will be proven through a modelling tool highlighting geographical areas of improvement calibrated against a real-life trial of a local flexibility solution(s).

The output of both the modelling tool and real-life trial of the flexible solution will feed into a report which captures all learnings and provides system planning with appropriate guidance of areas of focus for investment on the network. The method will be transferrable to other parts of the UK where the appropriate data is available.

2. Objective(s)

1. Understand how increased EV uptake and tourist patterns will impact seasonal peak demand on the network.

2. Identify the scale, location and duration of any increased charging demand broadly for the North of Scotland followed by an in-depth study of specific locations.

3. Enhance stakeholder engagement for helping local community groups, local authorities and other organisations to understand impacts of heightened EV tourism will have on local demand.

4. Identify suitable local flexible solutions to assist in demand management during seasonal peaks but also benefiting residents all year round. These solutions may extend beyond charge points only to options such as valet charging.

5. Inform investment strategies for network development based on expected impacts of EV uptake and tourist patterns.

3. Success Criteria

If the project delivers the anticipated learning to GB stakeholders, then it is deemed successful.

4. Performance compared to the original project aims, objectives and success criteria

Details of how the Project is investigating/solving the issue described in the NIA Project Registration Pro-forma. Details of how the Project is performing/performed relative to its aims, objectives and success criteria.

All the original objectives of E-Tourism have been met in the following ways.

We now understand how increased EV uptake and tourist patterns will impact seasonal peak demand on the network. The scale, location and duration of any increased charging demand broadly for the North of Scotland was investigated. This was followed by an in-depth study of specific locations. Stakeholder engagement was conducted to understand the impacts of heightened EV tourism on local demand. Most of this work was in Scotland and the evidence and findings are published in the report titled E-Tourism: charging demand by electric vehicles in Scottish tourist hotspots.

Follow up work in the Isle of Wight was able to identify suitable local flexible solutions to assist in demand management during seasonal peaks. We were able to extend these solutions beyond charge points to include alternatives such as valet charging, park and ride, local generation, on site storage and a combination of these. This work is published in the report titled E-Tourism: charging demand by electric vehicles on the Isle of Wight.

We have produced a matrix of these solutions which will help to inform alternatives to network reinforcements and investment strategies for network development based on expected impacts of EV uptake and tourist patterns. This work and a summary of everything we have found over the course of the E-Tourism project is published in the final report titled: Isle of Wight E-Tourism: alternative solutions to network reinforcement.

The project has satisfactorily achieved the aims and objectives as presented below.

1. Understand how increased EV uptake and tourist patterns will impact seasonal peak demand on the network.
and
2. Identify the scale, location and duration of any increased charging demand broadly for the North of Scotland followed by an in-depth study of specific locations

The project has worked closely with key stakeholders in Element Energy and Transport Scotland to understand potential EV vehicle flows based on current conventional vehicle movements.

The following eight use cases were investigated and were chosen with Scottish Government and Transport Scotland to cover journey starting points, tourist hotspots for stopping and overnight accommodation as well as arterial routes:

- Ferry Journey - Uig, Isle of Skye to Tarbert, Isle of Harris
- Tourist hot spot - Fairy Pools, Isle of Skye
- Overnight accommodation / popular hotspot - Portree, Isle of Skye
- Tourist hot spot - Urquhart Castle
- Dundee City Centre
- A9 Perth to Inverness
- A82 Loch Lomond to Inverness
- A87 Inverness to Isle of Skye

The study analysed the scale and duration of charging demand against the relevant primary or secondary substations for each use case. The study identified the location of each constraint that relates to additional tourism demand. The study confirmed that constraints relating specifically to tourist demand are not expected to occur on primary substations, however, will more likely be realised at secondary substations and on the low voltage network.

Although the study focussed on the above use cases, it highlighted that isolated and rural areas with small residential populations are most likely to be a constraint as the electricity grid here often has lower capacity and therefore less ability to accommodate additional demand than more populated towns and cities. Sites such as these will require the provision of flexibility services where feasible, or network capacity upgrades.

In addition, the study highlighted that the seasonal increases in tourism are often thought to occur in the summer. However, across the use cases investigated large peaks in tourism are noticed in the winter as well, which could provide additional strain to the network especially with the winter demand being higher due to heating.

Individual analysis of each use case can be found in the project report produced by Element Energy which is available here https://ssen-innovation.co.uk/wp-content/uploads/2021/10/20200706_E-Tourism_report_V3.pdf.

Following this study completed by Element Energy for SSEN in 2020/2021, which investigated the impacts of E Tourism in Scottish tourist hotspots, a new study was agreed to take place which focused on E Tourism on the Isle of Wight. Engagement with local stakeholders was undertaken to understand which tourist sites are particularly popular and where good quality visit and tourist behaviour data could be obtained. Based on this engagement, five use cases were selected, four on the island and one on the mainland. These sites
include two ferry terminals and two tourist attractions where visitors are expected to stay overnight. The selected use cases are shown below:

- Southampton ferry terminal
- East Cowes ferry terminal
- Woodland Resort
- Shanklin

Following a similar approach to the previous study for the North of Scotland, the study highlighted that the impact of the charging demand from an increased amount of EVs visiting the Isle of Wight is likely to cause network constraints at tourist resorts and attractions located in rural areas on the island, such as the Woodlands Resort in Yarmouth. These constraints are projected to only impact on the secondary substations, with the primary substation being mostly unimpacted by the uptake of tourist and residential EVs. Rural secondary substations will be impacted most heavily because, given the small number of customers they serve, their transformer rating is very low and hence cannot cope with the additional load on the network from EV charging points.

Meanwhile, the substations which serve tourist attractions in towns either on the island (East Cowes and Shanklin) and on the mainland (Southampton) are expected to be able to operate in 2030 without any constraints on the substation as a result of tourist or residential EV charging demand. In the case of the ferry terminals, this is because both terminals are served by relatively large secondary substations. The secondary substations in Shanklin are also relatively large compared to the transformer serving the Woodland Resort.

Individual analysis of each use case can be found in the IoW project report produced by Element Energy which is available here: https://ssen-innovation.co.uk/wp-content/uploads/2021/10/20210924_IOW-E-Tourism-final-report.pdf.

3. Enhance stakeholder engagement for helping local community groups, local authorities, and other organisations to understand impacts of heightened EV tourism will have on local demand.

While the ability to engage with stakeholders was disrupted in earlier phases of the project by the emergence of Covid-19, stakeholder engagement has become an important part of the project and a focus of the current work. Relationships have been built with several stakeholders on the Isle of Wight who are well aligned with the project’s aim to help tourist destinations and communities manage the energy transition while ensuring this does not adversely impact the electricity distribution network.

Work has answered questions on the potential impacts from increases in EV tourism give an assessment of alternative solutions to grid reinforcement that are available to tourist site managers facing the challenge of increased electricity demand form tourist EV charging. Deliverables serve as a useful suite of information for stakeholders in the tourism industry as well as local community groups and councils, allowing them to better understand the options available for accommodating increased electricity demand in popular tourist destinations.

4. Identify suitable local flexible solutions to assist in demand management during seasonal peaks but also benefiting residents all year round. These solutions may extend beyond charge points only to options such as valet charging.

Following on from the E-Tourism study completed for the Isle of Wight in 2020/2021, the project scope was expanded to include the assessment of the feasibility of using alternative solutions to avoid the need for reinforcement due to electricity network constraints in locations where high levels of tourist EV charging demand are expected. This work reported feasible options that would be suitable for the use cases studied and will help inform SSEN’s broader aim of developing a suite of solutions that can be used to mitigate constraints at similar sites across their licence area.

The list of alternative solutions reviewed is provided below:

- Smart charging – shifting demand
- Smart charging – dynamic charging rates
- Local generation
- Energy storage
- Combined generation and storage
- Novel EV charging options (e.g. valet charging, ticketed charging, overnight charging)
- Flexible connections (seasonal and time of day connections)
- Network based solutions

5. Inform investment strategies for network development based on expected impacts of EV uptake and tourist patterns.

Following the previous study on predicting electric vehicle (EV) charging demand at typical tourist sites across the Isle of Wight in 2030 and identifying areas where current electricity network infrastructure may be insufficient as a result of the growing demand from E-Tourism, typically increases in electricity demand are accommodated by network reinforcement, however, these upgrades are expensive and may take several years to complete. This study assessed alternatives to network reinforcement that can be employed to deal with the challenge of increased electricity demand from tourist EV charging.

We selected two key use cases to investigate:

1. The Woodland Resort: an upcoming eco-tourism resort which will be situated on the north west of the island
2. The Needles: a landmark and tourist attraction on the westernmost tip of the island

These were selected as sites where tourist EV charging in 2030 is likely to lead to increases in electricity load beyond the network capacity. The contexts of these sites are also quite different, meaning different solutions are likely to be applicable at each.

Following a literature review of seven alternative solutions to network capacity upgrades, a short list of five alternative solutions were assessed at the two case studies. They were:

- Smart charging
- Local generation
- Energy storage
- Combined generation and storage
- Novel EV charging options (this will include valet and ticketed charging, overnight charging services, and park and ride)

For the Woodland Resort, and the Needles, the applicability of each solution was assessed. At both sites, smart charging offers an effective and cost-efficient method to reduce site peak demand. At the Woodland Resort, overnight charging demand could be shifted later into the evening to avoid large peaks in the load. This could reduce the peak load from EV charging by up to 55%. At the Needles, delaying charging is not possible due to the shorter time visitors spend on site. However, some benefit from smart charging may still be possible by using dynamic charging rates, which would limit the power drawn by each vehicle when there is limited spare capacity on the network. Our analysis demonstrated that the peak EV charging load of the Needles could be reduced by 20% on a peak August day while still delivering vehicles 9 kWh of energy, sufficient for 45 km of additional range. In addition to smart charging, our analysis suggested that battery storage could accommodate the peak EV charging load at the Woodland Resort, drawing from the transformers installed at the site to serve the site's base demand. At the Needles, tourist visits are strongly influenced by season and weather, therefore, there is likely to be a good correlation between available solar generation capacity and tourist EV charging demand. Hence, charging demand can broadly be matched with solar generation, which can be combined with battery storage to meet charging demands when weather conditions result in lower solar generation capacity.

A variety of novel EV charging options were considered for the Woodland Resort and the Needles. These solutions have the potential to provide effective EV charging peak load reduction, however, not all these solutions are applicable to both sites. The novel EV charging options, along with all the other short-listed solutions, are detailed in section 4. Alongside applying each solution to the two use cases, the applicability of the short-listed alternative solutions have been applied to general EV charging sites influenced by E Tourism. This analysis found that there are several viable solutions to mitigate network reinforcement caused by increased demand from E Tourism. The report shows the priority of the solutions and denotes the order in which they should be considered by sites as potential solutions to network capacity issues. Smart charging is likely to be the most cost-effective alternative to network upgrades, however this is only true for sites where it can be effectively applied. The applications and benefits of novel EV charging are wide ranging and uncertain due to it being an emerging technology. However, as it is likely to cost significantly less than installing local generation or battery storage systems, it may be a more cost-effective option for avoiding network upgrades in certain contexts. In areas where neither smart charging or novel EV charging would be sufficient, combined generation and storage is the next most likely option for accommodating EV charging without upgrading the electricity network. Energy storage systems alone are generally less applicable than combined generation and storage, but may have some potential applications.

The order of suggested alternative solutions looks like this:

1 - Smart charging

- Sites where significant overnight EV charging demand is expected
- Sites with limited network capacity but large demand for EV charging during the day

2 - Novel EV charging

- Sites which need to be booked in advance where EV charging could be booked at the same time
- Sites where a park and ride arrangement could be implemented
- Sites with limited space or network capacity available for EV charging
- Towns with limited on-street charging availability

3 – Combined generation and storage

- Sites which are busiest when the weather is good
- Sites where the majority of EV charging demand occurs during the day
- Alternatively, sites with evening peaks of short duration and predictable occurrence, so can be reliably managed by energy storage of daily solar generation

4 – Energy storage

- Sites where additional transformer capacity can be cost effectively replaced by battery storage
- Sites with peaks of short duration and predictable occurrence, so can be reliably managed by energy storage

5 – Local generation

- Unlikely to be a solution by itself due to intermittent nature of solar power

The report goes further and stipulates each possible solution by the headroom which could be released, the practicality of each solution and the feasibility of make each solution work. This, along with all other learnings, can be found on page 19 of the report (https://www.ssen.co.uk/globalassets/E-Tourism/2208-E-Tourism-alternative-solutions.pdf)

More details are listed in point 5 below.

5. Required modifications to the planned approach during the course of the project

The Network Licensee should state any changes to its planned methodology and describe why the planned approach proved to be inappropriate. Please confirm if no changes were required

Tourism was significantly affected by the Covid-19 Pandemic. This has hindered stakeholder engagement and workshops, which has caused a programme delay, however no time extension has been required. The project has completed its first objective in Scotland.

A change request was submitted in May 2021 to expand the project to include our southern region. SSEN worked with an already formed consortium on the Isle of Wight.

We replicated the approach used in Scotland to understand the differences in available data between Scotland and England to develop a UK replicable methodology for realising seasonal charging impacts. Working with the Isle of Wight consortium has highlighted opportunities to complete the remaining objectives to test suitable local solutions to support the seasonal increase in network demand which was not available in Scotland after the study as can be seen in this report issued in July 2020.

6. Lessons learnt for future projects

Describe how the project (methodology, stakeholder engagement etc.) changed, or provided opportunities, from your expectation at the start of the project and therefore could be useful for a future project. In addition, please discuss the effectiveness of the research development or demonstration undertaken.

Understanding Covid-19 impacts on Tourism

Very little is understood about the long-term impacts of the Covid-19 Pandemic on tourism. Particularly the increase in 'staycations' and potential
higher volumes of EV Tourism. The methodology which was developed as part of stage 1 is being exploited further to analyse the Isle of Wight. Consideration has been made for uncertainty around Covid-19 long term impacts.

Whole System Planning

Whole system planning combines electricity, gas, transport, tourism, a local and national government, regulated networks and community stakeholders to provide a better understanding of infrastructure requirements. Alongside this, Local Energy Plans are being developed by the local authorities. The data and methodology around seasonality obtained in the first part associated with EV Tourism are being incorporated into the Regional Energy System Optimisation Planning (RESOP) tool which is part of the NIA_SSEN_0043 Whole System Growth Scenario Modelling Phase 2 project.

This will allow DNOs to assess specific geographical challenges and risks to the demand capacity and identify specific solutions for flexibility around EVs. For example, Dundee is close to St Andrews and when large golfing events take place in St Andrews, large numbers of visitors choose accommodation in Dundee and travel to the event. This has the potential to increase the number of EVs in the surrounding area which will produce a temporary increase in electrical demand for a few days only. Studying this influx of visitors in Dundee and the resultant energy demands will help to plan for temporary infrastructure or travel hubs, for instance.

7. The outcomes of the project

When available, comprehensive details of the Project's outcomes are to be reported. Where quantitative data is available to describe these outcomes it should be included in the report. Wherever possible, the performance improvement attributable to the Project should be described. If the TRL of the Method has changed as a result of the Project this should be reported. The Network Licensee should highlight any opportunities for future Projects to *develop learning further.*

The project has achieved its aims to:

1. Understand how increased EV uptake and tourist patterns will impact seasonal peak demand on the network.
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5. Inform investment strategies for network development based on expected impacts of EV uptake and tourist patterns.

All the reports detailing the research, the findings, and the proposed solutions are published on the ENA website at https://smarter.energynetworks.org/projects/nia_ssen_0038/. The reports relating to the Scottish phases and the initial Isle of Wight evaluation phase were presented at ENIC in 2021, videos and animations were also used to inform and engage stakeholders.

The final report is available on our website at https://www.ssen.co.uk/globalassets/E-Tourism/2208-E-Tourism-alternative-solutions.pdf. This report details the patterns we can expect to see, which areas will experience the impact of seasonal demand and what can be done about it by local authorities, tourist sites, DNOs, and other organisations.

Local flexible solutions are also identified and ranked in order of cost and simplicity so they may be used as a toolkit of people looking to connect any number of EV charge points in rural locations.

8. Data Access & Quality Details

A description of how any network or consumption data (anonymised where necessary) gathered in the course of the Project can be requested by interested parties. Please include a link to the publicly available data policy.

For information how to request data gathered in the course of this project, see Network Innovation Competition (NIC) and Network Innovation Allowance (NIA) Data Sharing Procedure at https://ssen-innovation.co.uk/innovation-strategy/.

The network and consumption data used during E-Tourism is displayed in the reports at https://ssen-innovation.co.uk/nia-projects/nia-ssen-0038-E-Tourism

9. Foreground IPR

A description of any foreground IPR that have been developed by the project and how this will be owned.

N/A.

10. Planned implementation, recommendations or next steps

Please describe the next steps to implement this innovation project. What policies and standards need to be updated or created as part of this implementation.

SSEN Connections teams are aware of the E Tourism project, the findings, recommendations, and the various reports. As well as the report being embedded as part of the EV Connections process publicly, our Connections Team will be able to signpost stakeholders to the advice should it be deemed beneficial.

11. Other comments

SSEN remain happy to share the learnings from E-Tourism with any interested parties. Please contact futurenetworks@sse.com

12. Standards Documents

Identify any industry standards that may require updating due to the outcomes or understanding developed from this innovation project. If no standards will need to be updated, please state - not applicable

Not applicable