Notes on Completion: Please refer to the appropriate NIA Governance Document to assist in the completion of this form. The full completed submission should not exceed 6 pages in total.
Network Licensees must publish the required Project Progress information on the Smarter Networks Portal by 31st July 2014 and each year thereafter. The Network Licensee(s) must publish Project Progress information for each NIA Project that has developed new learning in the preceding relevant year.

NIA Project Annual Progress Report Document

Date of Submission

Jun 2025

Project Reference Number

NIA2_NGESO067

Project Progress

Project Title

Mass mobility data for demand forecasting

Project Reference Number

NIA2_NGESO067

Funding Licensee(s)

NESO - National Energy System Operator

Project Start Date

July 2024

Project Duration

1 year and 1 month

Nominated Project Contact(s)

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Scope

- This project seeks to utilise third-party mobility measurement data (telematics data capturing journey information) with a hypothesis of strong potential added value to support enhanced geographically-resolved electricity demand forecasting.
- Mass mobility data consisting of anonymised telematics vehicle monitoring data will be explored to generate new features for electricity demand forecasting models. This has the potential to bring new insights into normal, and temporally abnormal, behaviour patterns concerning citizens in transit, home, workplace, and state transitions across the population that have strong potential to impact current and near future energy demands.
- These impacts are both indirect (i.e. behavioural) and increasingly direct through the adoption of electric vehicles.
- These new measurements for behaviour will be prepared and collated to evaluate utility in electricity demand forecasting.
- The project seeks to ensure technical means to supply aggregated anonymised behavioural data.
- It will investigate potential features of value supporting energy demand estimation and use historical data to correlate and evidence potential predictive value from created new data features.
- It will test the data features providing input by regions of interest in 30 minute estimation updates (potentially to be available in near real time) to support fit to commercial usage.
- While the main project focus is not EV usage, it can explore features related to EV charging behaviour and the associated impacts on demand. Given journey and effort tracking by region, estimated EV battery usage can be indicated that should forecast later recharge needs.

Objectives

The objectives of the project are:

- To investigate whether inclusion of aggregated anonymised telematics data can improve the electricity demand forecast.
- Create relevant candidate feature specification, including requirements, feature register, and attribute tables.
- Evaluate candidate features, considering data, outputs and plots.
- With the telematics data, provide a demand forecast model with new data which can help in better forecasting the human behavioural aspect of demand and EV charging effects. Create gap analysis between telematics data feature inclusion in the test model, and real world operational forecasting.

Success Criteria

- New features using anonymised, historic telematics vehicle monitoring data generated for electricity demand forecasting models.
- Reduction in regional electricity demand forecast error realised from new data features including within the model, evaluated using historic data provided for the project.
- Reduction in mean absolute error for national demand forecast, evaluated using historic data provided for the project.
- Clear gap analysis completed to detail route to real world deployment following innovation project.

Performance Compared to the Original Project Aims, Objectives and Success Criteria

National Energy System Operator ("NESO") has endeavoured to prepare the published report ("Report") in respect of Mass mobility data for demand forecasting, NIA2_NGESO067 ("Project") in a manner which is, as far as possible, objective, using information collected and compiled by NESO and its Project partners ("Publishers"). Any intellectual property rights developed in the course of the Project and used in the Report shall be owned by the Publishers (as agreed between NESO and the Project partners).

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Background information
GB demand is currently forecast using a model based mainly on weather variables. While this partially covers changes in consumer behaviour (e.g. the level of solar irradiance impacts whether consumers would stay out of buildings therefore consuming less electricity), it is deemed that human behaviour is an important factor explaining demand variability. This is especially the case on atypical days such as the festive Christmas period, which account for high balancing costs due in part to the inaccurate demand forecasts.
This project aims to assess the suitability of mass mobility data for predicting these changes in behaviour.

Progress against original aims and objectives
9 geographical regions (GSPs or grid supply points) with contiguous boundaries across Birmingham have been identified to be targeted by the study as they represent a diverse range of electricity consumers.
A baseline demand forecast model with benchmark features (time features, embedded solar PV, public holidays, and weather) has been developed to provide the testing framework for the inclusion of the telematics data.
A feature register has been created, based on the availability and easiness of extraction/handling of the third-party mobility measurement data. Several features have been selected to be assessed against the baseline. The models are based on historical actuals as opposed to historical forecasts, which is deemed appropriate for evaluating feature importance and feature value.

A few model variants have been trained and validated, first with various permutations of telematics data, then each with individual additional features. In addition, the project has put together a list of the worst performing dates relating to the demand forecast (such as the Christmas festive period, unusual public holidays), since these will most likely be days where consumers exhibited atypical behaviour with respect to electricity demand. So far, two models integrating individual features showed improved model performance relative to the baseline model; in particular, some of the worst performing dates showed significant improvement.

The project is now looking to aggregate small geographical areas by a variety of characteristics readily available in third party datasets (e.g. census data such as population density and land use). The aim is to produce the two promising telematics data features by geographical cluster (e.g. volume of traffic travelling from a region of high residential population to high commercial activity) and

assess the effect on the two model variants.

Required Modifications to the Planned Approach During the Course of the Project

The exploration of features related to EV charging behaviour has not been pursued. It would require additional work to augment existing telematics data, such as obtaining vehicle fuel type by matching vehicle models to the model specifications. In addition, this exercise could potentially undo anonymisation and therefore risk disclosing PII (personally identifiable information).

Lessons Learnt for Future Projects

Interim Project Outcomes

A register of traffic data features has been created, from which a list of potential features to be assessed in the demand forecasting model has been selected.
A benchmark demand forecasting model has been developed based on energy and time variables such as weather and holidays. A model framework has been developed to easily add or change variables to the model. Data relating to the shortlisted traffic data features has been gathered and is being tested in demand forecasting model variants against the baseline model.
A more focused analysis has been performed on the worst performing dates for demand forecasting.

Review of benefits case

Two model variants integrating individual features showed an improvement in overall model performance when compared to the baseline demand forecasting model.
Another benefit is the improvement to demand forecasting on difficult dates such as the Christmas festive period, which currently incur a high balancing cost.

Next steps

- Further evaluation of features to determine value for demand forecasting.
- Visualisation of data: baseline and model variants integrating new features.
- Test of candidate traffic data features on clusters of small geographical areas classified as having similar characteristics.
- Gap analysis to usage in NESO operations: steps needed to productionise and deploy features within NESO demand forecast model.

Note: The following sections are only required for those projects which have been completed since 1st April 2013, or since the previous Project Progress information was reported.

The Outcomes of the Project

The project is currently 75% completed.
Work packages 1 and 2 have provided a shortlist of traffic data features to be assessed in the demand forecast model as well as their requirements.

Work packages 3 and 4 have recently been completed, the project supplying several batches of data to be tested. A baseline demand forecasting model has been developed. A Jupyter notebook has been created to test features in demand forecast model variants and visualize results.
Currently the project is working on work packages 5 and 6, refining and assessing the value of the traffic data features. Initial results show that when integrating any of the two most promising traffic data features, an improvement of 5% in model accuracy has been observed compared to the baseline model. The improvement was much higher when considering specific “worst performing” dates for demand forecasting such as dates during the Christmas festive period.

Preparation for the last work package – final report write-up of project results and gap analysis for deployment in NESO operations – has also started.

Data Access

Details on how network or consumption data arising in the course of NIA funded projects can be requested by interested parties, and the terms on which such data will be made available by NESO can be found in our publicly available “Data sharing policy related to NIA projects (and formerly NIC)” and Innovation | National Energy System Operator.

National Energy System Operator already publishes much of the data arising from our NIA projects at www.smarternetworks.org. You may wish to check this website before making an application under this policy, in case the data which you are seeking has already been published.

Foreground IPR

The following reports are expected to be released on to the Smarter Networks Portal:
Report on evaluation of features, validation review, performance of models built, impact and gap analysis to enable operational deployment.