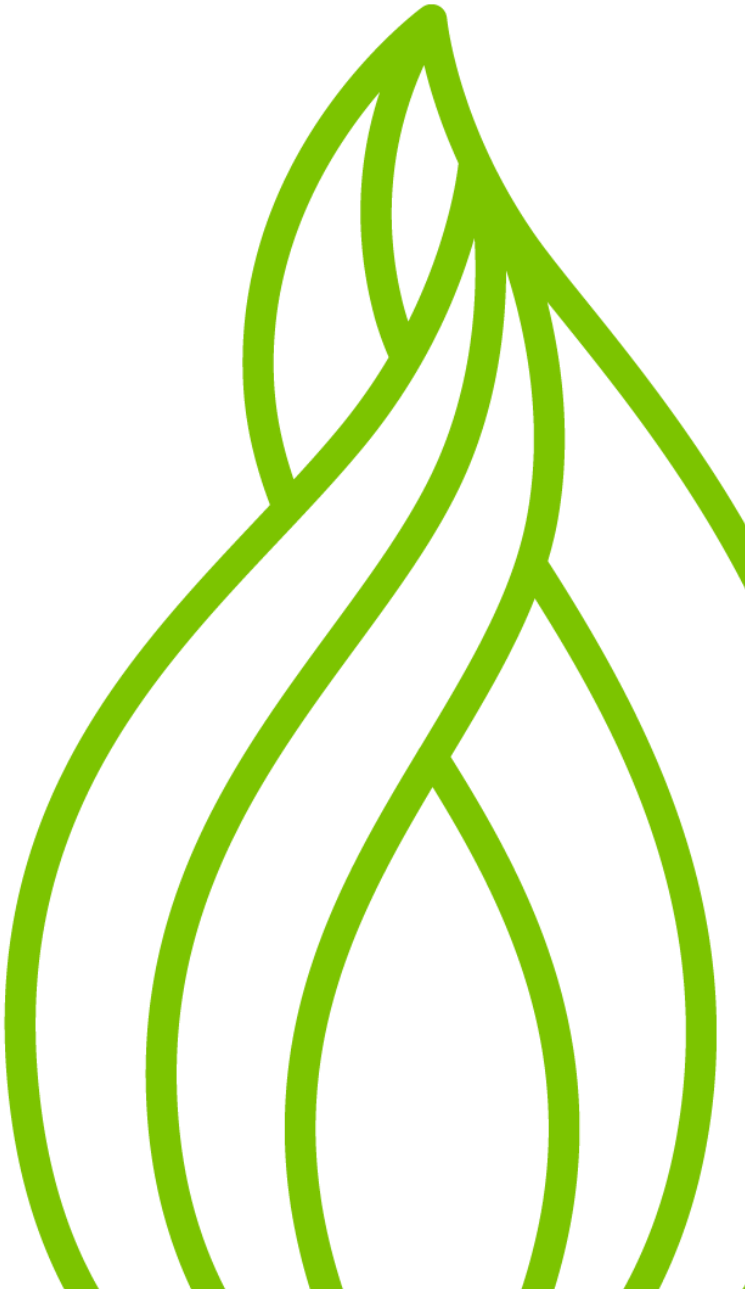
national gas transmission

Spatial GB Clean Heat Model

Value Tracking Case Study



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Background

Following the publication in May of 2019 of the Committee on Climate Change's advice on Net Zero to the UK Government, the UK became the first major economy in the world to pass law that will require greenhouse gas emissions to be reduced to net zero by 2050. To meet this target, deep decarbonisation of all sectors is needed. Generating heat currently constitutes approximately one-third of UK emissions; full decarbonisation of the heating sector will be required by 2050 as part of achieving the 2050 net zero target.

National Gas Transmission has a critical role to play in the transition of the UK heating system. As steward of the national transmission infrastructure and as the system operator for GB, NG needs to facilitate the low carbon transition while maintaining continuity of supply for all customers. This project developed the Spatial GB Clean heat pathway model, an integrated, cross-vector model of the whole heating system within Great Britain. This tool is intended to enhance NG's understanding of the potential decarbonisation routes, their likelihood, and the impact of these on networks as well as on consumers.

What's new?

A ready to use model for assessing heat decarbonisation pathways has been delivered. The model consists of a Python back-end and an excel front. Shapefiles are already created for use with a suitable geospatial software. The model is formed of 6 modules, which run in the following order:

- Module 1 – heat demand of all GB stock modelled as building archetypes using a standard assessment procedure (SAP) and calibrated to energy consumption in the UK (ECUK) demand. Building stock projection to 2050 generated.
- Modules 3 and 4 – the supply and network cost of hydrogen and district heating (DH) is modelled using a variety of supply methods; steam methane reforming (SMR), electrolysis, imports, etc for hydrogen, and air source heat pump (ASHP), biomass, biomethane, ground source heat pump (GSHP), Gas combined heat and power for DH) and optimized with storage.
- Module 2 – the cost of transition from any technology to any other technology is modelled for the whole stock.
- Module 5 – the technology pathway modelling – based on cost optimization or consumer behaviour.
- Module 6 – the output generation. Key outputs are costs, fuel use, and technology uptake at different spatial resolutions. Annual, minimum and peak demands are also generated, along with hourly heat, dispatch and fuel demand profiles.

The benefits

This work will accelerate the convergence on optimal solutions for heat decarbonisation across GB by defining the suitability of technology options for building archetypes by geographic location which would help:

- consumers make the best possible purchasing choices for their low-carbon heating.
- Policy makers identify the type and level of support required by vulnerable consumers and
- help inform the design of intervention programmes to empower them decarbonise their heating

It will also improve demand modelling capability and efficiency: the prototype version of the

proposed modelling platform would focus on the heating sector and would initially serve as a prove of concept. The full benefits of the model are however realised by extending the prototype version to include other demand sectors such as industrial demand, transport demand, home and office appliances demand, and Demand-Side-Response. Benefits accrue from both the higher quality of model outputs and from the overall efficiency savings by consolidating several modelling capabilities into a single platform with a central database for modelling technology uptake, multi-vector fuel demands, carbon emissions, costs, network impacts, with multiple scenario simulation capability and at high spatial resolution.

3. Improve network investment planning: Output from this model in the form of daily and hourly energy demand profiles as well as peak demand by vector will form primary inputs into transmission and distribution network development planning.

Implementation

The results of the Spatial Heat Model were fed directly into the Future Energy Scenarios (FES) for the heat sections of the Data Workbook. This includes units of stock for each heating technology, fuel use for heat and the tech mix. Heat model outputs also went into other models in the Energy Demand Team, as gas demand for heat. Outputs from the Spatial Heat Model used in the FES analysis are: demand for heat for each technology, fuel use for each technology, technology stock numbers & proportions, peak demand and fuel use, demand savings from insulation and heat storage used.