

Local Energy Flow Toolset

Professor Stuart Galloway & Dr Rory Telford

Research-policy workshop on heat decarbonisation

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stuart.galloway@strath.ac.uk

Local Energy Flow Toolset

Main Components/Functionality

<http://www.caledonia-energy.net/>

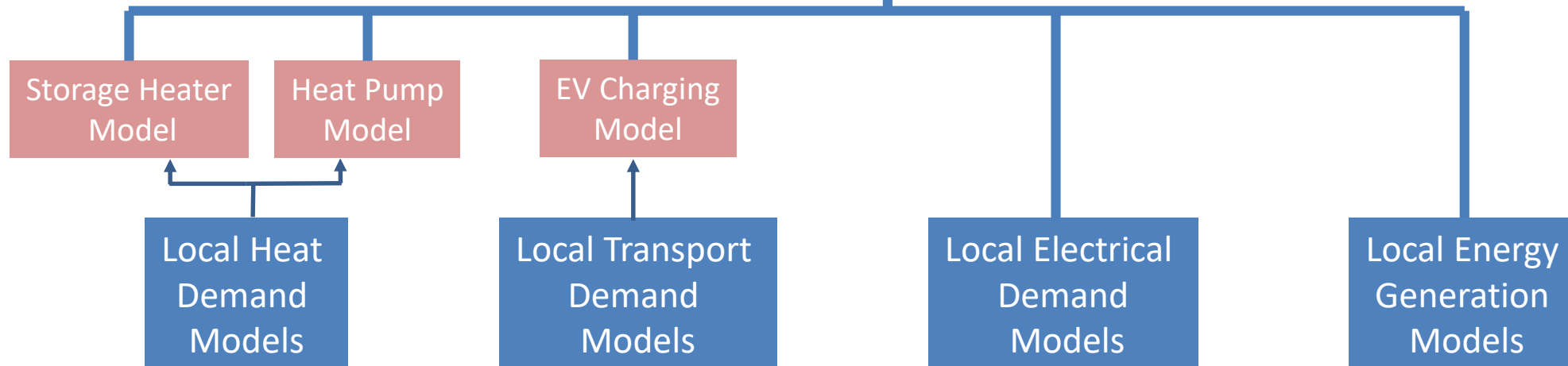
User Inputs

- Uptake of households with heat pumps/storage heaters
- Uptake of EVs
- Location - Local Authority & GSP
- New local Energy Resources (Wind, PV)

Local Energy Flow Toolset

Tool Outputs

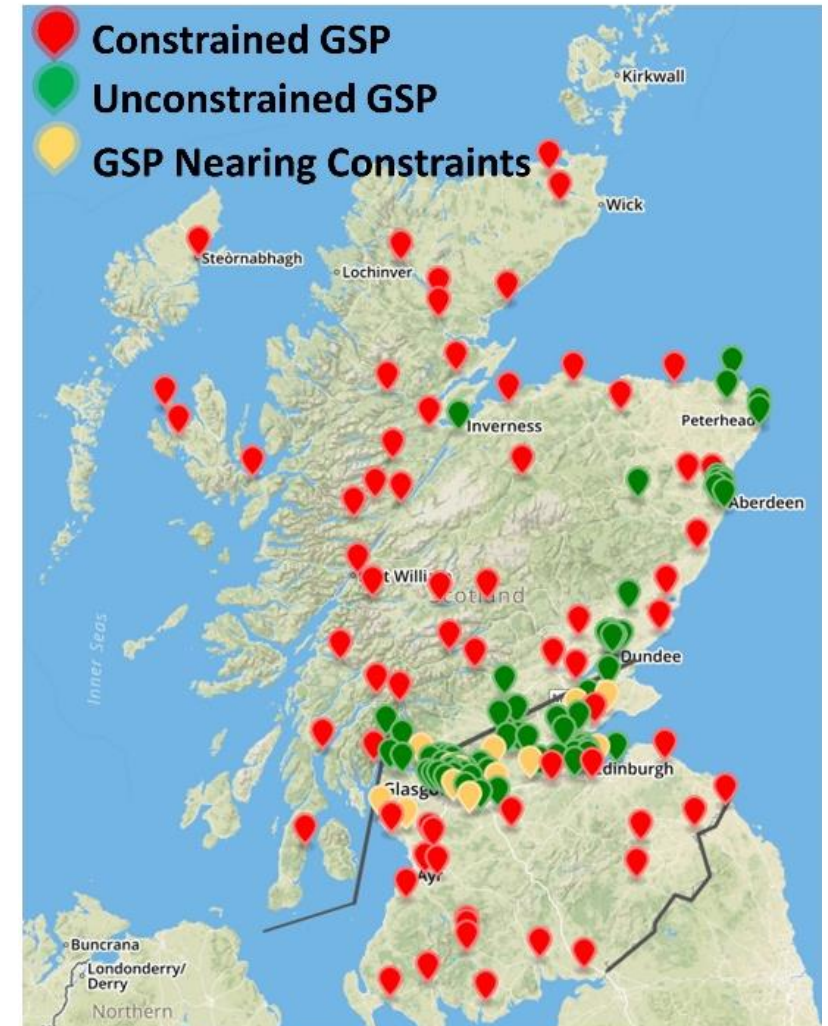
- Hourly energy flows across multiple energy vectors
- Modelled GSP electrical flows



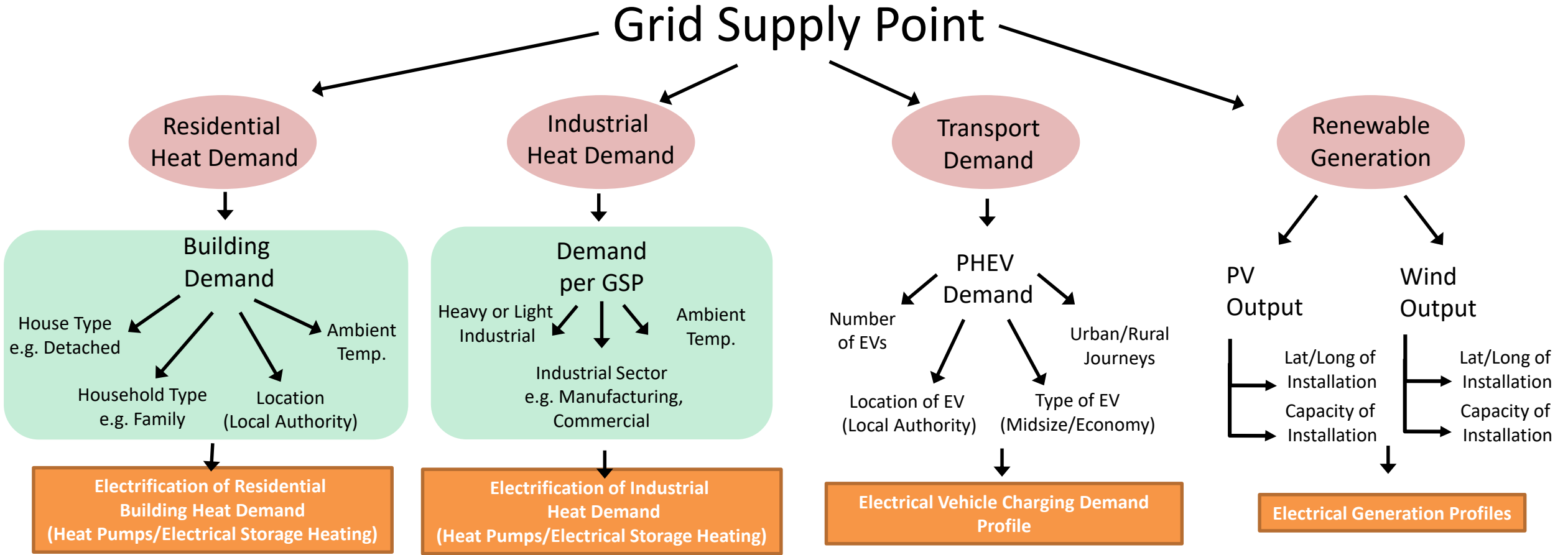
Potential Benefits of Smart Local Systems in Scotland

- Many areas throughout the Scottish electrical networks do not allow new, low carbon energy resources to connect.
- Infrastructure in these areas already at maximum capacity - traditionally, the network operators would have to invest in infrastructure to increase capacity.
- Low-carbon demand flexibility (EVs, heat pumps) and energy storage within smart local energy systems may overcome the need for network investment.

How can we understand where and how local solutions can be of benefit?

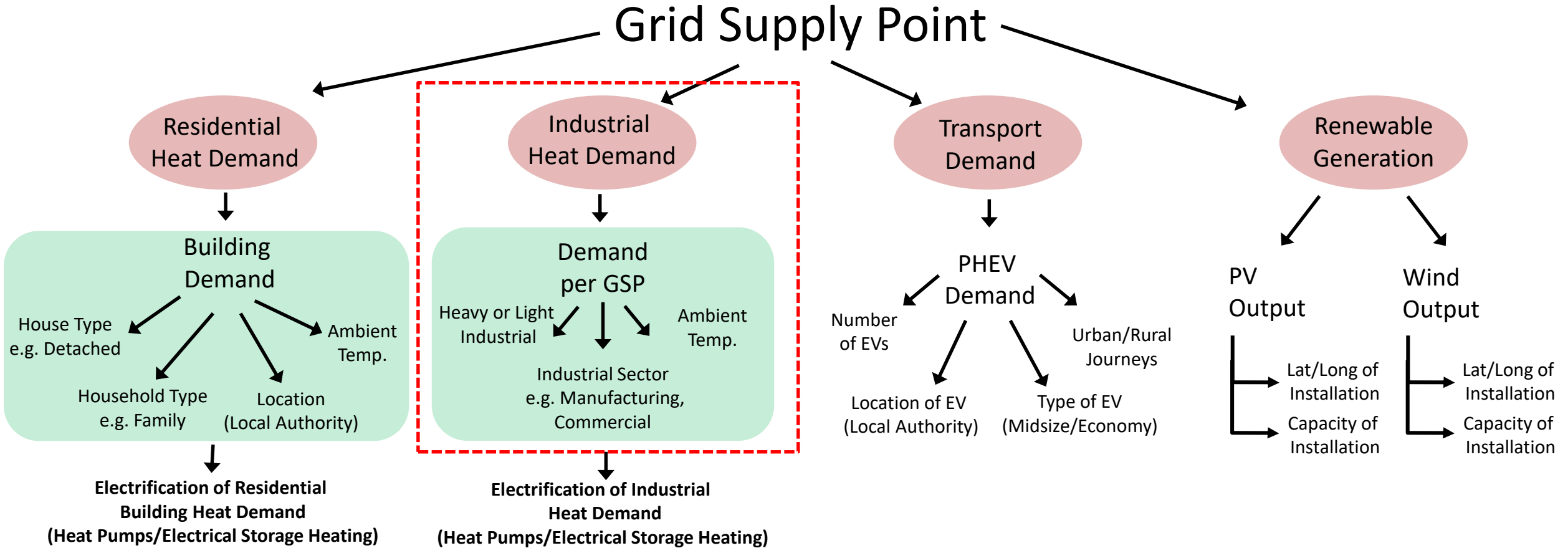


Local Energy Flow Toolset



Focus on the impact that the electrification of Heat & Transport Demand & integration of renewable generators has on electrical flows

Industrial Heat Demand Model



Industrial Heat Demand Model



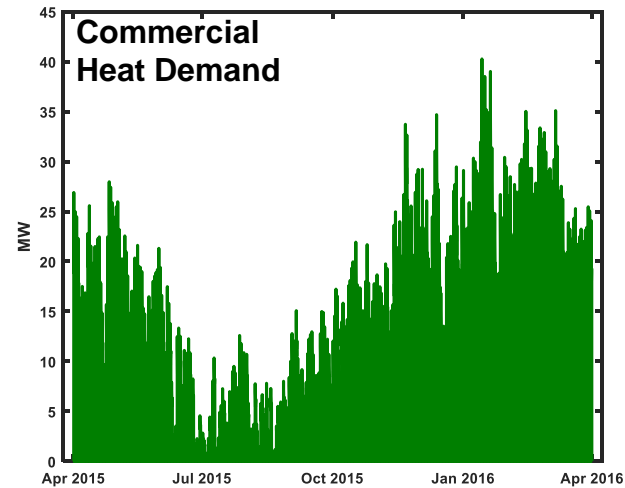
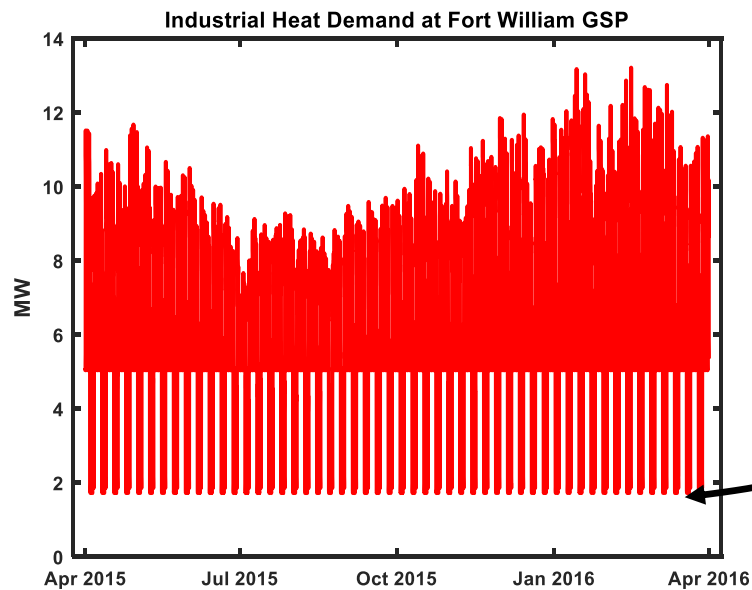
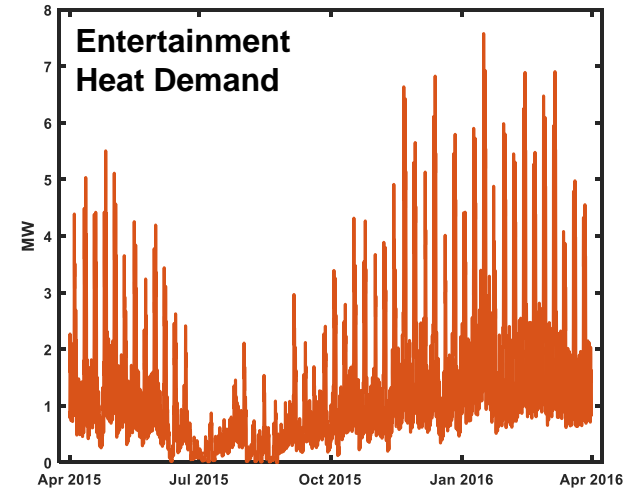
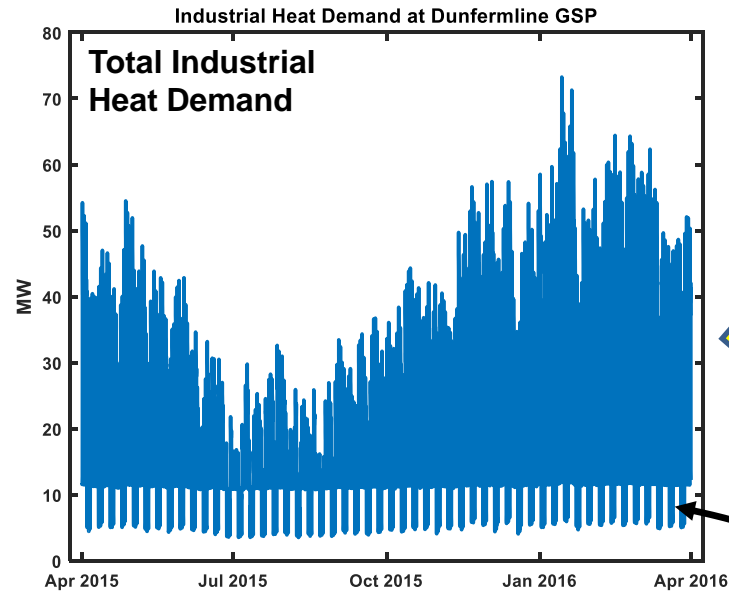
Heat demand calculated for different industrial sectors:

- Manufacturing
- Commercial
- Entertainment
- Education

Industrial heat demand modelled at a GSP level

i.e. the number of industries connected to each electrical
GSP

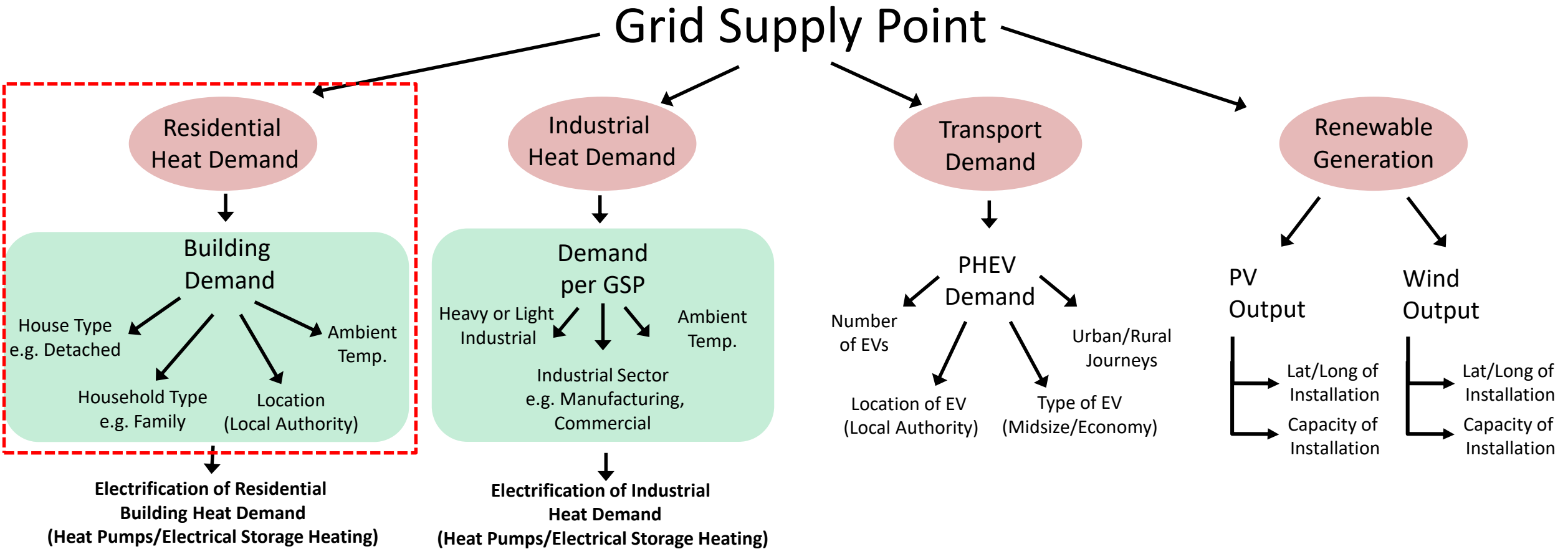
Industrial Heat Demand Model



Also...

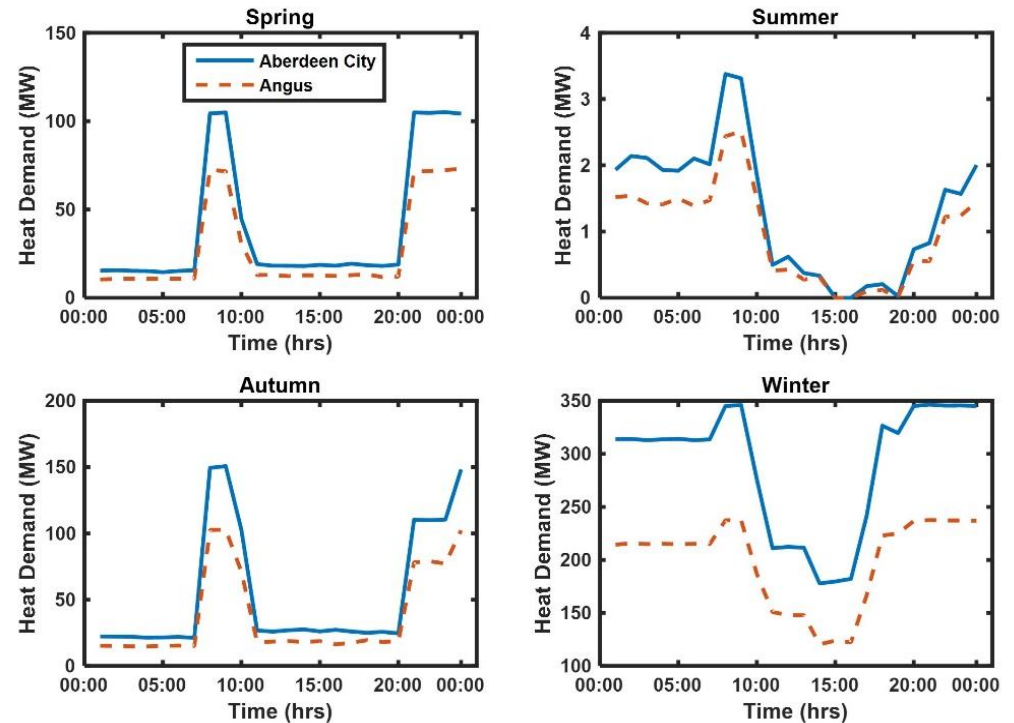
**Manufacturing &
Education Heat
Demand**

Residential Heat Demand Model



Residential Heat Demand Model

- Developed using Census data and an empirical heat model.
- Sensitivities include: dwelling types; dwelling floor sizes; household types (family, couple, retired...etc.); occupancy profiles; local authority.
- User inputs these parameters and model outputs heat demand.

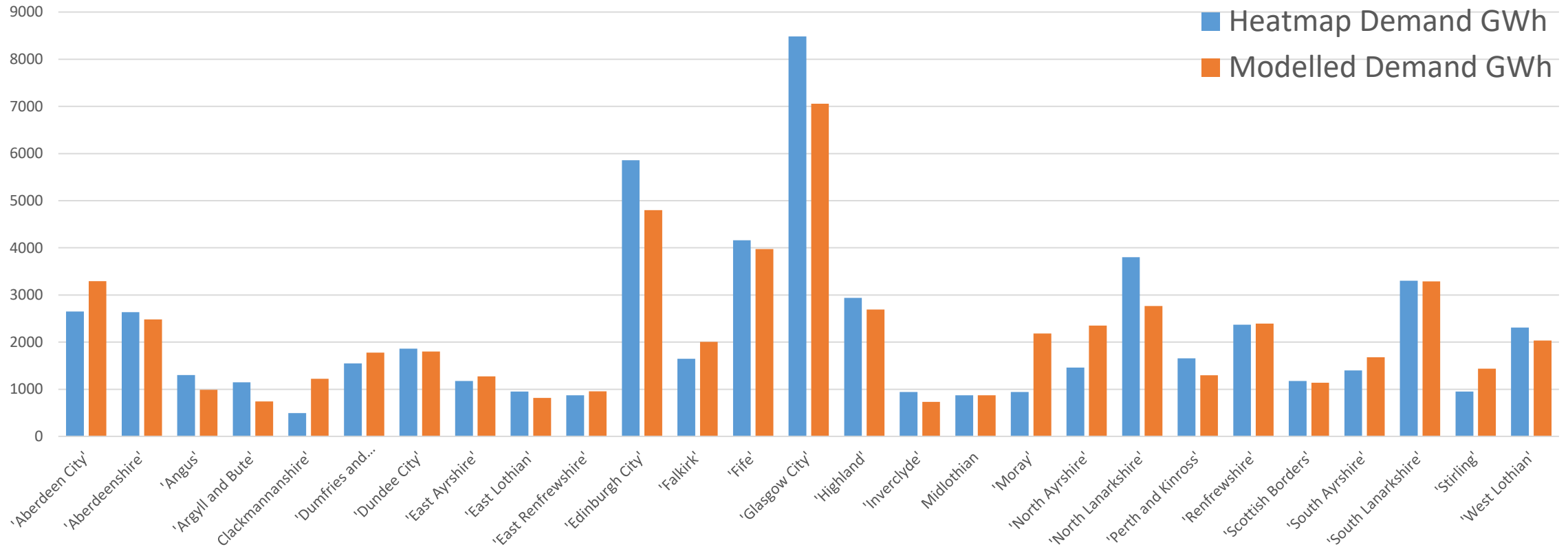


Examples of Local Heat Demand Model
Outputs

Heat Demand Model (GSP level) - Validation



Model Comparison with SG Heatmap for each Local Authority



Analysis of Future Scenarios

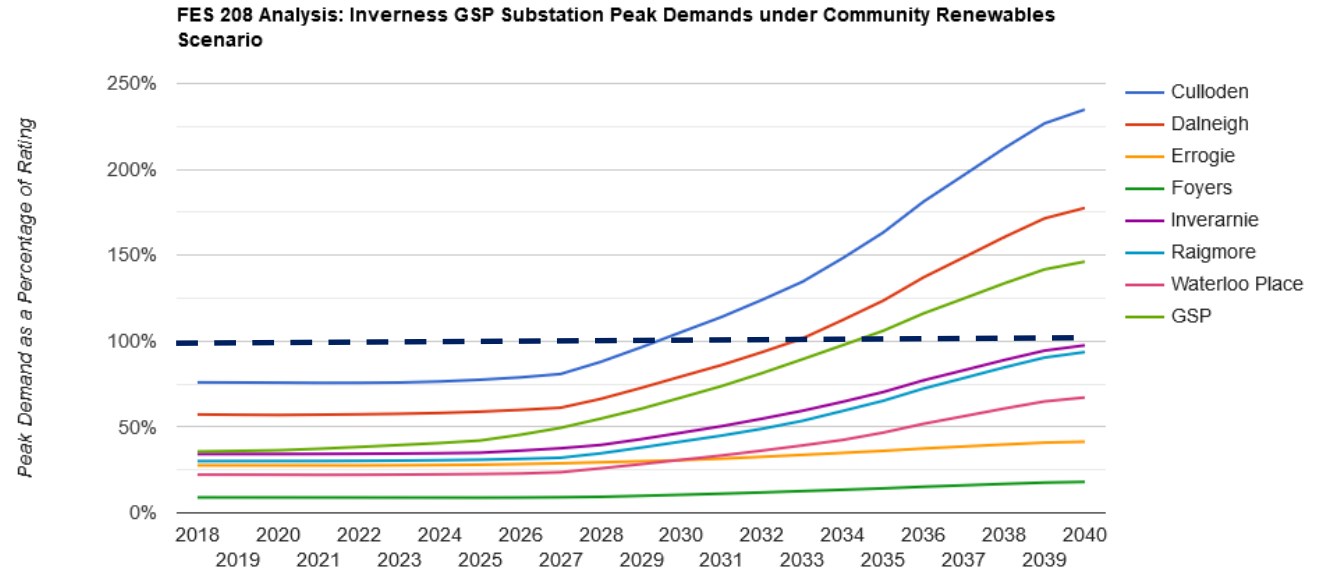
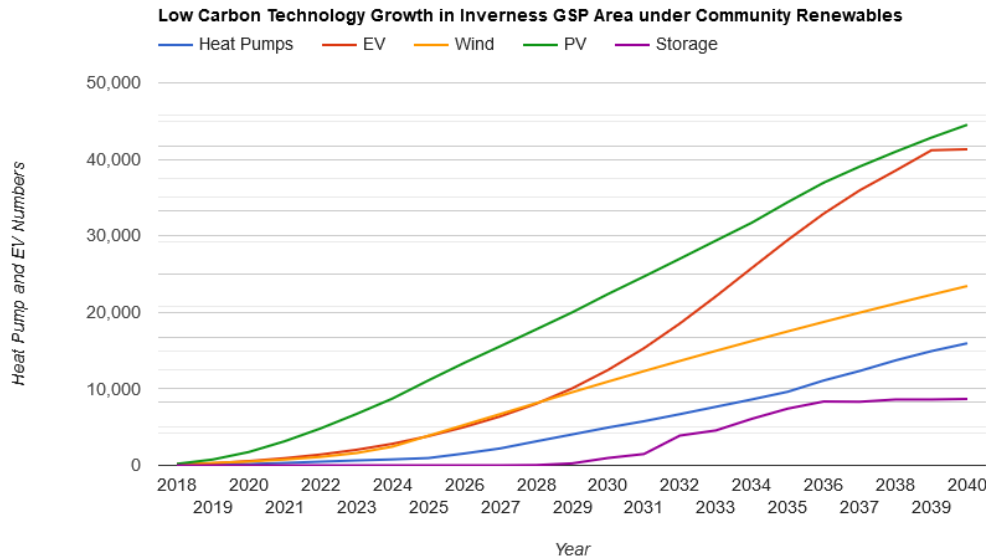
Analysis of Future Scenarios

- Toolset used for analysis of National Grid Future Energy Scenarios (FES)¹
- FES outline different pathways for the future of energy for the next 30 years and beyond
- Four different scenarios – we focussed on analysis of the **Community Renewables** scenario
- The Community Renewables scenario outlines a future system that has:
 - A large growth of renewables supported by storage and smart appliances
 - Almost completely decarbonised Transport
 - Made significant progress on the decarbonisation of heat due to factors such as the improved thermal efficiency of homes and the rollout of heat pumps

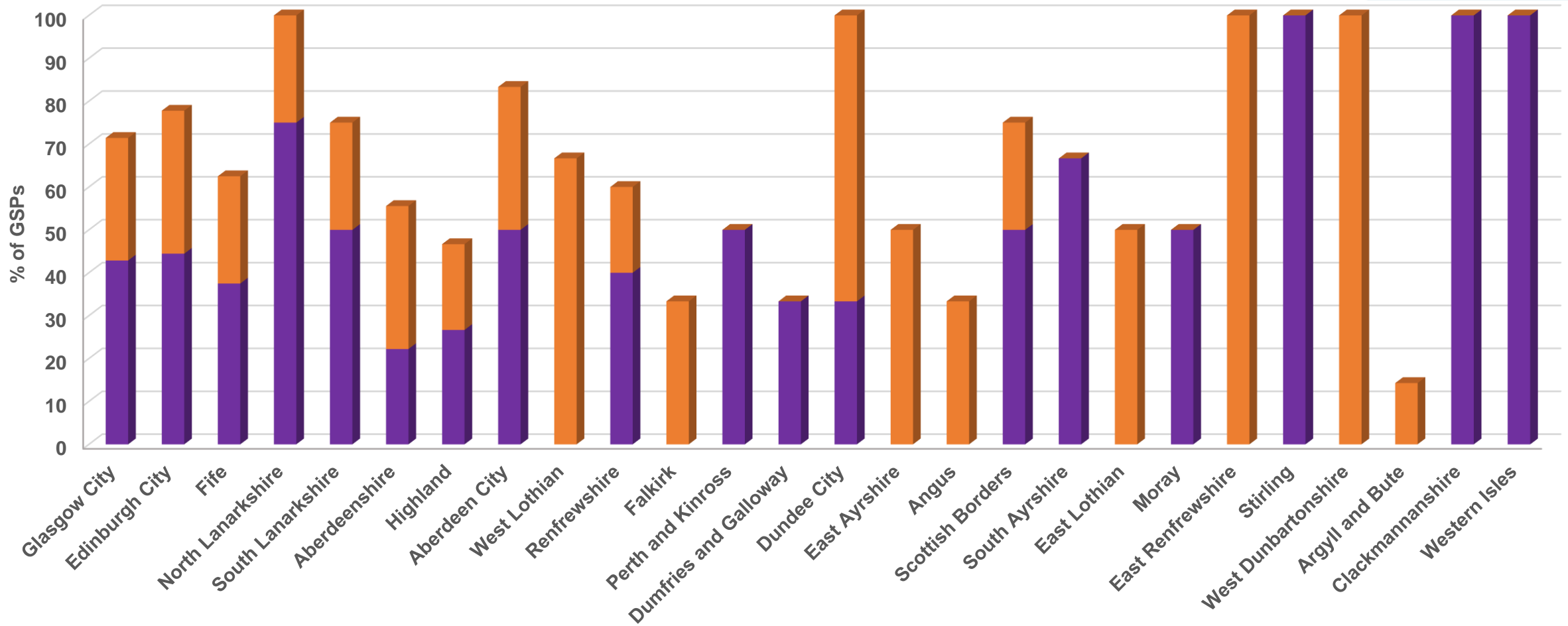
¹<http://fes.nationalgrid.com/>

National Grid Future Energy Scenarios

- How does low carbon technology integration influence peak demand growth across the network?
- Where will investment be required? When?



Community Renewables Scenario: Local Authority Level Analysis

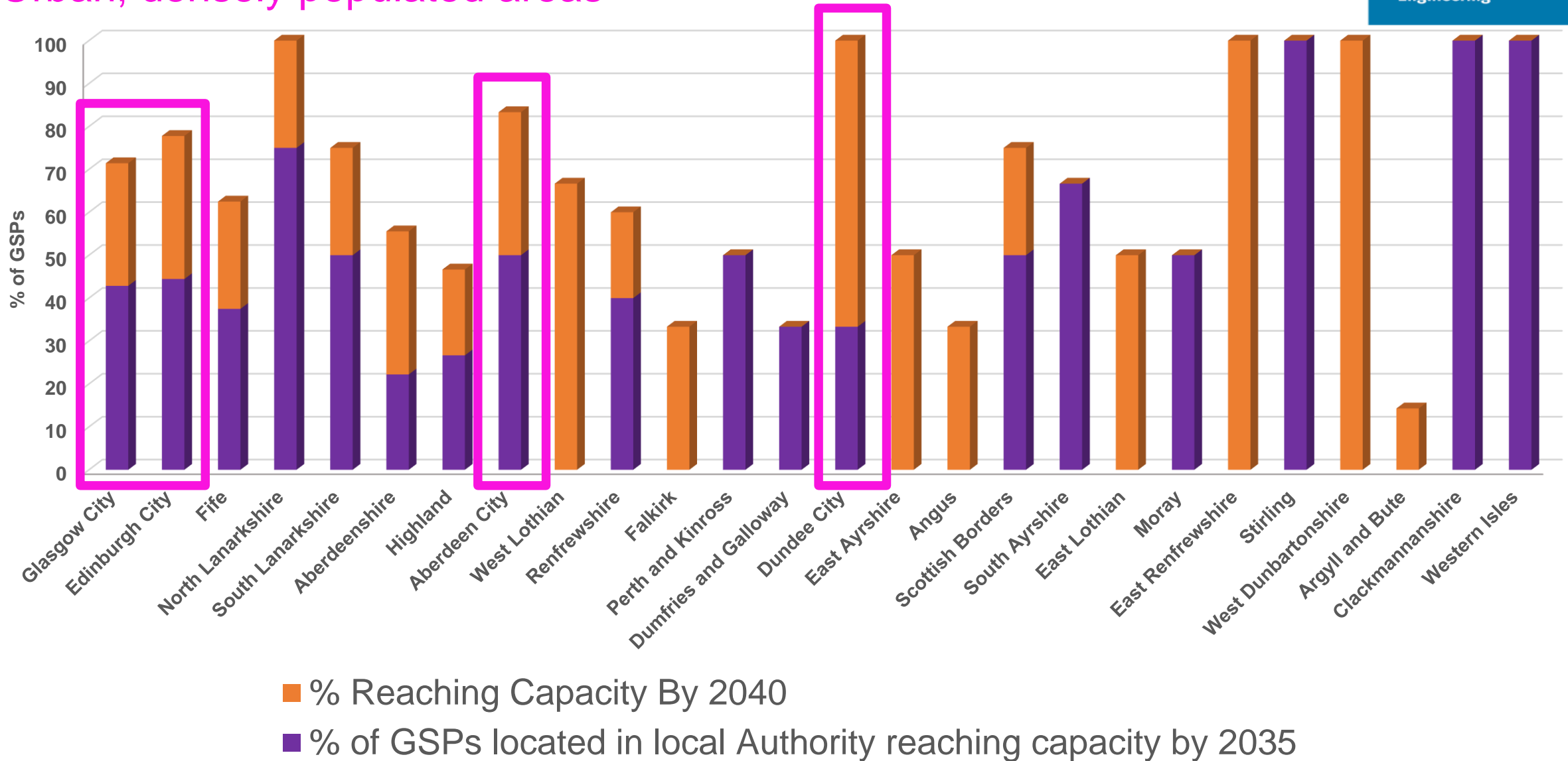


■ % Reaching Capacity By 2040

■ % of GSPs located in local Authority reaching capacity by 2035

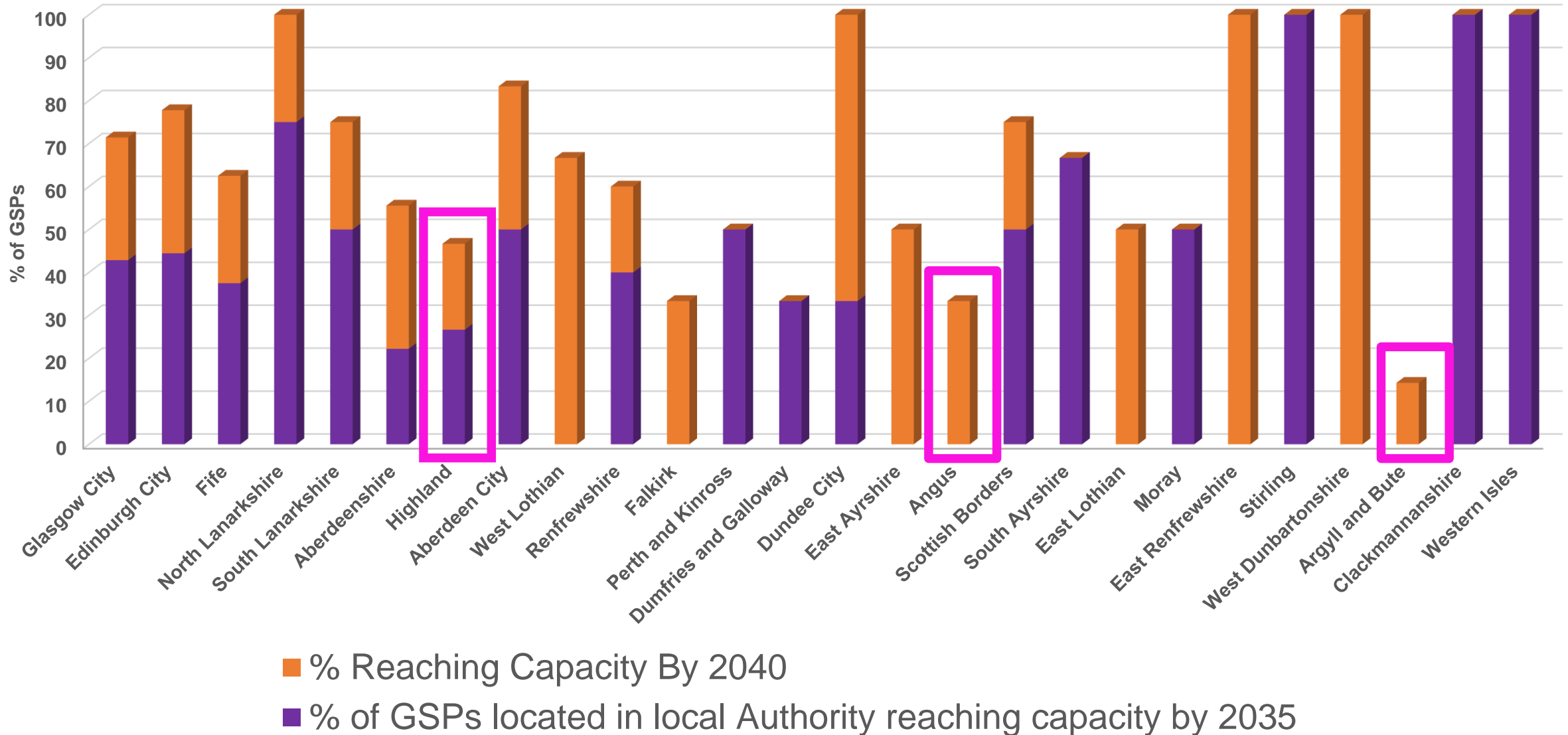
Community Renewables Scenario: Local Authority Level Analysis

Urban, densely populated areas



Community Renewables Scenario: Local Authority Level Analysis

Rural, sparsely populated areas





University of
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