

# Economic Analysis of the Pathways

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Realising Transition Pathways

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# Overview

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- Overview of Economic Analysis Scope
- Economic Research Highlights
- Summary of Key Findings

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- Key areas explored in RTP economic analysis:
  - Relative costs of different energy system transitions (Market Rules, Central Coordination, Thousand Flowers)
  - Spatial distribution of investment requirements under each pathway
  - Exploring the interactions between the power sector and other key economic sectors assuming decarbonisation in line with climate targets
  - Exploring the influence of actor behaviour and stakeholder dynamics within energy system transitions

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Conventional accounting framework “EconA” model

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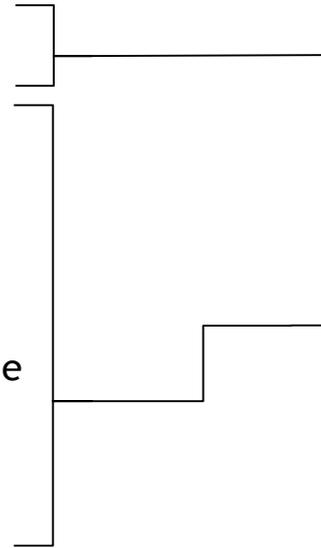
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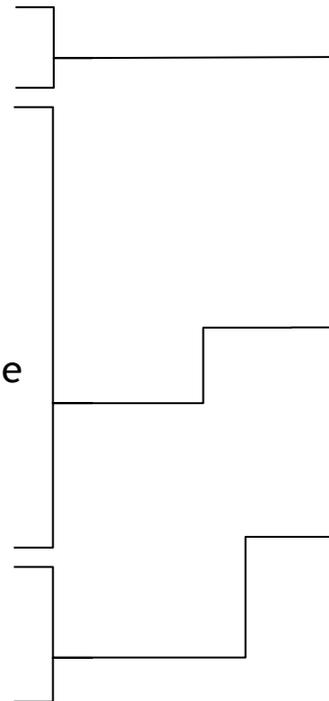


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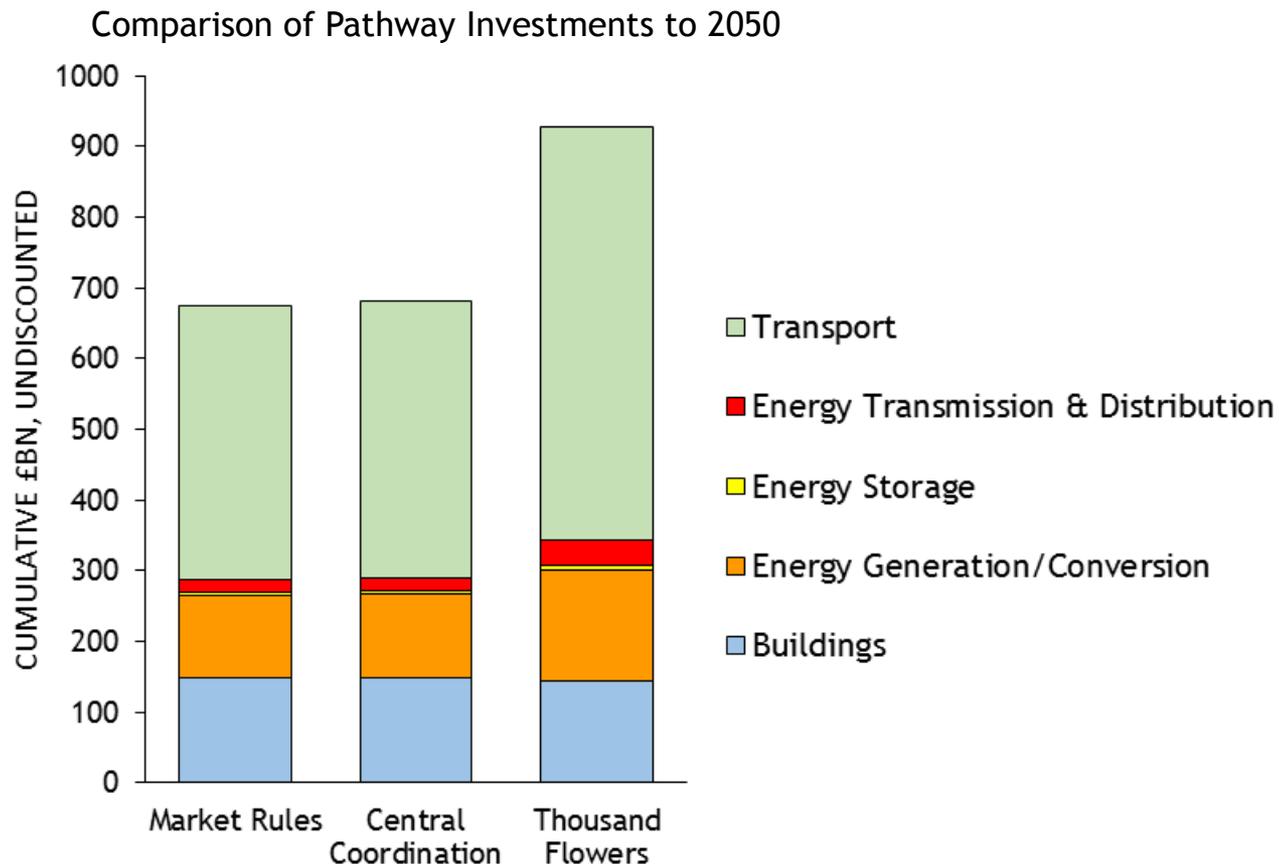
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# Relative Investment Costs of Transitions

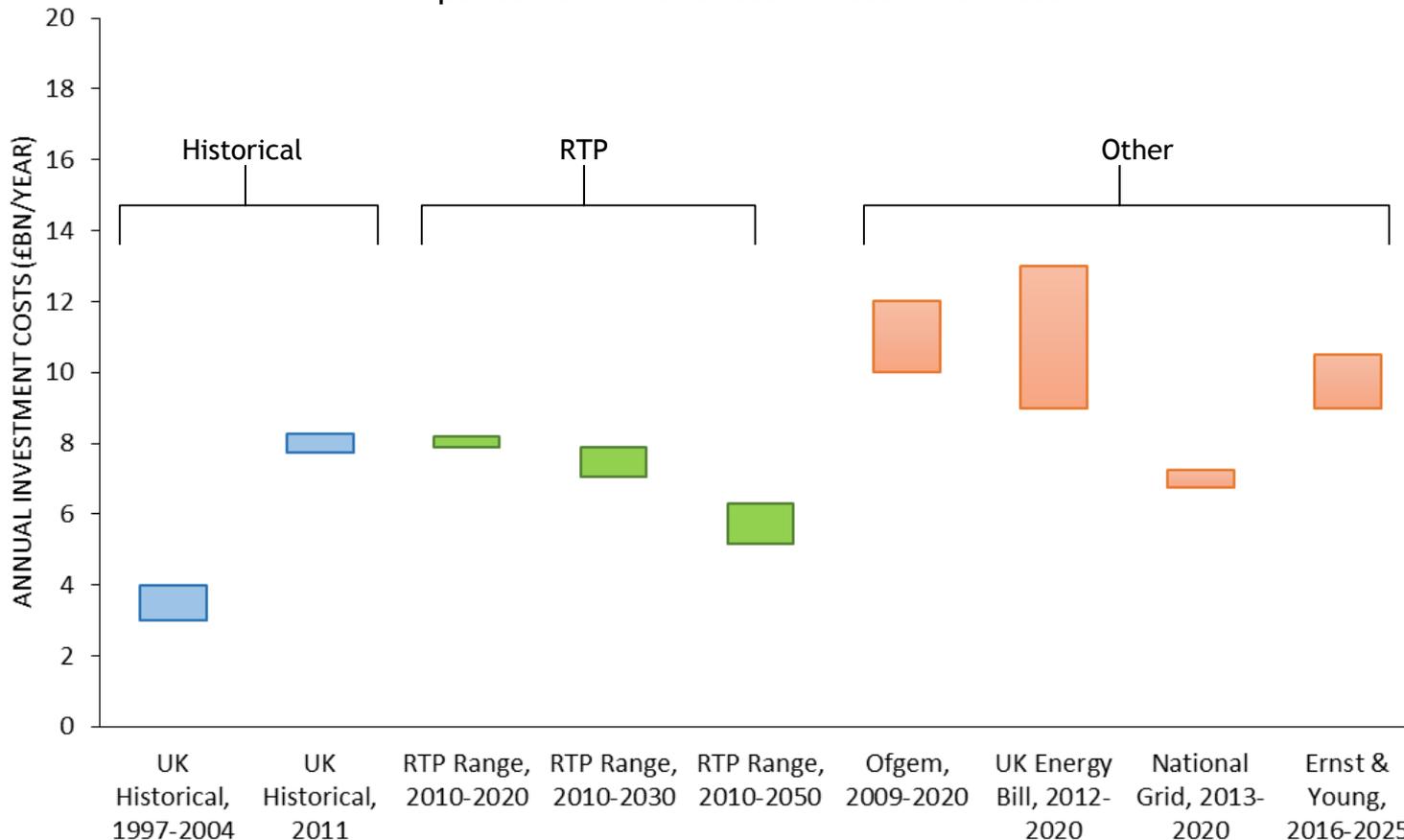
- EconA and ESME models both estimate cumulative investment into the energy system:
  - Differentiated financing assumptions and sensitivities
  - Different system boundaries for cost assessment
- Thousand Flowers pathway likely to incur higher capital investment costs than other pathways, but this is sensitive to assumptions about costs for key transport technologies and bioenergy conversion



# Relative Investment Costs of Transitions

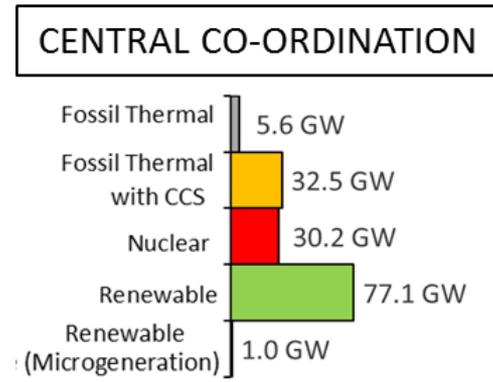
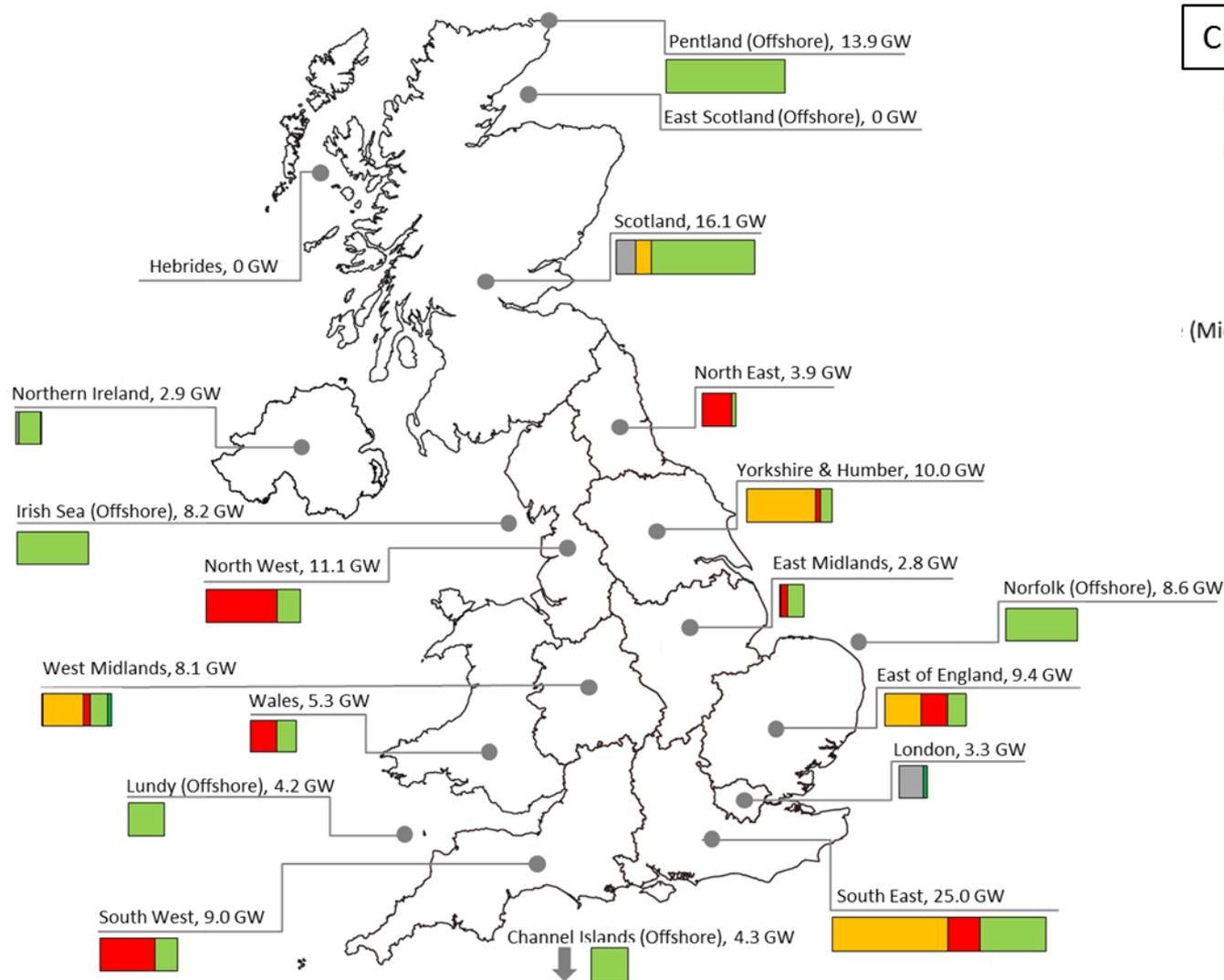
- Just focusing on annual power sector investment costs shows that trajectories for RTP lie within the range of historical observations
- However: financing transitions with high penetrations of renewable energy may be complex due to perceived maturity of the asset class (see presentation by Tim Foxon this afternoon for additional insights)

Comparison of Power Sector Investment Rates



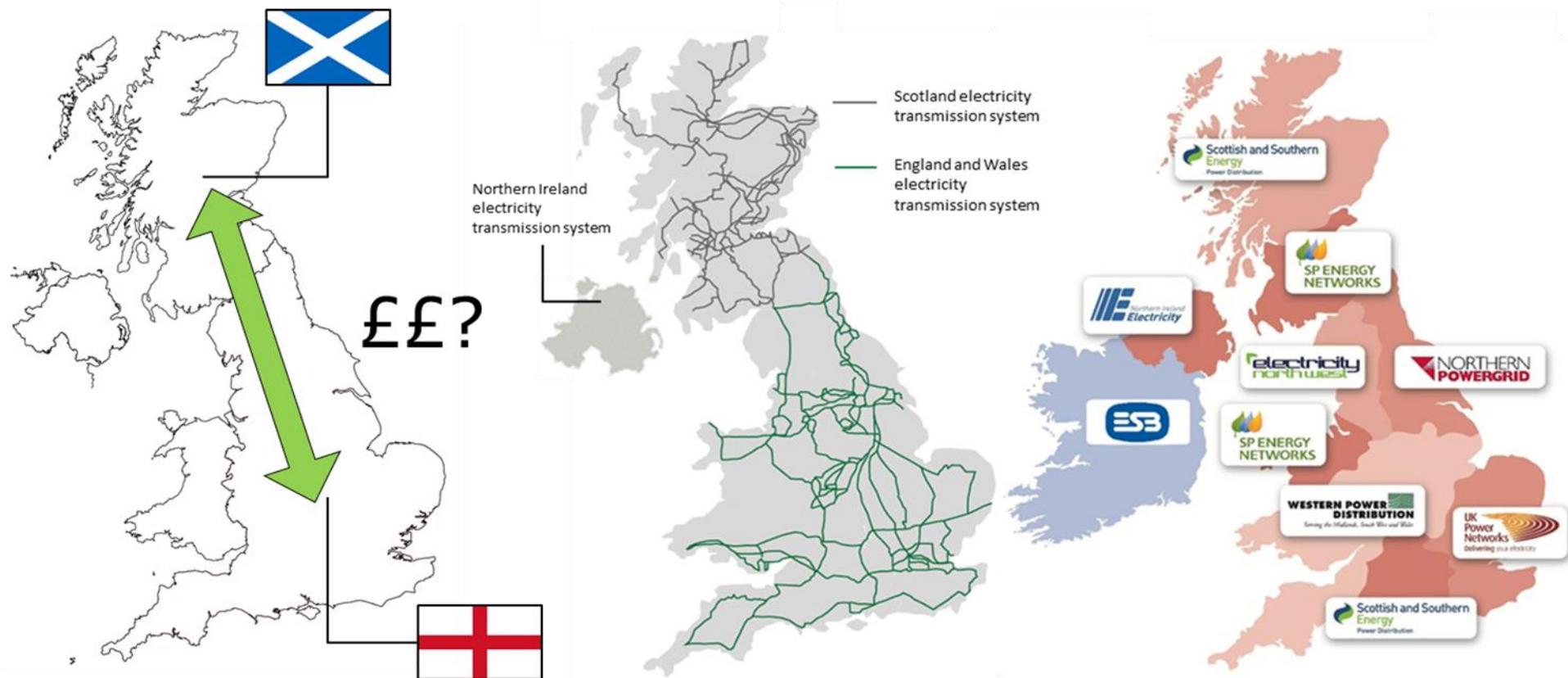
# Spatial Distribution of Investments

- Spatial functionality in ETI ESME model used to model all three pathways to understand geographical allocation of different technologies:



# Spatial Distribution of Investments

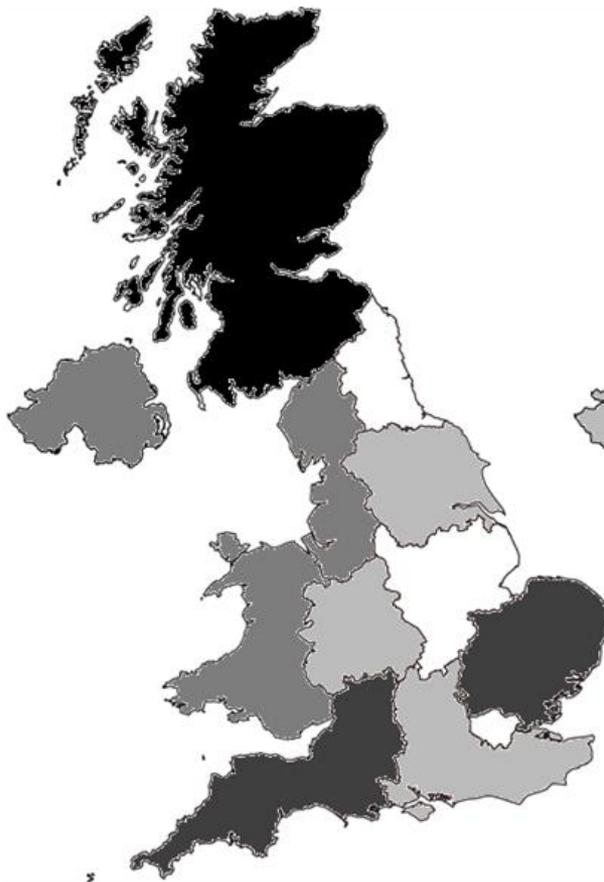
- Spatial distribution of investments does vary significantly between future energy pathways, with implications for regional actors in the UK's liberalised energy market:
- e.g. under some pathways transmission system reinforcement between England and Scotland is doubled
- See Stuart Galloway's presentation this afternoon for more insights into the regional dimension



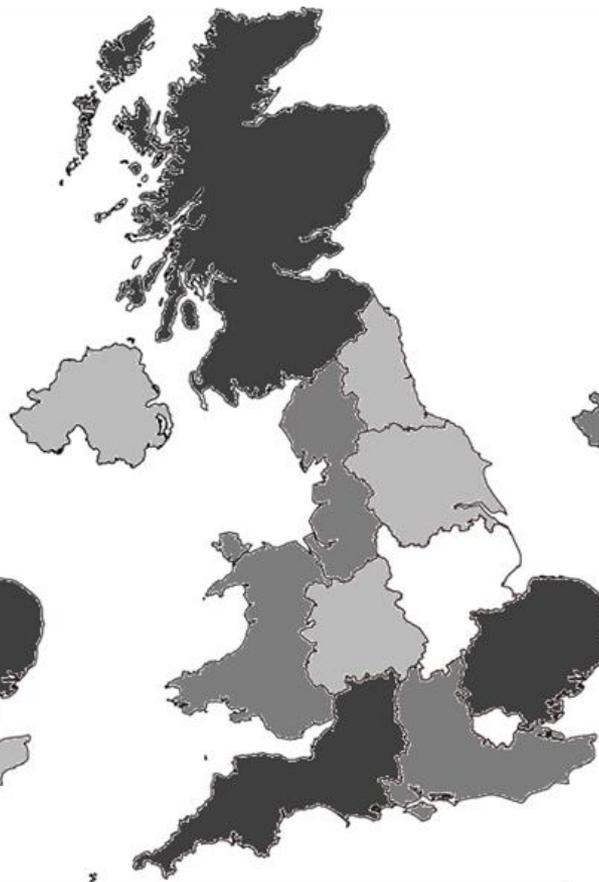
# Spatial Distribution of Investments

- Consistently high investment: the South East, the South West, the East of England, and Scotland
- Other regions, (e.g.) North East of England, were found to be exposed to large swings in potential investment under different pathways

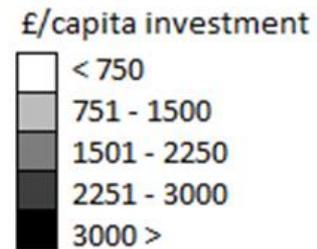
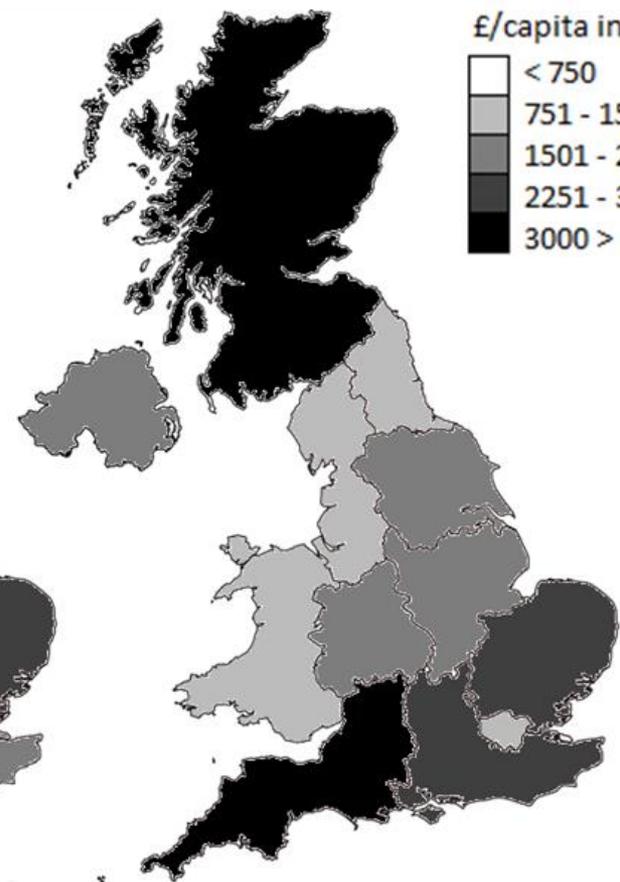
MARKET RULES



CENTRAL COORDINATION



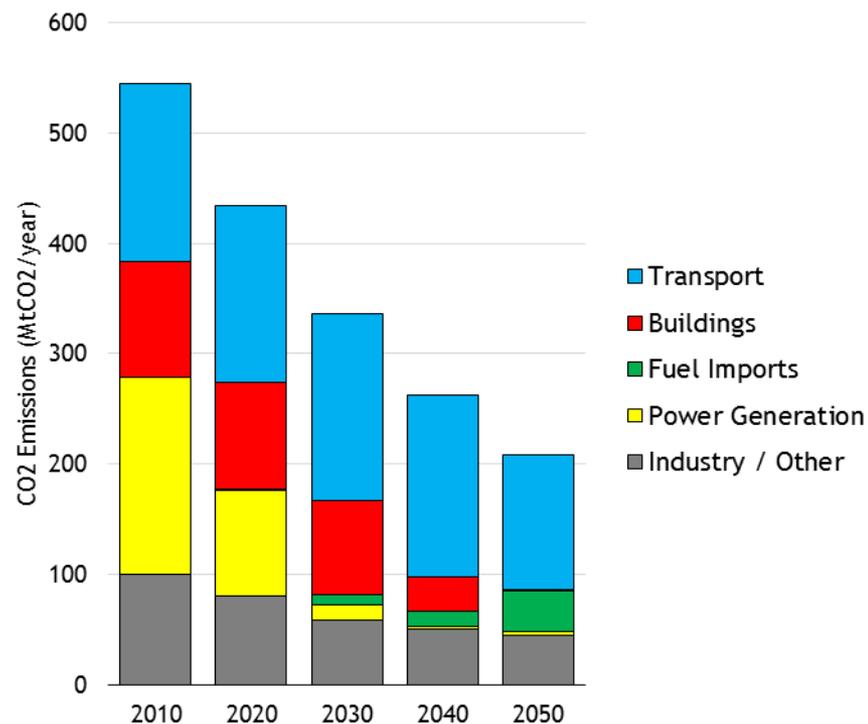
THOUSAND FLOWERS



# Interactions Beyond the Power Sector

- ESME used to assess all pathways' ability to achieve UK climate targets for 2050
- Modelled in ESME, all RTP pathways have strong residual emissions in 2050 from air travel, shipping, and industry
- To reach 2050 targets, model relies heavily on bioenergy with CCS for negative emissions sequestration (potentially contentious), e.g.
  - Biogas (heating + power)
  - Hydrogen (industry + transport)
  - Aviation biofuels

Residual Emissions Example - Market Rules



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- All pathways imply rates of power sector investment that are close to historical observations
- The highly distributed energy future envisaged under the Thousand Flowers pathway may imply higher total investment costs than the other options, but this is subject to key technology sensitivities
- The decarbonisation challenge has a strong spatial dimension, with implications for regional actors and sub-national governance arrangements
- Demand reduction, significant bioenergy availability and the realisation of working CCS at scale appears to be a prerequisite for the RTP pathways to meet UK 2050 targets

# Future Work

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- Economic analysis to date assumes that sub-national actors and institutions are acting in a coordinated fashion, that consumers make rational choices, that political and social barriers to new technologies can be overcome
- Going forward we will be exploring the energy transition using a stochastic energy simulation model (BLUE) that incorporates:
  - Multiple actor perspectives
  - Complex behavioural parameterisation
  - Probabilistic treatment of uncertainty
- For insights into the role of actors and institutions in past transitions, attend Peter Pearson's presentation this afternoon



# References

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