Hybrid Energy System Analysis

S Galloway & E Robertson
University of Strathclyde

RTP Final Dissemination Event
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Presentation overview

- HESA, UK+ and how they work
- The RTP context
- Modelling and results
- Research outputs, engagement and impact

HESA tool

HESA: Hybrid Energy System Analysis

Explores spatial aspects of the case studies

- Energy Hubs represent the conversion of energy between carriers (i.e. generation)
- Network Theory to calculate flows
- Deterministic least-cost optimisation (fuel, generation, transport – very flexible)

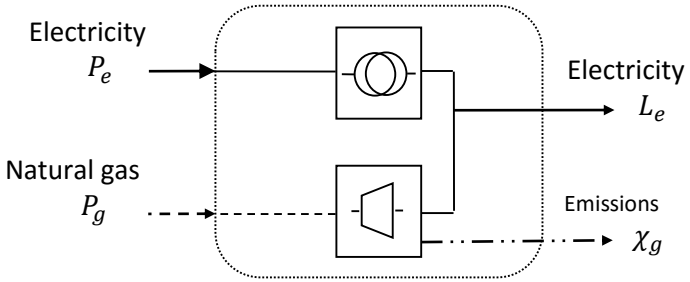
Inputs:

  - UK+ data spatially disaggregated info

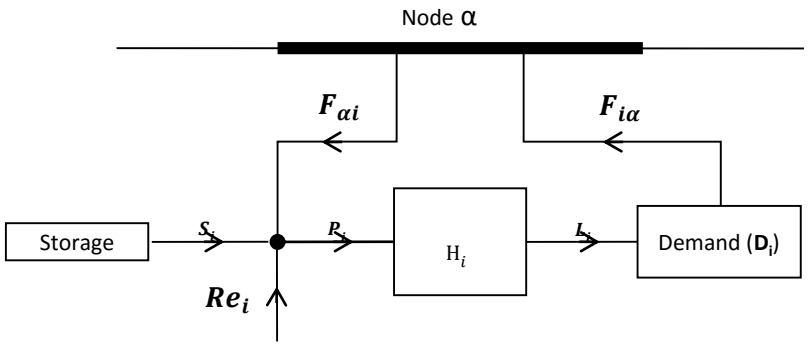
Outputs (levels for each zone):

  - Transportation solution for electricity, gas, coal, oil, biomass and CO_2
  - Generation level and costs
  - Storage dispatch and costs

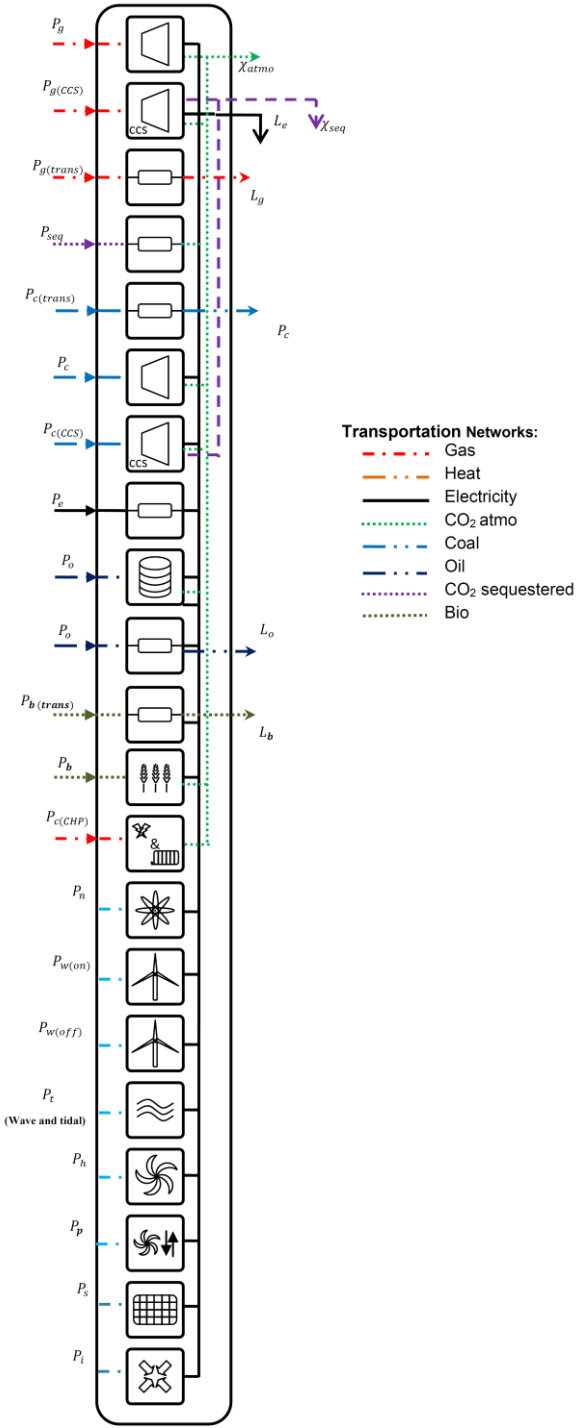
HESA tool (2)



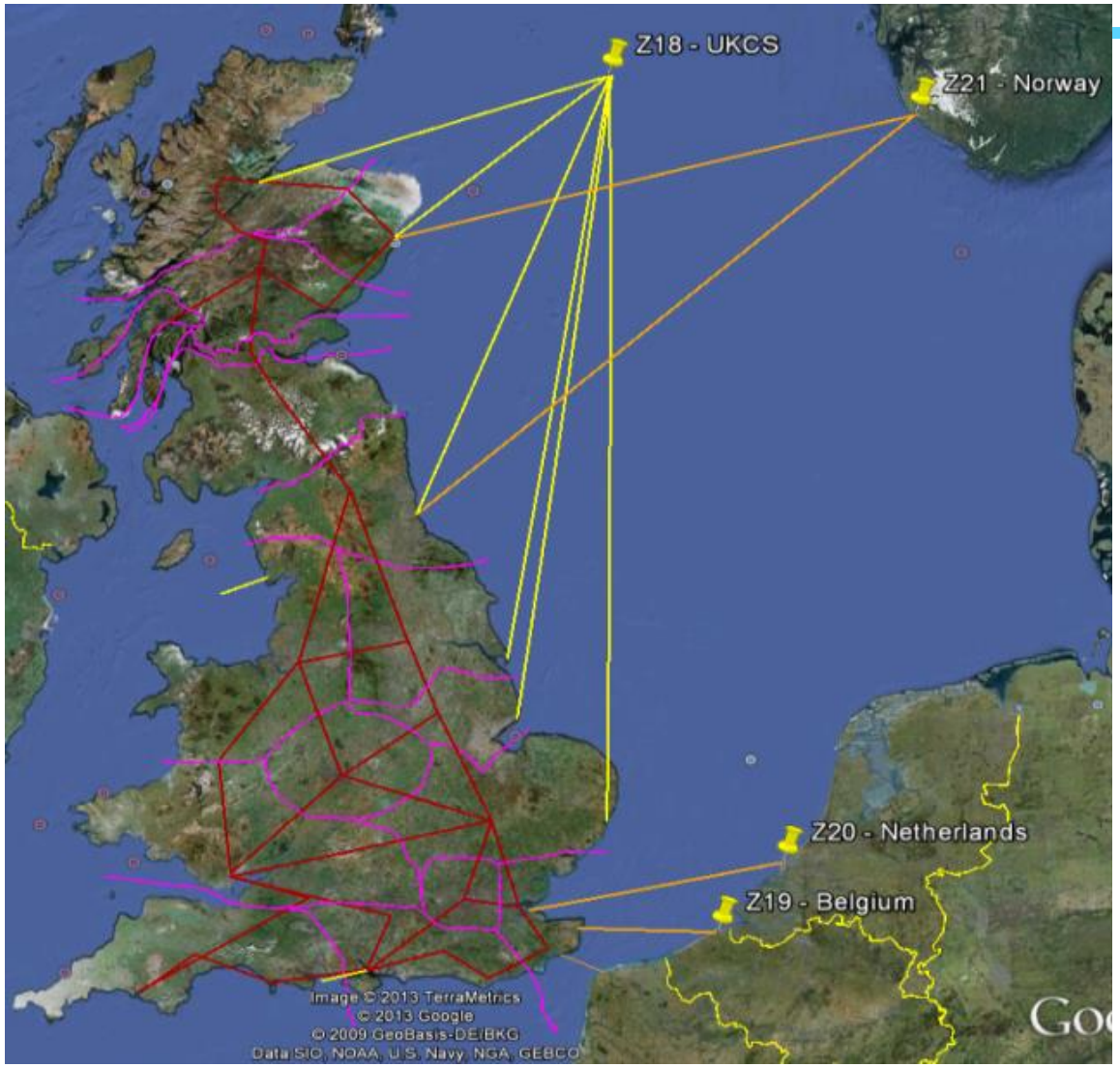
A simple 2-component, 3-carrier energy hub



An energy hub with renewable energy sources (Re_i). The hub is connected to a system with local storage.



Strathclyde UK+ model (2008-2050)



- 17 onshore zones
- 5 offshore zones (UKCS, Norway, Belgium, Netherland, France)
- 39 connections transporting elec, gas, coal, Oil, Biomass and CO_2

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UK+ model (2)

UK +

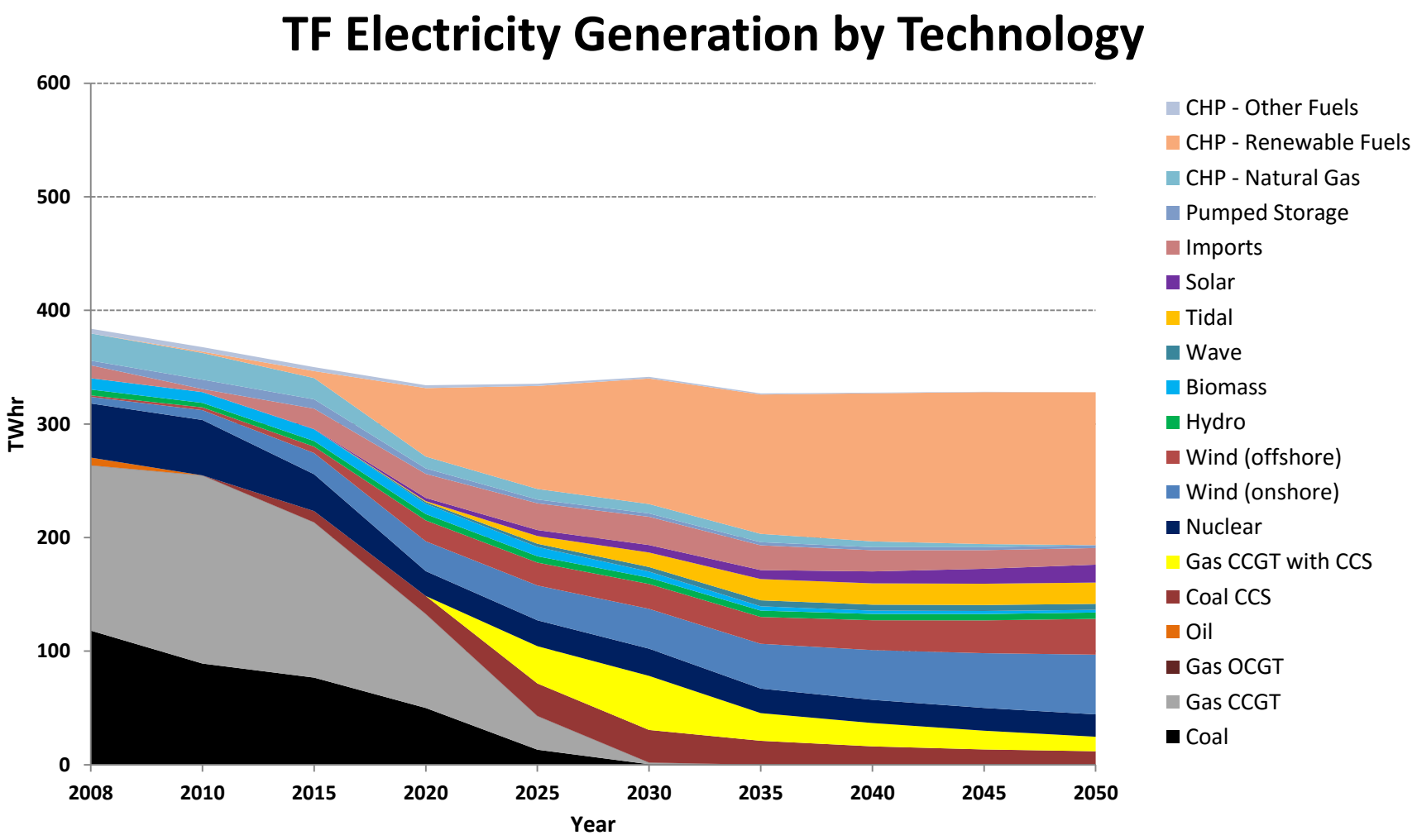
Data banks for all TPs at 08, 20, 35 and 50

Inputs: National Transition Pathways datasets

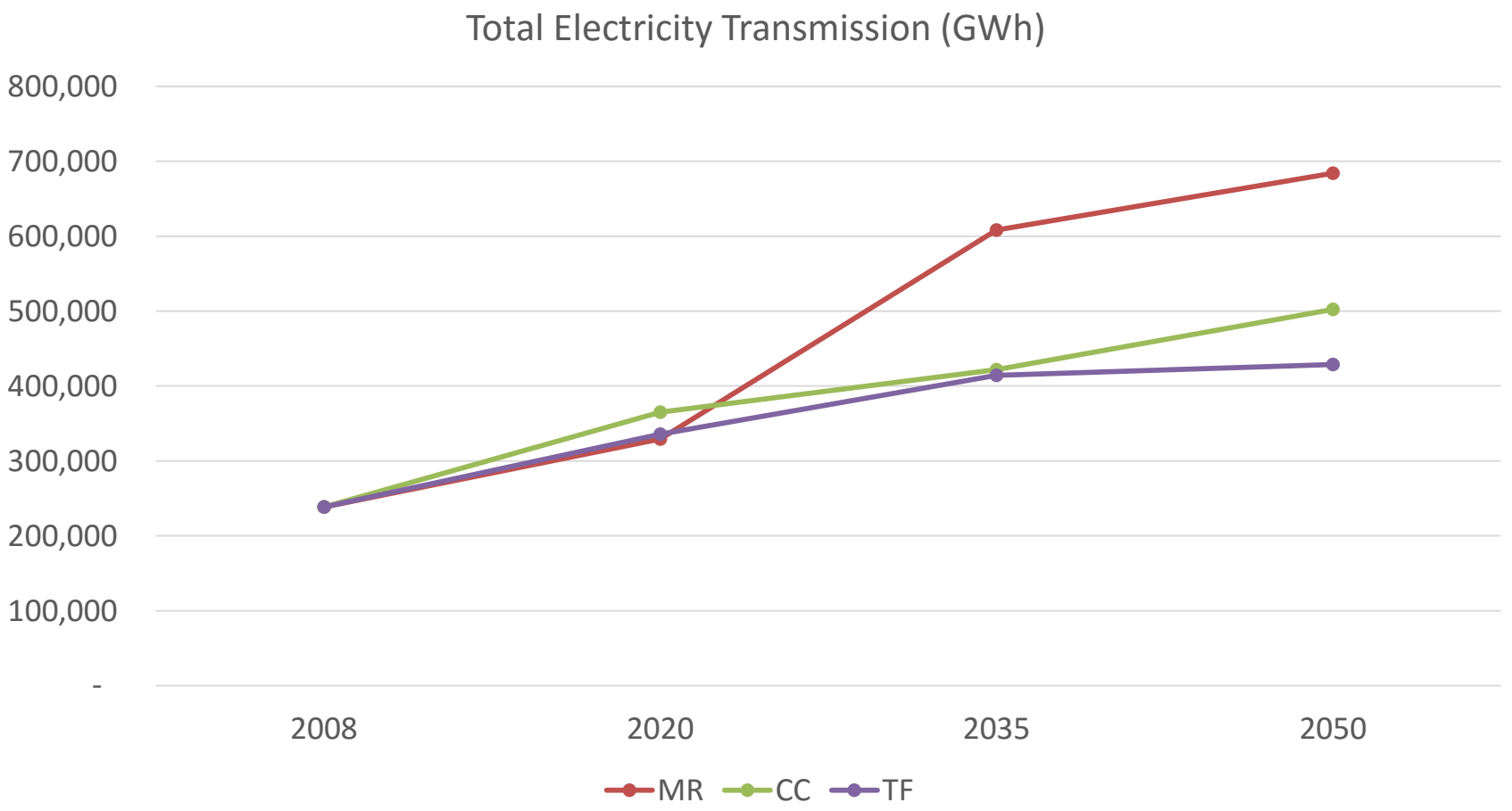
Outputs: Disaggregated information

- Generation capacities, c.f. and costs
- Demand (electricity, gas, coal, biomass, oil)
- Supply and storage (electricity, gas, coal, oil, biomass, CO_2)
- Supply costs
- Transpiration / transmission max. capacities and costs

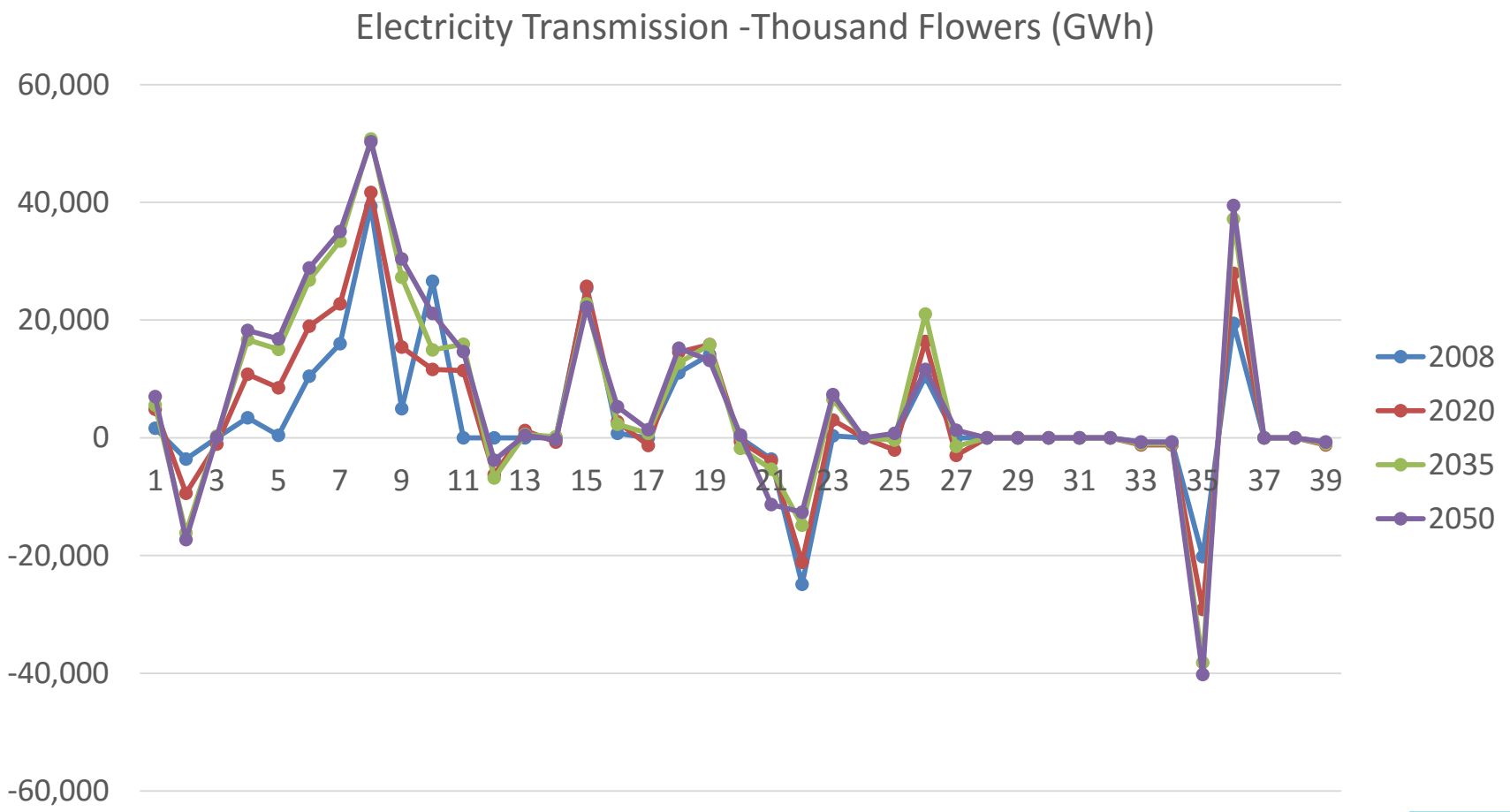
TP Electricity Generation



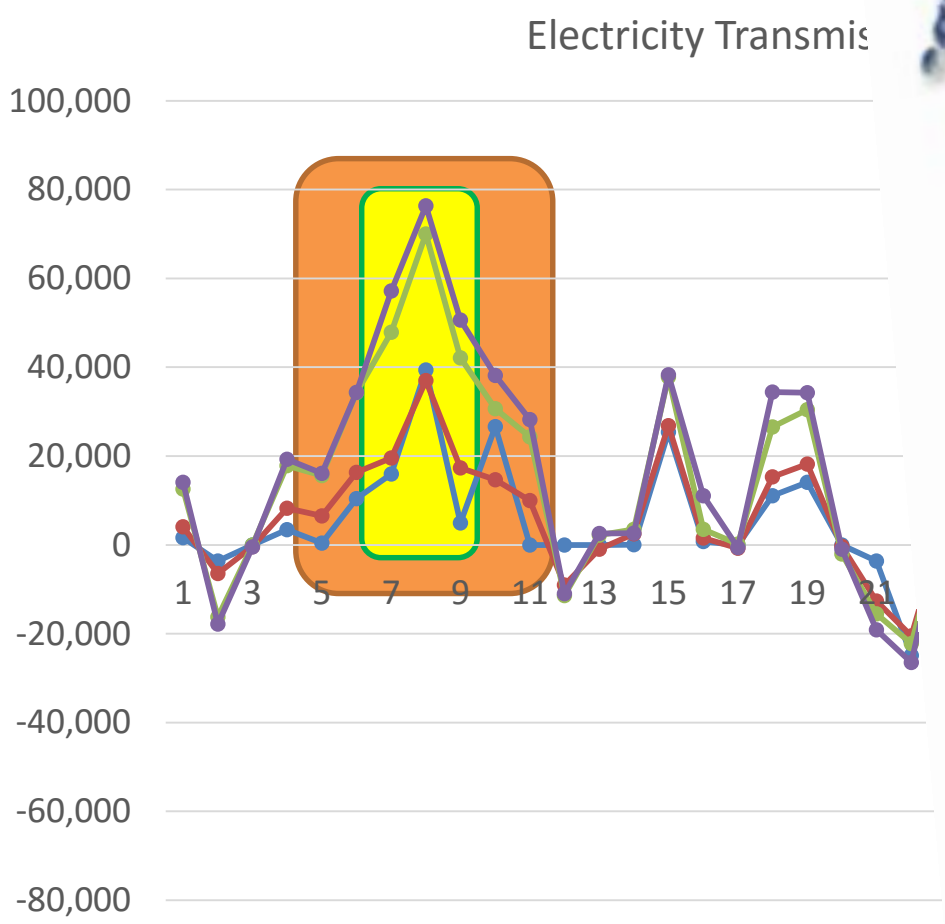
Total Transportation

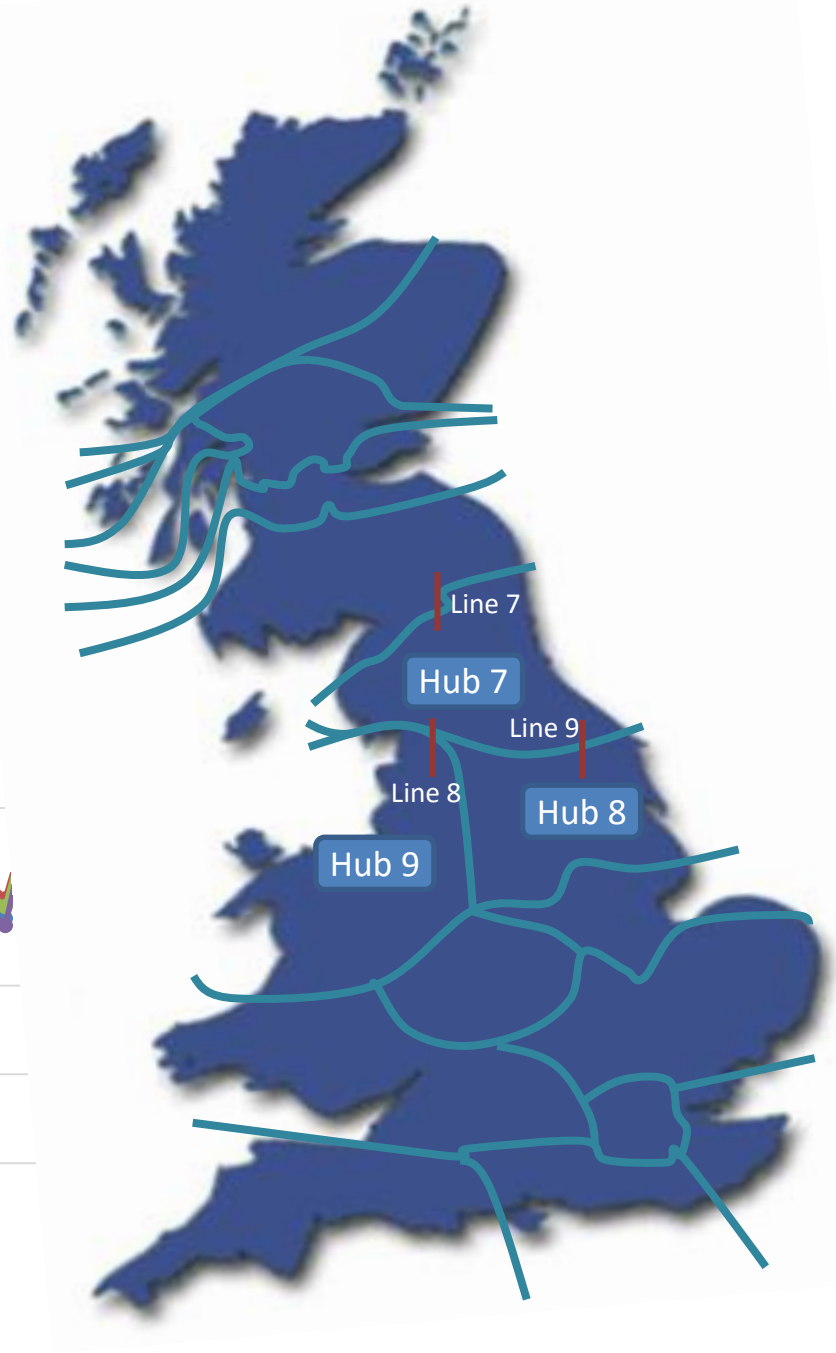


Electricity transmission - TF

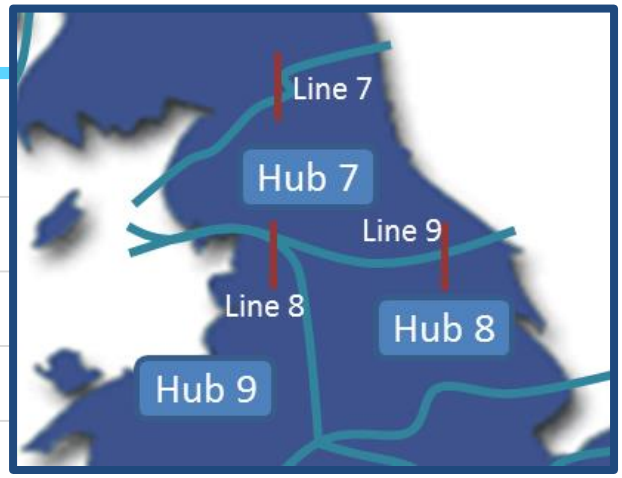


Electricity transm





North-South Corridor



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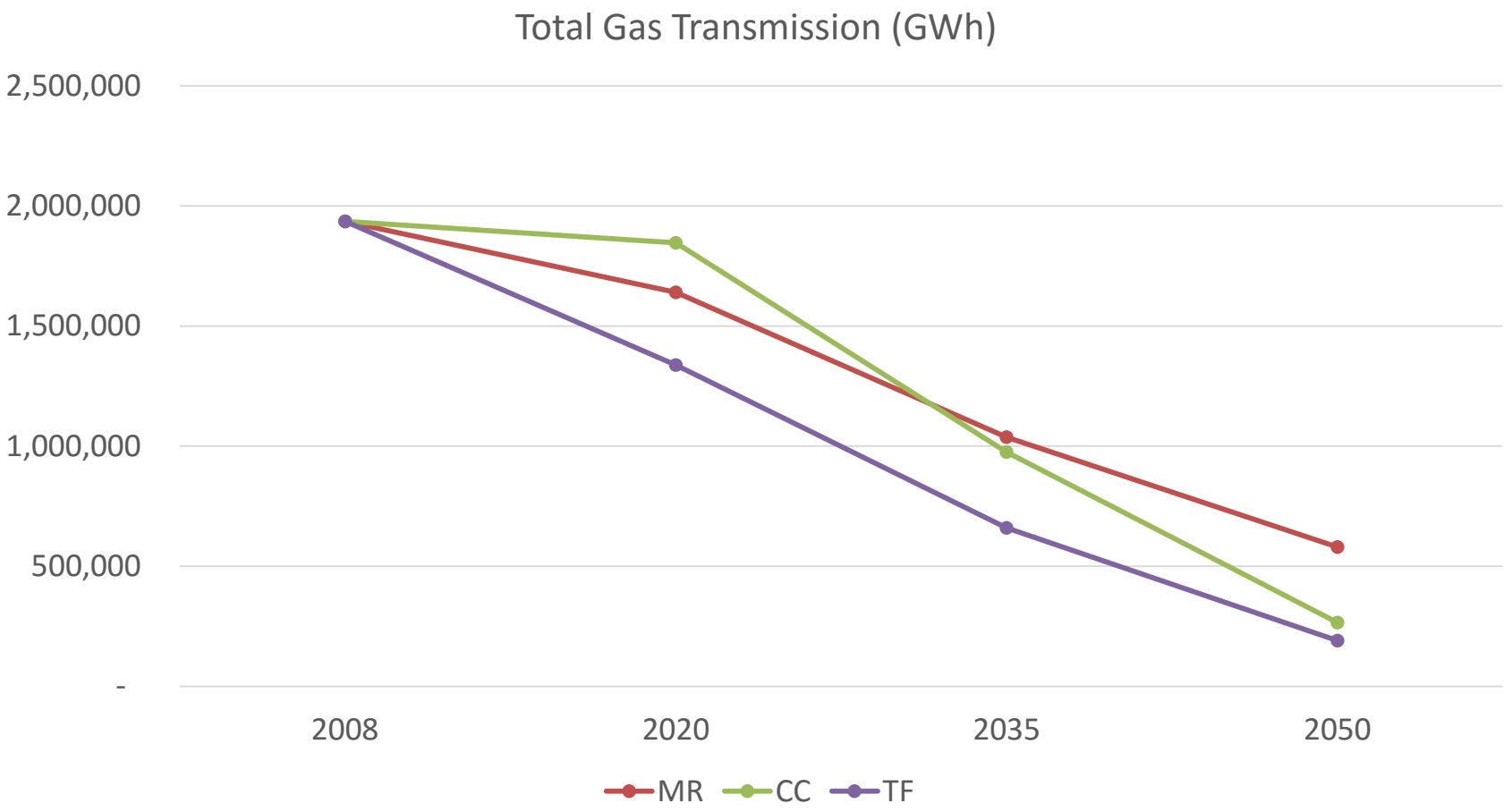
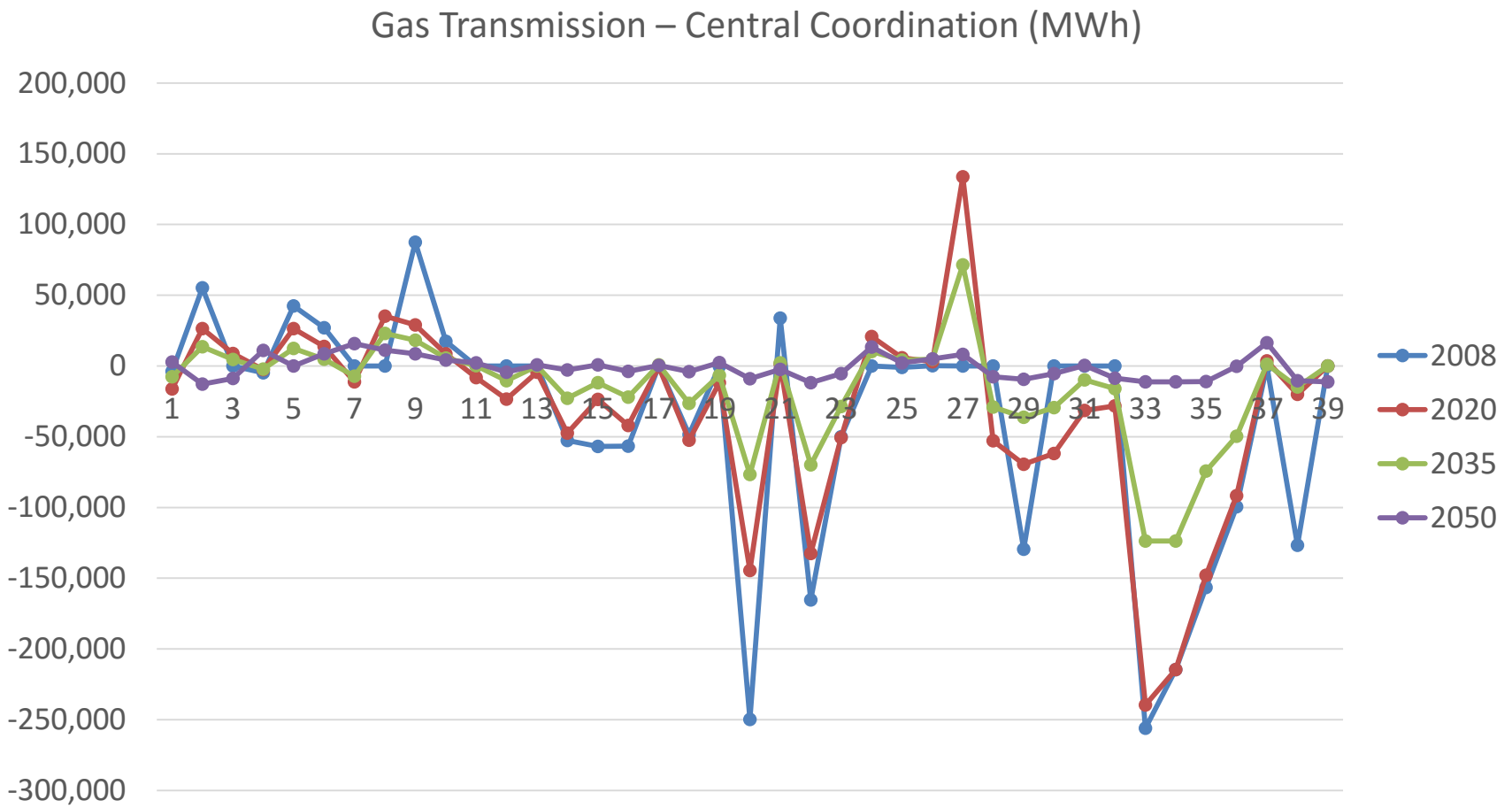
Total Transportation



Gas transmission particulars



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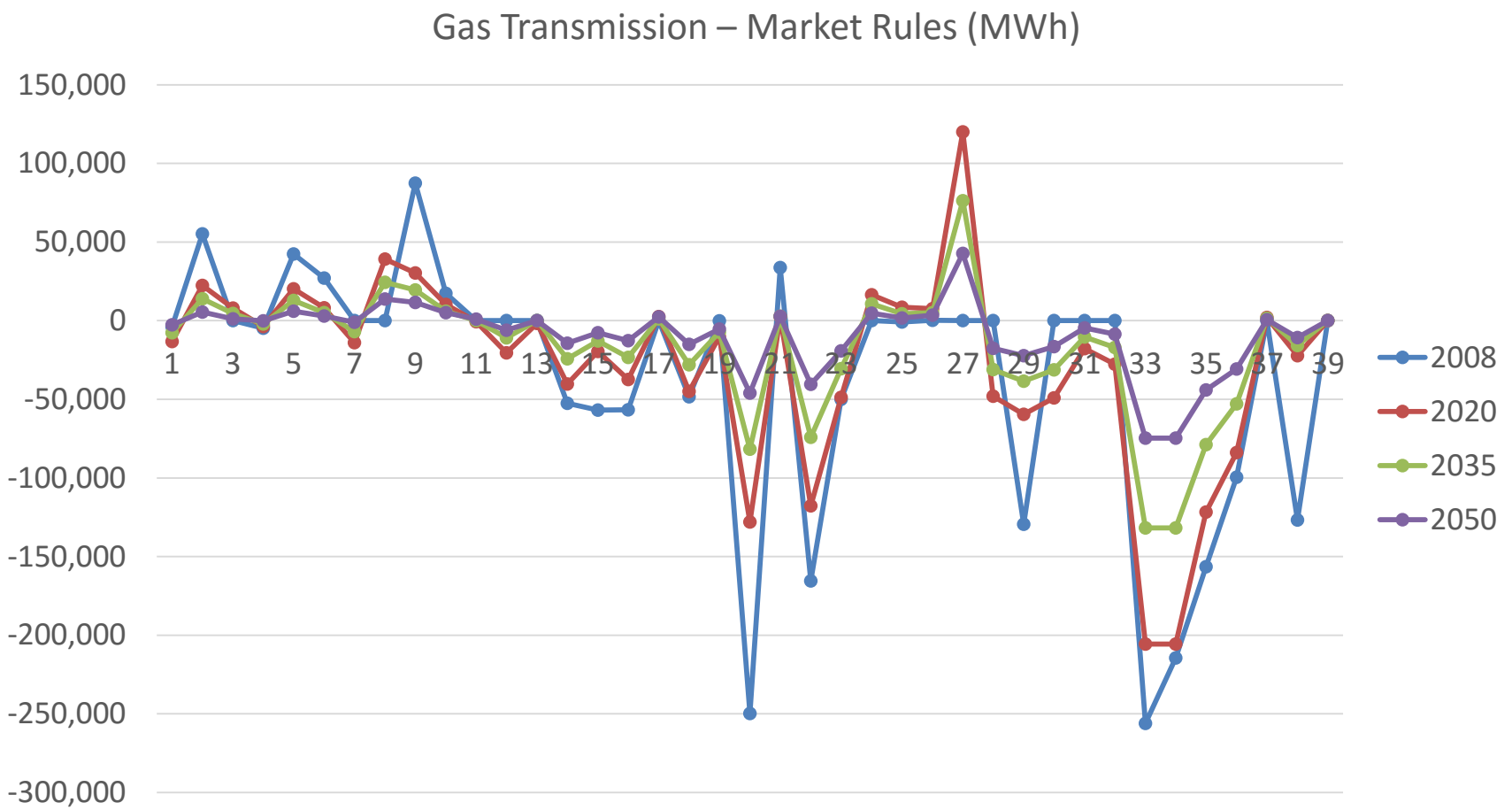

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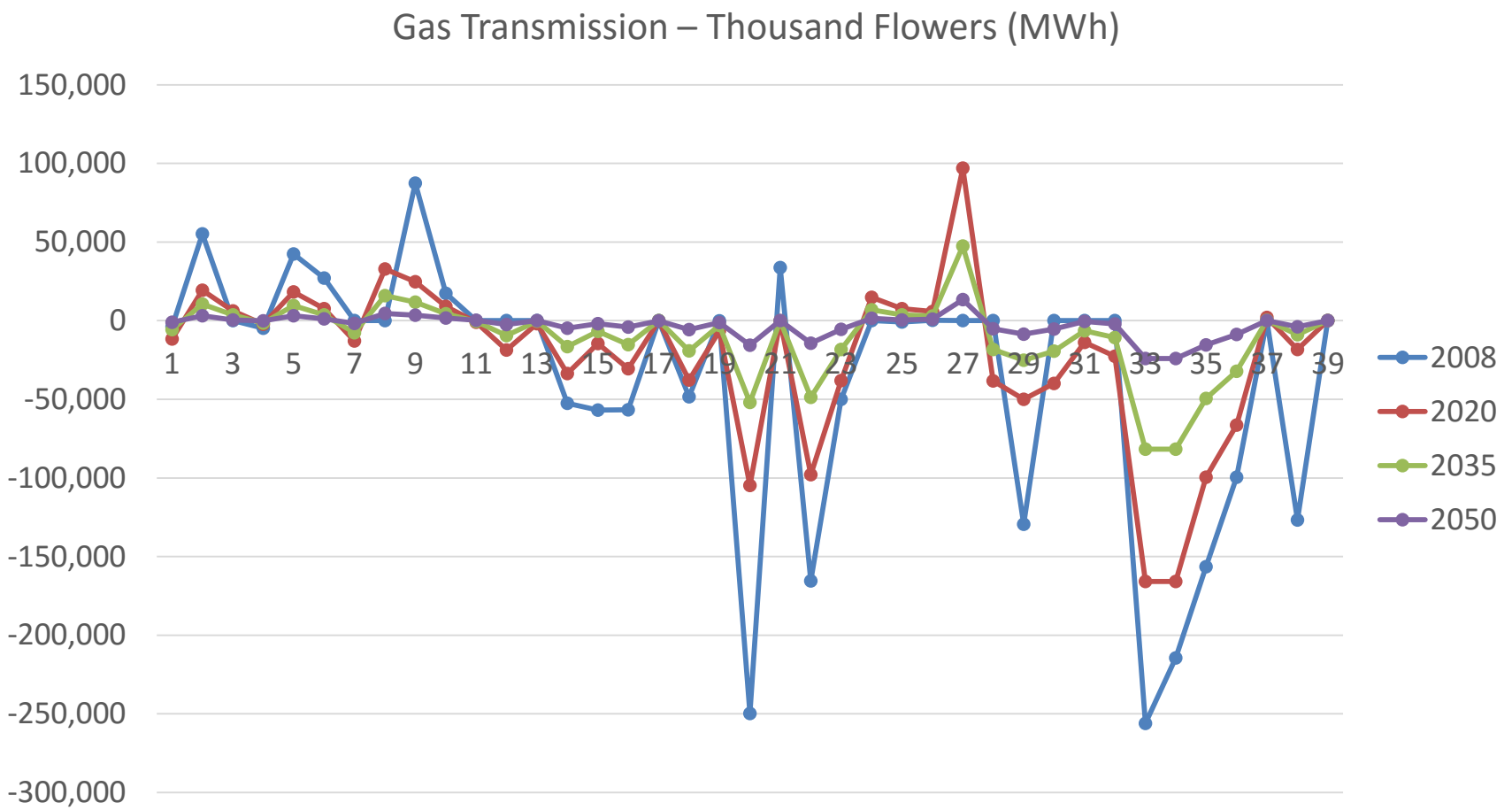
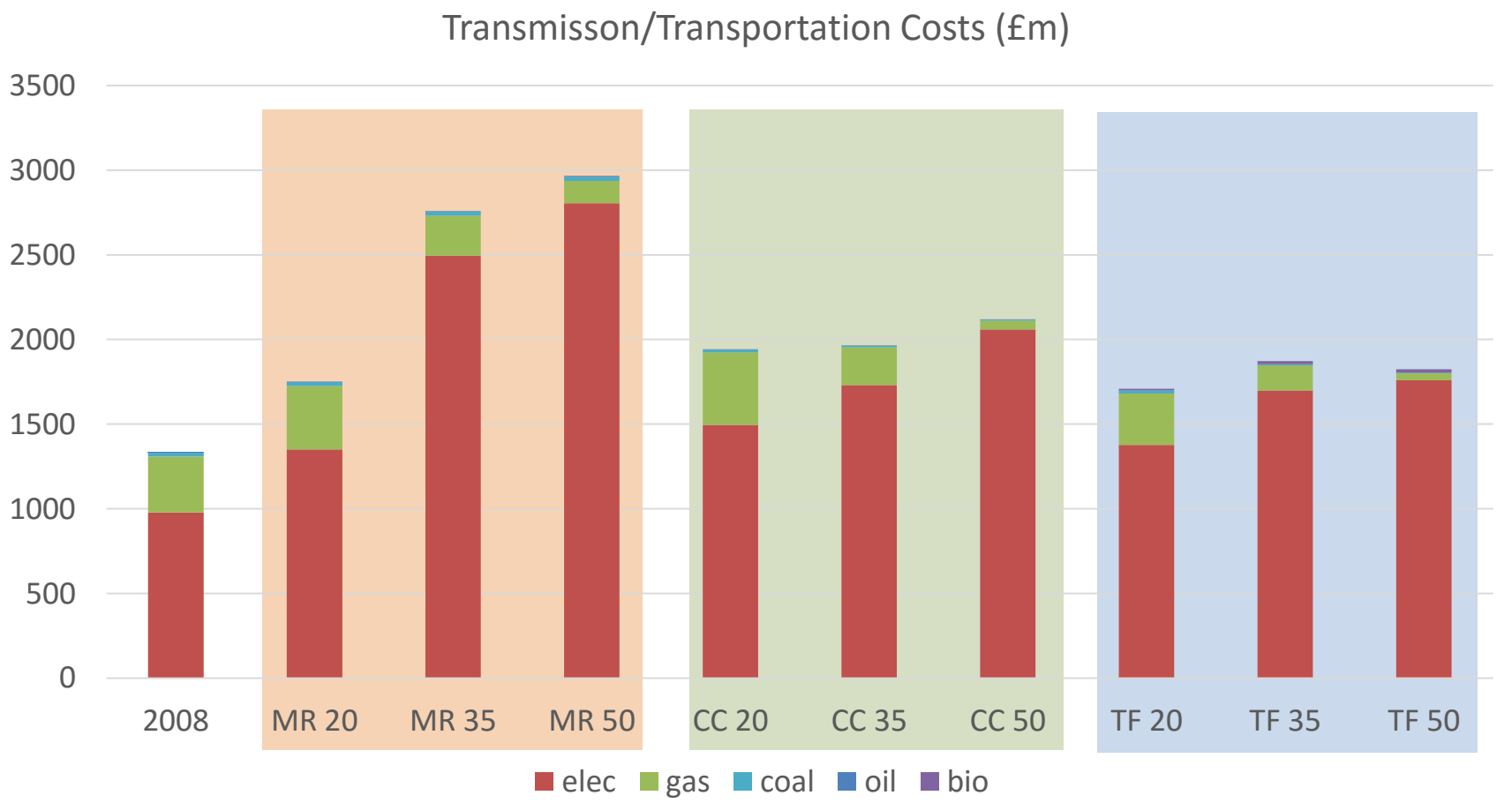
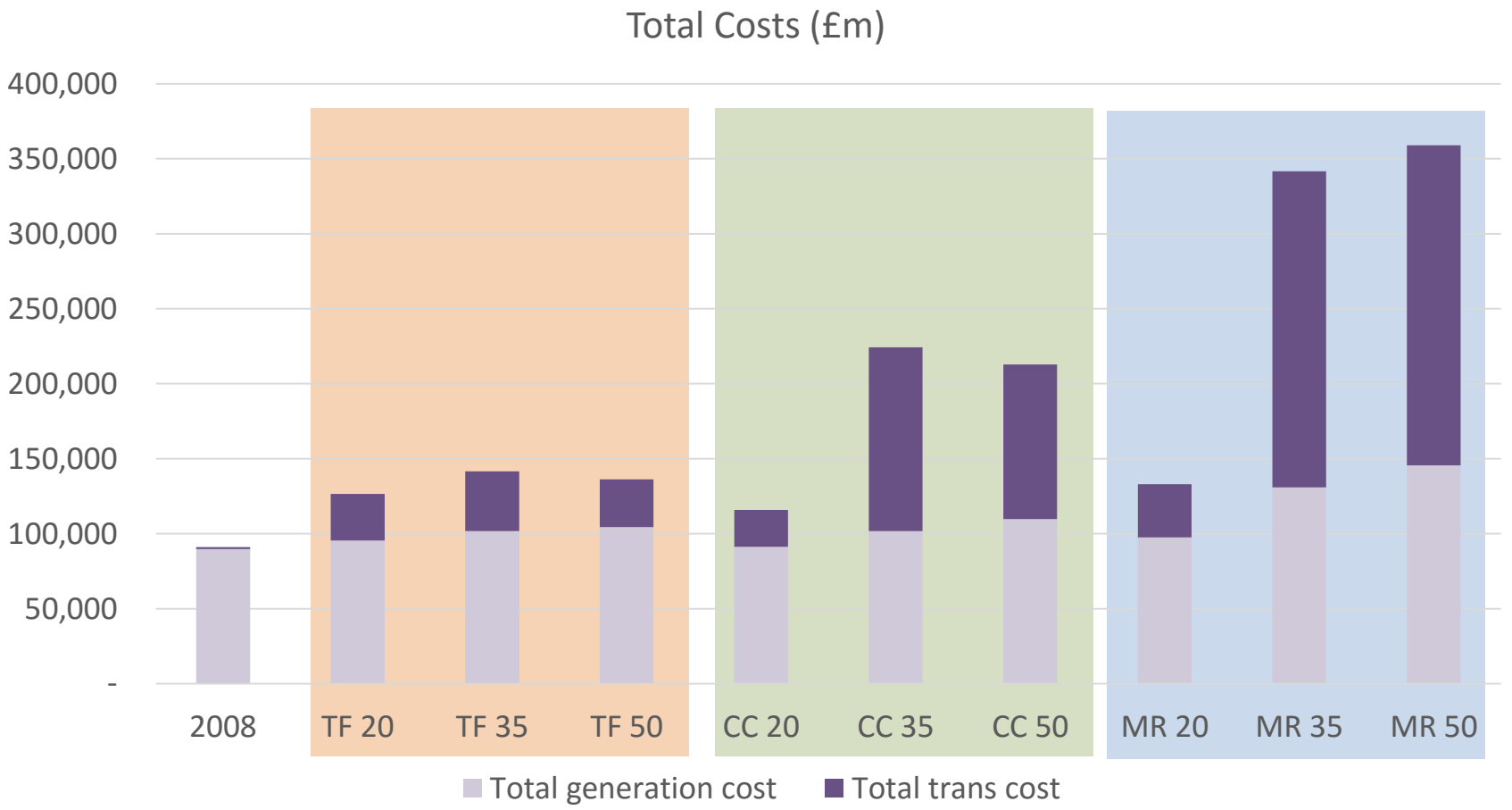


Transmission/Transportation Costs



Total cost comparison



Conclusions

What does this mean in terms of the pathways?

- Even in a system with greater localised energy sources (TF) there is still a need for MEC national energy infrastructures.
- An increase in capacity of the electrical North-South corridor is essential for the success of all three pathways
- A decrease in use of the national natural gas transmission system means an underutilisation of the network
- Total transmission and generation costs are increasing out to 2050 across all three of the TPs

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Research Outputs

- Robertson, E., L. Anderson, and S. Galloway, The Impact of Distributed Generation in Scotland (on the Energy System, to Consumers and to National Emission Levels), in CIGRÉ. 2012: Montréal, Québec.
- Robertson, E., S. Galloway, and G. Ault, The Impact of Wide Spread Adoption of High Levels of Distributed Generation in Domestic Properties, in Power & Energy Society General Meeting, 2012. PES '12. IEEE. 2012.
- Linking storylines with multiple models: an interdisciplinary analysis of the UK power system transition Trutnevyte E., Strachan N., Barton J., O'Grady A., Ogunkunle, D., Pudjianto, D., Robertson, E Submitted to Technological Forecasting and Social Change; available on request
- 'Community energy and equity: The distributional implications of a transition to a decentralised electricity system' V Johnson and S Hall, Contributors: J Barton, D Emanuel-Yusuf, N Longhurst, Á O'Grady, E Robertson, E Robinson, F Sherry-Brennan. People, Place and Policy, 149-67, 2014
- Transition pathways for a UK low carbon electricity system: Comparing scenarios and technology implications. Barton, J, Davies, L, Foxon, TJ, Galloway, S, Hammond, GP, O'Grady, A, Robertson, E and Thomson, M Realising Transition Pathways Working Paper 2013/5.
- Facilitating interdisciplinary learning among the Realising Transition Pathways models. E Trutnevyte, J Barton, S Galloway, G Hammond, M Leach, Á O'Grady, D Ogunkunle, P Pearson, D Pudjianto, E Robertson, N Strachan, G Strbac, M Thomson, RTP Working paper Nr. 2013/4
- Robertson, E., O'Grady, A., Barton, J., Robinson, E., Emmanuel-Yusuf, D., Aunedi, M. and Huang, S. (2014). Technological archetypes for a UK energy system transition. Realising Transition Pathways Working Paper 2014/2.
- Barton, J., Davies, L., Foxon, T.J., Galloway, S., Hammond, G.P., O'Grady, A., Robertson, E. and Thomson, M. (December 2013). Transition pathways for a UK low carbon electricity system: Comparing scenarios and technology implications. Realising Transition Pathways Working Paper 2013/5.

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