Imperial College London

Overview of Energy Scenarios

Dr Aidan Rhodes, Research Fellow, RCEP Energy Strategy Fellowship

24 October 2012

Imperial College London

Aim

- To explore future energy research needs, we need to understand the possibilities that exist for the future UK, EU and global energy systems.
- Comparisons of future energy scenarios to elicit commonalities and differences
- Looking at government, NGO, academic and corporate scenarios.
- Have identified several key metrics, which we'd like to explore in the workshop today.

Imperial College London

Key Metrics

- Energy Demand
- Electricity Supply Technologies
- Transportation
- Level of ‘Smart’ technologies
- Heating
- Role of Gas

Difficulties and Uncertainties

- Predicting the future is difficult!
- Lots of studies, and multiple scenarios for each project.
- Forecasting vs backcasting
- Quantitative vs qualitative
- ‘gaps’ in data and difficulty of obtaining raw data.
- Differing definitions and aggregation

Imperial College London

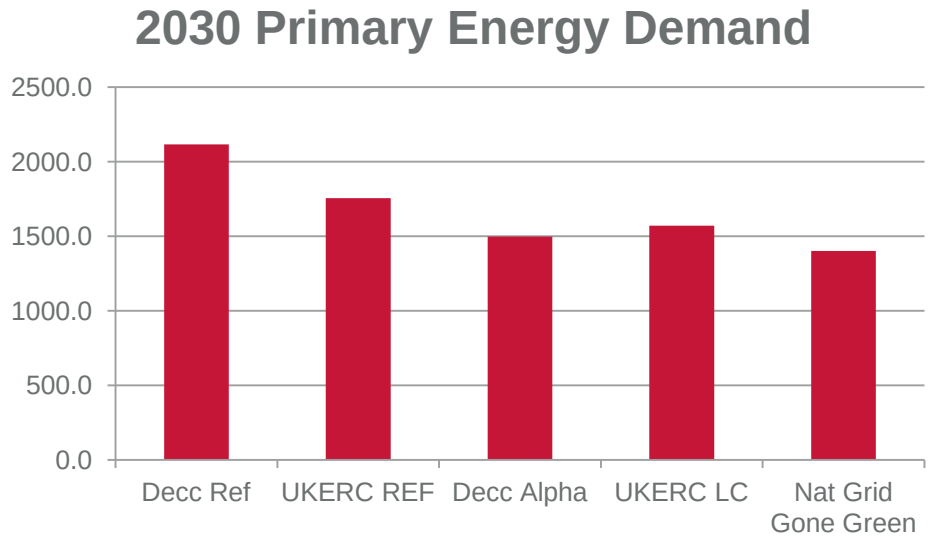
Scenarios looked at so far:

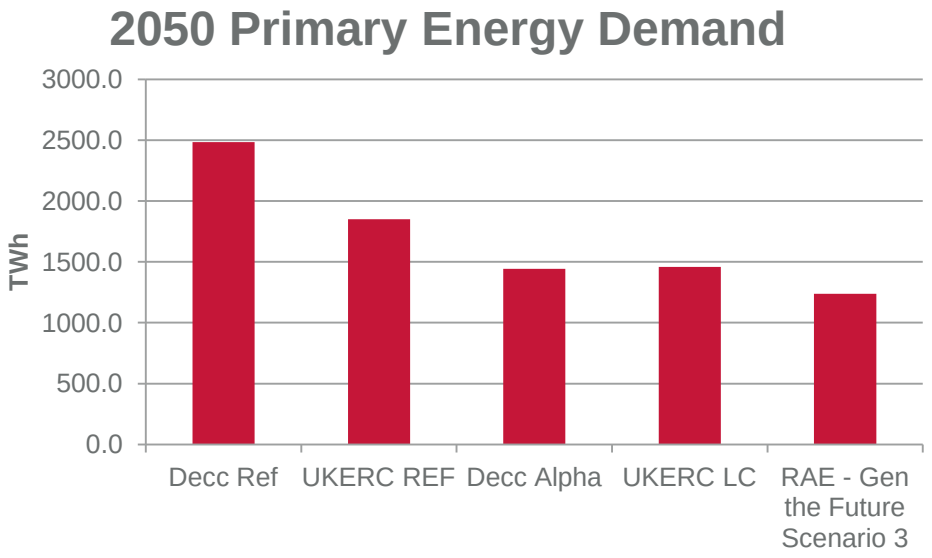
- DECC 2050 Calculator – Reference and Alpha pathways
- UKERC revised 2050 scenarios – REF and LC scenarios
- National Grid 2011 Future Energy Scenarios – Gone Green
- CCC 4th Carbon Budget
- RAEng – Generating The Future
- Transition Pathways to a Low Carbon Economy
- IEA Energy Technology Pathways – 2DS and 4DS scenarios
- Exxon Energy Outlook 2012
- EU Energy Roadmap 2050

Imperial College London

Total Energy Demand

- Demand reduction and energy efficiency measures are considered essential to fulfilling all surveyed UK low-carbon scenarios.
- Total demand reduction of between 25-50% from reference by 2050.
- Electricity demand increases as percentage – from less than 10% to nearly 150%

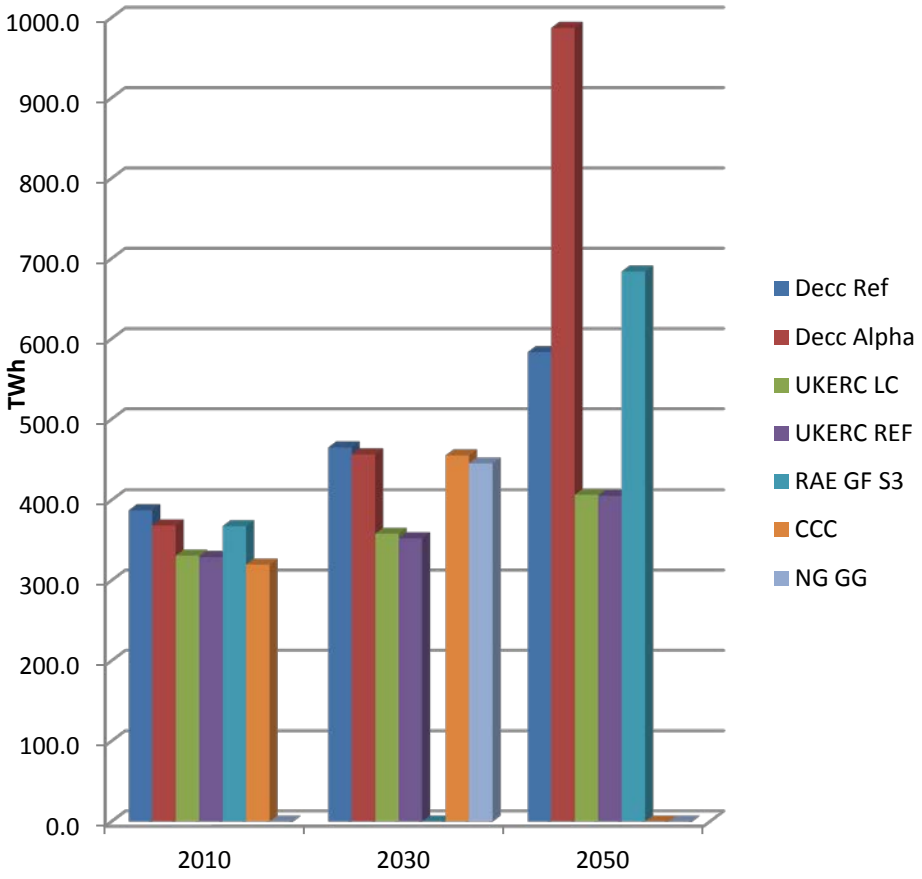




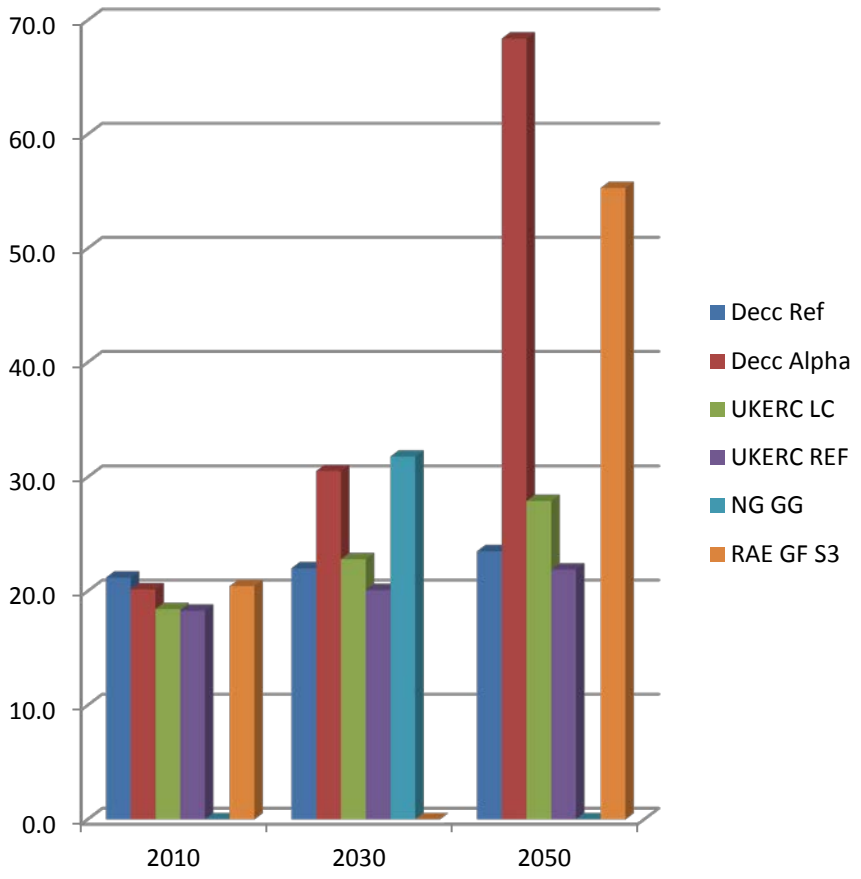
Imperial College London

Electricity Demand

UK Electricity Demand

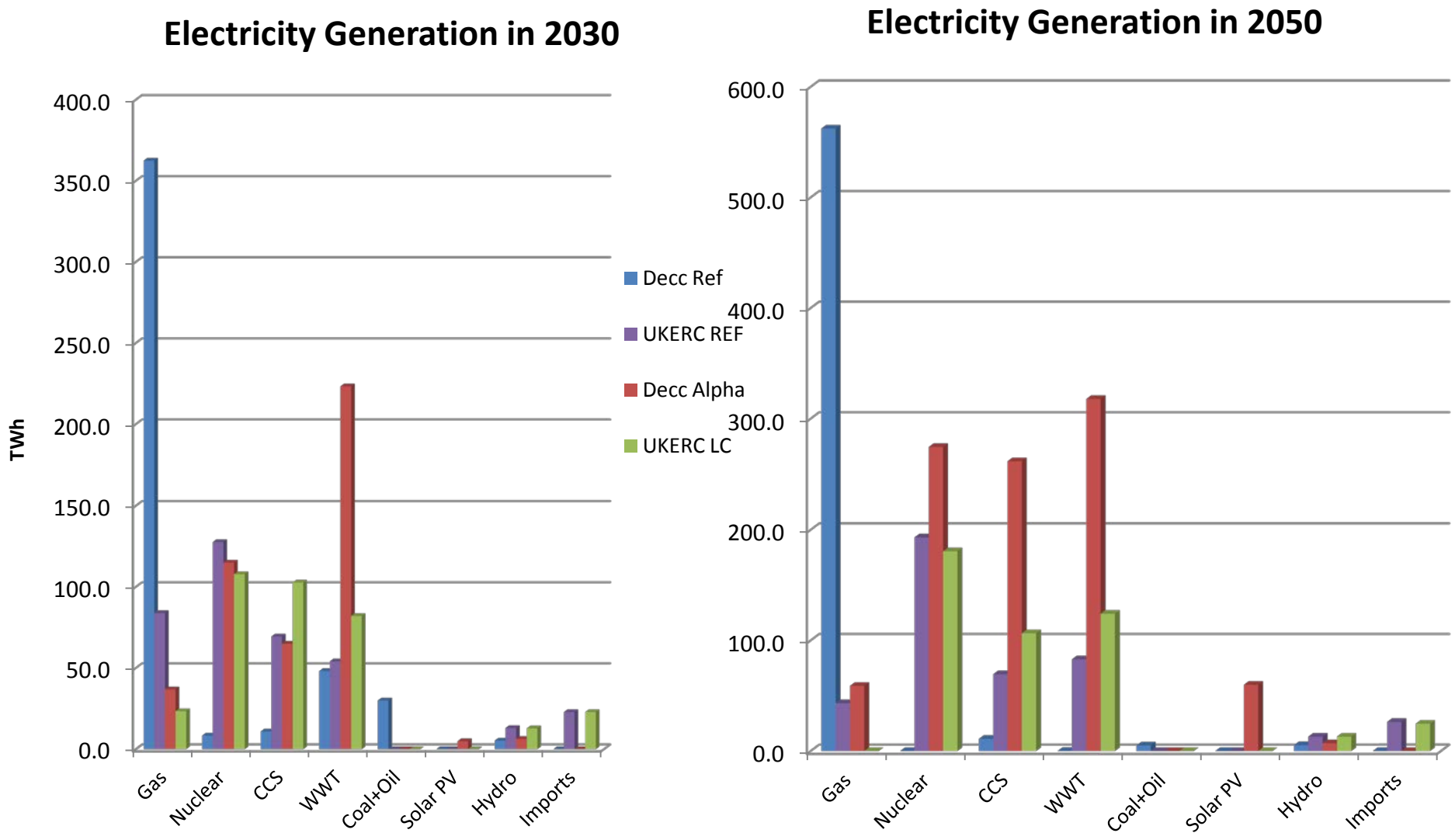


Electricity % of Total Demand



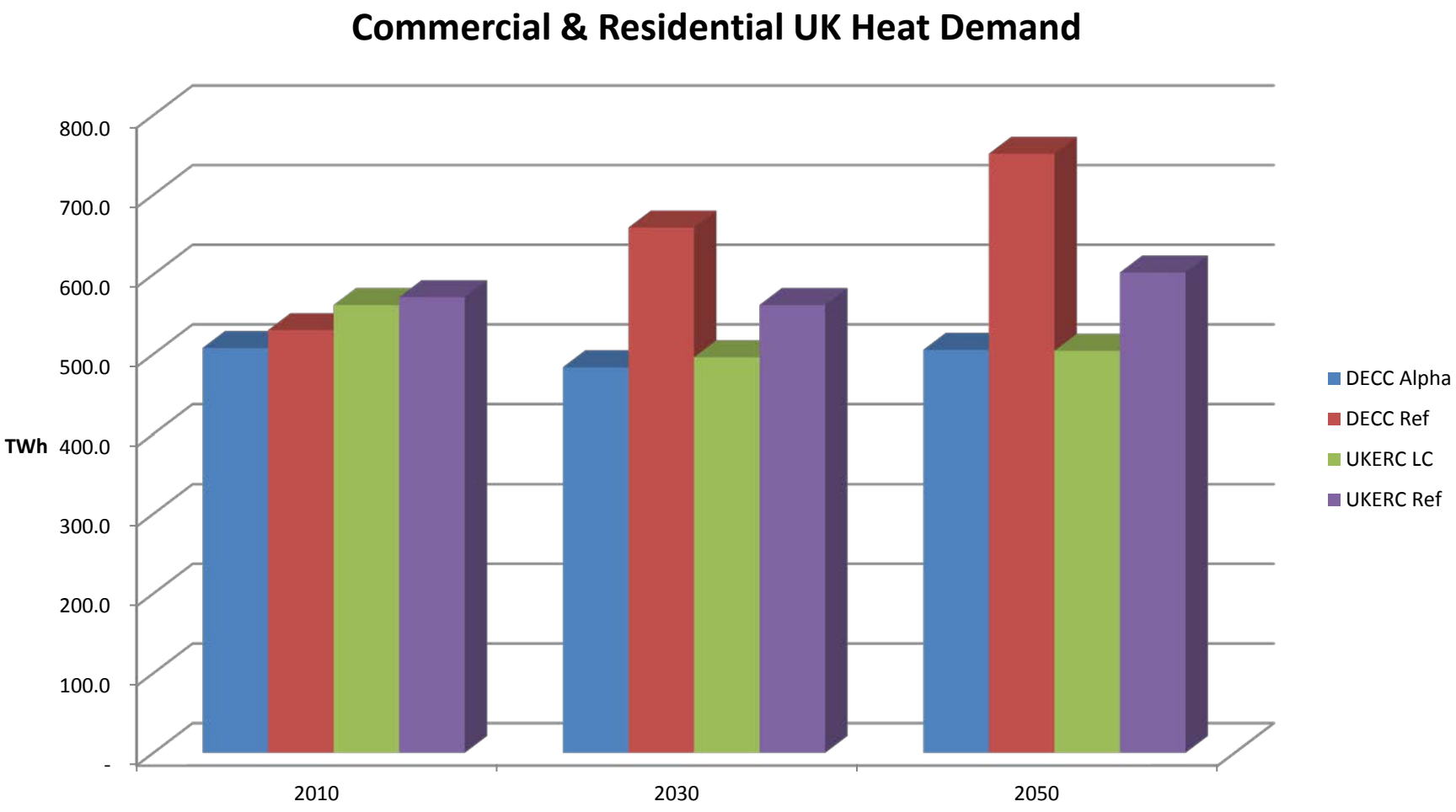
Imperial College London

Electricity Generation Mix



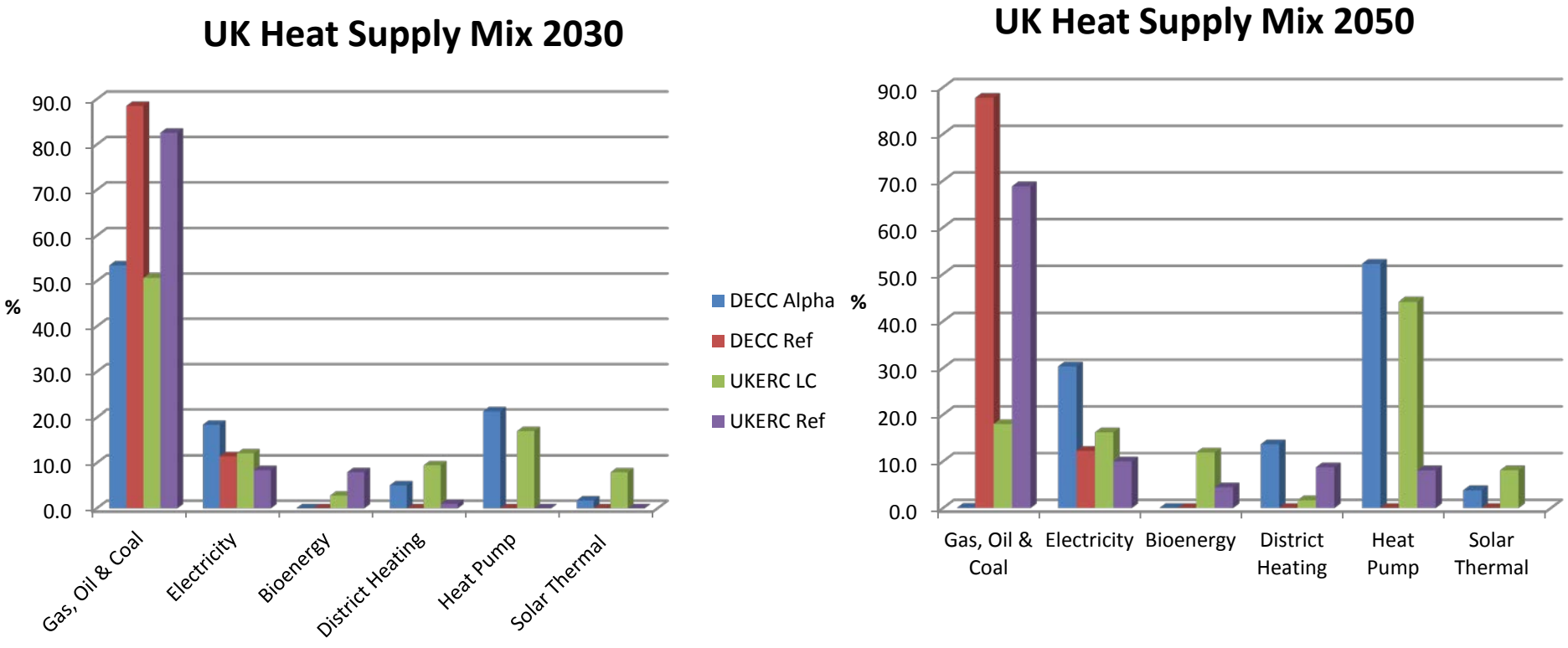
Imperial College London

Future UK Energy Heat Demand



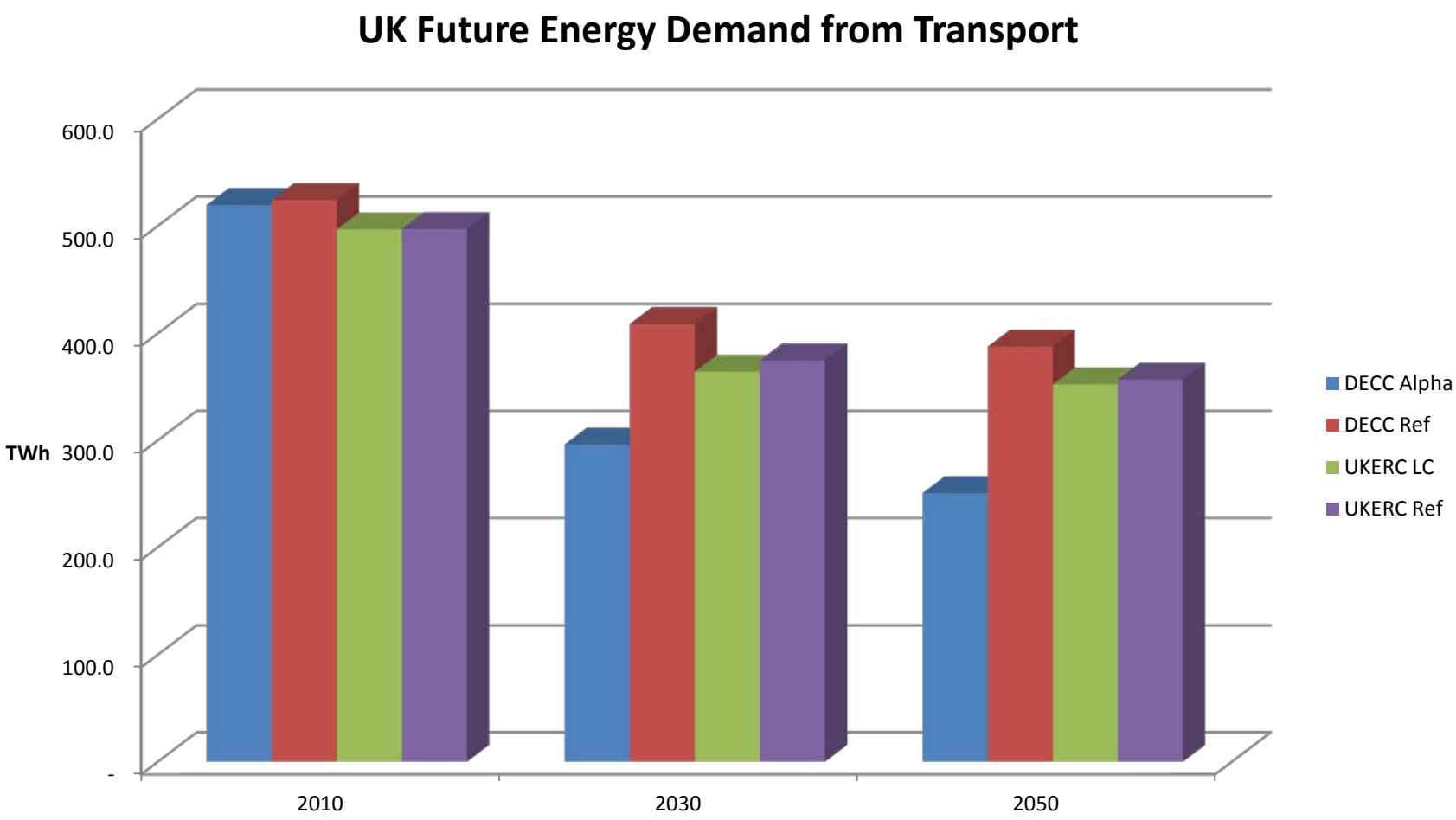
Imperial College London

Future UK Heat Supply Mix



Imperial College London

Future UK Transport Energy Demand



Imperial College London

Transport Headlines

Vehicle Efficiency Continues to Improve

2020 – 2030: Average emissions intensity of cars falls by 39% and vans by 33% (CCC)

2050: efficiency of ICE cars & vans improves by 54%; EVs by 37% and PHEVs by 50% (DECC) (i.e. a reduction in TWh/billion vehicle kms)

Distance Travelled Increases

2020 - 2030 - Distance travelled by car increases by 9% and van by 24% (CCC)

Imperial College London

Road Vehicle Mix

2030: Vehicle stock becomes electrified

Approx. 60-76% of new car & van sales electric (NG GG & CCC) and 30-35% of car & van kms by electric vehicles (CCC & TPs)

Mix of BEV/HEV/PHEV uncertain

Approx. 80% of electric vehicles are PHEV (CCC) **BUT** UKERC predicts 0% PHEV and 65% HEV

2050: Long-term future of electrification uncertain

Approx. 65% of car & van kms are by electric vehicles (TPs & DECC) **BUT** UKERC predicts 0% of journeys by electric vehicles, replaced instead by hydrogen, biofuel and diesel/biodiesel hybrid vehicles

2050: Uncertainty whether buses will become predominantly hydrogen fuelled *(CCC & UKERC)* ***or electric*** *(TPs & DECC)*

Imperial College London

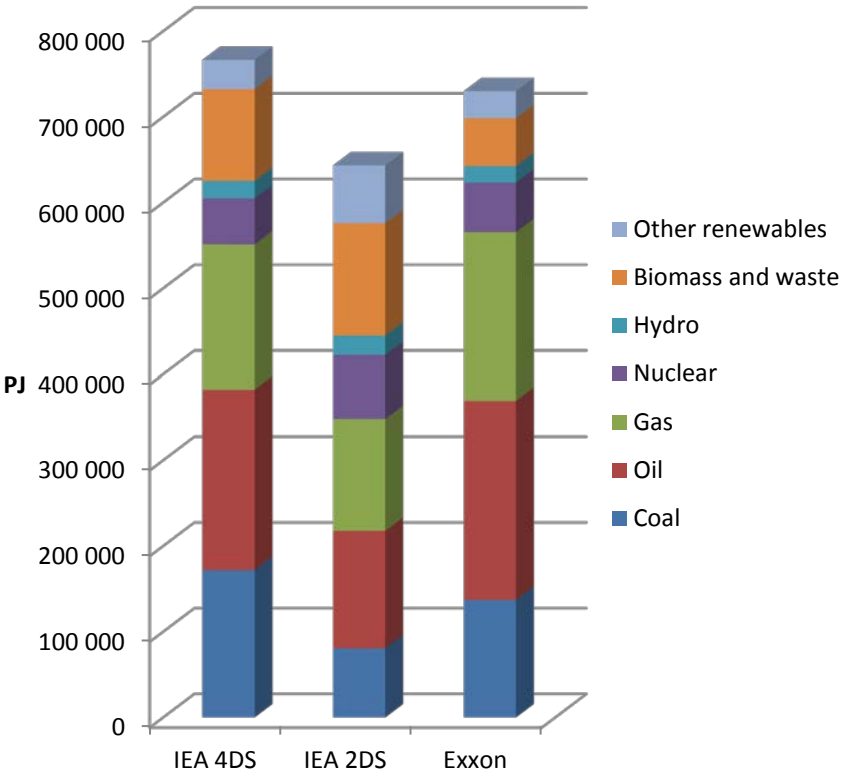
Energy infrastructure/smart grids

- Energy infrastructure plays an important role in fulfilling any low-carbon future scenario.
- Inflexible and intermittent generation must be balanced, by backup generation, flexible demand management, energy storage or a mixture of technologies.
- ‘Smart’ technology development and end-user acceptance is difficult to forecast.
- Interested in gaining views on this.

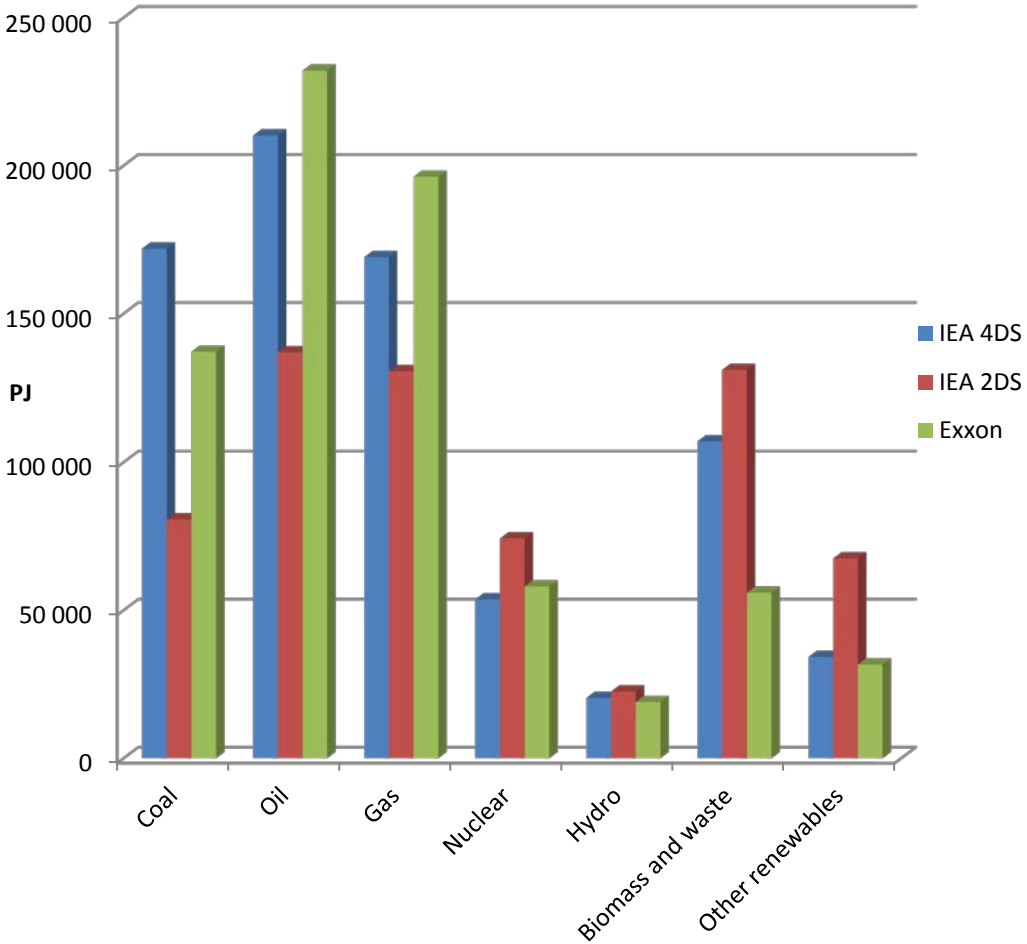
Imperial College London

Global context

2040 World Energy Demand



2040 Demand by Fuel



Imperial College London

Conclusions

- Nothing is certain!
- Some areas have high levels of convergence…
  - Need for energy efficiency and demand reduction
  - Need to decarbonise the electricity sector quickly
  - Nuclear, wind and CCS have parts to play, though in different quantities
- …and some do not
  - Little agreement on the mix of low-carbon heating technologies.
  - Role of battery-electric vehicles questioned
  - Disagreement on the quantities and role of natural gas in the system
- Very preliminary work!