Overview of Energy Scenarios

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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.
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
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
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%
Electricity Demand

UK Electricity Demand

- Decc Ref
- Decc Alpha
- UKERC LC
- UKERC REF
- RAE GF S3
- CCC
- NG GG

Electricity % of Total Demand

- Decc Ref
- Decc Alpha
- UKERC LC
- UKERC REF
- NG GG
- RAE GF S3
Electricity Generation Mix

Electricity Generation in 2030

Electricity Generation in 2050

- Gas
- Nuclear
- CCS
- WWT
- Coal+Oil
- Solar PV
- Hydro
- Imports

TWh

- Decc Ref
- UKERC REF
- Decc Alpha
- UKERC LC
Future UK Energy Heat Demand

Commercial & Residential UK Heat Demand

- DECC Alpha
- DECC Ref
- UKERC LC
- UKERC Ref
Future UK Heat Supply Mix

UK Heat Supply Mix 2030

UK Heat Supply Mix 2050
Future UK Transport Energy Demand

UK Future Energy Demand from Transport

- DECC Alpha
- DECC Ref
- UKERC LC
- UKERC Ref

TWh

2010 2030 2050
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)
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)
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.
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!