Building a Roadmap for Heat:
2050 scenarios and heat delivery in the UK

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ICEPT provides an academic hub for the interdisciplinary study of energy and the environment, specialising in the interface between technology and policy. ICEPT addresses key policy challenges, including climate change, energy security and energy for development.

The Centre for Environmental Strategy (CES) is an internationally-acclaimed centre of excellence on sustainable development. It takes a multi-disciplinary approach to the analysis of sustainable systems, integrating strong, engineering-based approaches with insights from the social sciences to develop action-oriented, policy-relevant responses to long-term environmental and social issues.

Overview

- Context: all-electric future
- Our brief: role of heat in 2050
- Energy flows under the all-electric future
- Developing an ‘integrated’ scenario
- Key Findings

Low carbon scenarios: 'all-electric' orthodoxy

- 'Low Carbon Transition Plan' to 2020 built on 2050 modelling work.
- Model runs present increasing share of electricity in 2050.

MARKAL Model Runs

- UK Energy Research Centre 'Energy 2050'
- Committee on Climate Change 'First Report'
- Department of Energy and Climate Change
- Department of Environment Food and Rural Affairs

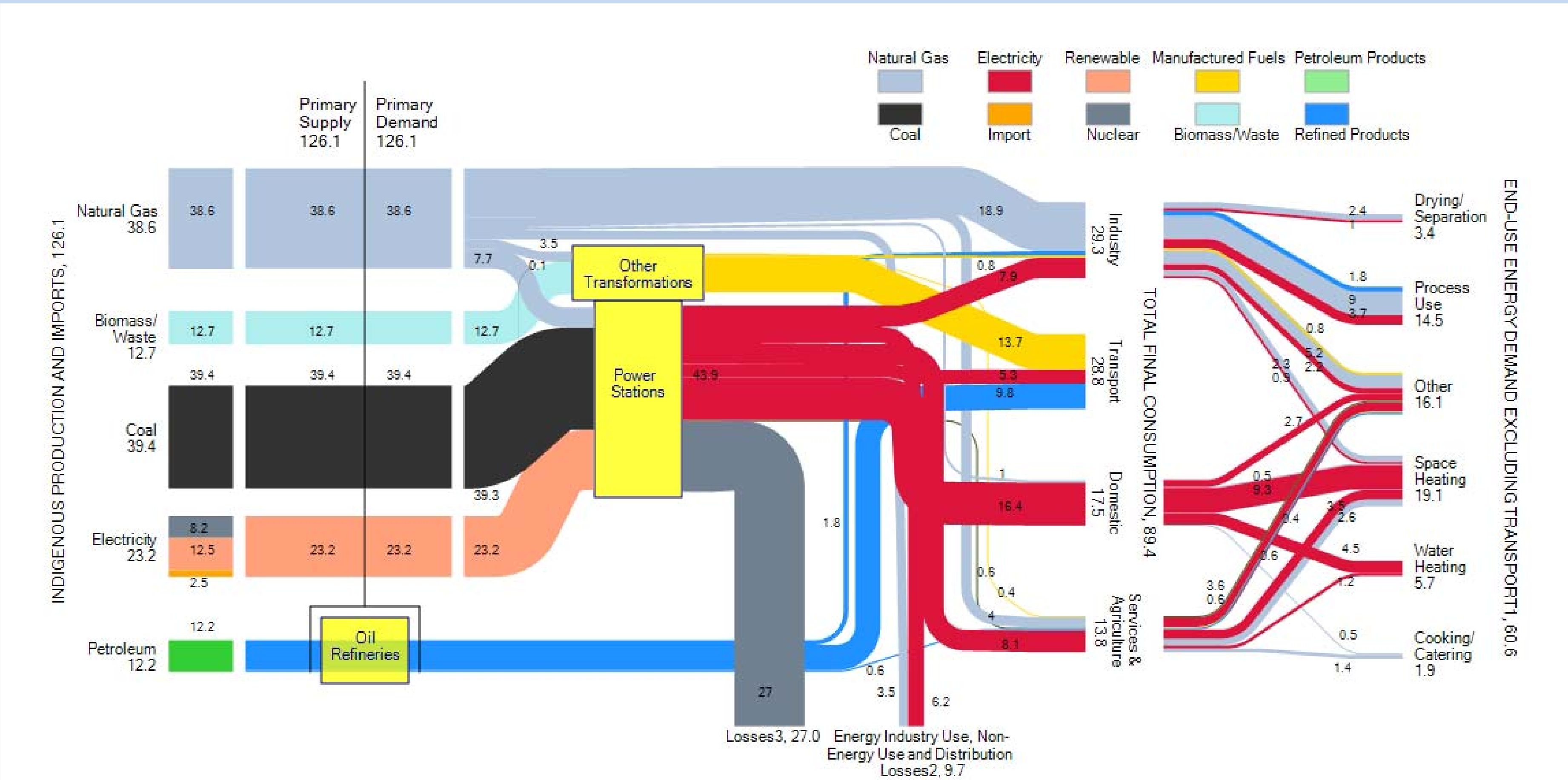
Our Brief

- Examine the role for heat in 2050
- Examine the ‘all-electric’ orthodoxy
- Discuss practicalities of implementation
- An open brief

Interpreting the 'all-electric' future?

- CCC 80% scenario as a proxy
- Examine its results in terms of:
  - Primary energy in
  - End-uses
  - Interpret transmission and distribution losses
- Represent in 'energy flow' (Sankey) diagram

Energy flows in the CCC 80% CO_2 reduction scenario



Challenges for the all-electric future

- Managing power flows and peak loads
  - Peak electricity demand and resistive heating
- Managing intermittency
  - High renewables penetration in future confounding issues of peak load management
- Build rate for new low carbon generation
  - 27 GW coal; 23 GW gas; 13 GW nuclear; 35 GW RE
- Installing heat pumps and insulating homes

An ‘integrated’ scenario

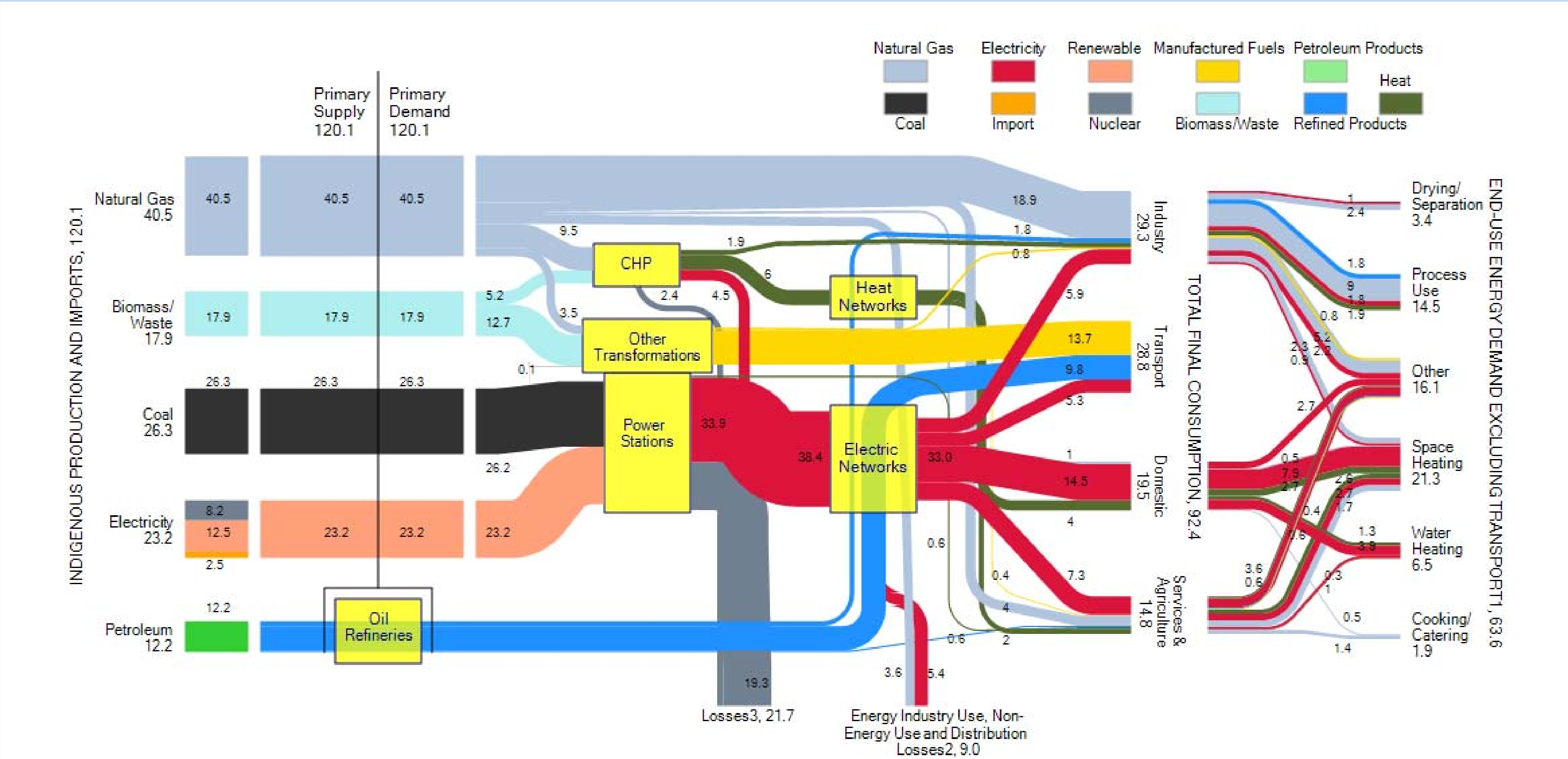
Can we diversify delivery of heat through use of CHP and DHNs?

- Can we decarbonise CHP?
- Can we source biomass to fuel low carbon CHP?
- What are the practicalities for CCS CHP?
- How big a role can DHNs play in 2050?
- How much industry energy and heat demand can be collocated in 2050?

Quantifying the 'integrated' scenario

- DHN potential
  - Calculated using GIS maps of heat demand and assuming heat transmission networks at power station locations
- Biomass potential
  - Estimated increase in biomass potential derived from literature
- Industrial potential
  - Again estimated from literature
- Conservative in all cases

An ‘integrated’ scenario



Benefits of a diverse scenario

- Reduced peak electricity load
- Increased mitigation of intermittency through heat storage and system diversity
- Primary energy demand down 5%; demand for electricity down 13%; 9 - 14 GW coal eliminated
- Reduced end-user disruption associated with installation of heat pumps

Key Findings

- The ‘all-electric’ future
  - Is low carbon but potentially hard to deliver
  - Creates problems: build rate, power flows, end user issues
- Synergies through diverse heat delivery are possible
  - Combination of technologies can overcome criticalities
- No route to low carbon heat is problem free, but diversity brings benefits
- Policy for low carbon heat should create and maintain options, maximise diversity

Thank You

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