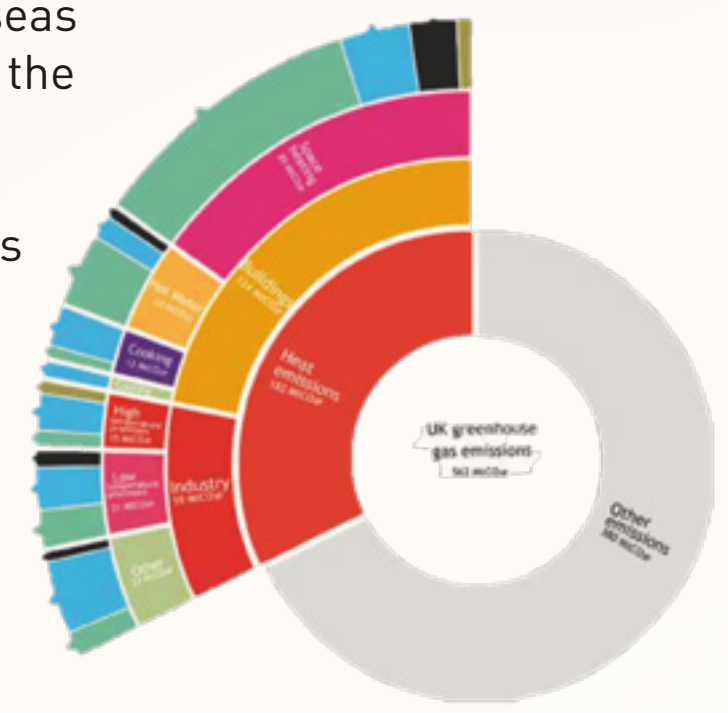


# Heat and the City – RCUK Energy and Communities

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## PROJECT MOTIVATIONS AND METHODS

- Research addressing 'the missing middle' – city-scale action for sustainable energy
- As much as 80% of final energy demand is concentrated in densely populated cities and urban areas
- Currently we waste a lot of heat, much of which we pay for, from leaky buildings and industrial emissions into the atmosphere, rivers and seas
- Policy evaluations suggest potential for district heating to be part of the solution for cities
- Our data focus on 'what works' and why
  - Interviews with 159 practitioners (local and central governments and agencies; legal, finance and engineering experts; supply chain businesses)
  - Ethnography of policy and project developments
  - Household surveys of experiences of district heating retrofit in two low income areas
  - Documentary and secondary data analysis
- Knowledge exchange: UK District Energy Vanguards Network



UK Greenhouse Gas Emissions. Source: DECC 2012<sup>1</sup>

## DISTRICT HEATING TECHNOLOGY

- Insulated pipework delivering heat for space and water heating to multiple buildings
- High cost, long lived infrastructure
  - Set against low cost heat sources
  - Speculative investment difficult: need a user base and long term guaranteed revenues
- Can play a balancing role for increasingly inflexible energy systems (renewables, nuclear)
- Source agnostic – many sources of heat may feed in



DH pipes before being laid in Edinburgh Wyndford energy centre, Glasgow

## HEAT SOURCES

- Industrial surplus heat can be used, but operators reluctant to be supplier of last resort for users
- Recent regulation encourages thermal power generation to supply heat, but has had no effect
  - EU Energy Efficiency Directive weakened to require cost benefit analysis only
  - UK Environment Agency guidance recommends 16% rate of return for project appraisal – far higher than heat networks typically produce
- Most UK urban projects use small scale gas CHP,
  - Marginal carbon savings over short term
  - Policy envisages replacement with lower carbon sources as electricity decarbonises

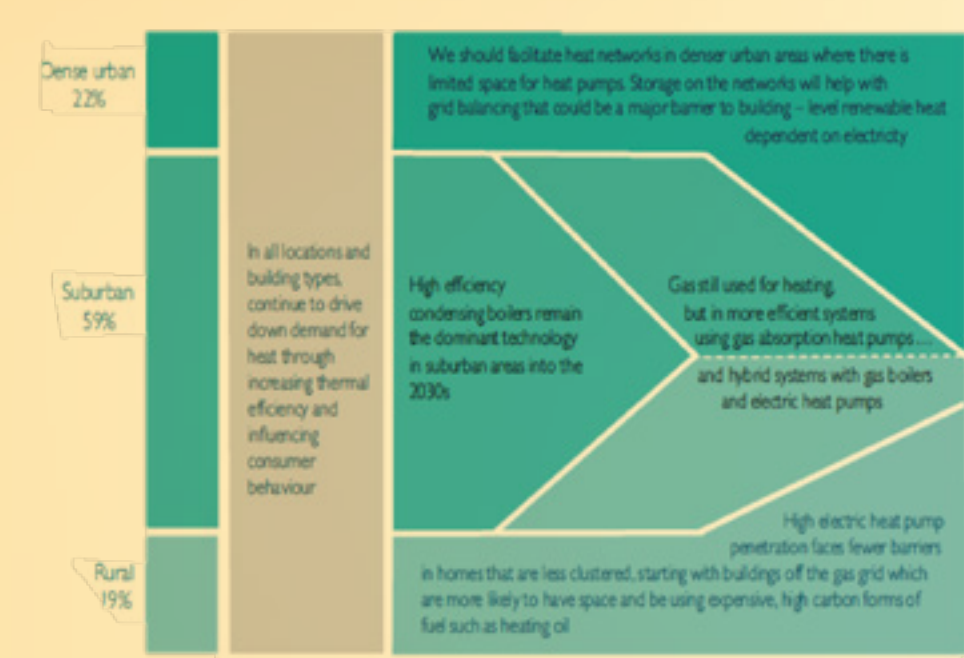


Biogas CHP at North British Distillery Caledonian Power Station<sup>2</sup>

*“The concept of a city being an energy manager, setting up an ESCo, was ... remote from both senior director and political party interests”*

## CENTRAL GOVERNMENT

- 'The heat challenge is a "systems problem" and can be addressed at different levels ... it cannot be fully solved by considering one part of the solution in isolation' (DECC, 2013, p.8)
- Early emphasis on electrification has shifted to more technologically diverse options
- Ofgem and Treasury roles centred on 'dismantling market barriers' for low carbon projects geared to commercial rates of return
- Support focuses on identification of opportunities
  - Heat mapping
  - Consultancy procurement



Strategic Framework for Low Carbon Heat in Buildings. Source: DECC 2013<sup>3</sup>

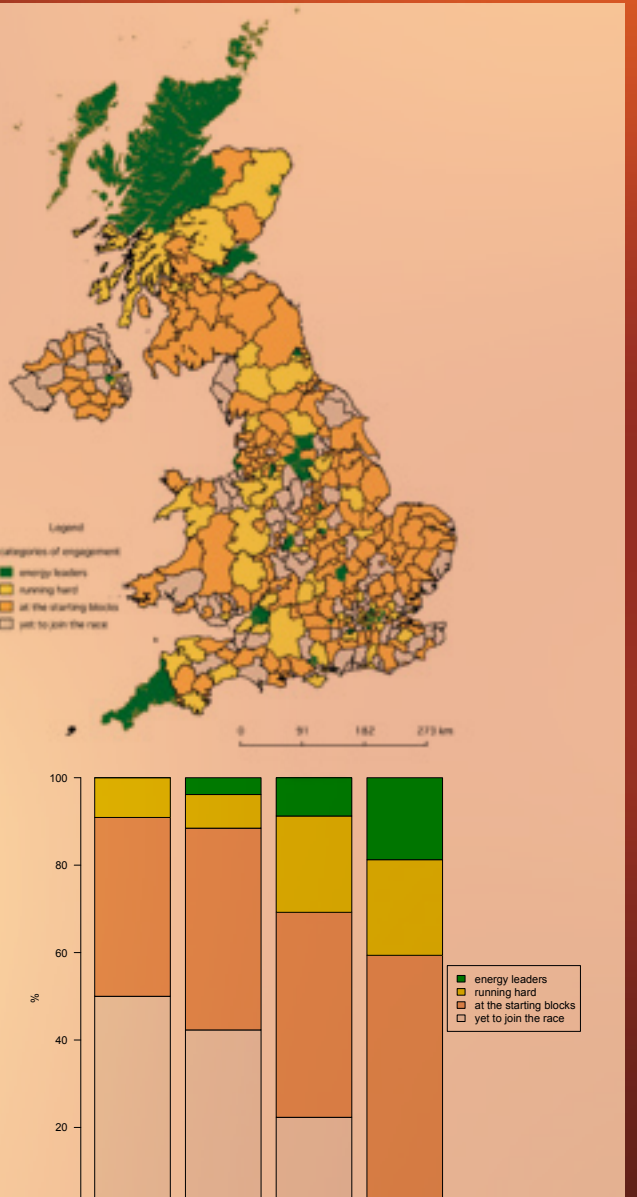
## CURRENT HEAT NETWORK PROJECTS IN THE UK

- Niche opportunities conditioned by
  - Voluntary participation
  - Access to finance (e.g. ECO grants)
  - Willingness and capacity of complex organisations to coordinate development and investment
- Fragmented, incremental development
- Campus-based systems (hospitals, universities) which then struggle to integrate with wider patterns of heat demand
- Social housing as stand-alone system
- Public sector performance measures such as best value tend to work against local collaboration
- Structured as financial opportunities
  - Generating returns on investment
  - Absorbing low carbon subsidies and government loans
- Construed as natural monopolies and commonly operated as vertically integrated systems



## UK LOCAL GOVERNMENT AND HEAT

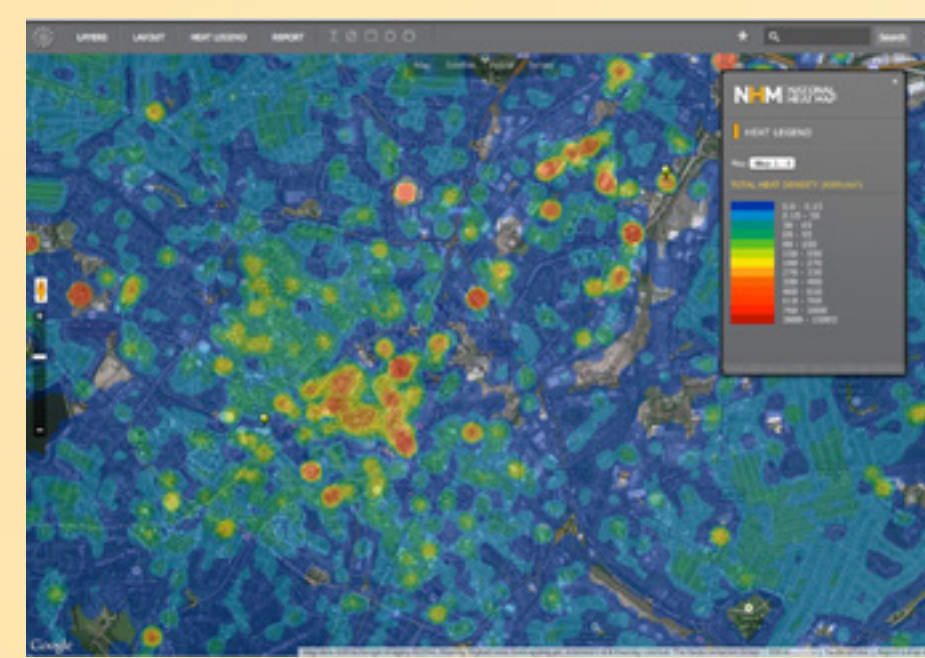
- Expected to coordinate translation of heat policy into local and cross-sectoral solutions
- Councils struggle to configure capacities and resources for low carbon heat development
  - Shrinking, centrally-controlled budgets, limited discretion and no direct powers over energy
  - City councils are increasingly commissioning, rather than service providing, bodies
- Patterns of local authority engagement vary across the UK
- Projects rely on 'coalitions of the willing'
- Committed actors discover multiple rationales for community energy
  - Economic regeneration
  - Housing stock upgrades to improve revenues
  - Affordable warmth
  - Energy from waste
  - Avoided costs
- Teams devise diverse business models and risk allocation



UK Local Authority Engagement in Energy Systems<sup>4</sup>

## HEAT NETWORK DEVELOPMENT REQUIRES COLLABORATION BETWEEN MULTIPLE PARTIES, BUT MEANS OF COLLABORATION ARE ELUSIVE IN A LIBERALISED SYSTEM

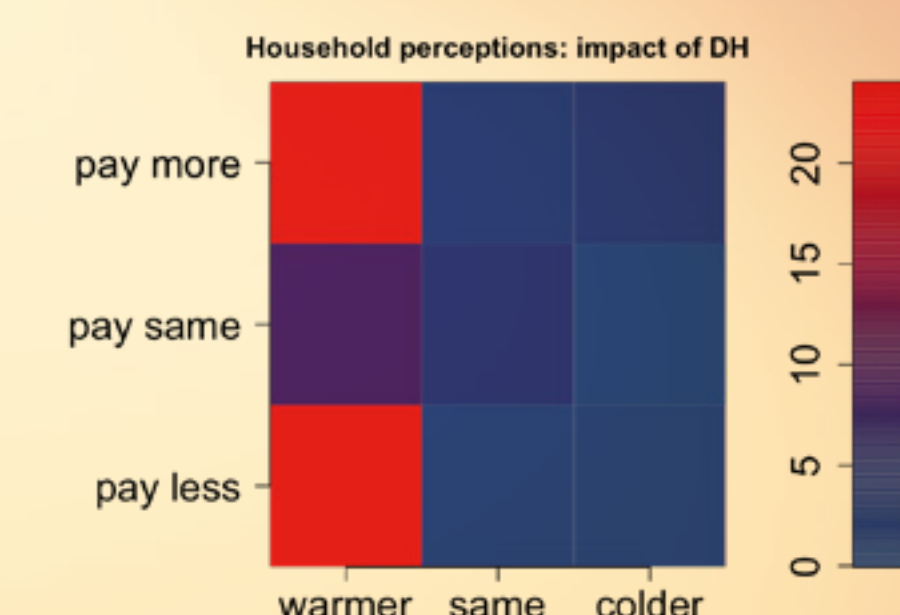
- Most energy assets are owned by large corporations and expected commercial returns remain too low to create financial incentives for big companies
- Utilities and institutional investors seek investment opportunities many times greater than the scale local authorities have been able to organise
- Heat is unregulated in the UK, contributing to investor uncertainty
- Industry-led, voluntary models of regulation emerging
  - Consumer protection and technical standards
  - No regulatory support for coordination of local user base



National Heat Map - Birmingham

## DOMESTIC USERS AND DISTRICT HEATING RETROFIT

- We interviewed 10% of households on a Glasgow estate where electric storage heating was replaced with a heat network
- Before the upgrade, most complained of being cold all or most of the time in winter, despite many spending 25% or more of their income on electricity
- The new system resulted in major increase in satisfaction with heating
  - for tenants this has leapt from 24% to 70%
  - 80% now say they were never cold during winter (compared with 8% the previous year)
- The cost of keeping homes warm is lower, but on average energy bills have not fallen
  - Households spending more on heat in the past tended to save under the new system
- Transition to new heat metering, billing and payment has caused problems for a number of residents
- District heating can improve people's quality of life, while reducing carbon emissions, but more work is needed to address affordability for all



## KEY CHALLENGES

- Policy has shifted over time, positioning heat as a systems problem.
- But current patterns of development are not systemic; even those local actors wanting to 'think big' end up 'acting small'
- This is because
  - They end up organising financial opportunities rather than systems of collective consumption
  - There is no clarity over lead responsibility for co-ordination of multiple parties
  - Knowledge and expertise is fragmented and there is a lack of public sector capacity
- The small scale and incremental character of heat networks is in tension with
  - Complex centralised energy markets and regulation
  - Utilities' objectives, sunk investments, business models
  - Market incentives and regulatory frameworks which prioritise large scale, centralised infrastructure

<sup>1</sup>UK Government Department of Energy and Climate Change (DECC), 2012. The Future of Heating: A strategic framework for low carbon heat in the UK. Crown Copyright. © DECC, 2013. The Future of Heating: Meeting the Challenge. Crown Copyright.  
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