

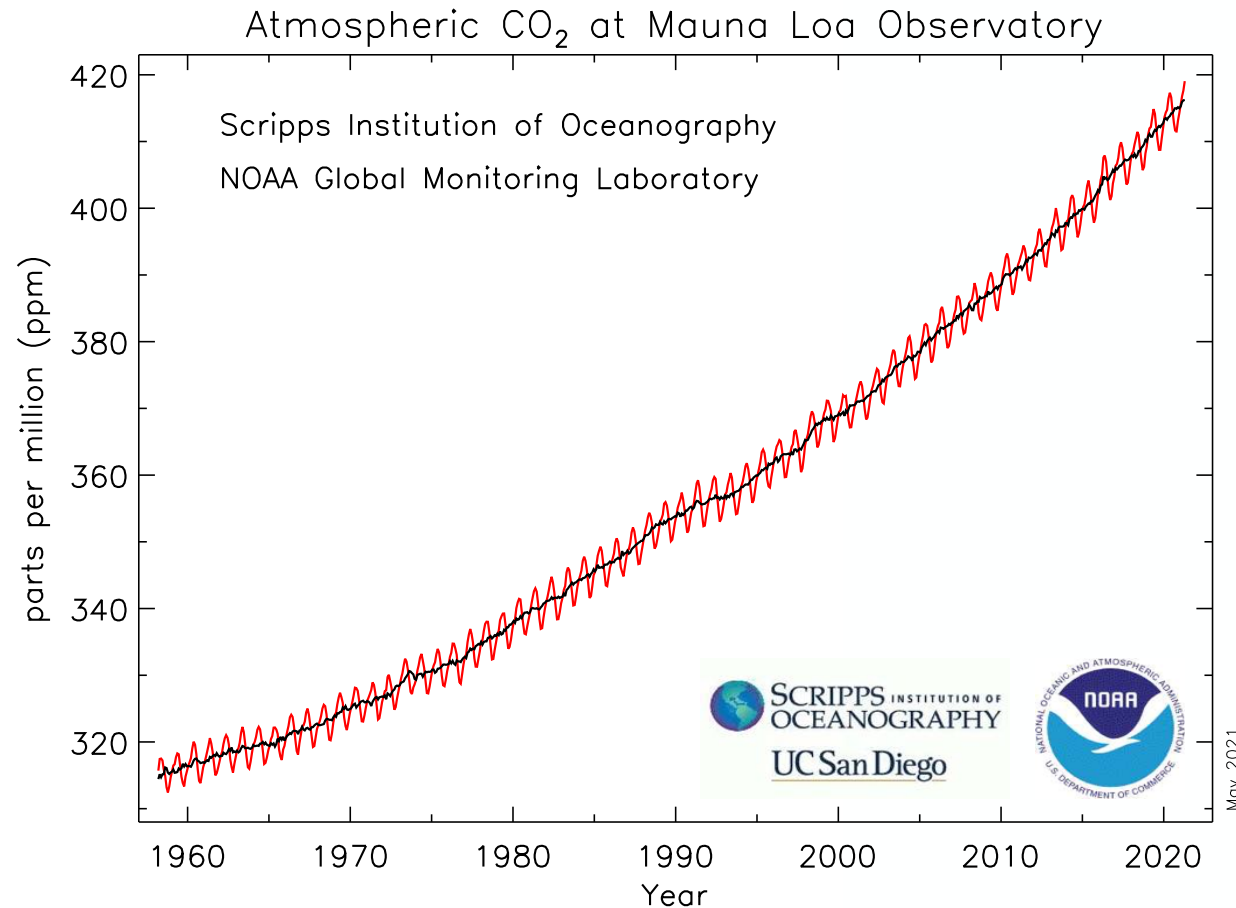
Local Energy in the UK: Social Science Perspectives

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University of Edinburgh

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Research stimulus: Climate Emergency and UK Energy Transition



UK:

Net-zero carbon by
2050

Reduce carbon
emissions by

- 78% 2035

Scotland:

Net-zero carbon by
2045

Reduce carbon
emissions by

- 75% by 2030
- 90% by 2040

Climate Change Inquiry 2011

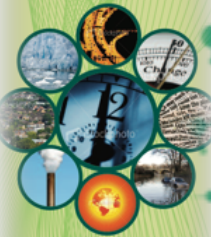
The risks posed by climate change are so large as to challenge the way humankind lives and exploits the planet's resources. Implementing the massive changes involved requires restructuring society and economy to prioritise low-carbon energy, zero waste consumption and industrial production based on recognition of finite natural resources.

Sugden, Webb & Kerr, 2012

RSE *The Royal Society
of Edinburgh*
KNOWLEDGE MADE USEFUL

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facing up to
**climate
change**



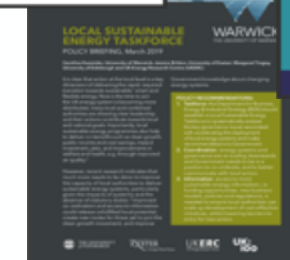
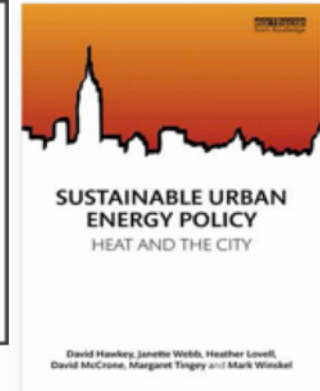
THE ROYAL
SOCIETY
OF EDINBURGH

The Research -



HEAT AND THE CITY

www.heatandthecity.org.uk



District Energy Vanguard

Scottish Heat Network Partnership

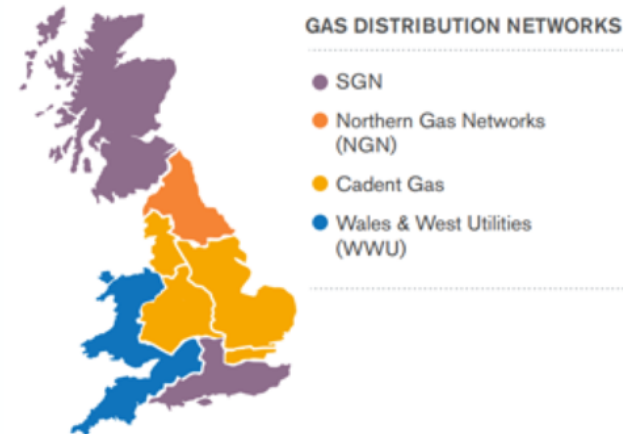
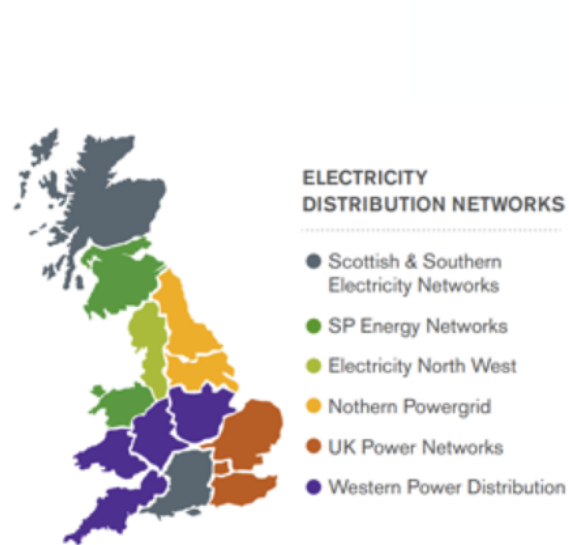
IEE Stratego heating and cooling plans

Image credits: Edinburgh Uni; Routledge; IPPR; Warwick Uni

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UK Energy System – large scale electricity generation & extensive methane gas grid

- Post-1945 focus on macro-economic planning for growth & welfare
 - Sought economies of scale through nationalising municipal & local energy
 - 1960s planned conversion and expansion of gas network from coal to methane
- 1980s efficient market hypothesis
 - 1980s-1990s privatisation of centralised gas and electricity systems



21st Century Turn to Local Energy? The Proposition



‘To enable a *cost effective* low carbon transition, more *advanced* local area energy *planning* is needed to ensure the *right solutions* are implemented in the right place, at the right time’

- *Whole* system services from integrated *local* energy systems
- Easing transition – 7Ds
 - More **distributed, decentralised** technologies for **decarbonising** heat
 - Heat networks with gas CHP & waste heat sources
 - **Digital** infrastructure for local systems’ integration providing efficiencies, flexibility and reduced **demand**
 - More **diverse** business structures/mixed market including local ownership
 - More participative **democratic** control
- Local government Climate Emergency Plans aim for 100% renewable energy for local benefit

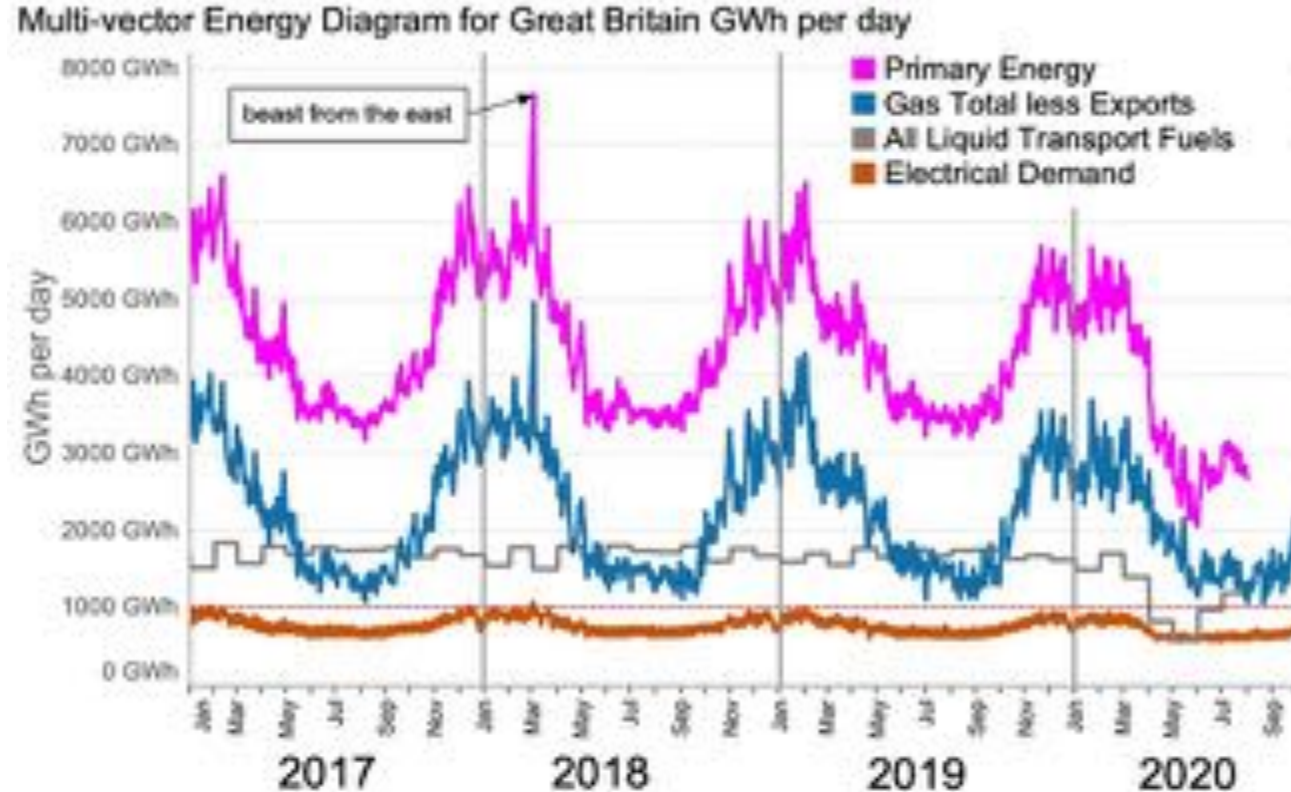


Scotland's Energy Efficiency Programme
Local Heat & Energy Efficiency Strategies and
District Heating Regulation

Ross Lowridge
Head of Industry & Heat
Regulation and Emissions
Trading



The Case for Local: *Heat* Supply and Demand

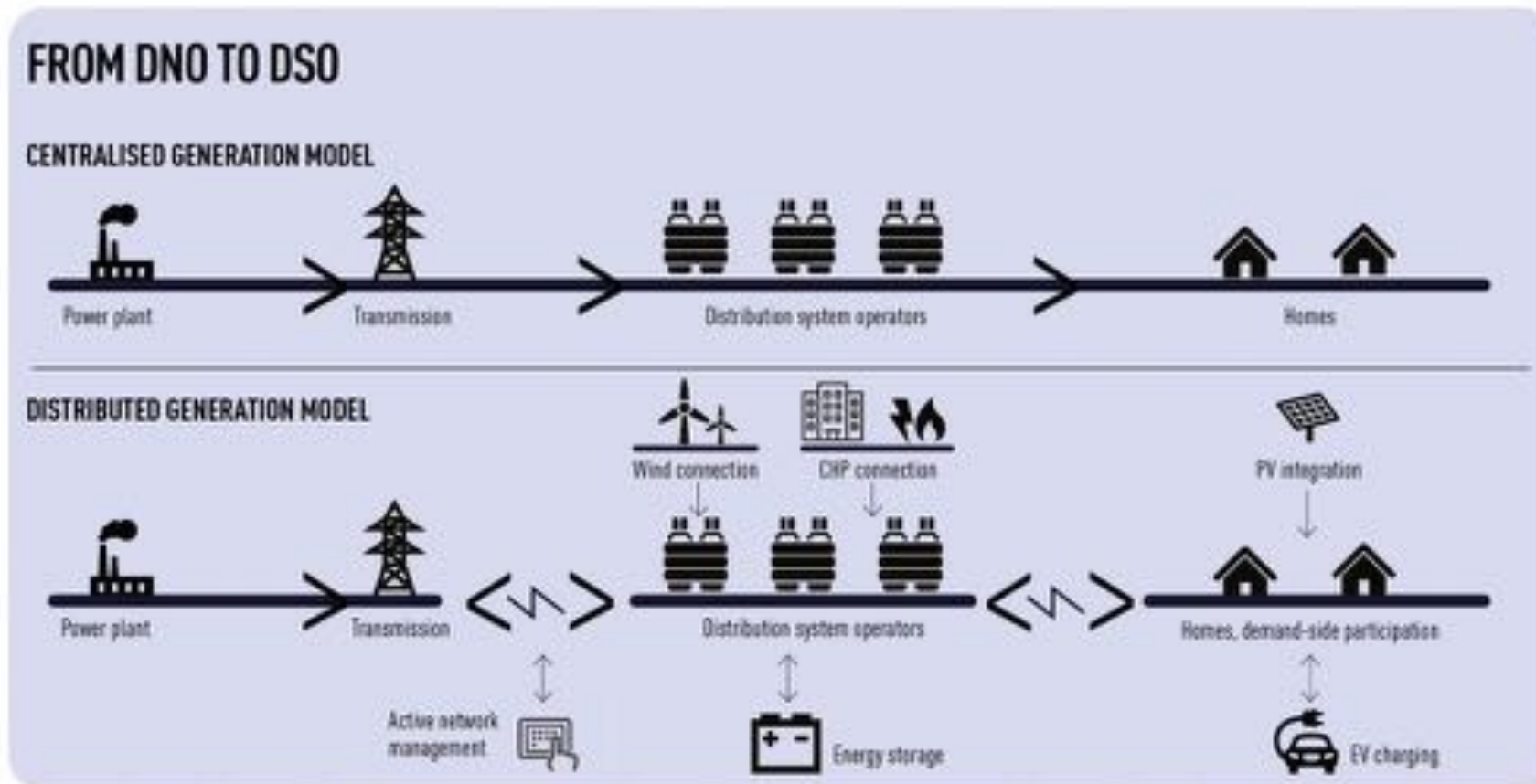


UNIVERSITY OF BIRMINGHAM | BIRMINGHAM ENERGY INSTITUTE

Underlying data are from National Grid, Elexon and BEIS
Figure created by Dr Grant Wilson: i.a.g.wilson@bham.ac.uk
Energy Informatics Group, University of Birmingham
slidepack available from <https://doi.org/10.5281/zenodo.3930979>

A Changing Electricity Mix

- Approx 40% of GB renewable generation is connected to *distribution networks*
 - Not designed for active management of supply
- This embedded generation is treated by Transmission Grid Operator as *demand reduction*
 - It reduces the amount of electricity to be delivered by the transmission network to meet total demand
 - But supply is variable and intermittent



<https://utilityweek.co.uk/dso-transition-must-accelerate/>

Local Energy Funding Patchwork

Energy Revolution £102m Industrial Strategy Challenge

Prove investable, scalable local business models by 2022 for

- Cleaner, cheaper energy services
- More prosperous & resilient communities
- Benefit to the whole energy system
- Integrated, intelligent services
 - Heat, power, mobility, storage

BUT limited local ref in 2020 UK Gov 10 Point Plan

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UK Gov Heat Networks Investment Project - £320m fund England and Wales.

Heat Networks proven reliable, cost-effective and low carbon means of heat, yet just 2% of British buildings connected.

UK Gov English Local Energy Hubs



Scottish DH Loan Fund and Low Carbon Infrastructure Transition Programme

Developing a Local Energy System – the Edinburgh Bio-Quarter Case

- Ambition: expansion of a university hospital site to globally competitive science park
- Greenfield development
 - Target GHG reductions 50% higher than building standards
- Cluster of two hospitals, university facilities, commercial buildings
- Nearby council facilities, social housing
- Local authority, Carbon Trust and Scottish Enterprise supporting
- Technical-economic options appraisal identified district energy and heat network as cost- and carbon-efficient *solution*



Edinburgh Bio-Quarter

- Organisations affirmed support for local heat and power system
 - But lack of specific information
- Technical and business models based on shared energy centre using gas CHP
 - Envisaged transition to heat supply from Energy from Waste plant under development
- Tested feasibility of *bounded* project
 - Return to finance 13%-15% with cost savings to users and GHG reductions
- New hospital a critical anchor load
 - Potential energy centre host
- During discussions, organisations also evaluating options for stand-alone systems

Arrangements at the hospitals

- Operational challenges to inter-dependent heat network
 - Any hospital downtime impacts on key targets (waiting times)
- Organisational challenges
 - Private Finance Initiative funding limits local flexibility

‘[The PFI SPV partners] have told us before and told the NHS that they do not wish to see any change in their risk profile and any change in their profit, because that will cause the banks major headaches, because they obviously... they’re buying into an income stream that they will project and if there’s any change... so for good or bad.’

Public procurement rules for new Hospital

'I think the NHS ... took the decision that in their view it was just... the certainties weren't there, and they felt because of that it couldn't be embedded within the procurement documentation. It was very, very disappointing for us'

Enterprise Agency Officer

- Timetable for NHS tender specification & infrastructure procurement
 - Narrow window of opportunity
 - Coordinated clean energy solution needed time to negotiate
- Any variation in procurement process subject to risk of challenge, and unwelcome precedent

‘Best sustainable local energy solution’ or single-user systems?

- Best value for public money imperative defined by organisational boundaries
 - Shared system feasibility analyses identifying financial savings prompted single-user options appraisals
- Single user system faced fewer procurement uncertainties
- Clean energy grants available
 - Organised by sector

‘Because [the grant funder] is giving the cash to ourselves it needs to be ring fenced around, [they] can’t be giving us money to enable somebody else.’

Reliance on voluntary collaboration

- But planning lacked a “problem owner”

There's no need for us to really interact with [university], and even less with [housing association]. [...] somebody has to bind all those people together, and you have to *bind* them together [...] first of all you have to force them to work together, and once you give them a common purpose, I think it will work, but it won't work naturally. We won't all come together

Even down at [bio-quarter site], you know, you just despair. [...] you can't even have a sensible discussion about integration because it is all your different stakeholders, different contracts. Unless you're legislated it ain't going anywhere

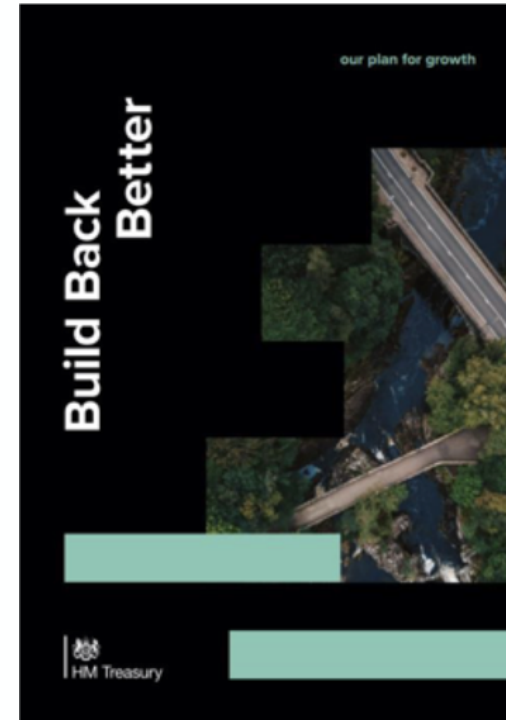
Case summary – the Collective Actor/Free Rider problem

- Technical-economic feasibility analyses:
 - Focused on the *local* organisations
 - Calculated returns to the *project* – non-existent economic actor
 - Noted wider local advantages but structured stand-alone financial case
- Organisations presented with feasibility
 - Are constrained by non-local *sectoral* performance rules & metrics
 - Seek to achieve best value delineated by organisational boundary
 - Perceive inter-dependencies in a local shared system as high risk
 - Do not need to collaborate in a shared energy business

Could policy relieve collective actor problems? – Local Government as enabler?

UK Gov CGS 2017 - Moving to a productive low carbon economy cannot be achieved by central government alone; it is a shared responsibility across the country. Local areas are best placed to drive emission reductions through their unique position of managing policy on land, buildings, water, waste and transport. They can embed low carbon measures in strategic plans across areas such as health and social care, transport, and housing (p118)

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UK Treasury 2021 - Delivering improved infrastructure, skills and innovation will be a joint endeavour between local authorities, combined authorities, the devolved administrations and the UK Government (p.25)

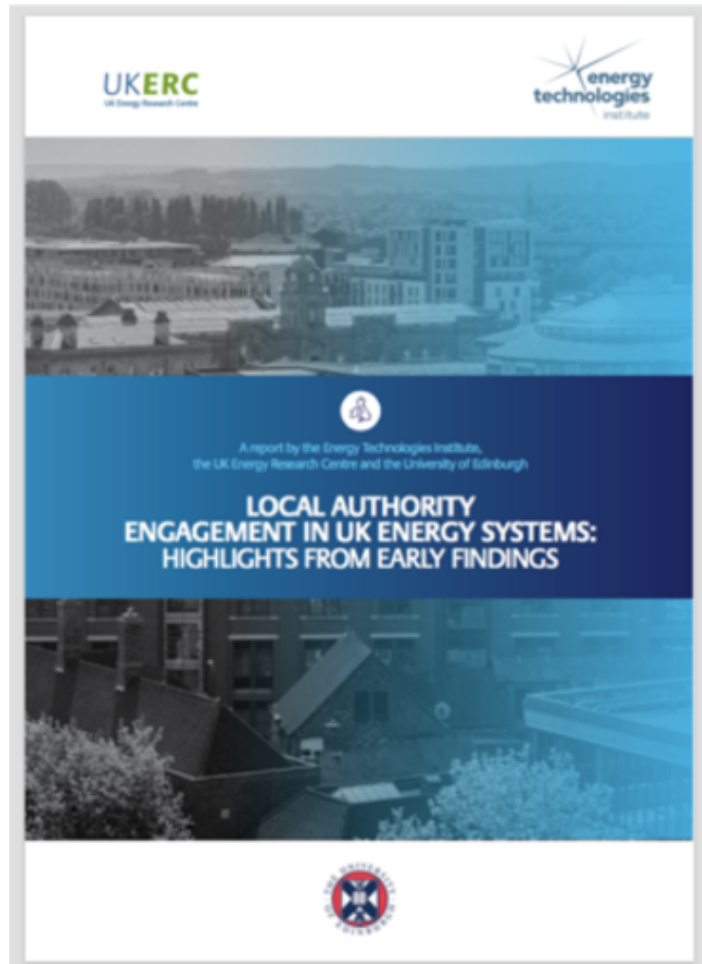
Local energy – a job for Local Government?

- ❖ Unavoidably committed to locality
- ❖ Democratically accountable
- ❖ Public engagement
- ❖ Expected to act on climate protection
- ❖ Planning and development powers
 - ❖ Transport, business & residential sectors = significant local dimensions
- ❖ Contract management
- ❖ Assets
- ❖ Cross-sector reach

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Local Authority Initiatives Research Phase 1 2017: mapping energy plans & investments across all UK LAs



Sources: Climate/Infrastructure Survey data 2012, 2013; National Statistics data 2013; NPSA data 2013; MPA data 2013.
Creative Commons Attribution 4.0 International License. Map created using QGIS (QGIS Development Team, 2016).

Widely established ambition, but small scale & uneven developments

Figure 1
UK Local Authorities According to Level of Engagement in Energy Systems

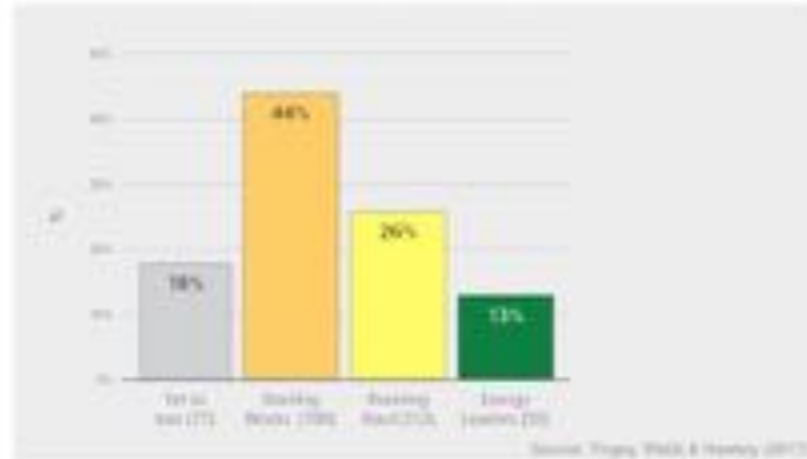


Figure 2
Estimated CHP Heat Output Compared with Overall Heat Demand Across the 'Energy Leaders' Areas (ordered by CHP heat output)

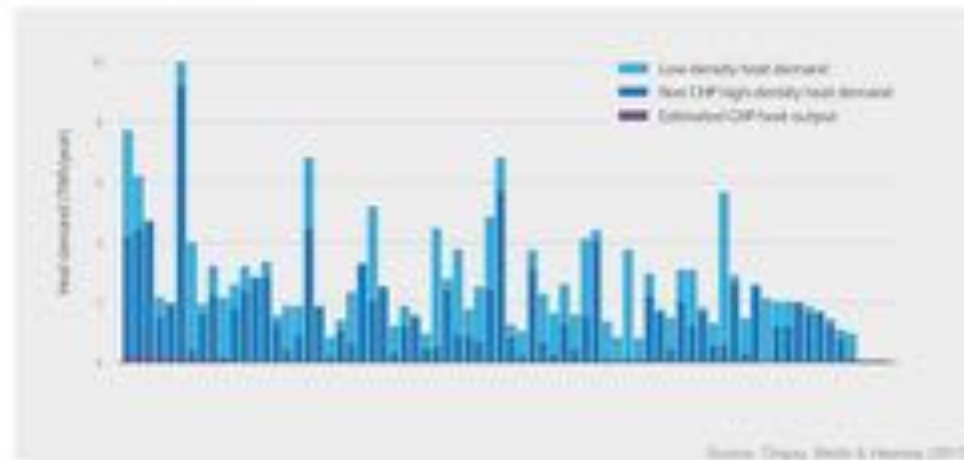
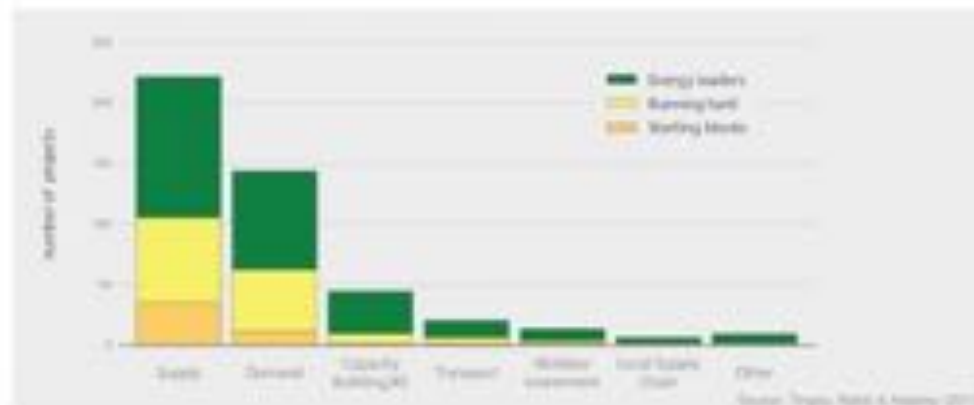
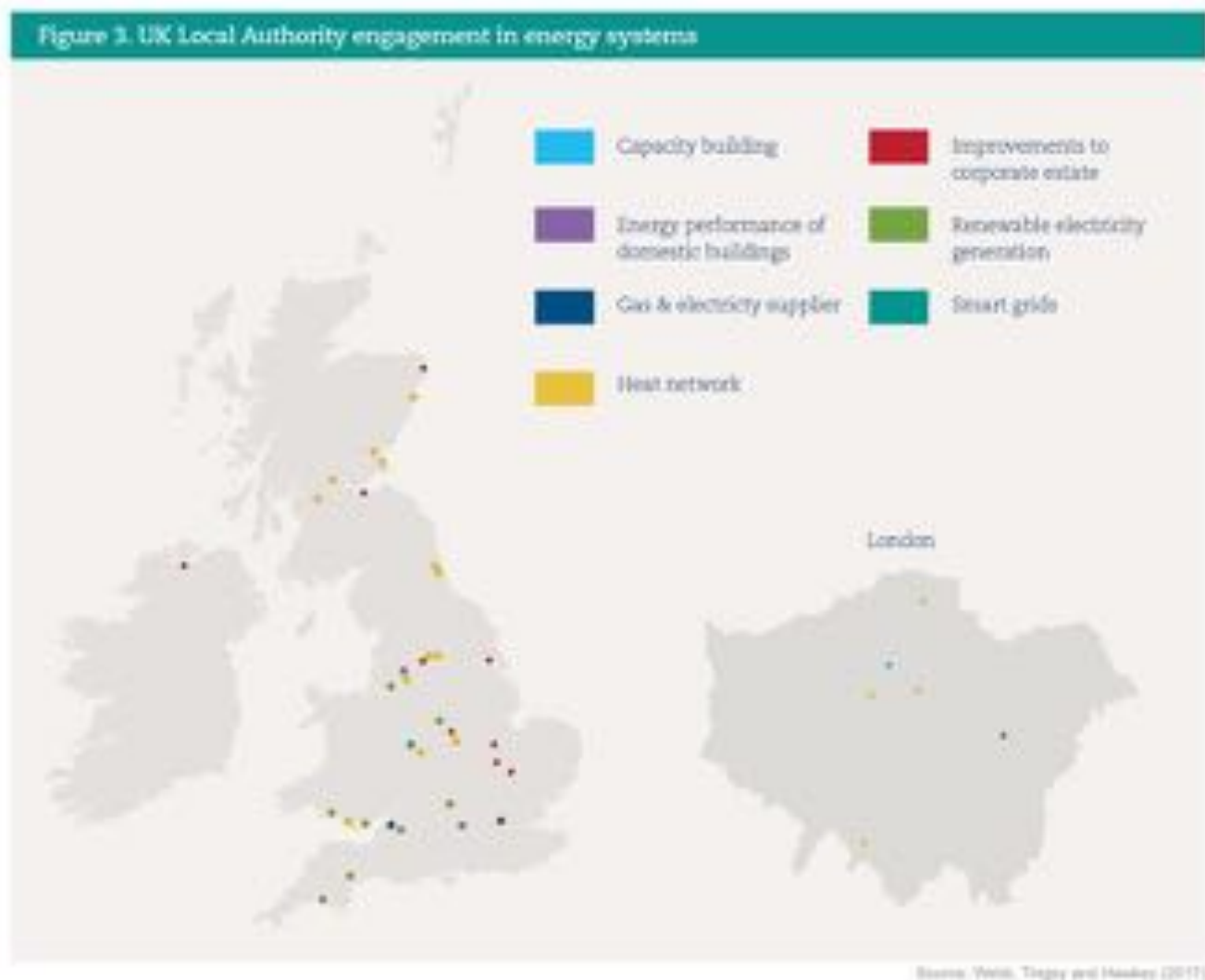


Figure 3
Number of Each Type of Energy Project and Category of Engagement



Phase 2: 40 local authority cases



Business structures

Table 6. The types of business structures adopted

Business structure	N cases
Direct management by council (with/without project partners)	25
Municipal ESCo	4
Private sector ESCo/SPV with a long term concession contract from a council	4
Community owned (Community Benefit Society and Industrial & Provident Society)	4
Business structure not yet established, but independent business intended	2
Total	39

- Contrasting business structures served similar purposes
- Structures adapted to local circumstances & expertise
- No direct relationship between technology and business structure

Figure 7. Types of projects according to business structure



Local energy businesses



Plymouth Energy Community

- Our primary mission is to give the people of Plymouth the power to transform how they buy, use and generate power in the city



- For the benefit of the citizens of Aberdeen



council homes and businesses around Leeds City Centre connected to heat network, providing low carbon heat and hot water, reusing heat from Leeds Recycling and Energy Recovery Facility (RERF)

Leicester District Energy Company

- supplying low-cost, low-carbon energy to major civic buildings and 3,000 homes across the city, cutting CO₂ emissions by 15,400t per yr



Local Authority Context: uncertain future & resourceful solutions

- UK centralised control over local governance
- No local energy powers or mandate
 - Projects stall
 - Heat and energy efficiency 'gap'
- Current local action
 - Piecemeal, incremental, small scale
 - High transaction costs
 - Higher cost of capital
- Austerity budgets
 - Skilled staff redeployed or lost jobs
 - Fragmented knowledge & expertise
- Short term funding cycles
- Priority on social care
- Contrast with Northern Europe
 - Significant local political and financial powers & municipal services

*in this era of
budget cuts all
over we have to
be extraordinarily
creative in finding
solutions*

Missing the opportunity for
locally integrated, energy
efficient, buildings, heat,
transport & storage systems

*We have a big role to play in this
[energy] agenda... There's obviously a
big transformation of local government
underway, and we must work differently
... we see the transformation of
Birmingham's energy system, and its
interactions with other service areas, as
a catalyst for delivering multiple
outcomes.*

Energy Officer, Birmingham City Council

Follow Up Research 2020 - Net Zero Carbon - Local & Regional Ambition

- Majority of UK local authorities declared Climate Emergencies
- And have plans **aiming** for 100% clean energy
 - sometimes integrating local heat, power, transport and storage, & reducing overall energy demand
- BUT new powers, resources & technical capacities needed
- A policy mandate for **net zero carbon localities** ?



Why? Accessing local & regional energy potential energy

Figure 1: Edinburgh's emissions reduction potential from investing in local energy.
Source: Williamson et al. (2019, 2020). Notes: Emissions include Scope 1 and Scope 2.



Payback

7.5 years

12.5 years

16 years

Value from investing in local authority skills & expertise

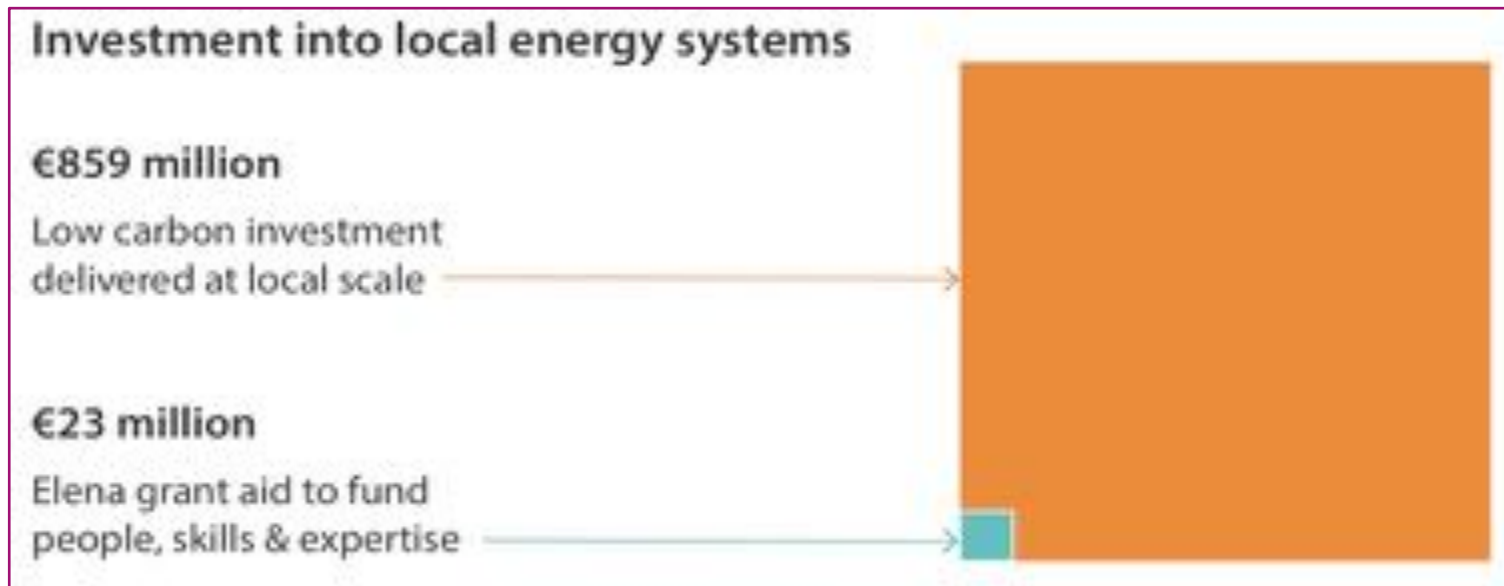


Figure 4: Scaling up local energy through investing in technical capacity within local authorities.
Sources: The ratios used here replicate the targets set by EIB for the sustainable energy category (1:20) and actual delivered investment ratio of the local Elena programmes (1:37) (EIB, 2019).



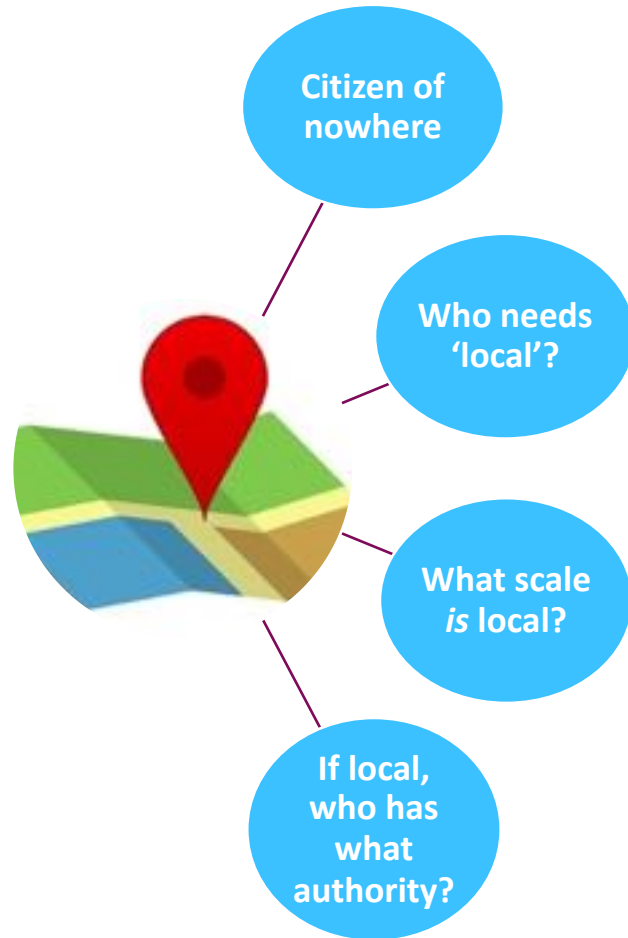
Key success factors – Local Authorities' Energy Investments



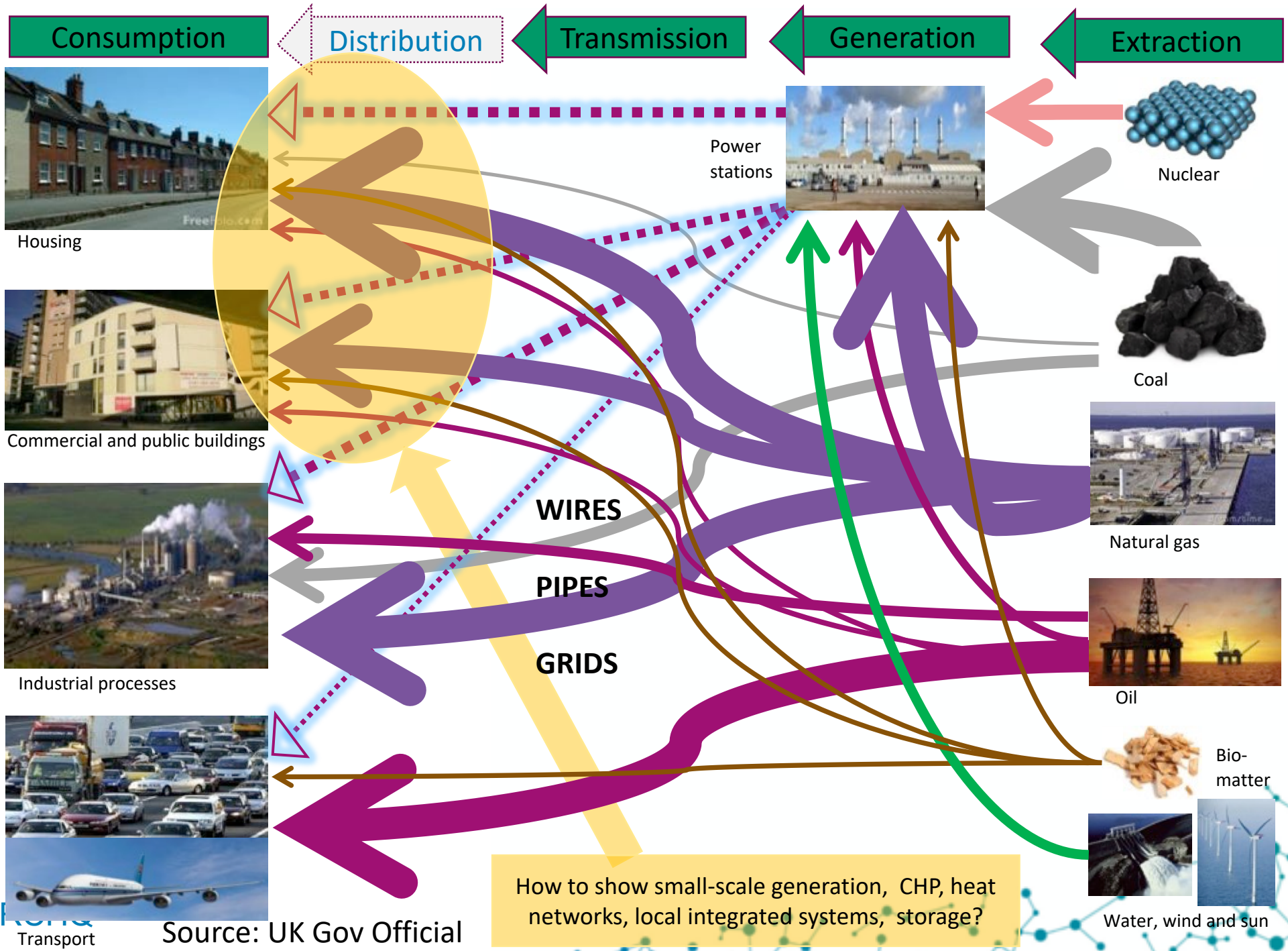
- A 'problem owner'
 - Energy and carbon committee and senior manager
- Enduring political commitment, combined with community action
- Officer skill in identifying and advocating the synergies between local energy, jobs & regen, welfare and environment
- Finance director willingness to integrate energy into local capital investment programmes, with revenue benefits
- Council willingness to use European (now UK...) regional investment funds to develop expertise to plan, manage and scale up local energy systems with partners
- Metrics to evaluate *all* local and regional public expenditure using net zero criteria



Value of *local* planning & decision making powers remains contested



intermediaries,
technical capacities
and resources for
any strategic local
energy planning



How to show small-scale generation, CHP, heat networks, local integrated systems, storage?

Conclusions and discussion

- In principle – UK commitment to integrated local energy for whole systems value
- In practice - coordinating multiple actors around local energy systems is challenging
 - UK liberalised market self-organising model particularly difficult with large scale systems pre-established
- Drivers for locally-integrated system not translated into case for users
- Local energy developers: “awash with feasibility studies”
 - Local energy ‘not bankable’
 - No route to solving collective actor/free rider problem
- Are cluster-based, financial package projects best means to achieving shared infrastructure and social goals?
- Could public policy and regulation relieve countervailing pressures?