Lock-in and lock-out: System interfaces, local networks, and the politics of low carbon transition

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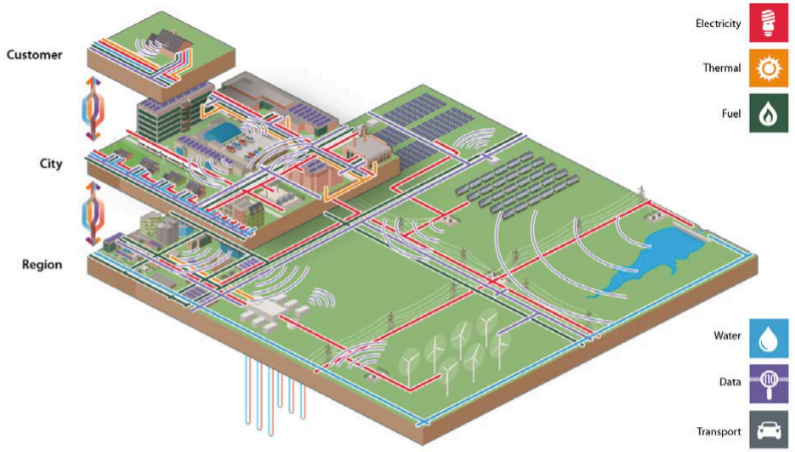
Research perspective

- Engineer by background
- Socio-technical approach to energy infrastructure and transition studies
- In-depth studies of network regulation, electricity markets, urban energy governance
- Publications in STS, innovation studies, energy policy & urban studies

Energy Systems Integration

- Emergence of Energy Systems Integration (ESI) as a field of inquiry
- Primarily an engineering problem framing – optimisation across systems

IIESI Vision



https://www.nrel.gov/docs/fy16osti/66616.pdf

Research questions

1. How are interfaces between different local energy networks and other infrastructures being reshaped

2. Who are the key system integrators?

3. Where and how is this emerging as a key site of technological ambiguity, contestation, and opportunity for radical innovation?

4. What are the synergies/tensions between different scales of energy systems integration

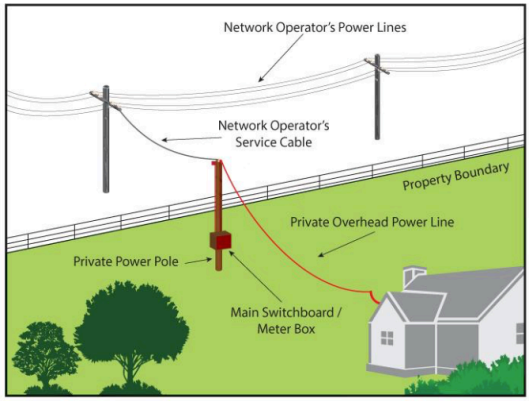
Couplings between local electricity and heat distribution networks

1. **CHP/DH in the UK: Lock-out of the market**:
   http://journals.sagepub.com/doi/abs/10.1068/a45575

2. **Lock-in to coal? Grid remunicipalisation and heat system transition in Hamburg**:
   http://www.sps.ed.ac.uk/research/research_centres/cross_school_research_clusters/reframing_energy_demand_innovation_for_sustainable_heat

Case 1: CHP/DH in the UK: Lock-out of the market

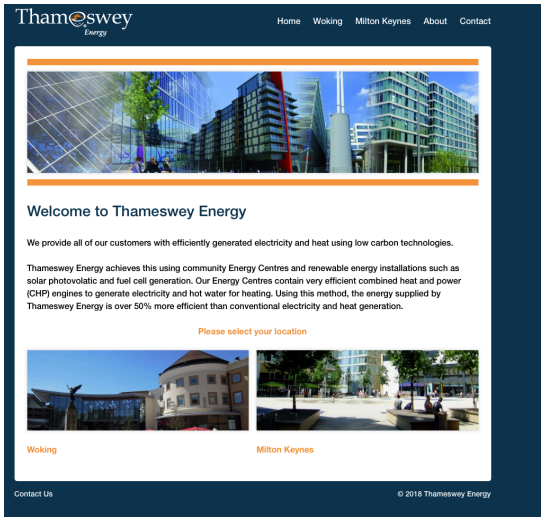
- Electricity revenue key to viability of district heating schemes
- Significant difference between the price per MWh in a PPA and retail price
- “Private wire” PPAs offer greater benefits
- Complexity and transaction costs of selling into wholesale market



https://www.commerce.wa.gov.au/energysafety/private-power-poles-and-lines-are-your-responsibility

Legal and regulatory aspects

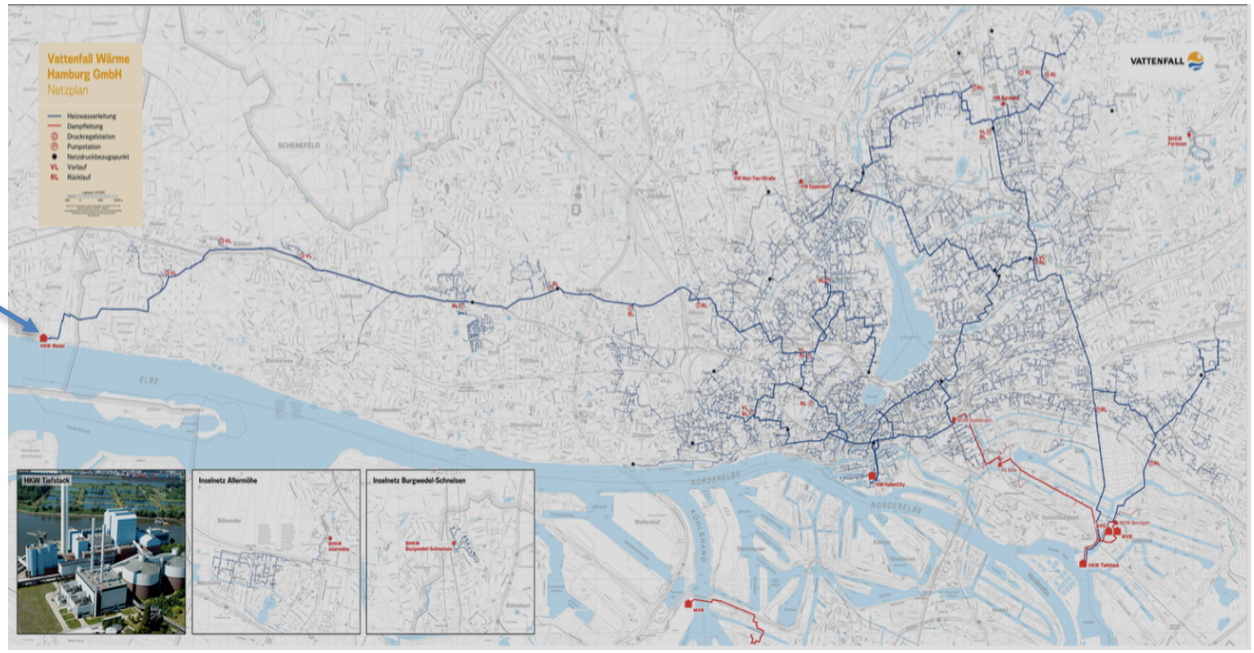
- Private wire via “Class Exemptions Order”
- Legal ambiguity: City-Works case
- “Licence Lite” option not taken up



http://www.thamesweyenergy.co.uk

Case 2: Heat in Hamburg

Wedel Plant



Source: Vattenfall

District heating

- DH = 21% of the city's heat
- 830km, the second largest in Germany after Berlin, and
- Connecting 475,000 housing units
- Coal CHP – 90% of DH supply

Wedel power plant

- Wedel is 300MW capacity – coal CHP
- Built between 1961-65 as an electricity-only plant by Hamburgische Electricitäts-Werke AG (HEW).
- Upgraded in 1987 to be CHP (2 generating blocks) and further upgraded in 1993
- Connected via a 23km pipe

Ownership

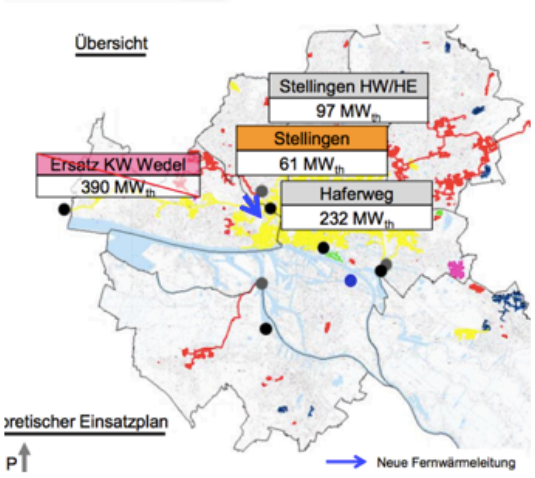
- Referendum to buy-back energy grids from Vattenfall in Sept 2013
- DH price still not agreed. Going to arbitration
- Wedel investment key to valuation of heating system – minimum price of e950m

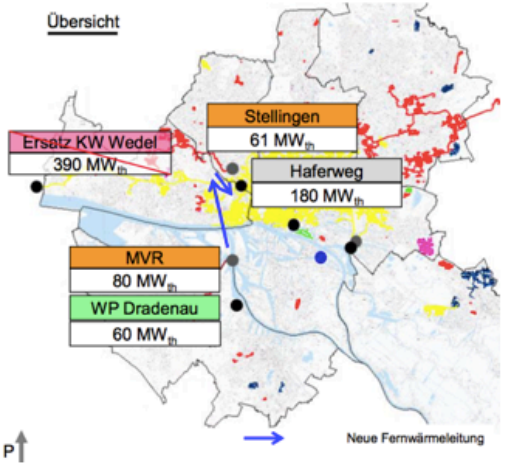
Wedel's future?

- Replace with gas
- Refurbish?
- Other options?

https://newatlas.com/azpa-green-mountain-power-station/27376/

Heat supply scenarios





Key factors:

- Political realignment and expertise
- Technology costs
- Wholesale power prices
- Heat system valuation

German power market

Electricity Prices

in € per megawatt hour (MWh) according to Phelix baseload (average price) on the EEX.

https://global.handelsblatt.com/companies/electricity-prices-in-a-free-fall-478046

Reflections: Electricity & heat networks

UK

- Institutional complexities of ESI: regulatory, legal and market design
- Duplication of assets
- Exemptions from grid fees and policy costs
- Wider concerns about micro-grid agenda – local vs 'whole-system' benefits

Hamburg

- Does ownership mean control?
- Link between heat and electricity – resulting in lock-in?
- Will DH become a lifeline for old coal plants? Or a radical reconfiguration of systems?
- Different scales and system logics. Local conflicts but looking at local only not enough

Thank You!

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http://www.sps.ed.ac.uk/staff/science_technology_and_innovation_studies/ronan_bolton