

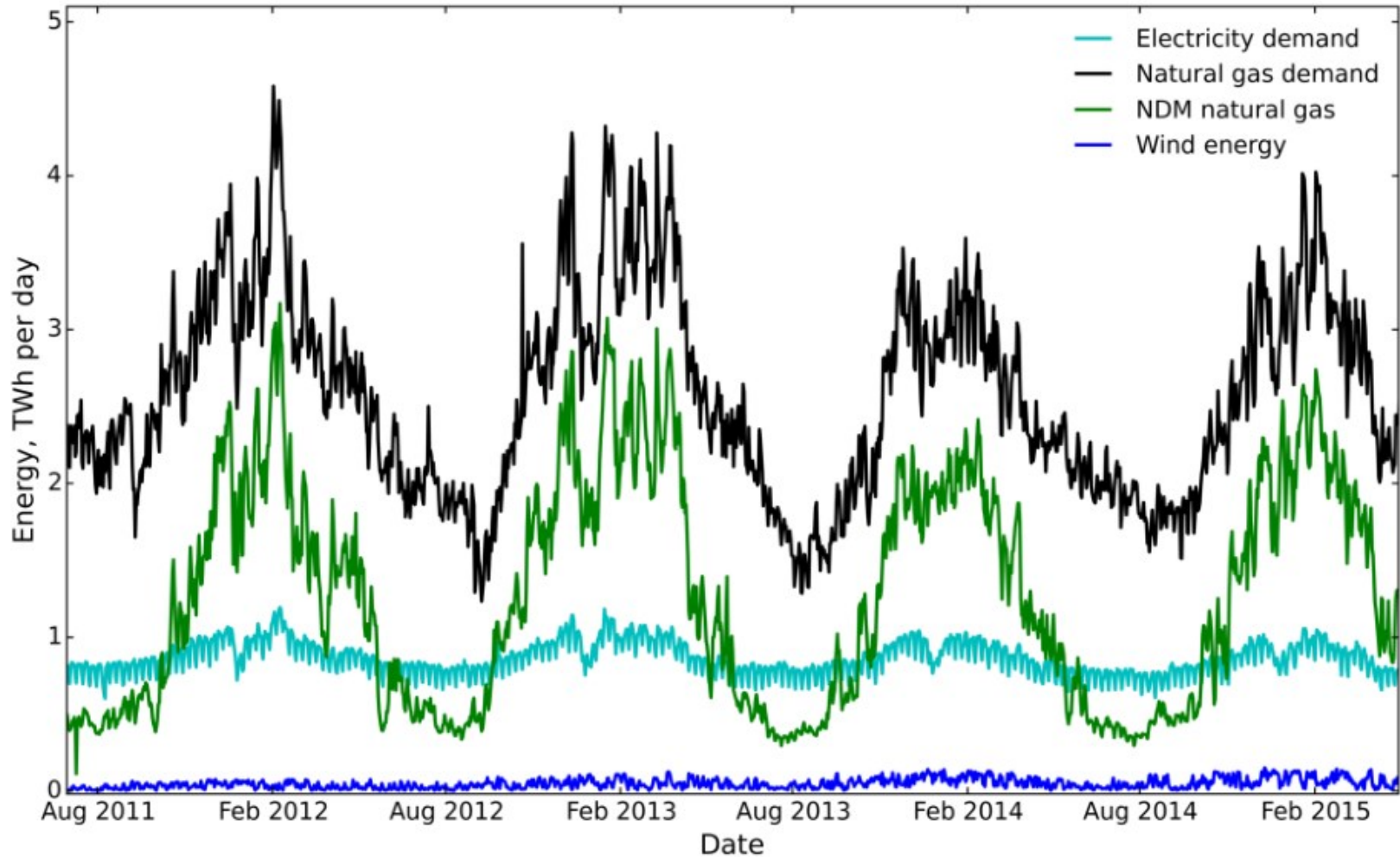


THE UNIVERSITY *of* EDINBURGH

Low carbon heating and cooling research network

University of Edinburgh, Edinburgh

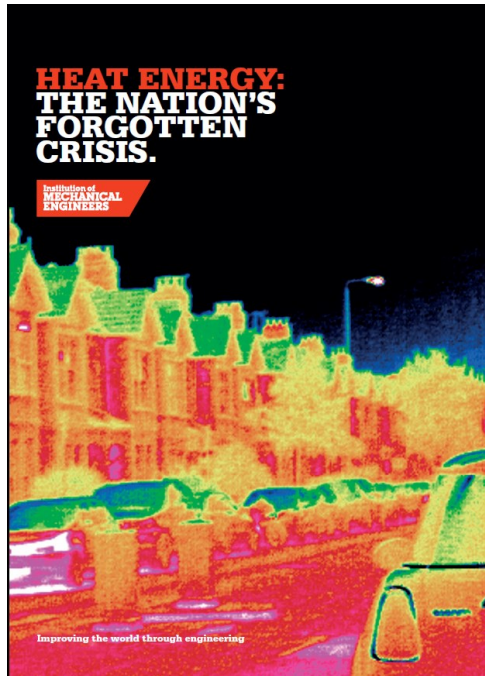
UK energy demand



Data from National Grid and <http://www.gridwatch.templar.co.uk>



Current focus is shifting to heat



Heat Policy Statement

Towards Decarbonising Heat:
Maximising the Opportunities for Scotland



**A VISION FOR
LOW-CARBON HEAT
IN SCOTLAND**
PRIORITIES FOR ACTION



Heating: challenges and opportunities

Challenges

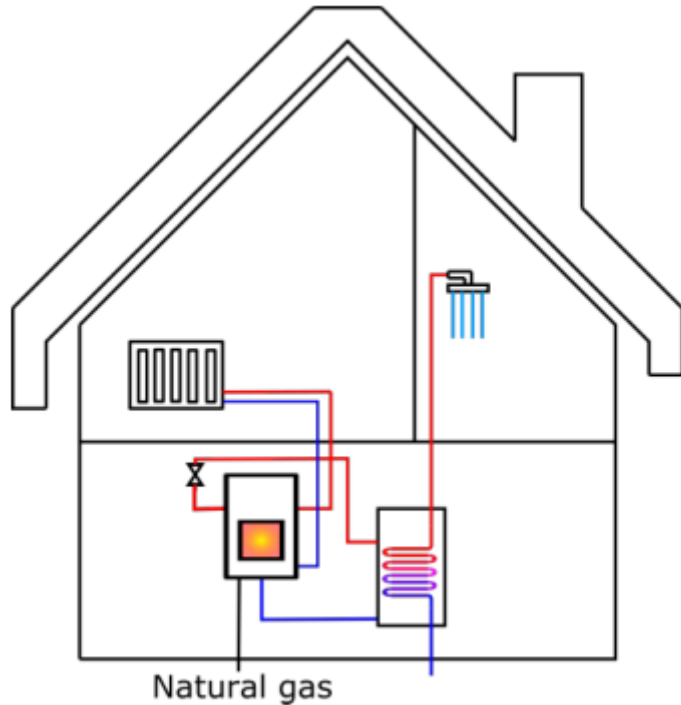
- Large scale of the heat demand
- Diverse and distributed heat demand
- Regulation, economics, public acceptance, ...
- Integration with the wider energy system: electricity and transport

Opportunities

- Large scale of the heat demand
- Potential for integration with renewables
- Efficient and affordable thermal energy storage (TES)



Current heating situation



Individual heating

- User control and on demand
- Boilers and gas are relatively cheap
- Gas boilers are robust and flexible
- Hot water tanks are removed
- Poor insulation

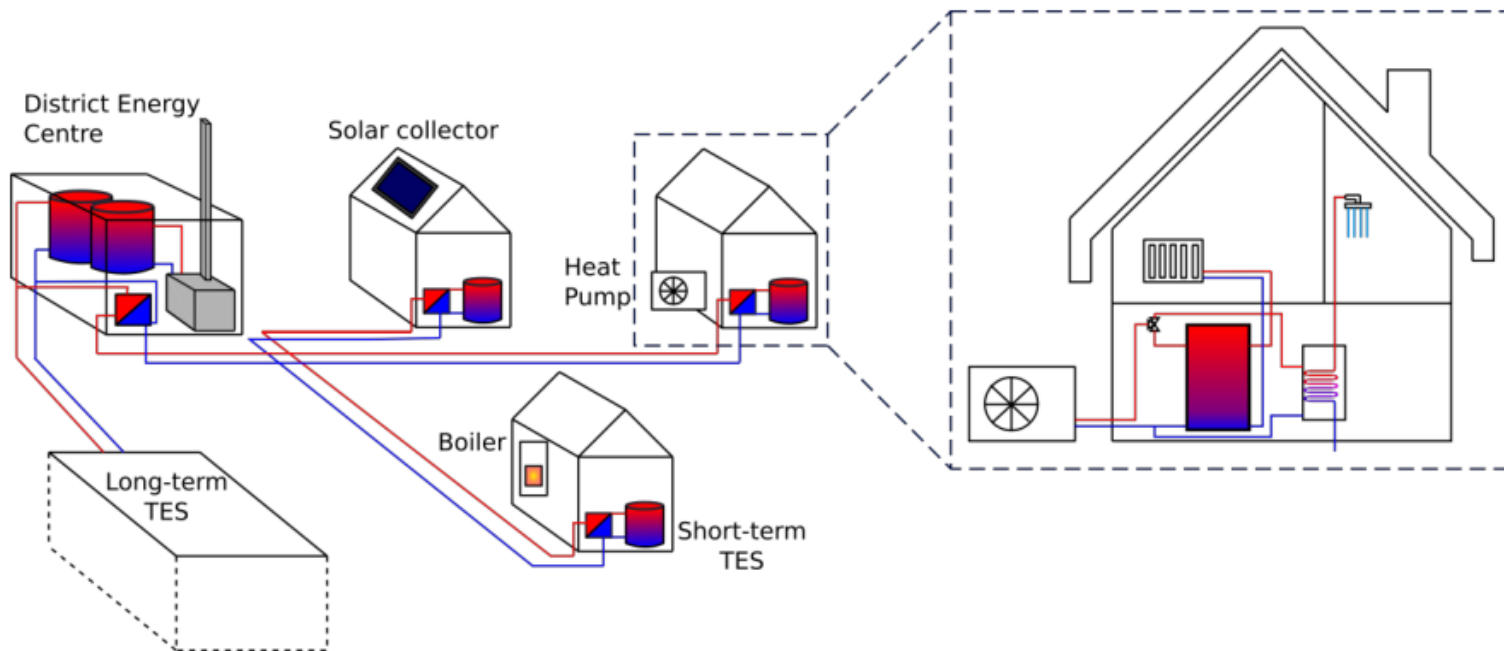
Decarbonisation of heating

Decarbonise heat

- Insulate buildings
- Renewable heat
- Demand side management

Heat sources

- Biogas or biomass boiler
- Combined heat and power
- Heat pump
- Solar thermal collector



Example: Vojens district heating pit storage

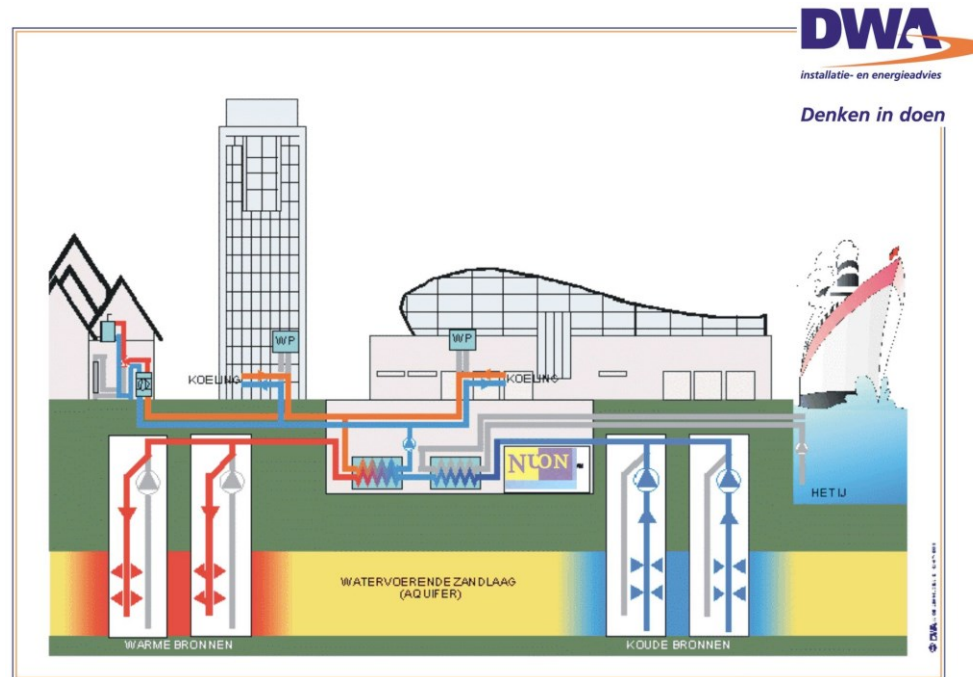


- Vojens district heating scheme in Denmark opened in 2014
- 200,000 m³ pit storage
- 70,000 m² solar thermal collectors
- Provides around 50% of the annual heat demand
- Remainder from 3 gas engines, a 10 MW electric boiler, an absorption heat pump and gas boilers
- District heating scheme has around 2,000 customers

<https://stateofgreen.com/en/profiles/ramboll/solutions/large-scale-thermal-pit-storage>



Example: Oostelijke Handelskade aquifer storage



- 8.2MW heat and cold demand, 50% from ATES
- Aquifer thermal energy storage with decentralized heat pumps
- ATES delivers around 2.7GWh and 2.3GWh of heat and cold annually
- Lower losses due to low temperature heat and high temperature cooling distribution
- Over 2000 further systems in the Netherlands

Duurzame koude en warmte aan de Oostelijke Handelskade, www.dwa.nl

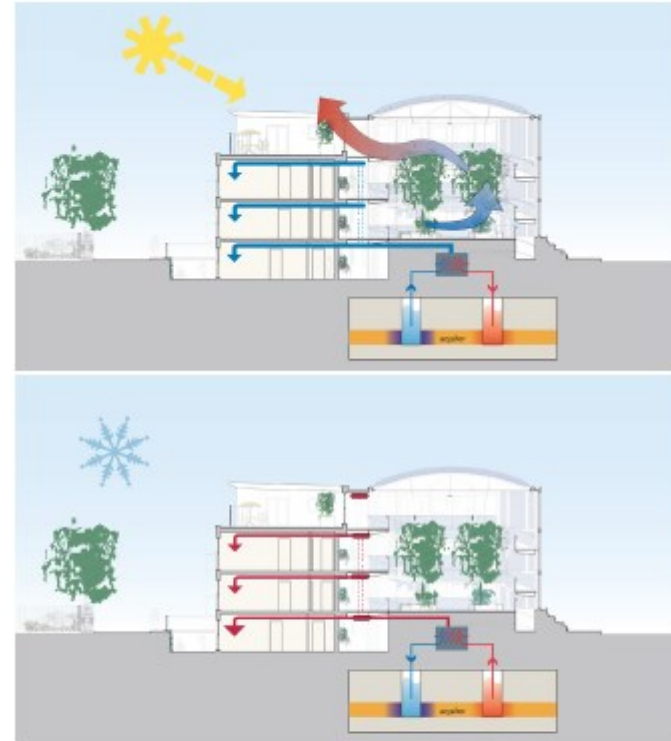


And in the UK?

Pimlico District Heating



Westway Beacons, London



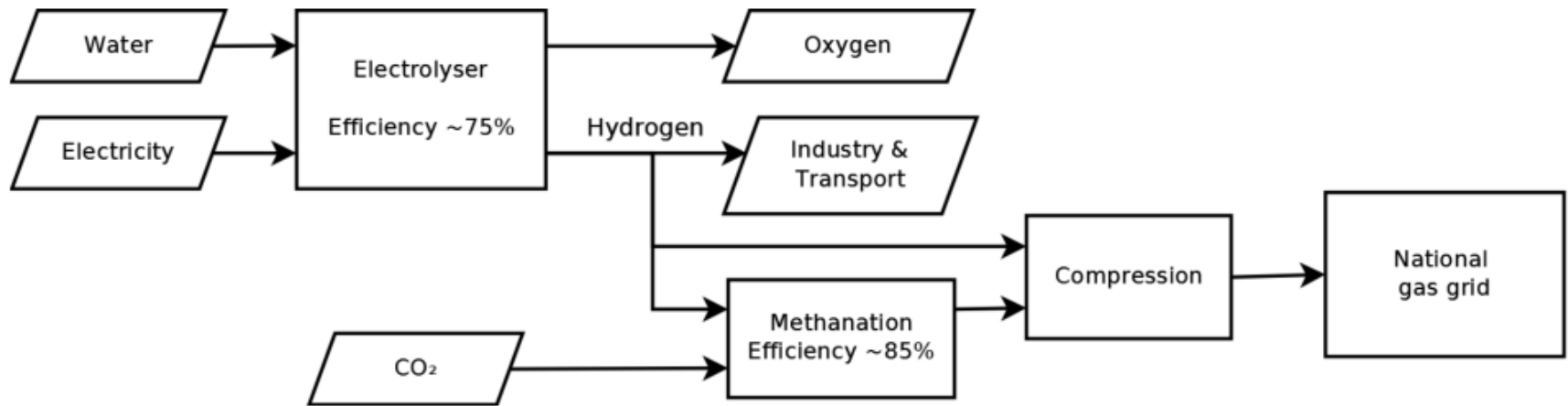
... and only a few more.

Pimlico accumulator tower 1, Licensed under CC BY-SA 2.5 via Wikimedia Commons
https://commons.wikimedia.org/wiki/File:Pimlico_accumulator_tower_1.jpg

Westway Beacons <http://gsa-studios.com/portfolio/project/westway-beacons>



Power to gas



- Use existing gas infrastructure
 - National grid storage capacity around 47 TWh
 - Low losses in the transmission network
- Round trip efficiency for electricity-gas-electricity is below 40%
- Better use the hydrogen for heating or transport
- ITM power 1MW PEM electrolyser Capex £1.7m

Efficiencies from Fraunhofer IWES, Energiewirtschaftliche und ökologische Bewertung eines Windgas-Angebotes

Biomass

Availability

- Widely differing estimates
- Estimates up to 25% of heat from indigenous sources
- Conversion efficiency from sun to biomass between 0.5 and 8%

Alternative uses of biomass

- Electricity production with CCS: negative emissions
- Transport fuel
- Feedstock for the chemical industry

Biomass use

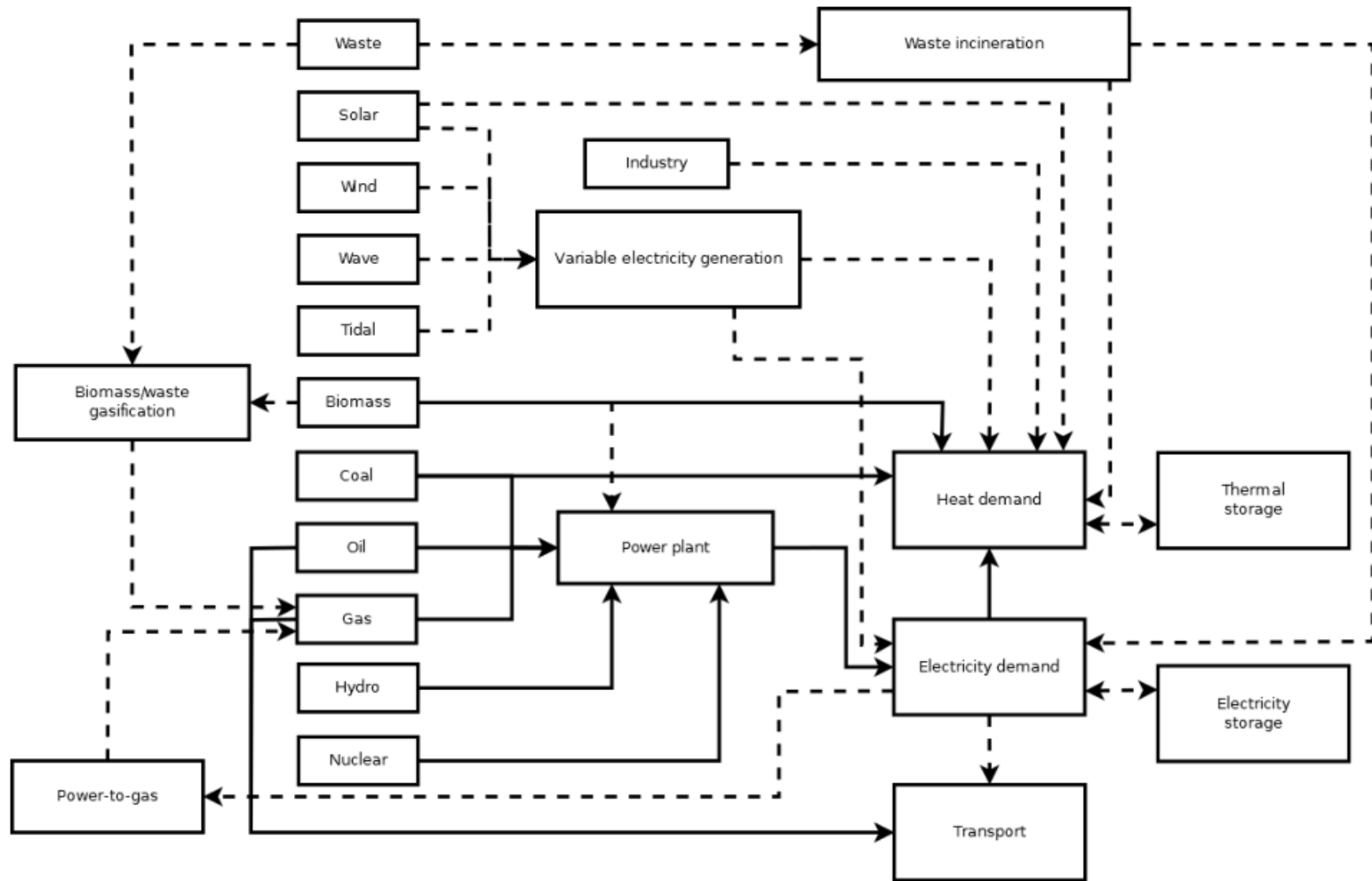
- Gasification
- Direct combustion
- Pyrolysis
- Anaerobic digestion
- Fermentation

Drax power station

- Three units of 630MW
- 2.3 million tonnes of biomass per year per unit
- Efficiency below 40%



Integrated energy system?



Guest speaker

Ragne Low

ClimateXChange Programme Manager



Discussion

- Direction of the Low Carbon Heating Research Network
 - Is it useful?
 - How can we make it more useful?
 - What events do you want to have?
 - Who else should we invite?



Funding and collaboration opportunities

- **Applied Research Programme ‘Transforming Energy Access (TEA)’**; For more information about the Transforming Energy Access Agenda, contact Michael Priestnall, Lead Technologist, Energy Catalyst or come along and meet with Michael on January 28th at the COSLA Conference Centre, Edinburgh. To register, visit: <https://energy-catalyst-r4-edinburgh.eventbrite.co.uk>
- **Energy Game Changer, Innovate UK**

Events and opportunities

- **SR Low Carbon Heat Conference 2016: 07.06.2016 in Perth.** Investment in renewable and low-carbon heat is essential not only to meet our energy targets but also to achieve our ambitions to decarbonise our heat supply, improve energy security and tackle fuel poverty. The 2016 conference will take a look at the challenges in the sector on the way to 2050 and explore the following key issues:
 - What role does low carbon heat play in the Scottish Governments new energy strategy?
 - What does the future hold for the Renewable Heat Incentive?
 - What changes can we expect to regulations and standards to encourage more low carbon heating?
 - Where will investment come from and how can the market be more attractive?
 - How do we integrate storage into our heating systems?
 - Short extract (fewer than 200 words please!) to Stephanie Clark by Thursday 28 January
- **UK Government ‘Carbon footprint of heat generation’**



Planned future events

- 1) Challenges and opportunities in low carbon heat:** Brainstorming session with informal round table discussions ('World Café' format) to facilitate the formation of networks and connections among the participants.
- 2) Our way to low carbon heat:** In this sandpit event the expertise across the network and the identified challenges and opportunities will be used to bring researchers with different expertise together with the aim of exploring synergies in tackling these challenges and maximising the opportunities. The ultimate goal of this event is the collection of ideas for collaborative projects which might lead to funding proposals.

