apse events

Climate Change for Local Councils

Ground source heat pumps : a viable alternative?

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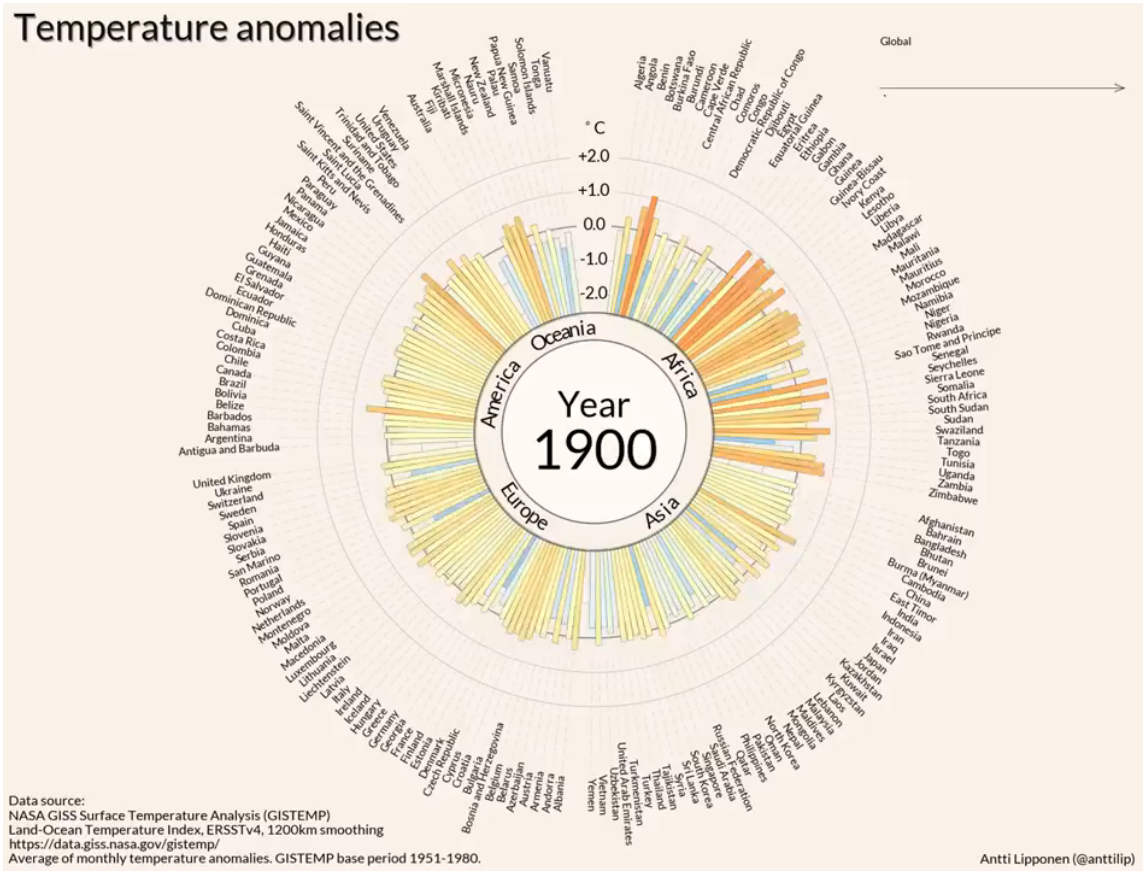
Thursday 23rd January 2020

Why are we worried –
Global Temperature Anomalies since 1900



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The Ultimate Renewable Energy Source

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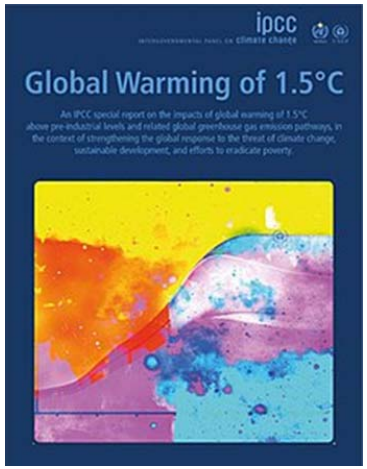
2019 - a year of publications

- Committee on Climate Change – Net Zero
- Committee on Climate Change – Reducing UK Emissions
- IPCC – Global Warming of 1.5°C
- Commons Science & Technology Committee – Clean Growth



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Why act now?

- The IPCC report gives us limited time to stop irreversible damage
- Current Building Regulations permit development that is adding to the problem by embedding yet more fossil fuel dependency
- Public awareness is shifting rapidly
- Generational pressure
- The Greta and Attenborough effect (public licence to operate)
- We have technologies available now that are tried and tested
- All industry watchers anticipate a much more regional and distributed energy (CCC and National Grid, etc.)
- The very rapid development of the electric vehicle market is transforming the power generation and distribution sector and plays to growth in the electrification of heat

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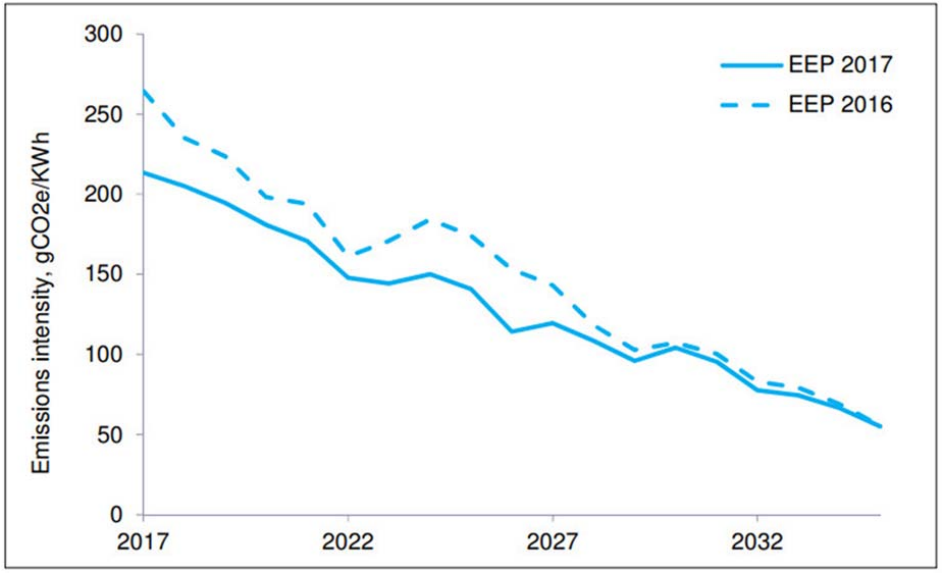
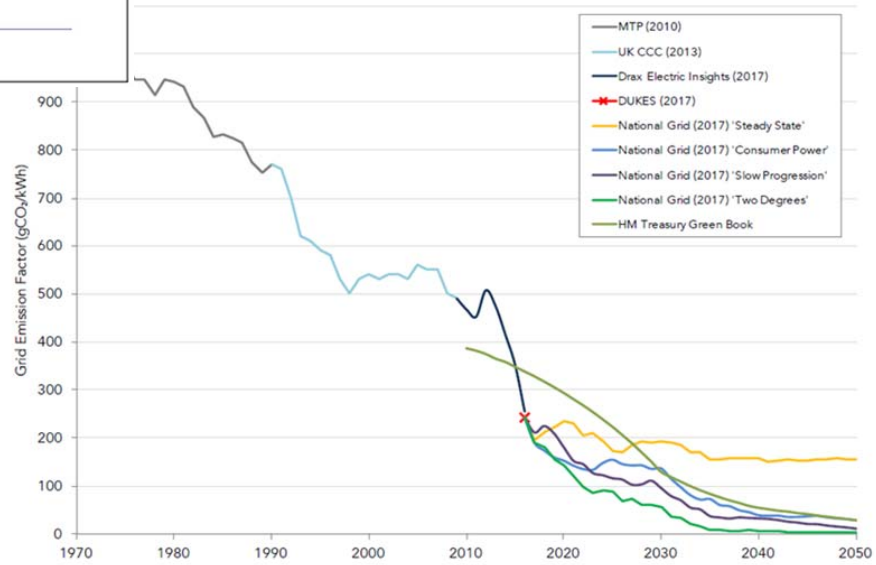
What drives electrification?





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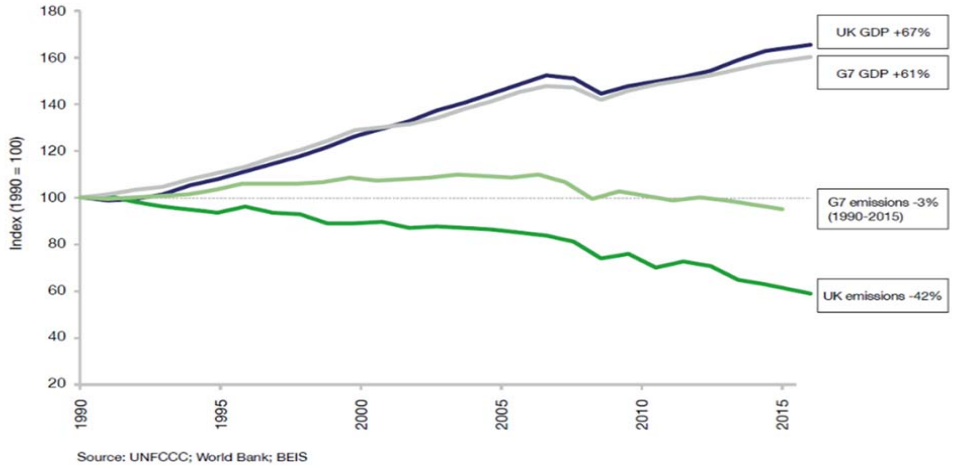
Will decarbonisation harm the economy?

- 1990 – 2015, UK GDP growth outstripped the G7 average whilst emissions reduction was significantly greater.
- The UK started the industrial revolution and so has a moral duty to lead on emissions



Source: UNFCCC; World Bank; BEIS

- Decarbonisation technologies tend to upskill the workforce
- The UK is now a net importer of energy

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What is the impact on emissions from heat?

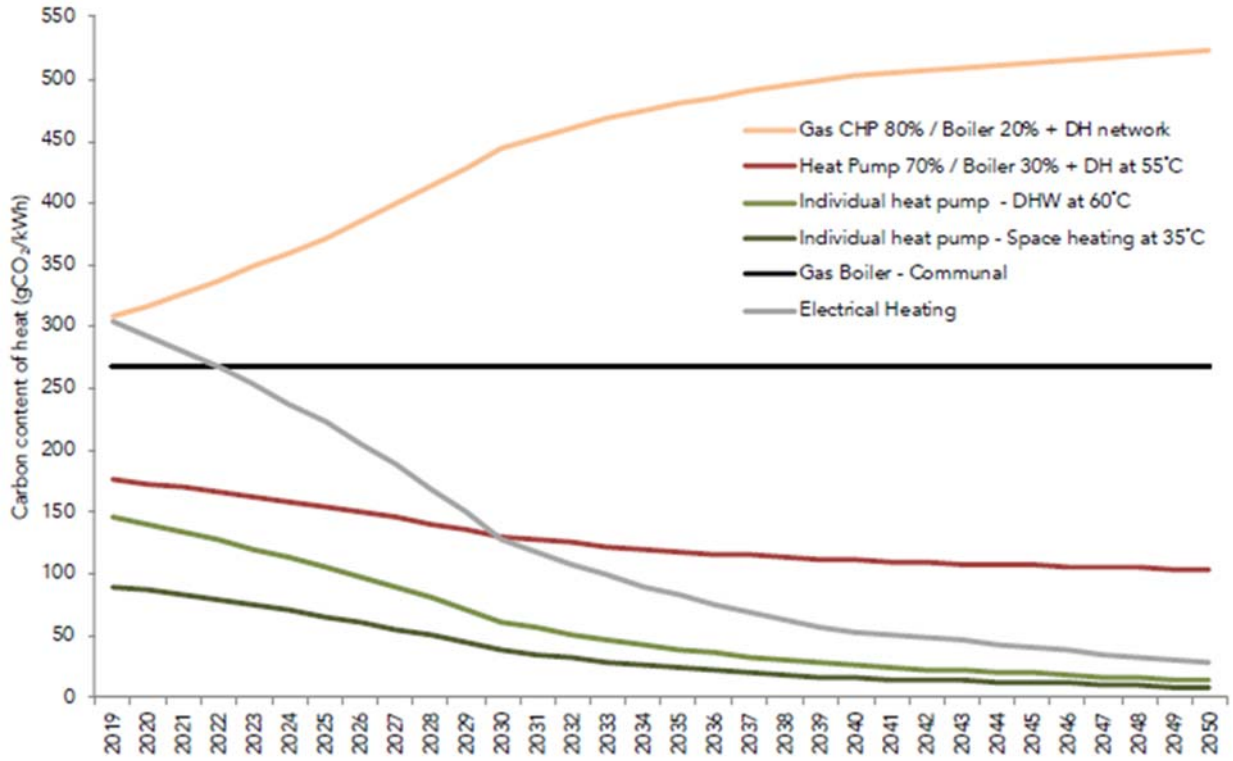

Figure 4.05 – Projected carbon factor of heat based on HM Treasury Green Book marginal emission factors

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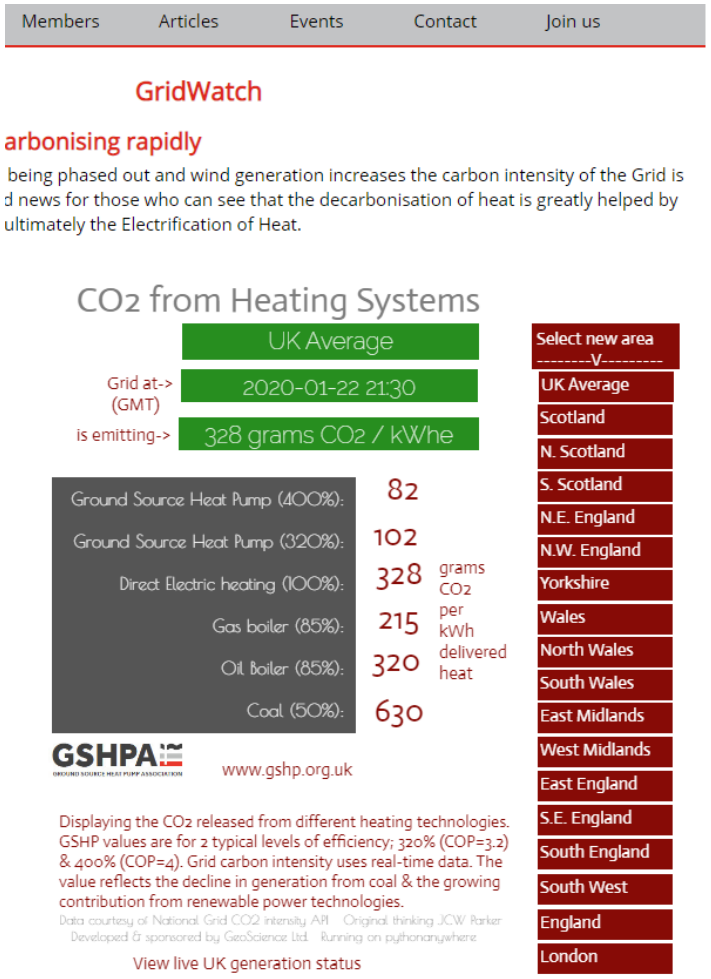
What is the impact on emissions from heat?

- GridWatch – real time monitoring
- Nominated for an award for the simple numerical representation of the relative efficiencies of all domestic heat technologies



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What has held heat pump deployment back?

- Resistance to recognising grid carbon factors in Building Regulations
- UK raw fuel spark gas favours gas
- All “green” levies are applied to electricity only – 18% or so inflationary result
- Hidden subsidies to the fossil fuel sector
- Lack of robust standards environment
- Poor renewables subsidy strategy
- The interests of the incumbents
- Consumer awareness
- Heating industry skills and knowledge

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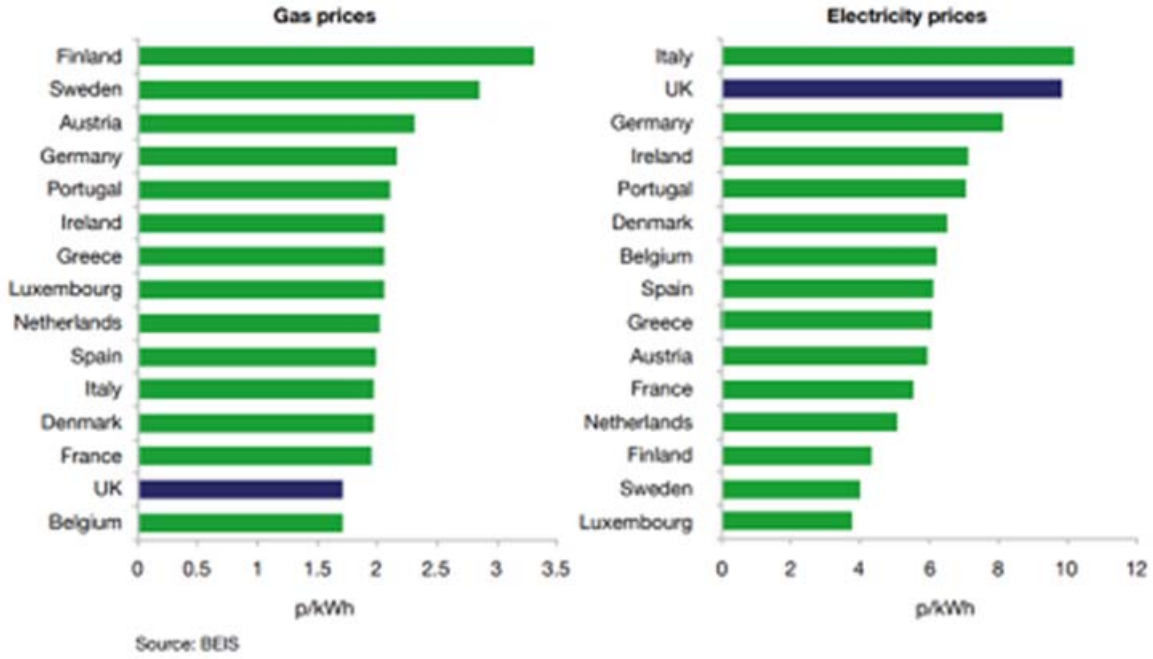
What has held heat pump deployment back?

Figure 12: Industrial electricity and gas prices for large consumers in the EU15 in 2016, including taxes[135]



Source: BEIS

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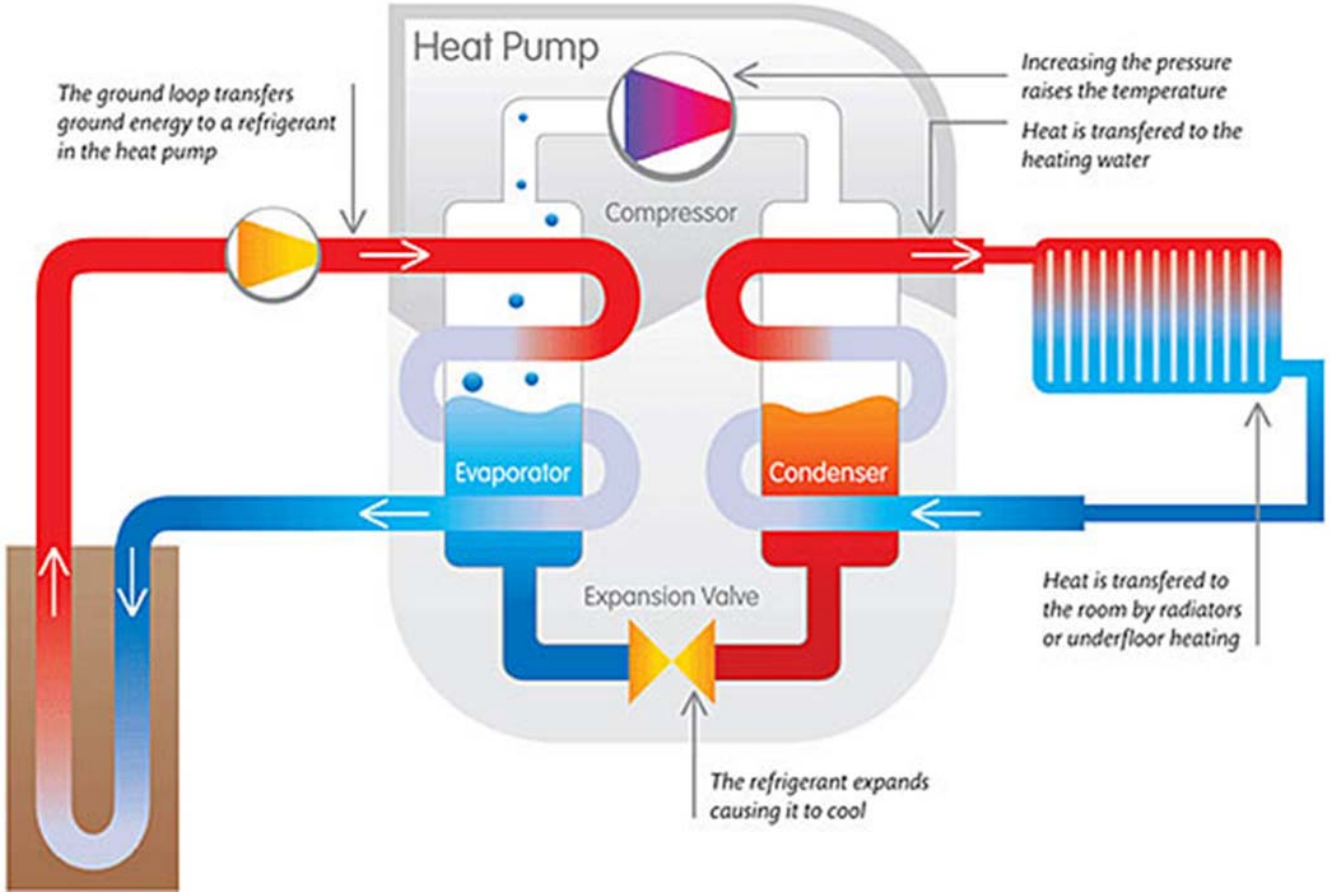
Heat pumps 101



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Heat pumps 101

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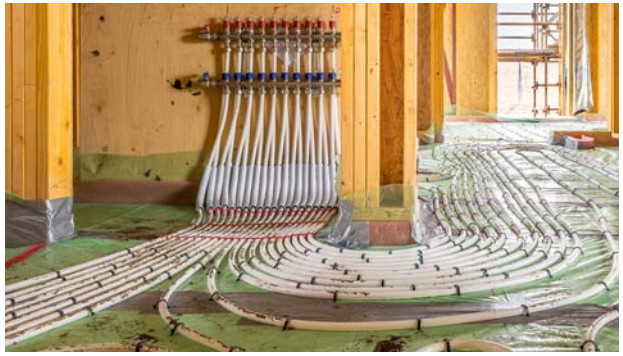
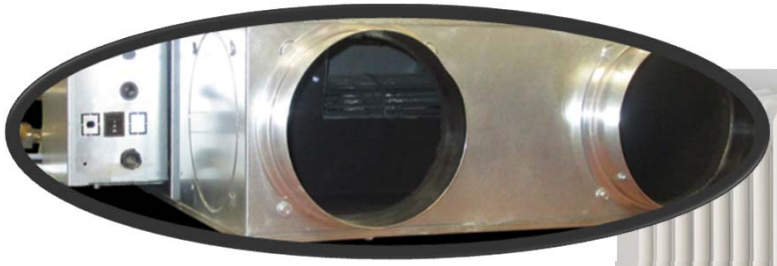
Heat pumps 101





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What is changing to make heat pumps the technology of **NOW**?

- Part L consultation on grid carbon factor and maximum emitter flow temperatures
- Adoption of innovative district heat solutions
- Co-location of a-seasonal heating and cooling loads
- New thermal storage technologies – can be as effective as battery storage
- The value of DSM, DSR and load shifting
- Smart integration between local electrical generation, electrical demand and heat (or coolth) demand
- Progressive development of design and deployment standards
- Knowledge, skills and training for consultants, designers and deployment engineers
- Heat as a service and other innovative funding models
- Public attitudes to emissions

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Planning – where London leads….

- New 2019 GLA Guidance
- Air Quality Gets Equal Billing

Fuel type	Fuel Carbon Factor (kWh/kgCO2)	
	SAP 2012	SAP10
Natural Gas	0.216	0.210
Grid Electricity	0.519	0.233

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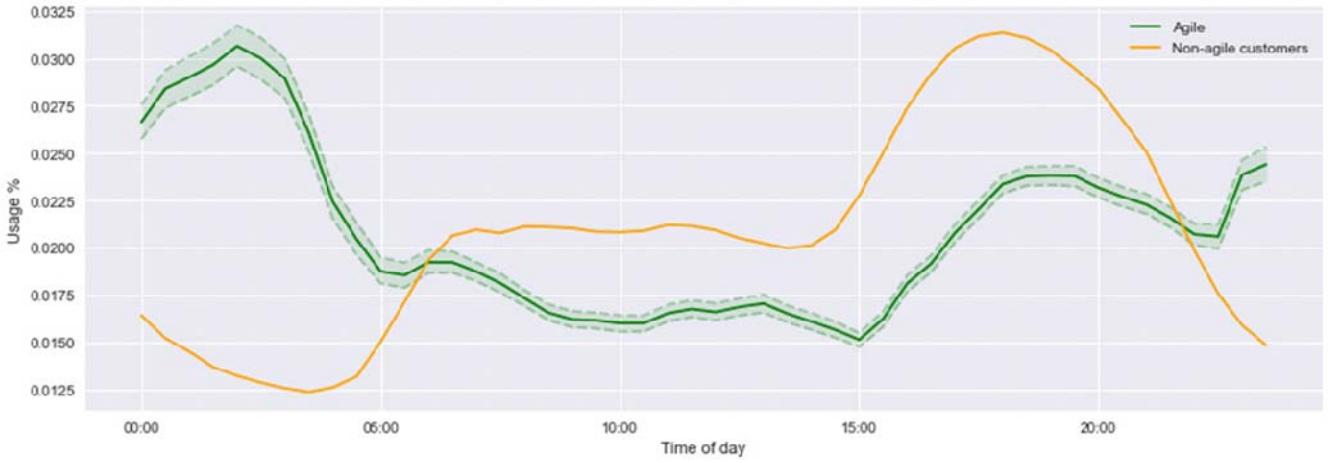
Nudge Theory Billing for Load Shifting

- Octopus Energy Agile Tariff consumers demonstrate significantly different consumption profiles compared to average non-agile consumers. Low cost electricity is a proxy for low carbon intensity. Initial benefits for EV charging but progressing to heat pump deployment with thermal storage



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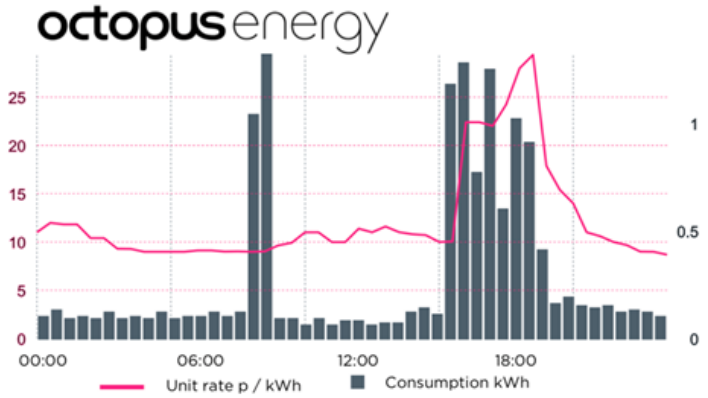
Tariff gains from load shifting

Sunday
18th March 2018



For electricity meter 17P3001648

Total cost
£ 2.26

Total consumption
13.82 kWh

Weighted average unit rate
16.36 p / kWh

Period	Rate p / kWh	Consumption kWh	Cost p
00:00 - 00:30	11.00	0.10	1.100
00:30 - 01:00	11.98	0.13	1.557
01:00 - 01:30	11.82	0.09	1.064
01:30 - 02:00	11.82	0.10	1.182
02:00 - 02:30	10.40	0.09	0.936
02:30 - 03:00	10.40	0.12	1.248
03:00 - 03:30	9.30	0.09	0.837
03:30 - 04:00	9.28	0.10	0.928
04:00 - 04:30	8.98	0.09	0.808
04:30 - 05:00	8.98	0.12	1.078
05:00 - 05:30	8.98	0.09	0.808
05:30 - 06:00	8.98	0.10	0.898
06:00 - 06:30	9.12	0.10	0.912
06:30 - 07:00	9.12	0.12	1.094
07:00 - 07:30	9.00	0.10	0.900
07:30 - 08:00	9.02	0.12	1.082
08:00 - 08:30	8.98	1.04	9.339
08:30 - 09:00	9.02	1.32	11.906
09:00 - 09:30	9.64	0.09	0.868
09:30 - 10:00	9.91	0.09	0.892
10:00 - 10:30	11.00	0.06	0.660
10:30 - 11:00	11.00	0.09	0.990

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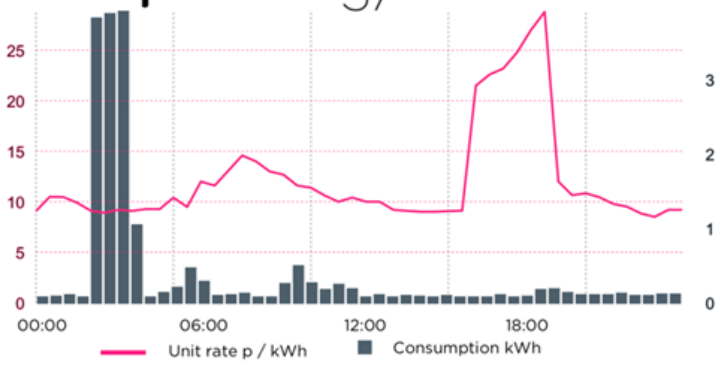
Tariff gains from load shifting

Thursday
22nd March 2018

For electricity meter 17P3001648

octopus energy



Total cost
£ 1.85

Total consumption
18.48 kWh

Weighted average unit rate
10.01 p / kWh

Period	Rate p / kWh	Consumption kWh	Cost p
00:00 - 00:30	9.07	0.07	0.635
00:30 - 01:00	10.49	0.08	0.839
01:00 - 01:30	10.46	0.10	1.046
01:30 - 02:00	9.90	0.07	0.693
02:00 - 02:30	9.10	3.82	34.762
02:30 - 03:00	8.90	3.88	34.532
03:00 - 03:30	9.20	3.91	35.972
03:30 - 04:00	9.10	1.04	9.464
04:00 - 04:30	9.27	0.07	0.649
04:30 - 05:00	9.27	0.13	1.205
05:00 - 05:30	10.40	0.20	2.080
05:30 - 06:00	9.48	0.46	4.361
06:00 - 06:30	12.00	0.28	3.360
06:30 - 07:00	11.60	0.09	1.044
07:00 - 07:30	13.09	0.10	1.309
07:30 - 08:00	14.58	0.12	1.750
08:00 - 08:30	14.00	0.07	0.980
08:30 - 09:00	13.00	0.07	0.910
09:00 - 09:30	12.68	0.25	3.170
09:30 - 10:00	11.61	0.49	5.689

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The resulting numbers

Heat demand 20,000kWh/ annum	Carbon emissions/ Annum Kg	Operational cost : Gas at 4.5p/kWh	Operational cost : Ground source electricity at 16p/kWh	Operational cost : Ground source electricity at 10p/kWh
Gas at 85% efficient	4,300	£900		
Ground source at SPF 3.5:1	1,120 Reduction of 74%		£914	£572 Reduction of 36%

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The resulting benefits

- Lower operational cost for heating and cooling
- Lower carbon intensity for heating and cooling
- The value of demand side management, demand side response and load shifting
- Smart integration between local electrical generation, local electrical demand, EV battery charging (and discharge to grid) and heat (or coolth) demand
- Reduced grid reinforcement investment required
- Reduced investment in generation capacity
- Can be combined with innovative retail models for heat as a service
- Potential for lower lifetime costs due to the long term value of in-ground ground source infrastructure
- Potential reduced decommissioning / recycling costs for thermal storage vs electrical battery storage

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Developments in thermal storage

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Case Study : London Borough of Enfield

400 social housing apartments, in eight blocks, each with two shared borehole arrays. Tenants' energy costs down by 30-50%. Over 700tCO2 saved per annum

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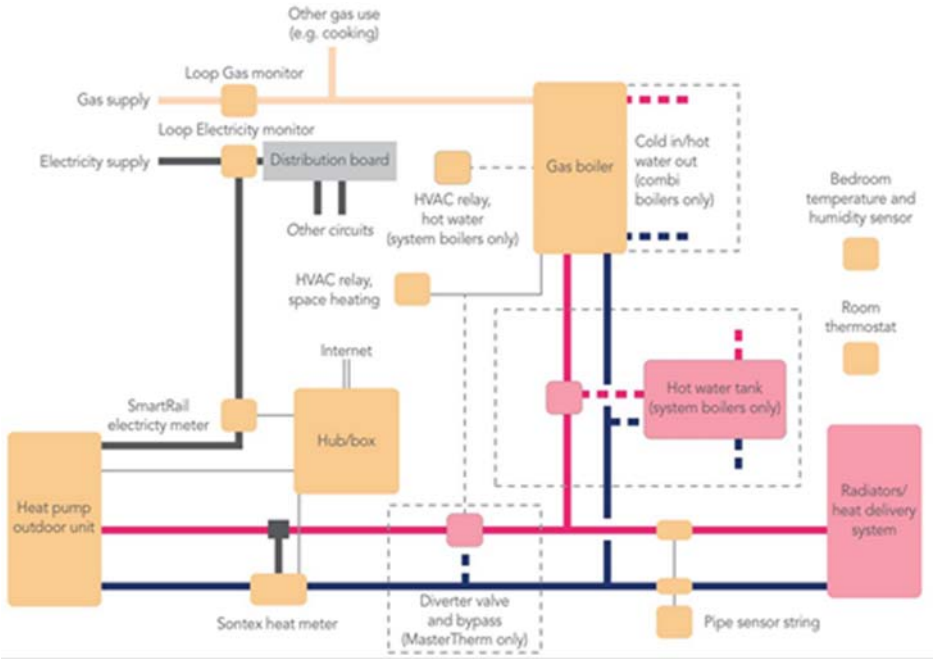
Case Study : Freedom Project, South Wales



Consumer focus on building trust in the technologies and interfaces. Consumer retains individual heating control via smartphone or Internet. Bi-valent switching is automated

Key messages

- First major UK project bringing together gas and electricity network operators
- Will demonstrate the most advanced load control of hybrid heating systems (gas boiler + air source heat pump) in UK
- Modelling UK system value of hybrid heating flexibility
- Outputs will help to inform UK policy makers on roadmap for heat decarbonisation
- Installations in a range of public and private housing types in Bridgend, South Wales

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Case Study : Private Development

9 new build detached houses, a single shared borehole array under the access road. Heat delivered by UFH. Comfort cooling delivered via fancoils.

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Case Study : Retrofit Social Housing

15 retrofit detached bungalows, 5 shared borehole arrays under the common areas. Displacing night storage heaters. Energy costs down by 42%.

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Where is the knowledge?

HPF
HEAT PUMP FEDERATION

- enhanced and consolidated political lobbying for UK energy policy development supporting the electrification of heating and cooling in the built environment. This includes working with government on related planning policy to better facilitate investment in our technology
- to encourage the broadest participation of the whole industry sector right through to the end user, including knowledge sharing, thus allowing all members to contribute to one of the great challenges of our time
- collaboration with all related bodies in the sector to build a genuine heat pump coalition with the strength and resources to build the sector during the coming decade and beyond
- to support the development and maintenance of industry leading technical standards and training, requiring cooperation with all other related parties to achieve this goal with a clear focus on robust consumer protection

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Questions……

and thank you

www.gshp.org.uk

Bean Beanland, Chairman, GSHPA

Bean.Beanland@gshp.org.uk

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