The Heat Strategy Framework and the role of innovation

iHEAT Conference 2012
Cambridge
http://www.cir-strategy.com/events/heat

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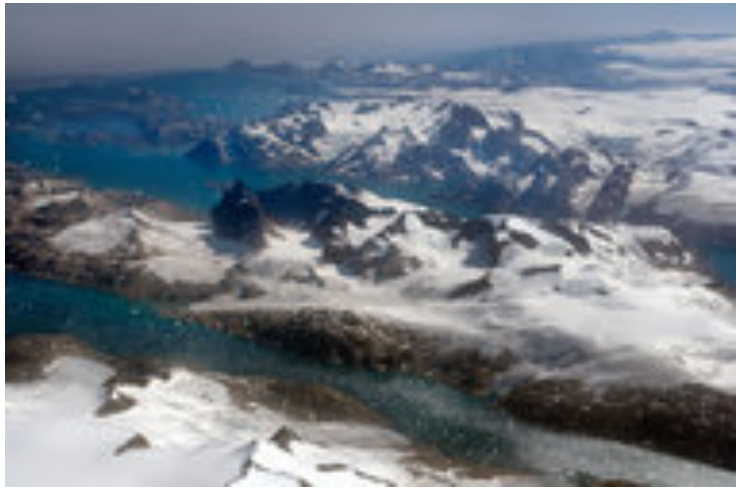
DEPARTMENT OF ENERGY & CLIMATE CHANGE

- Why heat is important
- How the Government's Heat Strategy considers we might address the greatest challenges
- Focus on two issues -
  - Heat research priorities
  - Heat metering under Renewable Heat incentive schemes
- Conclusions and Questions

Because climate change has not gone away



Ending Its Summer Melt, Arctic Sea Ice Sets a New Low That Leads to Warnings

The apparent low point for 2012 was reached Sunday, when sea ice covered 24 percent of the surface of the Arctic Ocean, down from the previous low of 29 percent set in 2007.

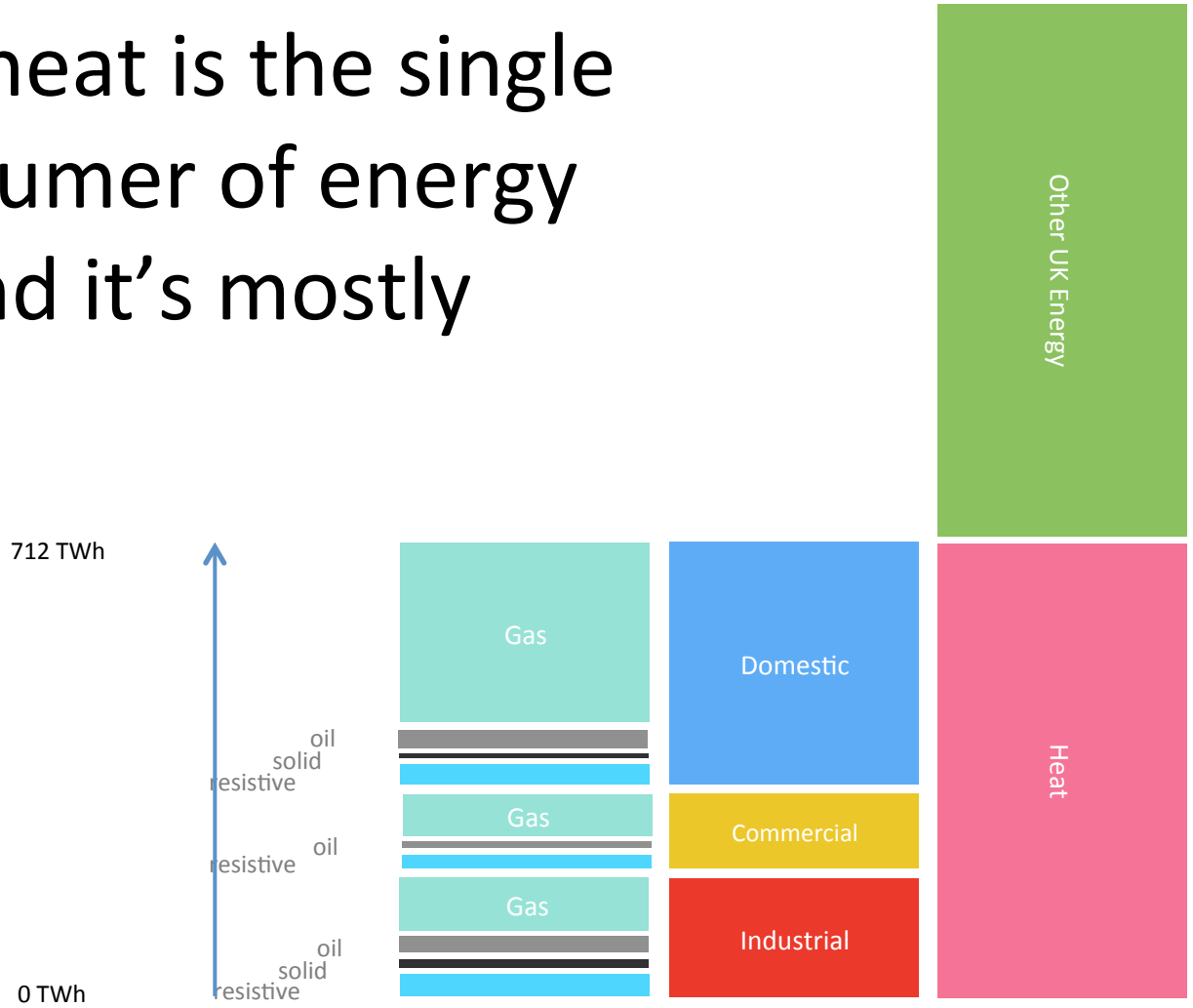
New York Times, **September 19, 2012**

Race Is On as Ice Melt Reveals Arctic Treasures

At stake are the Arctic's abundant supplies of oil, gas and minerals that are, thanks to climate change, becoming newly accessible along with increasingly navigable polar shipping shortcuts.

New York Times, **September 19, 2012**

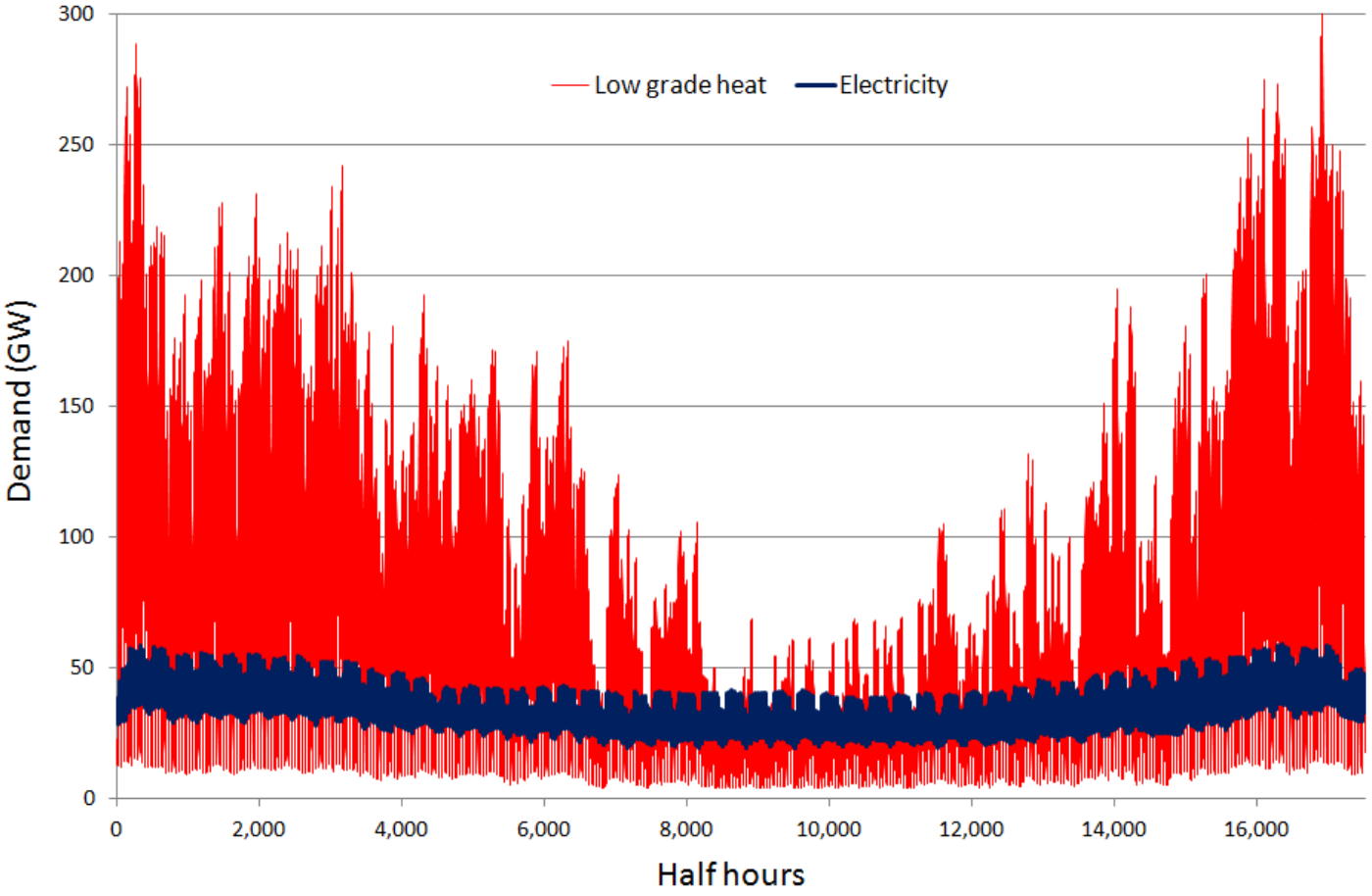
.....because heat is the single biggest consumer of energy in the UK, and it's mostly fossil fuel



Heat supply (2008)

Source: DUKES

….because demand is “peaky”



GB electricity and low grade heat demand - (Commercial and domestic buildings - 2010)

Imperial College

……because heat is local even if fuel supply is national

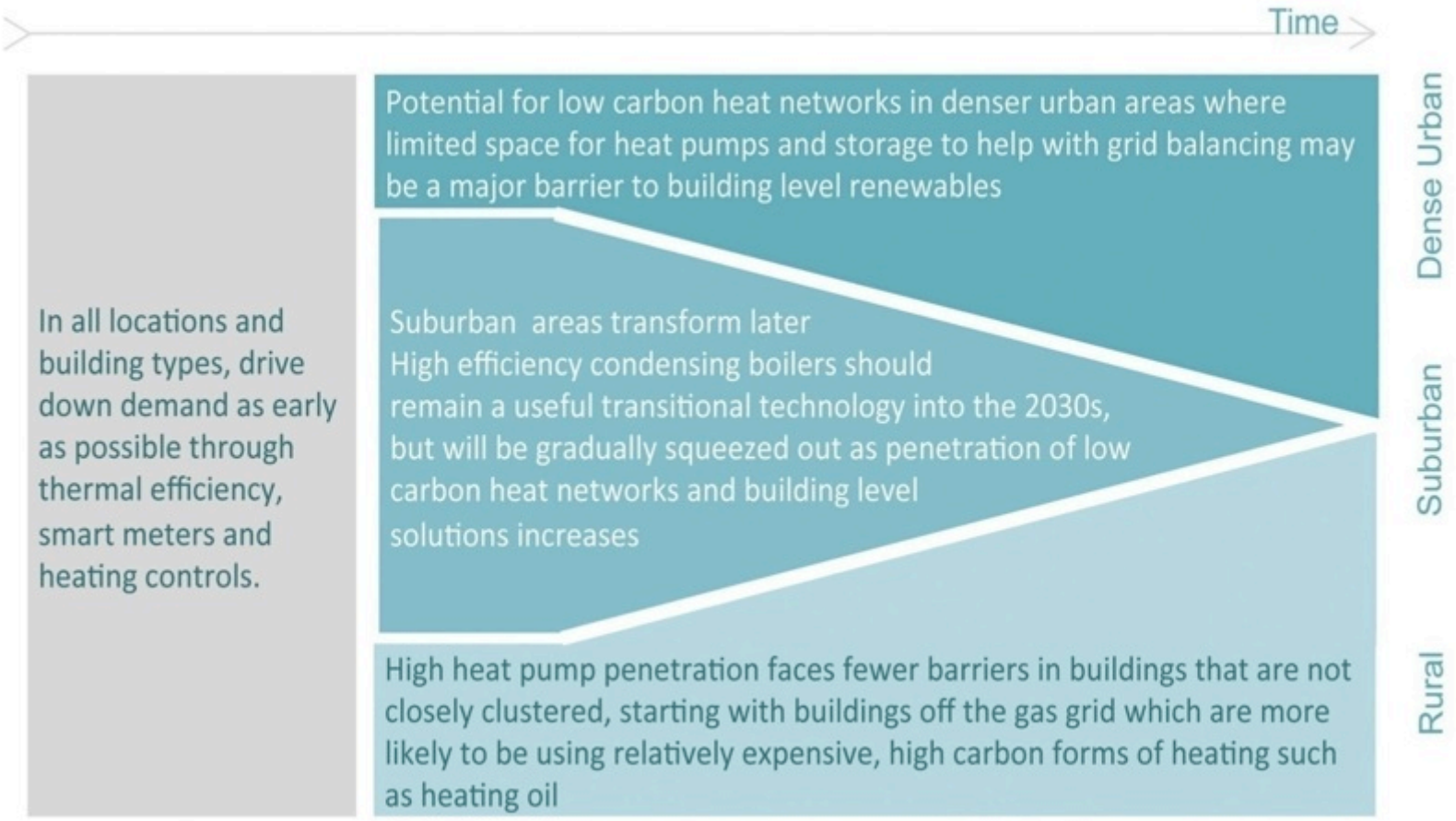
Renewable heat in individual buildings	Replacing fossil fuel based heating systems with alternative such as heat pumps and biomass boilers	At building level
Heating networks using a low carbon heat source	Generating heat for an area more centrally, from sources such as large scale heat pumps and supplying it to buildings and homes via pipes and heat exchangers	At district level
Creating a low carbon gas grid/ using low carbon electricity grid	Either injecting biomethane into the existing gas grid to replace natural gas, or building a grid that can use hydrogen	At national level

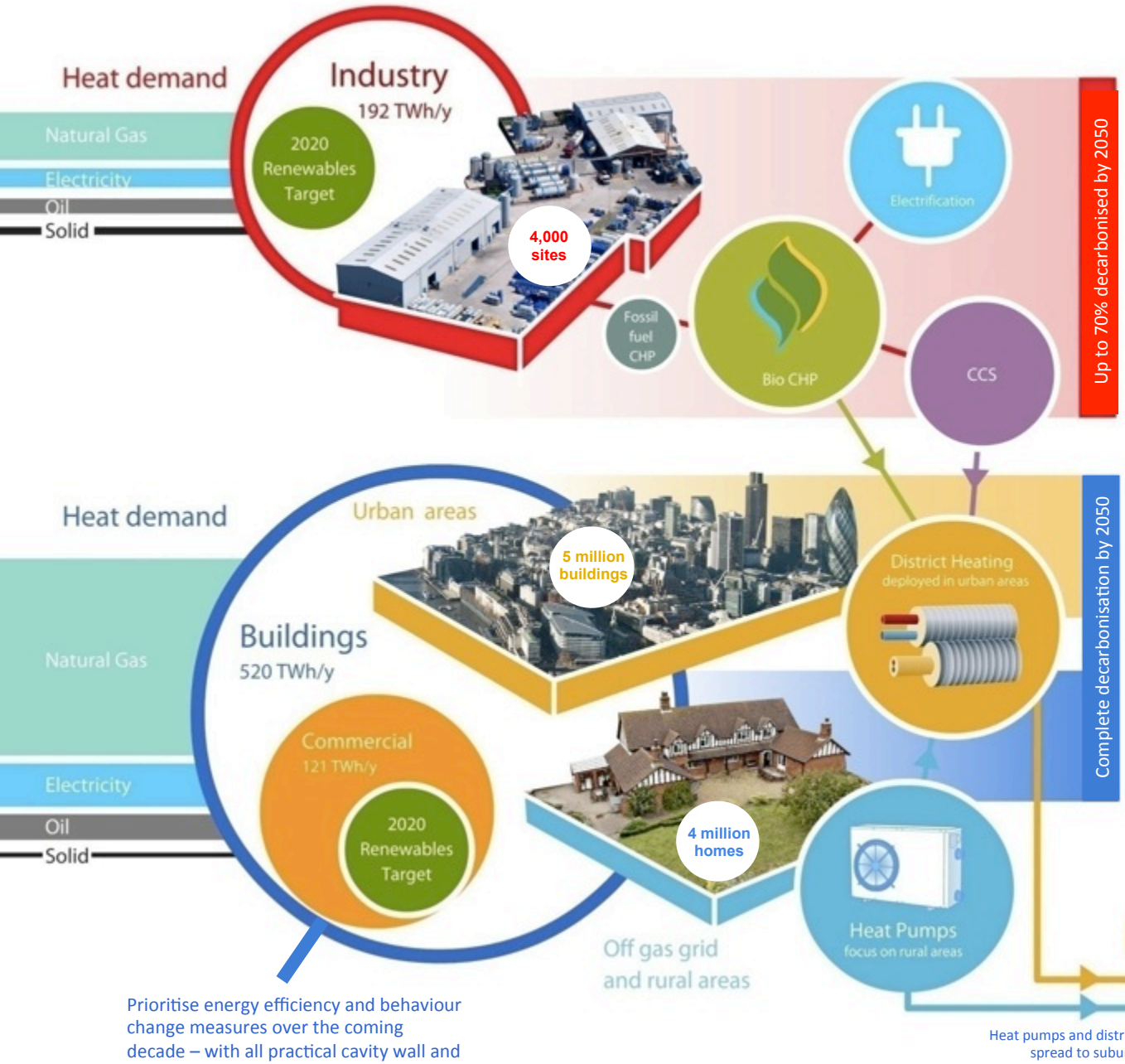
On 29th March this year, we set out the Government's overall strategy for heat...

A Strategic Framework for Low Carbon Heat in the UK

The full document can be found on the DECC Website at: www.decc.gov.uk

Government's strategic framework for low carbon heat in buildings





Prioritise energy efficiency and behaviour change measures over the coming decade – with all practical cavity wall and loft insulation installed by 2020.

Industry

- Use the Energy Intensive Industry package to support electricity intensive industries in the short term
- Begin now to target UK Government support for innovation – and efforts on influencing international innovation – at technologies such as industrial CCS, electrolysis and advanced bio which are likely to be critical to decarbonising UK industry
- From around the end of this decade, begin to use targeted financial support to remove barriers to fuel switching at specific UK industrial sites with the highest emissions
- Target ongoing support through the RHI at bio-CHP and biomass boilers for industrial heat between now and 2030, and at electrification in the long term.

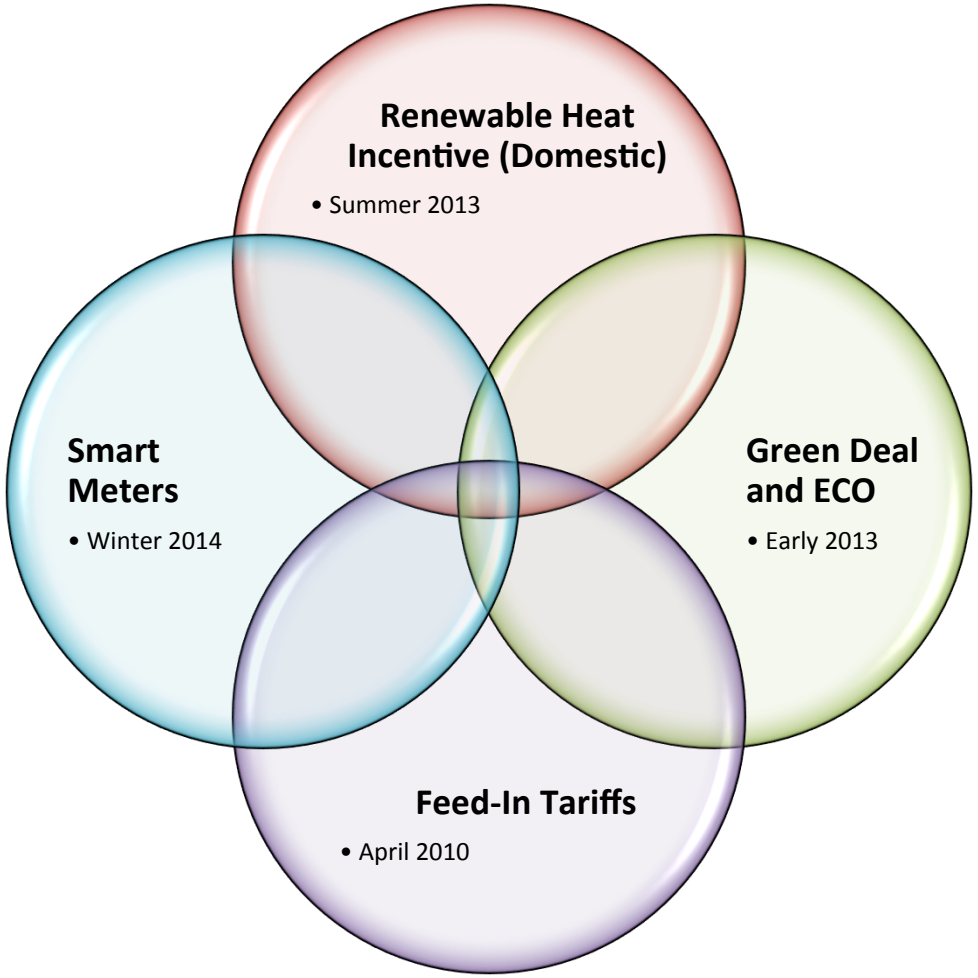
Urban areas

- By the next parliament, develop our evidence base on and begin measures to facilitate heat networks as a possible alternative to heat pumps in dense urban areas.

Rural areas

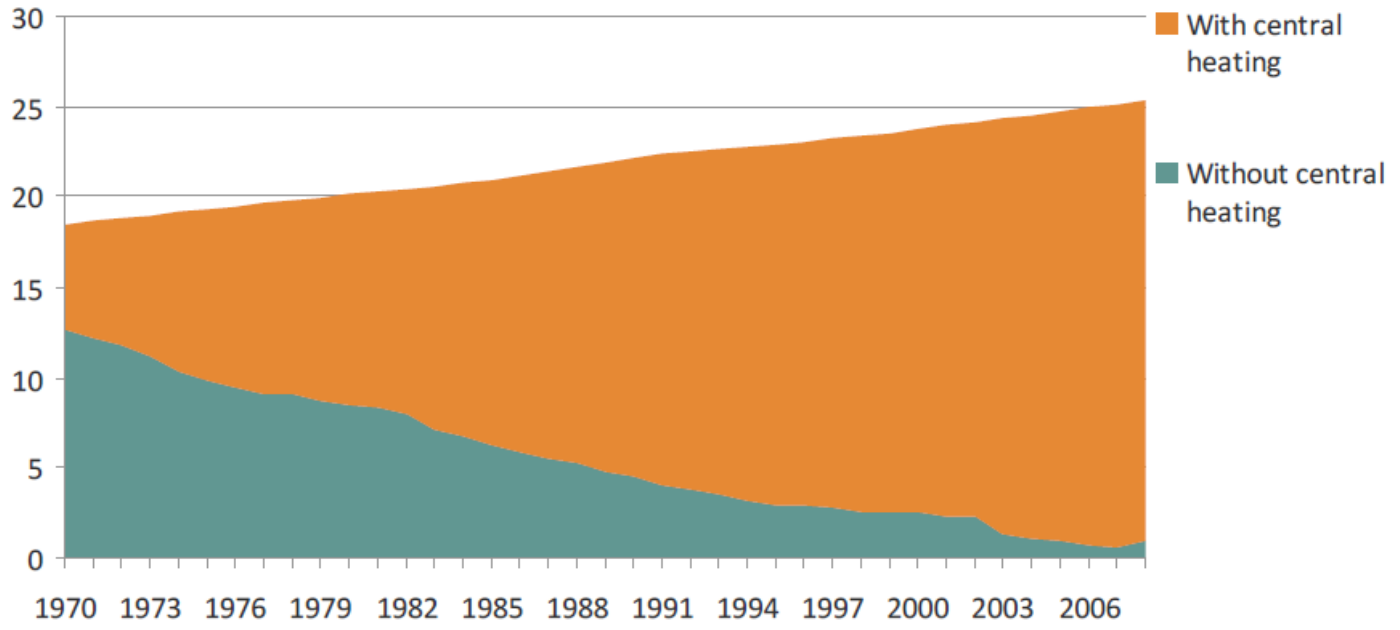
- In this parliament, target support for renewable heat on commercial buildings and off-gas grid homes. This will maximise cost effectiveness, develop the supply chain and allow energy efficiency to bed in.
- Develop a package of financial, regulatory and fiscal/market measures to secure large scale deployment of heat pumps in homes from 2015.

Maximising impact of existing DECC policies Policies developed separately will come together for consumers and supply chain



Speed in change of heating solutions

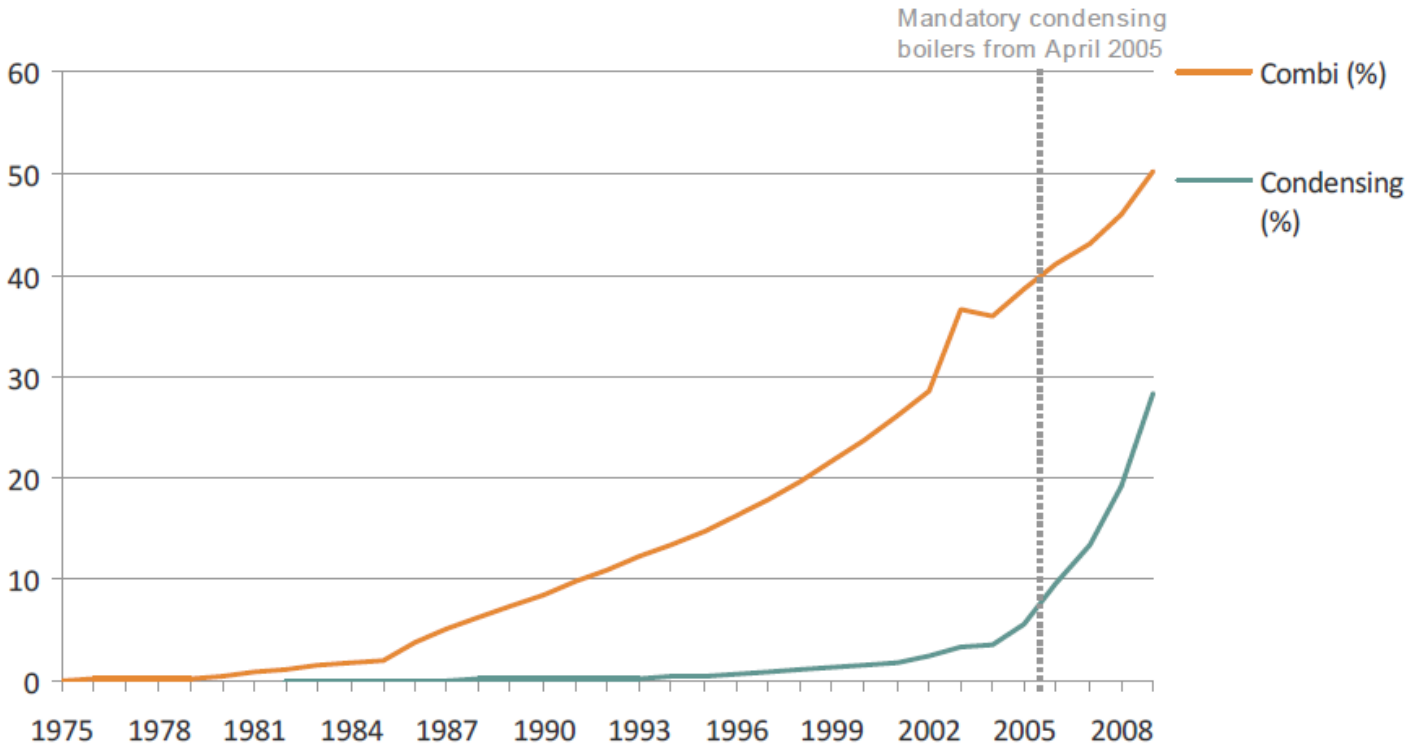
In 1970, less than a third of homes had central heating – see graph below. By 1990, this had risen to four fifths and, by the turn of the century, to more than nine out of ten homes. By 2008, only 4% of the housing stock had yet to install this one time luxury.



Households: millions

Great Britain's housing energy fact file, prepared for DECC, September 2011

Speed in change of heating solutions



Graph 6d: Ownership of condensing and combi boilers (%)

Over 98% of the 1.5m boilers installed each year now are condensing boilers

Great Britain's housing energy fact file, prepared for DECC, September 2011

Understanding Heat - The National Household Model

DECC's National Household Model - tool for the assessment of potential impact of different policy scenarios – estimated delivery in October 2013

A dynamic micro-simulation of the entire building stock

Initially limited to housing, based on English Housing Survey data but will extend to National Energy Efficiency Database

An energy module based on SAP/BREDEM methodology

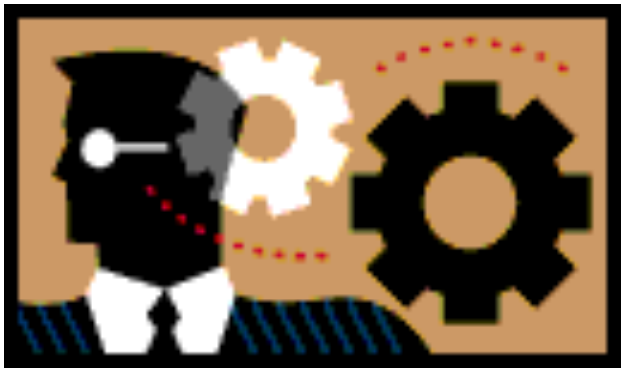
A take-up module based on the latest research

Identifies which homes will come forward to change their heating system associated with different triggers

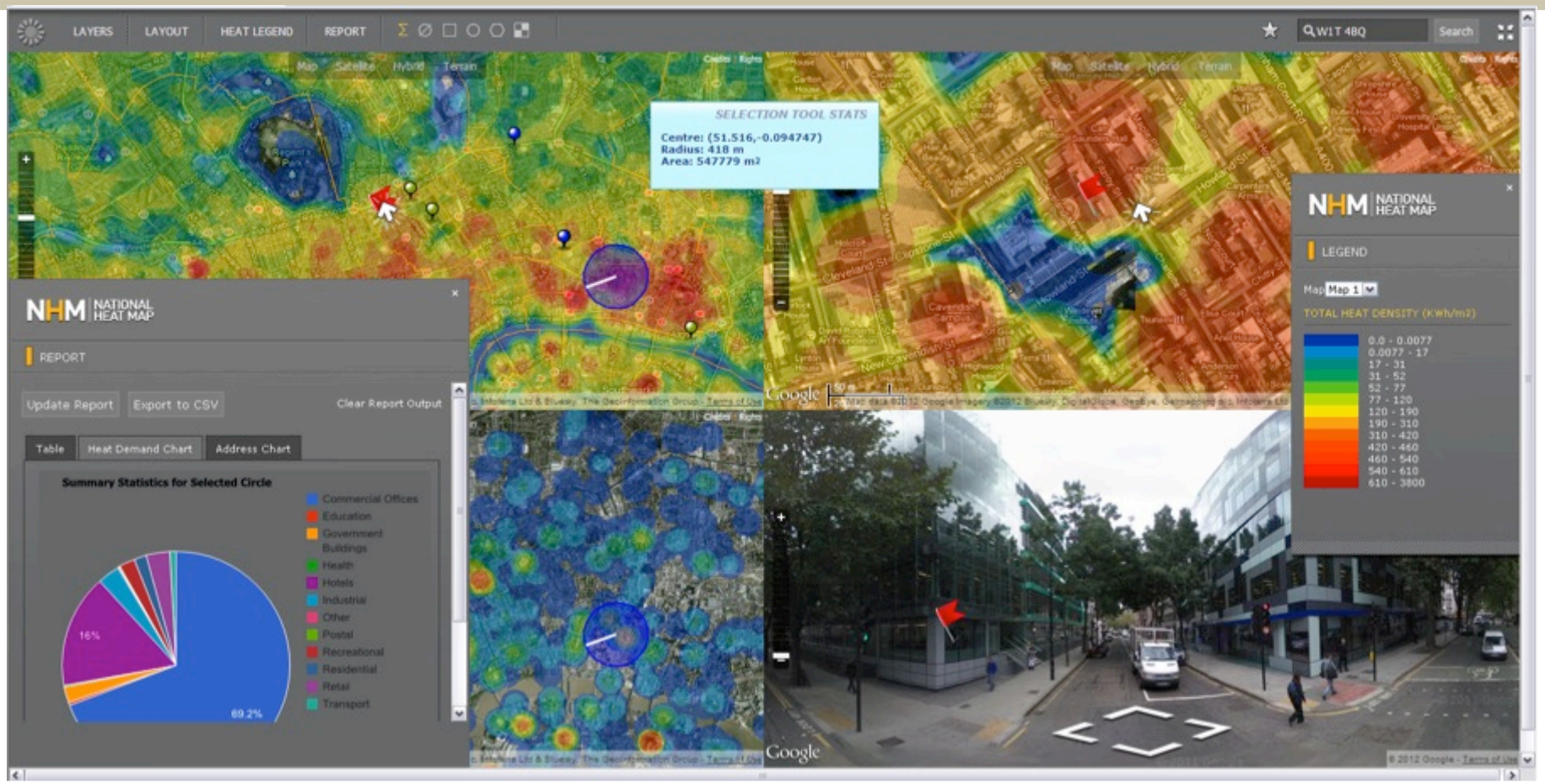
Technology choice is established based on suitability and sizing in line with different scenarios.

A flexible policy tool

All the variables can be adjusted for different policy scenarios



The National Heat Map



The National Heat Map is a comprehensive spatial plan of heat demand density, equipped with a range of tools to help developers and planners identify priority areas for low carbon heat projects.

http://ceo.decc.gov.uk/nationalheatmap

Technology Innovation Needs Assessment Research Framework - national

* Aim to identify and value the key innovation needs of specific low carbon technology families to prioritise public sector investment.

* Heat TINA just published – focuses on **heat pumps, heat networks and heat storage**

* **Heat innovation could reduce UK energy system costs by £14-66bn to 2050, with heat storage also offering additional value by enabling other system adjustments.**

http://www.lowcarboninnovation.co.uk/working_together/technology_focus_areas/heat/

Why these three?

• Heat pumps are a potentially very **cost-effective** means of delivering heat with low or zero GHG emissions
• Heat pumps also can accommodate a **variety of electricity generation** sources
• Heat storage and heat networks can be integrated into the energy system to **ease balancing requirements** related to the very "peaky" nature of heat demand

We estimate **potential 2050 deployment** levels of:

Heat pumps: 70-240GW (100-340TWh)
Heat networks: 10-95GW (20-200TWh)
Heat storage: 6-190GW

Dependencies: Extent of demand reductions,
the availability of biomass , and the balancing requirements of the electricity system

Heat storage

"Innovation in advanced (daily) heat stores, large-scale heat extraction technologies, and installation processes offer the bulk of the potential, with ***estimated system cost savings to 2050 of £3bn (£0.5 – 11bn),*** *split fairly evenly across daily and inter seasonal storage.*

Moreover, the ***additional enabling value*** *is estimated to be at least of the same order of magnitude."*

"Critically, achieving much of the innovation potential involves integrating heat systems either with the built environment (e.g. design and installation improvement opportunities) or with each other."

“Additional enabling value”

• Since 1970s, we have been removing thermal stores as we installed combi boilers – yet all our proposals for 2050 require heat storage

• Daily heat storage can help to improve the performance and consumer acceptability of heat pumps, which are less able to meet spikes in heat demand than the incumbent gas boiler technology.

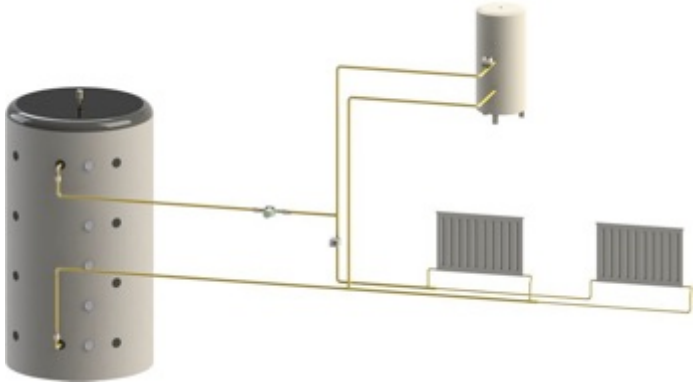
• Heat storage can help make heat networks more economical by allowing heat sources to operate more efficiently, reducing the amount of heat generation capacity to meet peak demand

• Heat storage could help balance electricity demand predicted to rise significantly with heat pumps and electric cars, reducing the costs of network reinforcement/ extra capacity

Market turnover

Chart 10. Estimated market turnover by technology area

	Estimated market turnover in 2050 (£bn, real undiscounted)			Estimated market turnover 2010-2050 (£bn, real, cumulative discounted)		
	Low scenario	Medium scenario	*High scenario*	*Low scenario*	Medium scenario	*High scenario*
Heat pumps	*33*	*76*	*130*	*390*	900	*1,500*
Heat networks	*10*	*26*	*77*	*130*	340	*990*
Advanced daily heat storage	*2*	*18*	*45*	*20*	190	*600*
Interseasonal heat storage	*2*	*9*	*36*	*30*	110	*400*



Together, £300 bn

UK business opportunity

Chart 12. Estimated UK business value creation potential

	Est. contribution to UK GDP 2010-2050, £bn, real, discounted			Est. net contribution to UK GDP 2010-2050, £bn, real, discounted			Major sub-sector opportunities for UK business
	Low scenario	**Medium scenario**	*High scenario*	*Low scenario*	**Medium scenario**	*High scenario*	
Heat pumps	*2.4*	**5.2**	*9.0*	*1.2*	**2.6**	*4.5*	Heat pump technology, followed by controls
Heat networks	*0.5*	**1.4**	*4.0*	*0.3*	**0.7**	*2.0*	Connection to the user, followed by interface with the user and project design
Advanced daily heat storage	*0.7*	**2.9**	*8.6*	*0.3*	**1.4**	*4.3*	Heat store technology
Interseasonal heat storage	*0.2*	**0.8**	*2.8*	*0.1*	**0.4**	*1.4*	Heat extraction technology , followed by project design

Storage – particular opportunity for UK

Research conclusions

So research is this area is not just looking at one technology, but enablers that allow us to look across the energy system in a number of ways.

For example – the interaction
• between the building, the consumer, heating supply and heating demand
• between the roles of different contractors in construction
• between different heating supply technologies in the same building
• between the National Grid, local grids and heating systems
• between the different uses of energy in the home or building – including electric cars, internet use, uses of appliances, role of hydrogen, as well as heating

•**Advanced Heat Storage Competition -** prototype demonstration (Phase 2) in Spring 2013

Smart Systems and Heat Programme

10 April 2012

Prime Minister launches ETI's £100m Smart Systems and Heat Programme

The Energy Technologies Institute (ETI) is a public-private partnership

Programme aims

- Understanding real mass-market **consumer behaviour**, requirements and profiles in order to design and communicate effective service products
- The provision of **energy services** and integrated products (i.e. the physical elements) to consumers in domestic and commercial buildings (primarily domestic & retrofit)
- Key focus on **space and water heating** (comfort, cleanliness), but including other energy service needs in or connected to buildings (e.g. vehicle charging)
- Understanding the **evolution of the whole energy system** out to 2050, including buildings retrofits and energy distribution system choices.

http://www.eti.co.uk/technology_programmes/smart_systems_and_heat

Heating controls

- Taking a keen interest in the potential for emerging heating control technologies to reduce domestic heat demand
- Models like RdSAP currently only record efficiency savings from going from on/off to bimodal operation with timers.
- Heating controls are a measure in the Green Deal – but need to demonstrate energy savings to customer better than previous controls to meet Golden Rule.

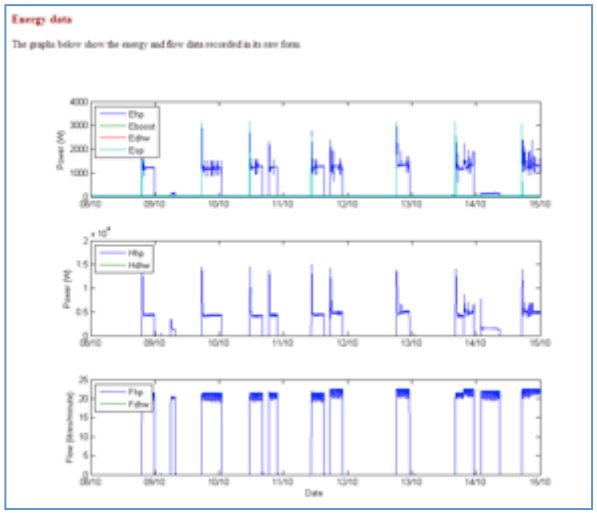


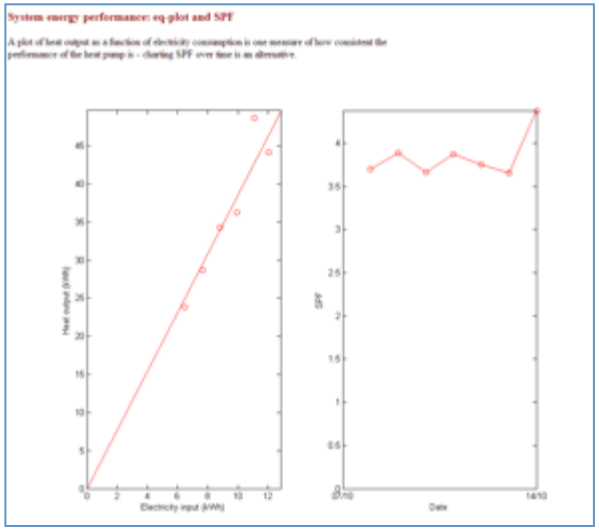
- Zonal heating?
- Remote control heating?
- Adaptive?

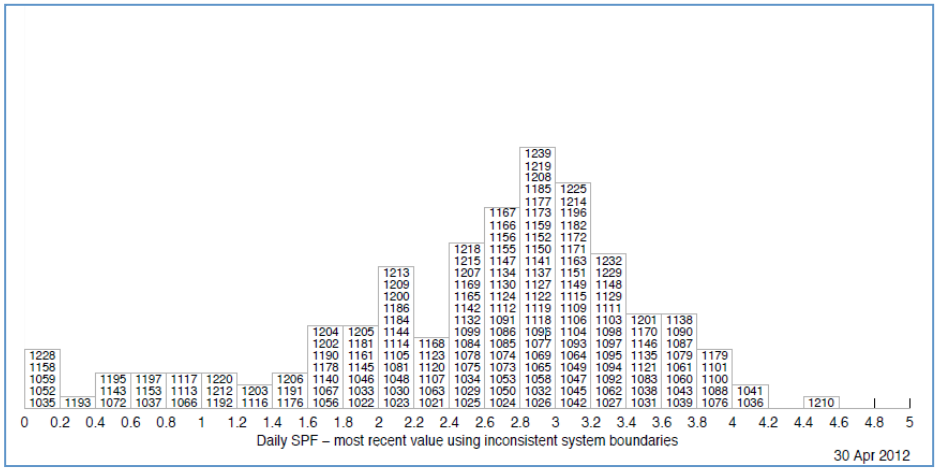
- So far research has been focussed on potential for energy savings through behaviour – see Consumer Focus (2012), "Consumer and Domestic heating controls: a literature review"
- Some US evidence that energy savings not as big as expected
- We'd welcome any data/views from experts in the field

Heat metering – evidence from Renewable Heat Premium Payment scheme

- Scheme opened August 2011 – now open till at least March 2013
- Requirement to allow heat meters – later "meter ready" after problems with mobile phone signal in rural areas
- Over 190 already in place
- Get daily reports – data recorded every 2 minutes
- Analysis over a heating season will take some time
- Lessons for future on how and where to meter heat especially for heat pumps which need additional sensors and electricity meters

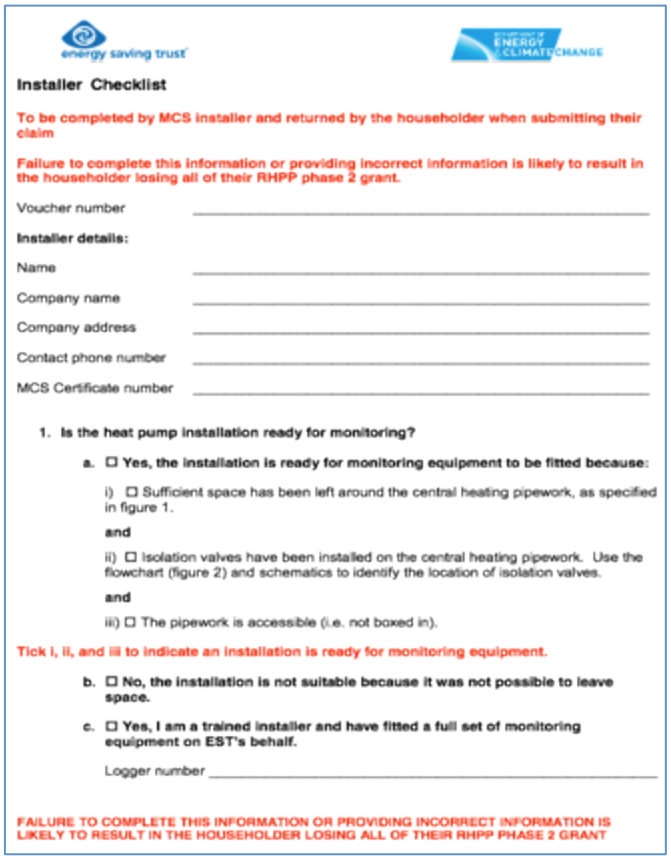






Heat metering lessons from Renewable Heat Incentive

- **Renewable Heat Incentive opened November 2011 for businesses/multiple dwellings**
- **Lessons on metering** – inappropriate monitoring strategy often reason not to accredit. Also some poor installations; and retrofit often difficult in space available.
- **From summer 2013** – domestic Renewable Heat Incentive through Ofgem E-Serve
- New proposals under public consultation
- **Includes proposals on metering** – we will need to be tendering for this shortly through OJEU
- Please reply to consultation before **7 December 2012**



energy saving trust

Installer Checklist

To be completed by MCS installer and returned by the householder when submitting their claim

Failure to complete this information or providing incorrect information is likely to result in the householder losing all of their RHPP phase 2 grant.

Voucher number _____

Installer details:

Name _____

Company name _____

Company address _____

Contact phone number _____

MCS Certificate number _____

1. **Is the heat pump installation ready for monitoring?**

   a. ☐ **Yes, the installation is ready for monitoring equipment to be fitted because:**

      i) ☐ Sufficient space has been left around the central heating pipework, as specified in figure 1.

      and

      ii) ☐ Isolation valves have been installed on the central heating pipework. Use the flowchart (figure 2) and schematics to identify the location of isolation valves.

      and

      iii) ☐ The pipework is accessible (i.e. not boxed in).

   Tick i, ii, and iii to indicate an installation is ready for monitoring equipment.

   b. ☐ **No, the installation is not suitable because it was not possible to leave space.**

   c. ☐ **Yes, I am a trained installer and have fitted a full set of monitoring equipment on EST's behalf.**

      Logger number _____

FAILURE TO COMPLETE THIS INFORMATION OR PROVIDING INCORRECT INFORMATION IS LIKELY TO RESULT IN THE HOUSEHOLDER LOSING ALL OF THEIR RHPP PHASE 2 GRANT

Conclusions

- Heating and cooling are crucial in understanding energy use, and thus carbon emissions reduction, in the UK

- Govt is focussing on urban areas and off the gas grid for the next decade or so

- Have identified research priorities – mainly enabling technologies such as pipework and stores

- Areas of innovation under discussion today are crucial in determining future pathways

- We are consulting on the renewable heat incentive – and would welcome your views – the closing date is 7 December 2012

Credit: Google

Domestic

Key proposals in the consultation include:
Indicative tariff ranges for air source heat pumps (6.9-11.5p/kWh), biomass boilers (5.2-8.7p/kWh), ground source heat pumps (12.5-17.3p/kWh) and solar thermal technologies (17.3p/kWh) that are MCS certified and meet relevant required standards
Payments for householders over seven years for each kWh of heat produced for the expected lifetime of the renewable technology and based on deemed heat usage
Tariff levels set to provide a better return for householders living off the gas grid
Budget management system similar to one introduced for the Feed-in Tariffs scheme
Minimum energy efficiency requirements based on Green Deal assessments

Commercial

The first consultation looks at the broader expansion of the scheme and closes on 7 December 2012. The second consultation focuses on air to water heat pumps and energy from waste and closes on 18 October 2012.

Key proposals to expand the scheme include:

- Inclusion of heating only Air to Air heat pumps with a proposed tariff of 0.97p/kWh for all sizes of installation
- Inclusion of Air to Water heat pumps with a proposed tariff of 1.7p/kWh for all sizes of installation
- Inclusion of biomass direct air heaters with a proposed tariff of 2.1p/kWh under 1MW and 1p/kWh over 1MW
- Extension of biogas combustion tariffs to installations over 200kW
- Introduction of a specific tariff for heat from biomass CHP of a proposed 4.1pkWh
- Introduction of bioliquid CHP tariff of 4.1p/kWh
- Increased tariff for deep geothermal installations from 3.4 p/kWh to 5p/kWh
- Increased range of waste feedstocks eligible for support
- Minimum energy efficiency requirements for district heating, commercial and industrial space and water heating
- Continuation of exclusion of reversible Air to Air heat pumps from the scheme

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Table 1: RHI tariffs table

Tariff Name	Eligible Technology	Eligible Sizes	Tier	Previous tariff (pence/ kWhth) - up to 31.3.12	New rounded tariff (pence/ kWhth) - from 1.4.12
Small Commercial biomass	Solid biomass including soild biomass contained in municipal solid waste (incl. CHP)	Less than 200 kWth	Tier 1	7.9	8.3
			Tier 2	2	2.1
Medium Commercial Biomass		200 kWth and above; less than 1,000 kWth	Tier 1	4.9	5.1
			Tier 2	2	2.1
Large Commercial Biomass		1,000 kWth and above	N/A	1	1
Small Commercial heat pumps	Ground-source heat pumps; Water Source heat pumps; deep geothermal	Less than 100 kWth	N/A	4.5	4.7
Large Commercial heat pumps		100 kWth and above	N/A	3.2	3.4
All solar collectors	Solar collectors	Less than 200 kWth	N/A	8.5	8.9
Biomethane and biogas combustion	Biomethane injection and biogas combustion, except from landfill gas	Biomethane all scales, biogas combustion less than 200 kWth	N/A	6.8	7.1