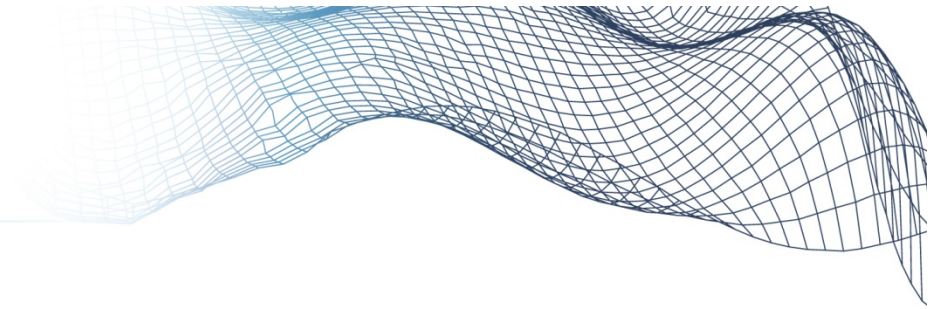




spencerhill.co.uk



RHI'd out ?

“Tentative” programme

RHI - something – DECC top person

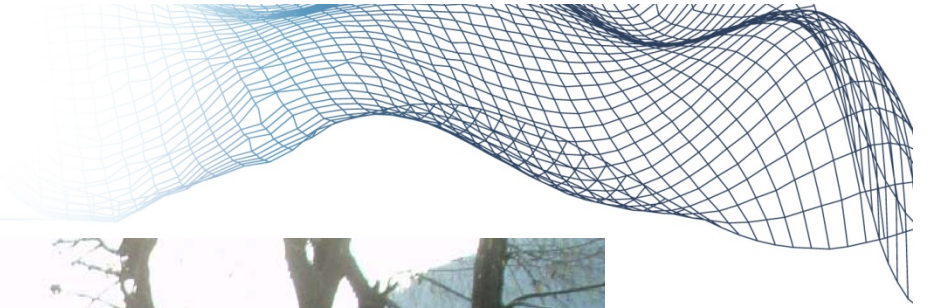
RHI - something else – Chair GSHPA

RHI - more something else – Marketing man GSHPA

RHI – pre-lunch slot – give Robin something to waffle about

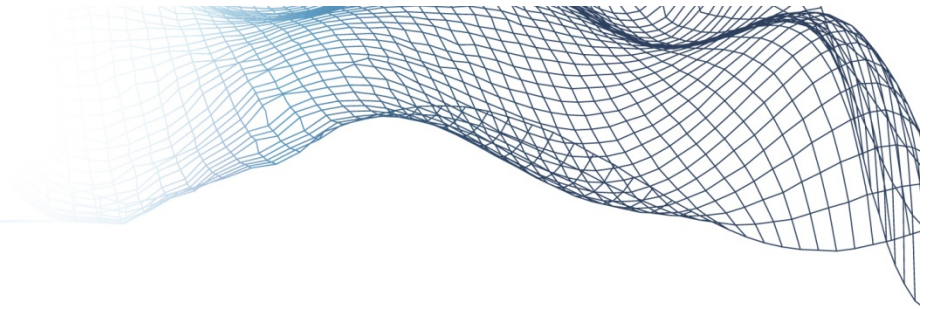
# Reel handler ?









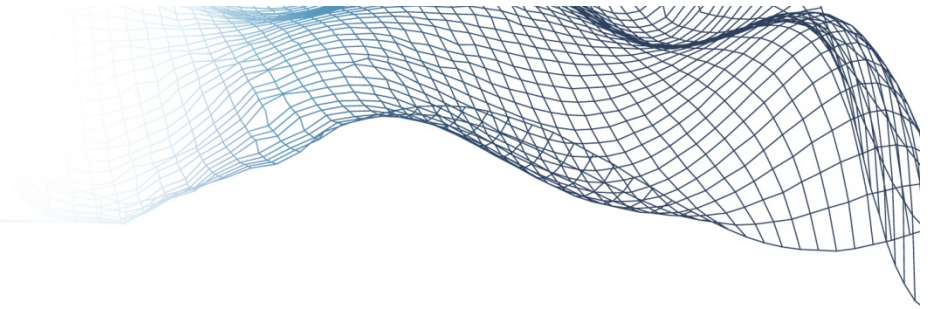


Why ?

Oil ~ 92 Sps / litre

Electricity ~5 Sps / kWh

(Sps = spondoolicks)



– 2014 AGM and Seminar

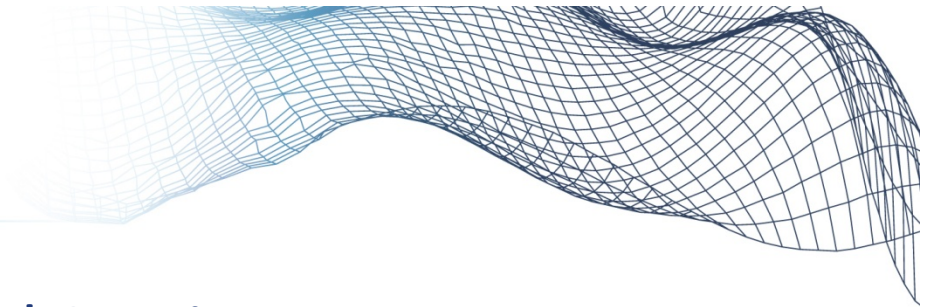
# How to sell GSHPs using the RHI

Robin Curtis  
GeoScience Ltd

Mount Bachelor, Oregon

Building Centre – London – 10<sup>th</sup> July 2014





– 2014 AGM and Seminar

# Onwards and upwards! (or downwards?)

Robin Curtis  
GeoScience Ltd

Mount Bachelor, Oregon

Building Centre – London – 10<sup>th</sup> July 2014

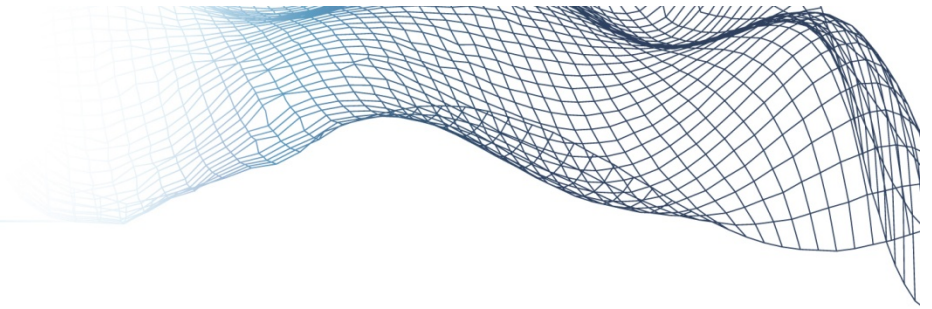
## Renewable Heat Incentive

March 2011

Inhibitor ?

or

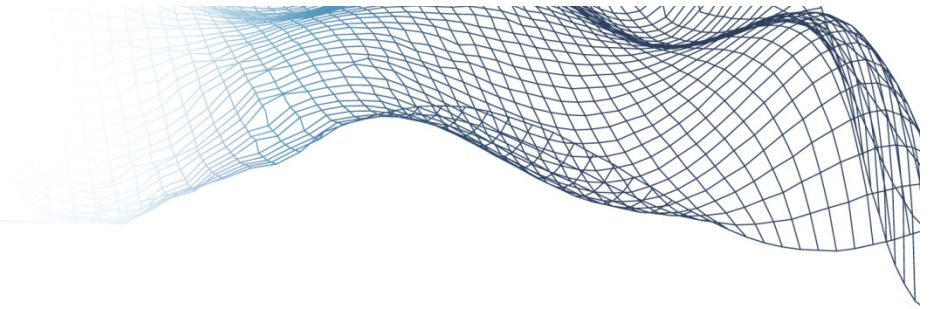
fiscal  
engineering?



We are where we are.

RHI is probably as good as it's going to get.

We now need to work with it to get this industry back on the rails in the UK.



You have had most if not all of the GSHP  
benefits already today.....

It's a tough technology

- there are easier ways  
to make a living....  
probably.....



GEOLOGICAL MAP  
OF THE  
BRITISH ISLANDS

BASED ON THE WORK OF THE GEOLOGICAL SURVEY  
75th EDITION 1965  
K. C. DUNHAM, D.Sc., F.R.S.,  
DIRECTOR

Scale of Twenty Five Statute Miles to the Inch - (1:250,000)

ATLANTIC  
OCEAN

INDEX

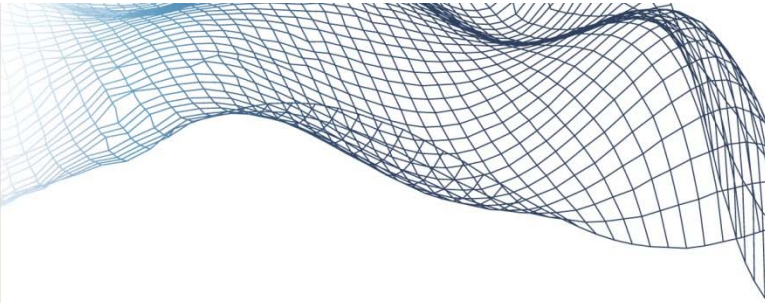
The geological map of the British Isles is color-coded according to geological periods and rock types. The legend on the right side of the map provides a key for these colors. It is organized into several sections: Quaternary (yellow, orange, red, pink), Tertiary (green, blue, purple), Cretaceous (light green, light blue), Jurassic (yellow, orange, red), Triassic (orange, red), Permian (orange, red), Carboniferous (green, blue, purple), Devonian (green, blue, purple), Silurian (green, blue, purple), Ordovician (green, blue, purple), Silurian and Devonian (green, blue, purple), Permian and Triassic (orange, red), and Tertiary and Quaternary (yellow, orange, red, pink). Each color is associated with a specific geological formation or period, and the legend includes a brief description of the rock type and its distribution.

Color	Geological Period / Formation	Description
Yellow	Quaternary	Recent alluvium, recent river terrace deposits, etc.
Orange	Quaternary	Recent alluvium, recent river terrace deposits, etc.
Red	Quaternary	Recent alluvium, recent river terrace deposits, etc.
Pink	Quaternary	Recent alluvium, recent river terrace deposits, etc.
Green	Tertiary	Recent alluvium, recent river terrace deposits, etc.
Blue	Tertiary	Recent alluvium, recent river terrace deposits, etc.
Purple	Tertiary	Recent alluvium, recent river terrace deposits, etc.
Light Green	Cretaceous	Recent alluvium, recent river terrace deposits, etc.
Light Blue	Cretaceous	Recent alluvium, recent river terrace deposits, etc.
Yellow	Jurassic	Recent alluvium, recent river terrace deposits, etc.
Orange	Jurassic	Recent alluvium, recent river terrace deposits, etc.
Red	Jurassic	Recent alluvium, recent river terrace deposits, etc.
Orange	Triassic	Recent alluvium, recent river terrace deposits, etc.
Red	Triassic	Recent alluvium, recent river terrace deposits, etc.
Green	Carboniferous	Recent alluvium, recent river terrace deposits, etc.
Blue	Carboniferous	Recent alluvium, recent river terrace deposits, etc.
Purple	Carboniferous	Recent alluvium, recent river terrace deposits, etc.
Green	Devonian	Recent alluvium, recent river terrace deposits, etc.
Blue	Devonian	Recent alluvium, recent river terrace deposits, etc.
Purple	Devonian	Recent alluvium, recent river terrace deposits, etc.
Green	Silurian	Recent alluvium, recent river terrace deposits, etc.
Blue	Silurian	Recent alluvium, recent river terrace deposits, etc.
Purple	Silurian	Recent alluvium, recent river terrace deposits, etc.
Green	Silurian and Devonian	Recent alluvium, recent river terrace deposits, etc.
Blue	Silurian and Devonian	Recent alluvium, recent river terrace deposits, etc.
Purple	Silurian and Devonian	Recent alluvium, recent river terrace deposits, etc.
Orange	Permian and Triassic	Recent alluvium, recent river terrace deposits, etc.
Red	Permian and Triassic	Recent alluvium, recent river terrace deposits, etc.
Yellow	Tertiary and Quaternary	Recent alluvium, recent river terrace deposits, etc.
Orange	Tertiary and Quaternary	Recent alluvium, recent river terrace deposits, etc.
Red	Tertiary and Quaternary	Recent alluvium, recent river terrace deposits, etc.
Pink	Tertiary and Quaternary	Recent alluvium, recent river terrace deposits, etc.

NORTH SEA

IRISH SEA

ENGLISH CHANNEL



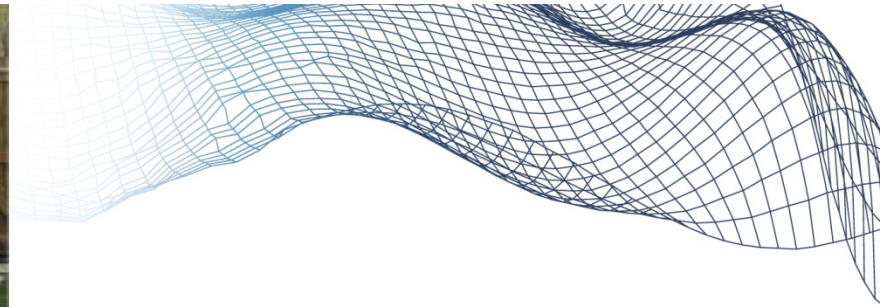


## Getting warmer: a field trial of heat pumps

The Energy Saving Trust



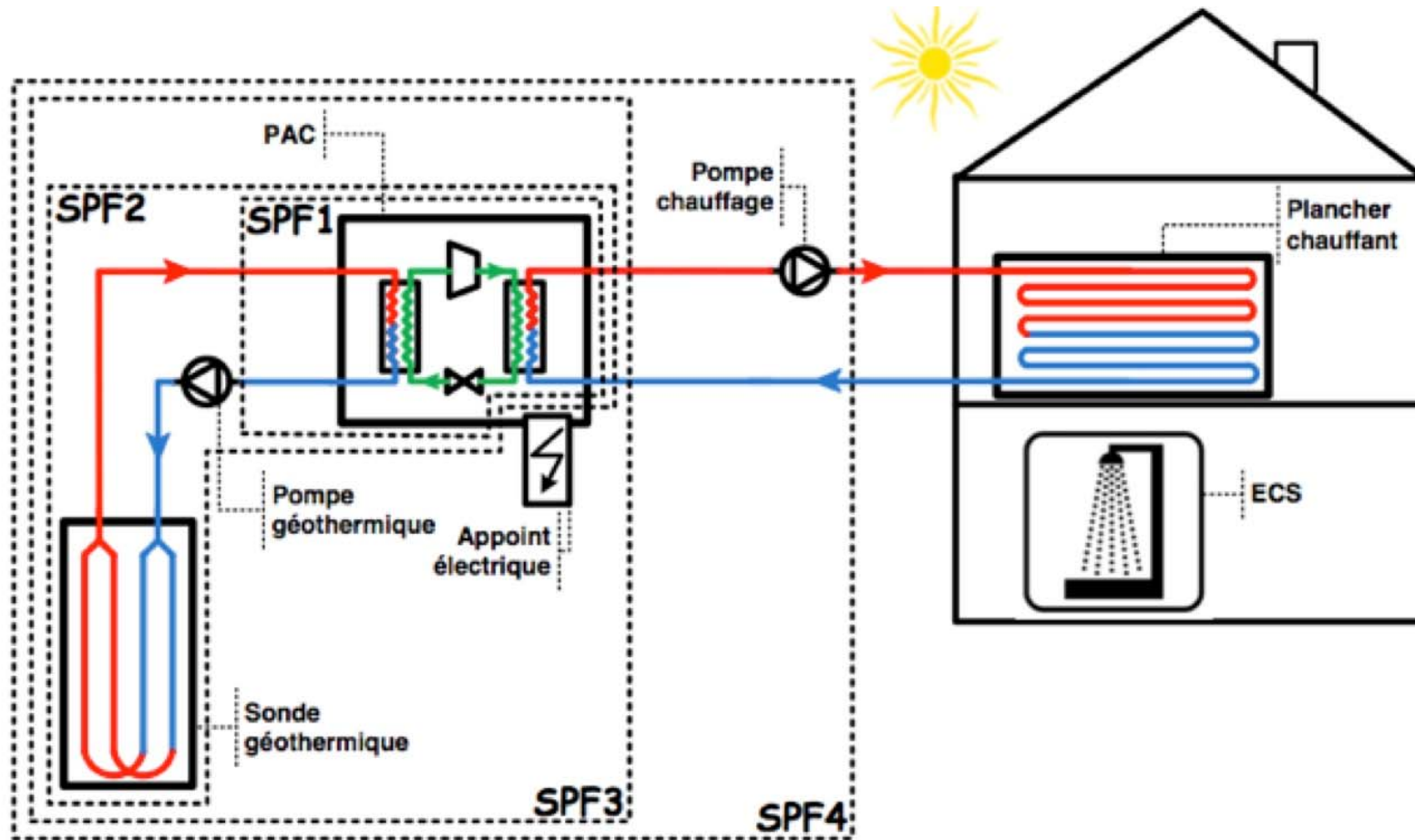
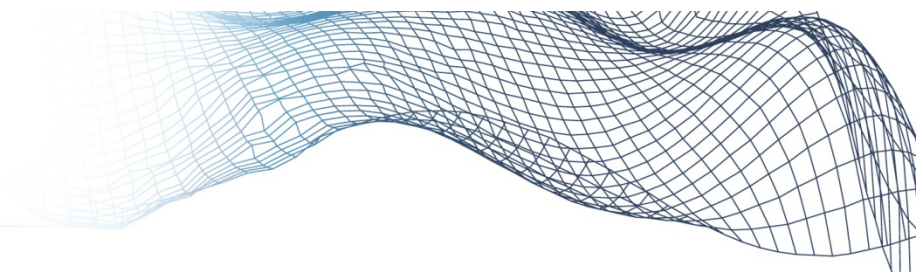
energy saving trust<sup>®</sup>



The EST study

...the intentions.....

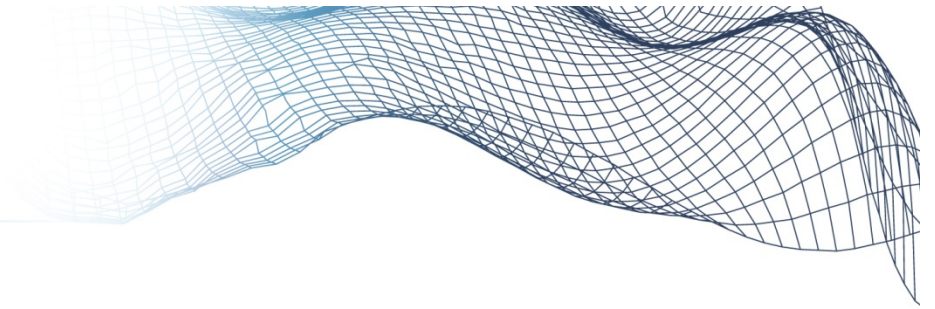
...the unintended consequences



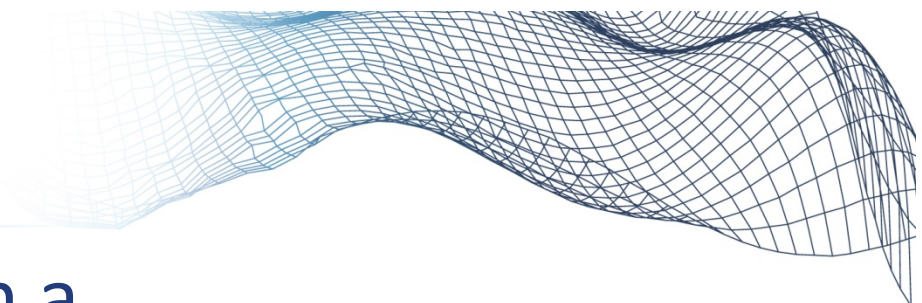
Performances measurement (example of a simple geothermal heat pump)

Definition from the SEPEMO project



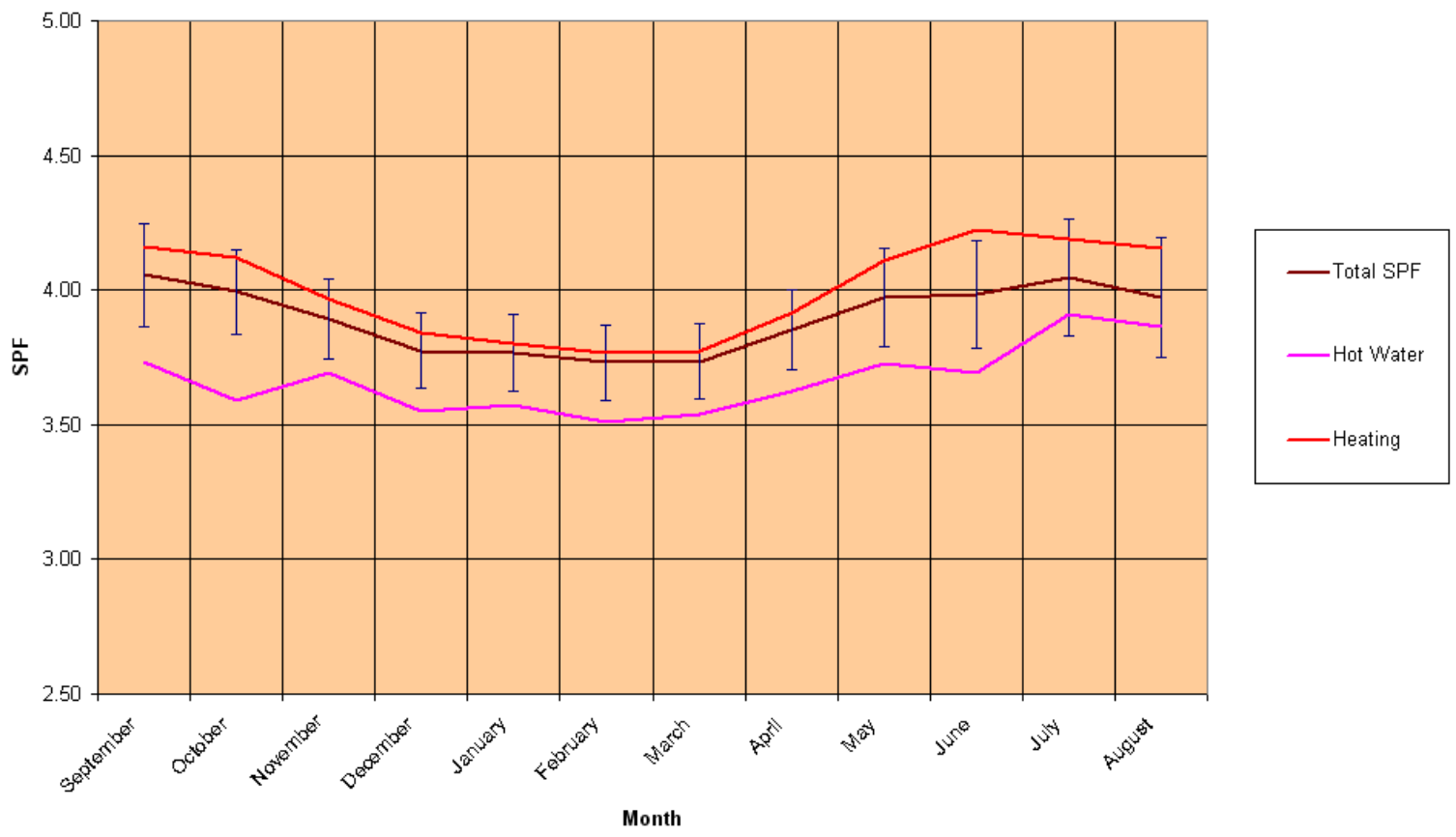


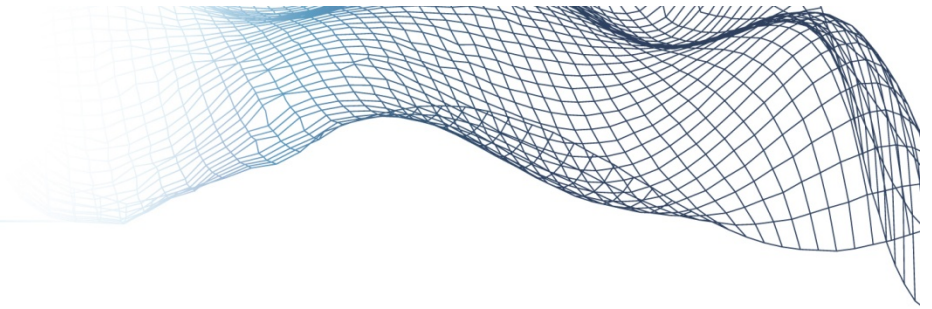
....but we know it delivers...



# Performance Results from a Properly Installed Domestic System in Truro

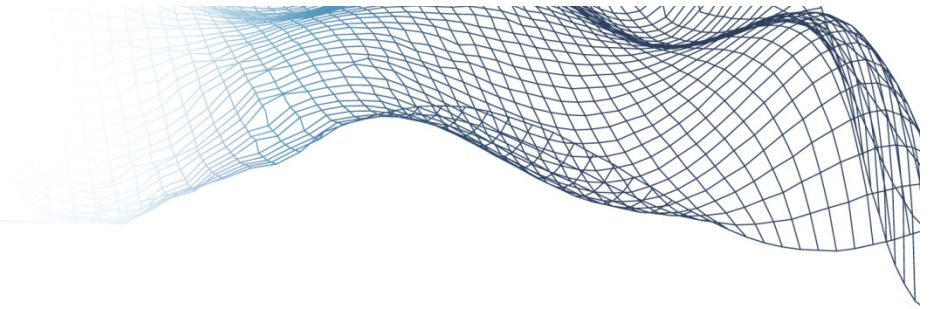
Annual SPF for Clifton Gardens Geothermal Heat Pump System





Don't bank on RHI - use it as a lever.

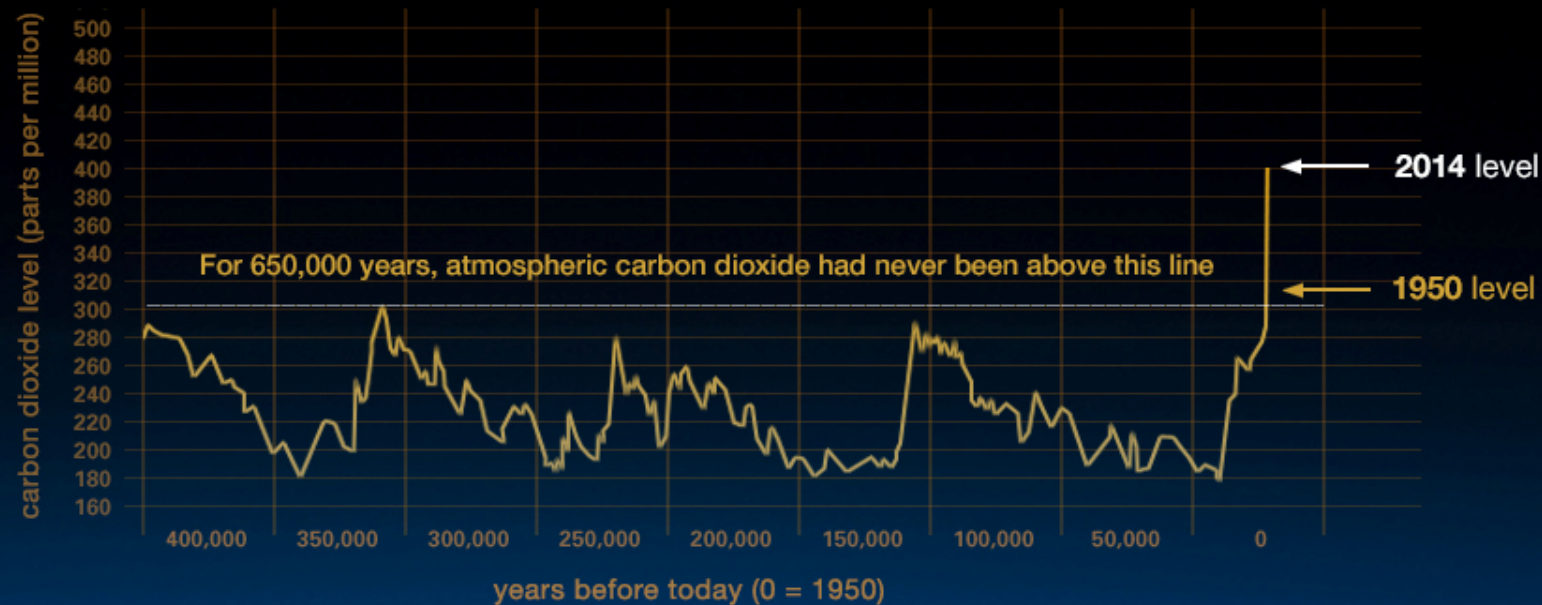
eg experience from Clear Skies/ LCBP.....



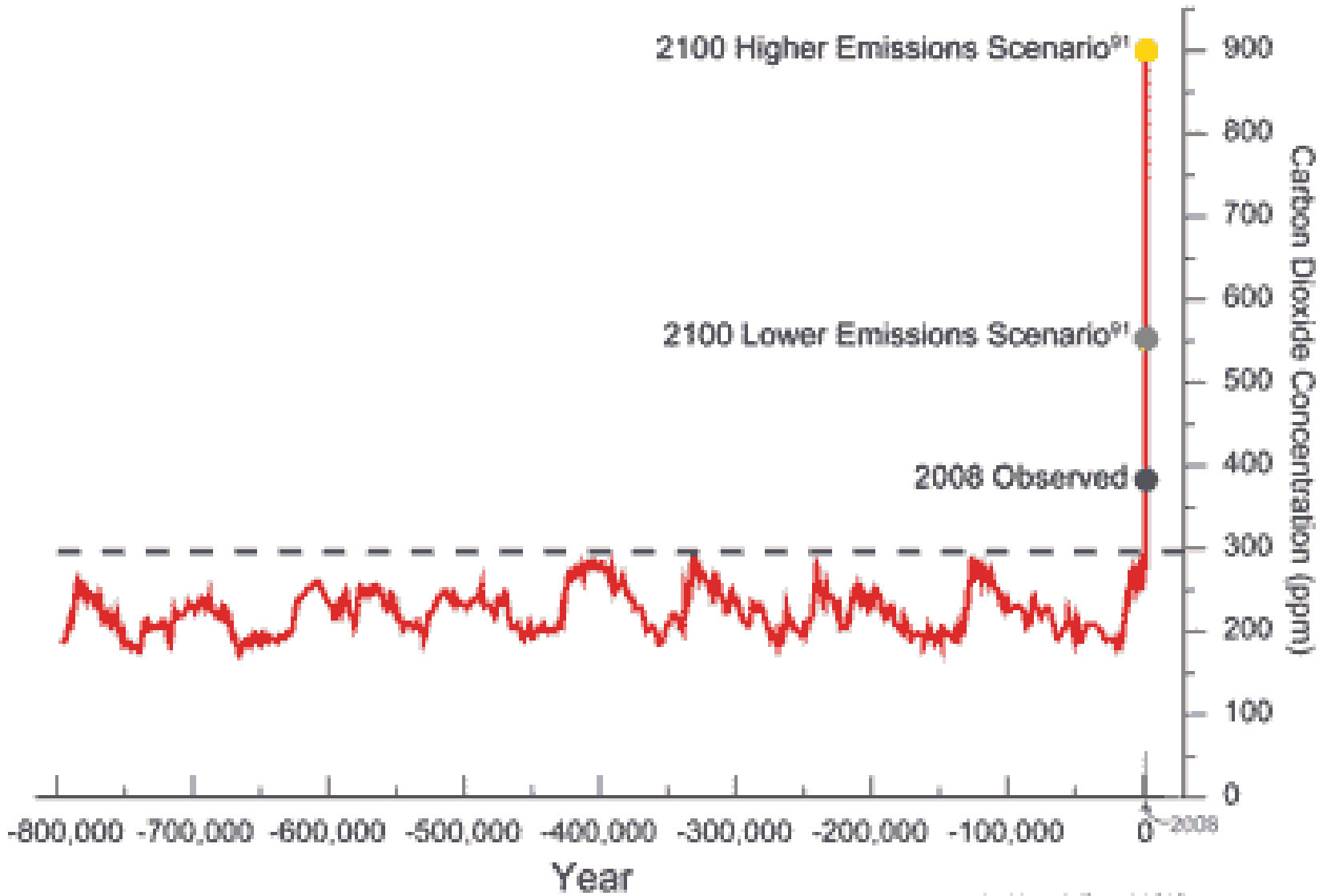
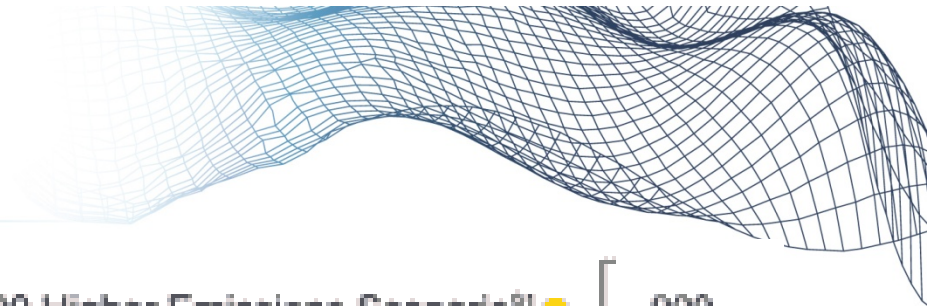
RHI may get you through  
the door

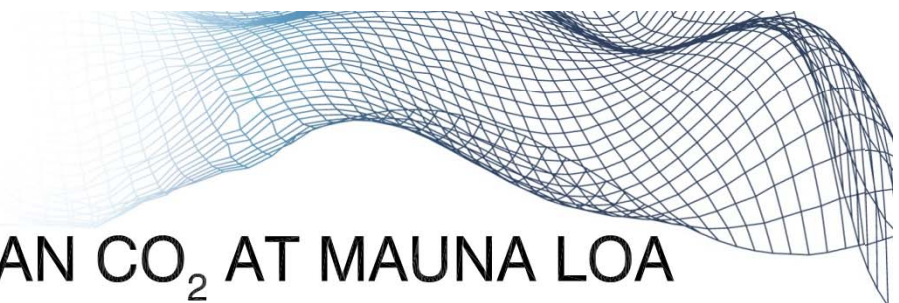
- other UK Drivers ?

# Atmospheric carbon dioxide is at its highest level in human history

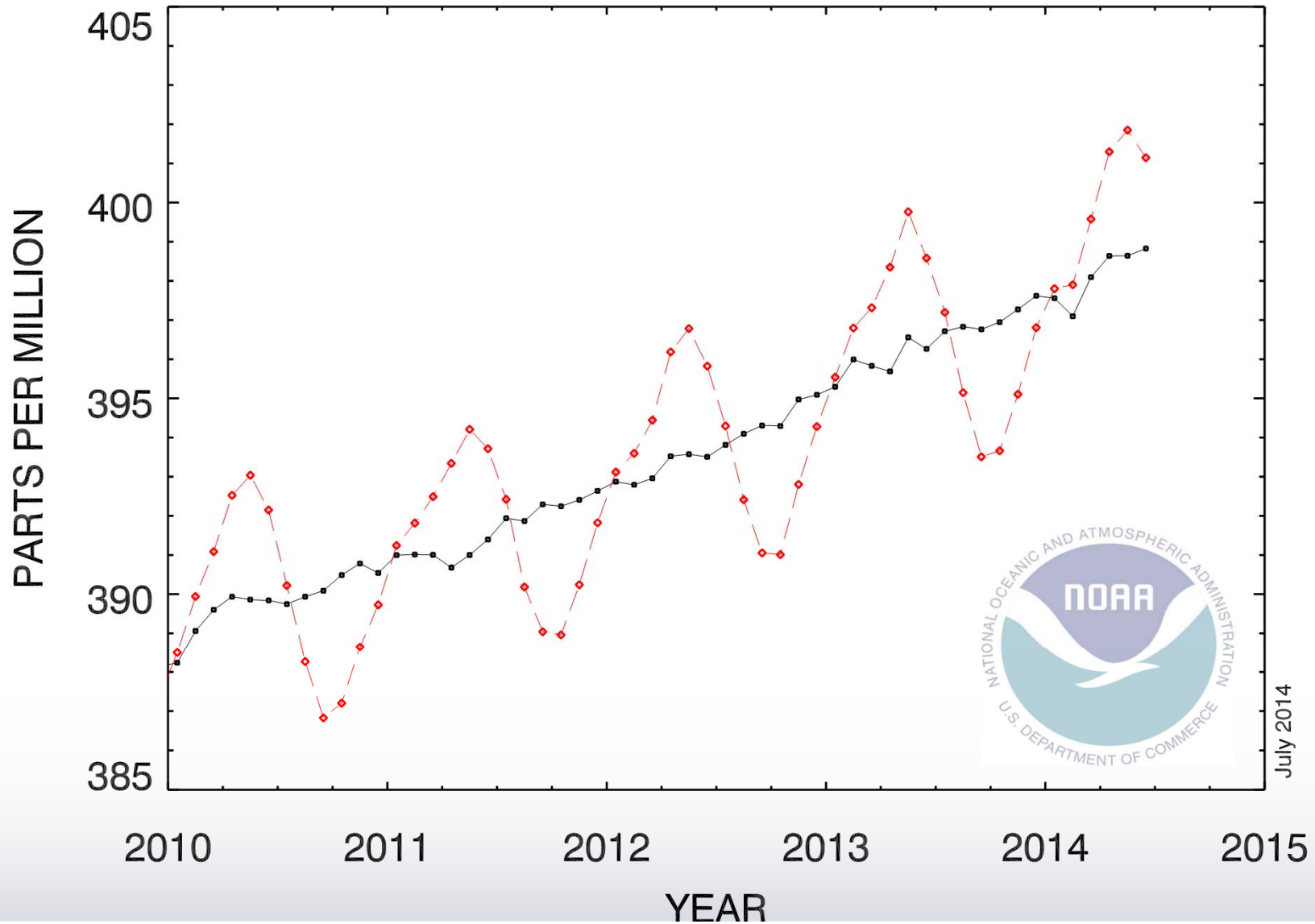


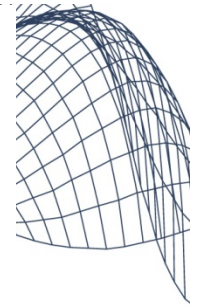
Credit:  
Vostok ice core data/J.R. Petit et al.;  
NOAA Mauna Loa CO<sub>2</sub> record.





# RECENT MONTHLY MEAN CO<sub>2</sub> AT MAUNA LOA





# Quick fixes won't solve CO2 danger

...and it's Carbon Emissions that are the main problem





# UN issued with roadmap on how to avoid climate catastrophe

Report is the first of its kind to prescribe concrete actions that the biggest 15 economies must take to keep warming below 2C

Suzanne Goldenberg, US environment correspondent

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[Follow @GuardianUS](#)

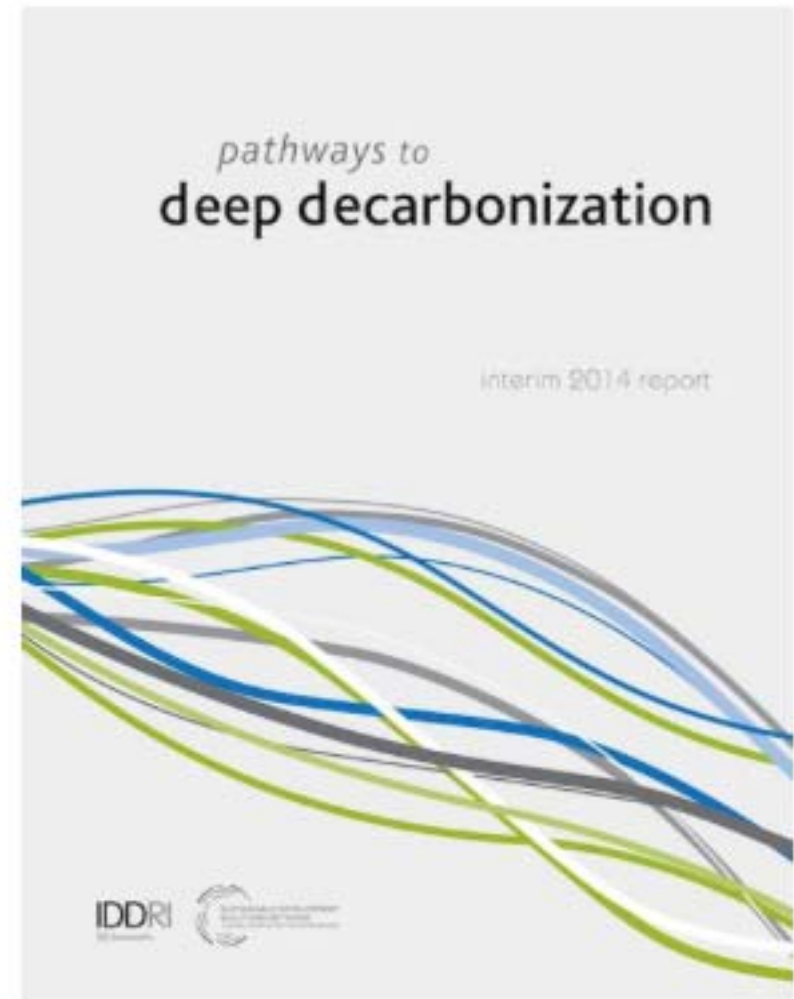
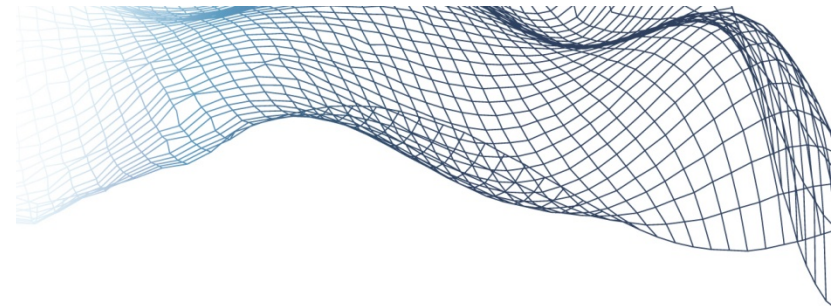
theguardian.com, Tuesday 8 July 2014 16.21 BST

[Jump to comments \(126\)](#)



Jeffrey Sachs, director of Columbia University's Earth Institute, said talking in the abstract was failing to produce the deep changes needed to move to a low-carbon global economy. Photograph: Ted Aljibe/AFP/Getty Images

The United Nations was presented with a roadmap to avoid a climate catastrophe on Tuesday, prescribing specific actions for the world's biggest economies to keep warming below 2C.

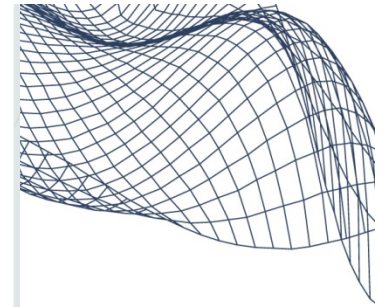


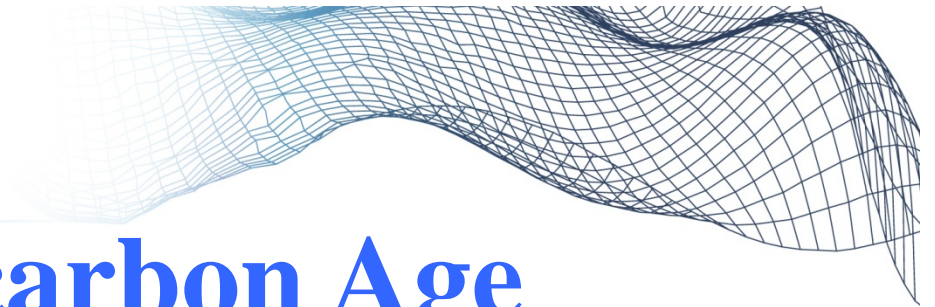
# EU unveils plans to improve sustainability of buildings

DATE RELEASED: 2 JUL 2014



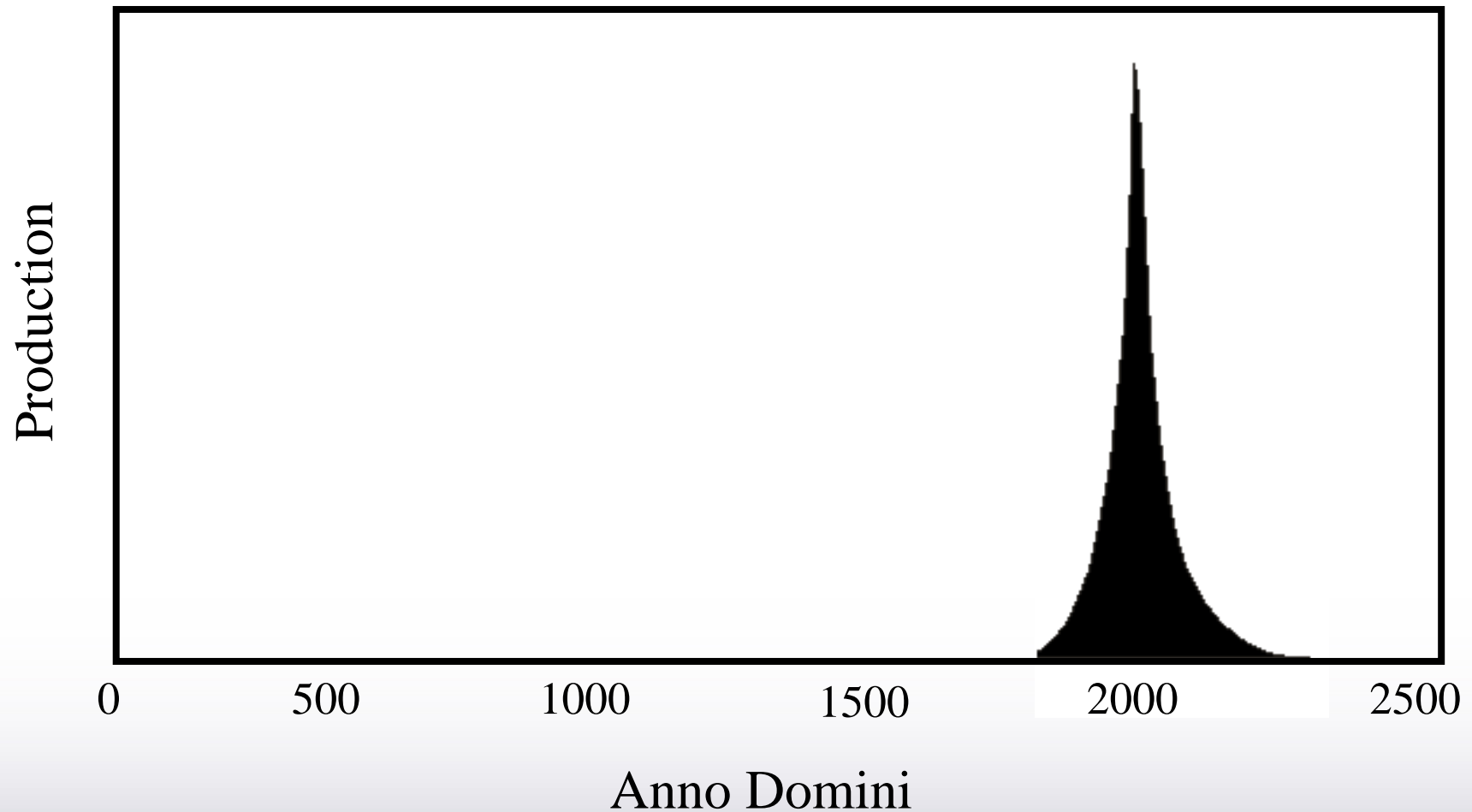
The European Commission has today adopted new proposals designed to raise the sustainability of new and renovated buildings by increasing resource efficiency and improving information on the environmental performance of buildings.

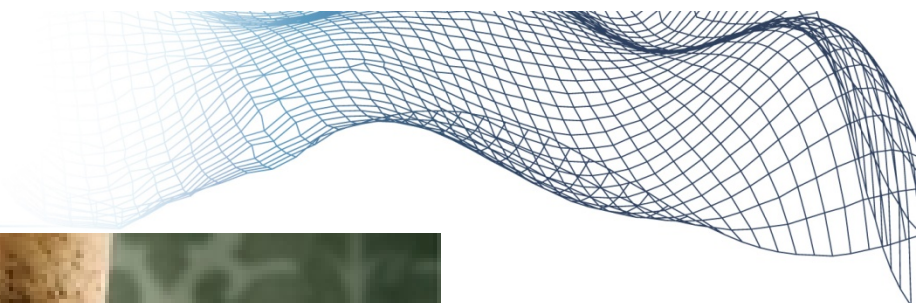




# The Hydrocarbon Age

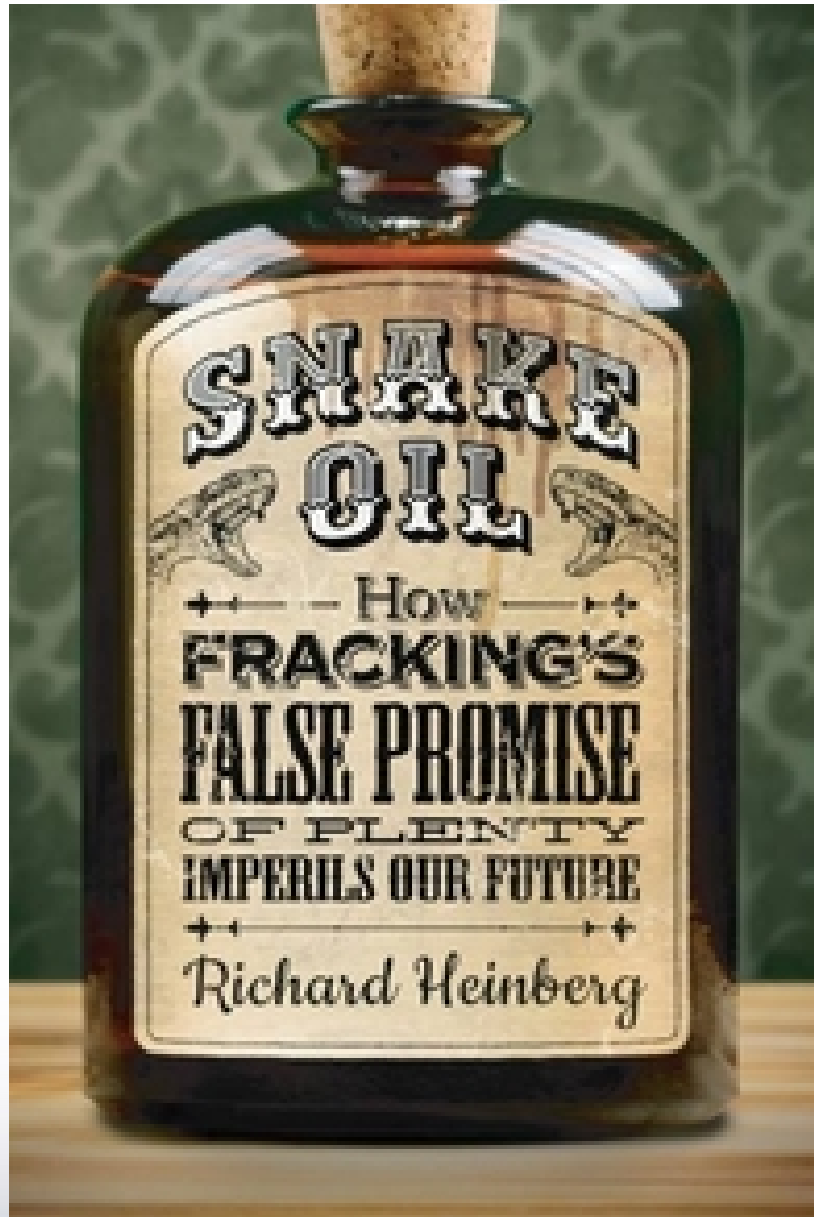
**A fleeting epoch in history**

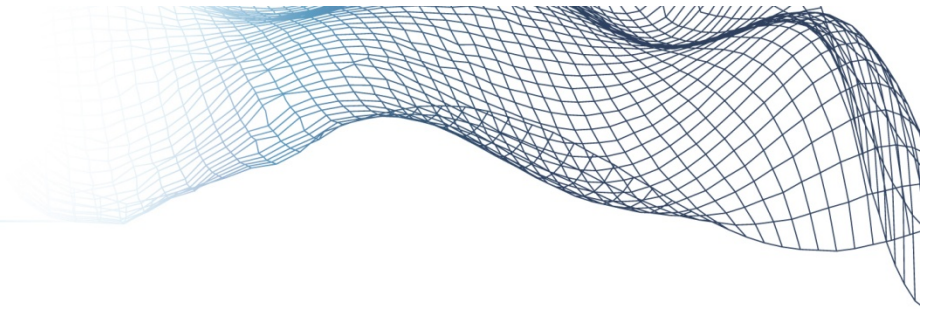




Richard Heinberg

Post Carbon Institute



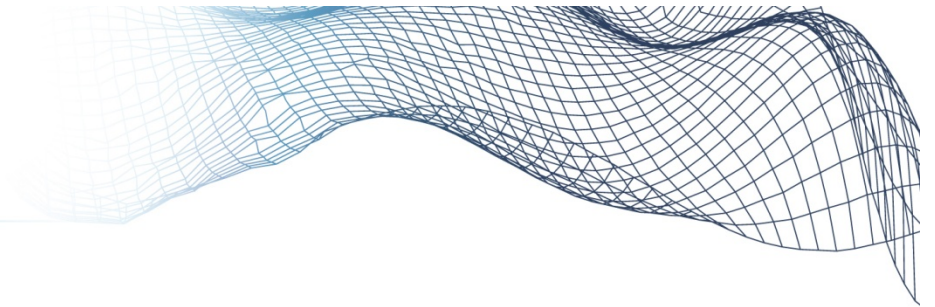


+ the Putin factor

Energy efficiency and

Energy security

now all over the press.....

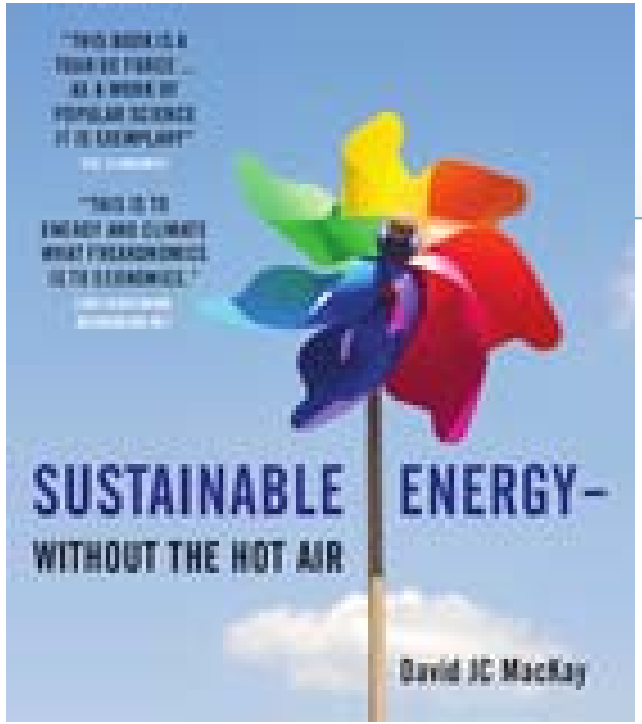
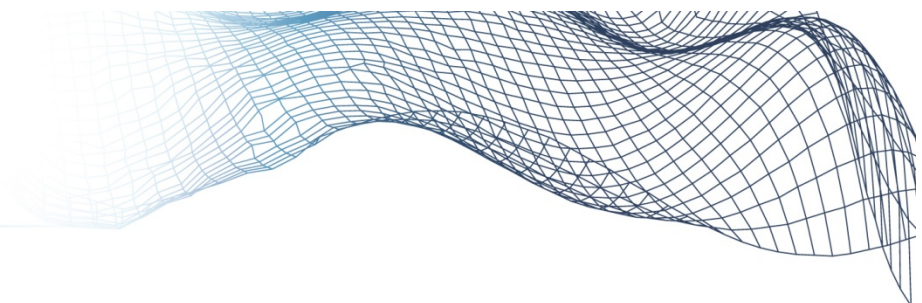


# UK Drivers ?

20/20/20

(well 15/20/20).....

and beyond.....

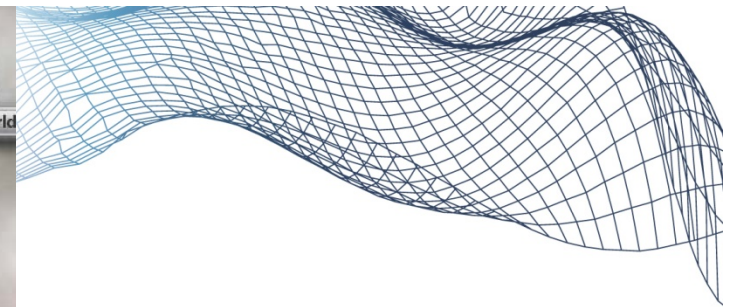
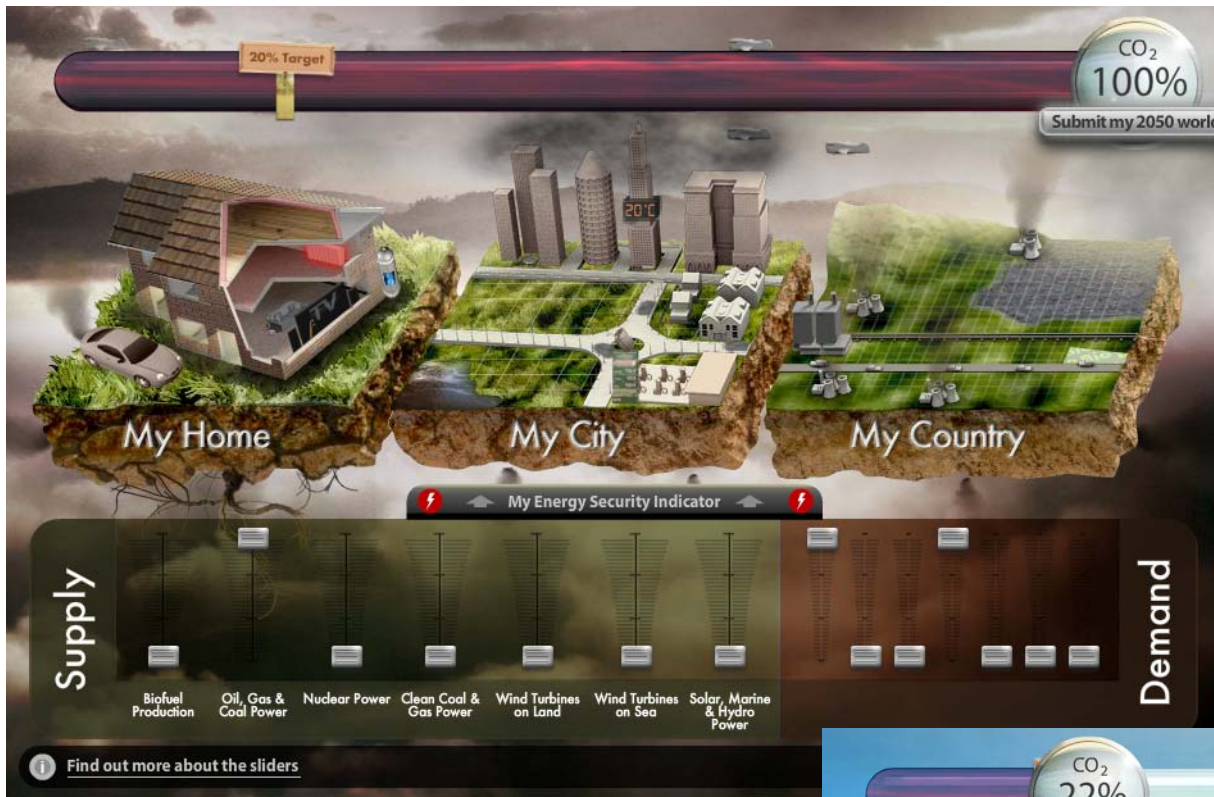


Sustainable Energy – Without the Hot Air  
Prof David MacKay  
[www.withouthotair.com](http://www.withouthotair.com)



<http://my2050.decc.gov.uk>





<http://my2050.decc.gov.uk>



Our Renewables Development Charter

Renewable Energy Farm near Week St Mary

Hampole Wind Farm

Creathorne Farm

Holm and Hollymill

**Delabole Wind Farm**

History of Delabole

Delabole consultation process

Delabole Wind Farm Community Fund

Our Dorset solar projects

West Raynham Airfield Solar Park

Renewable Heat

Working with landowners

Upcoming public consultations

## Delabole Wind Farm



The brainchild of the Edwards family, Delabole wind farm in North Cornwall was developed as a greener alternative to plans for a nuclear power station in the area.



### Project details

**Original number of turbines:** 10

**Original capacity:** 4MW

**Number of turbines after redevelopment:** 4

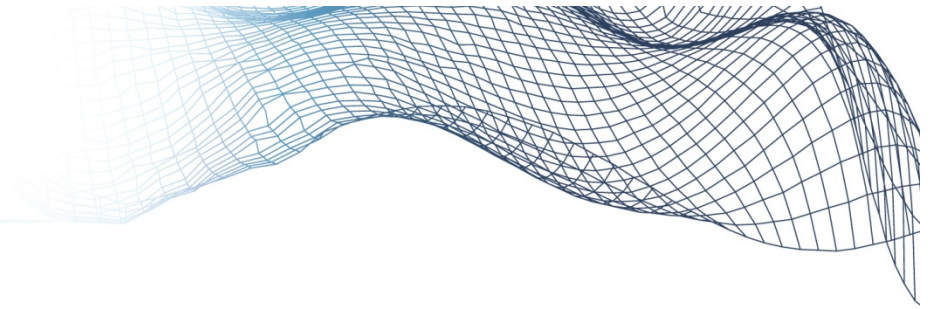
**Capacity after redevelopment:** 9.2MW

**Generation output:** Enough to power **5,700** homes

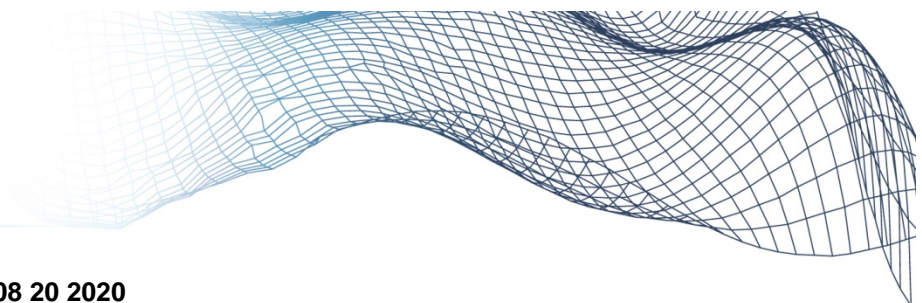
**Project status:** Redeveloped site operational since 2011

### Delabole Local Tariff

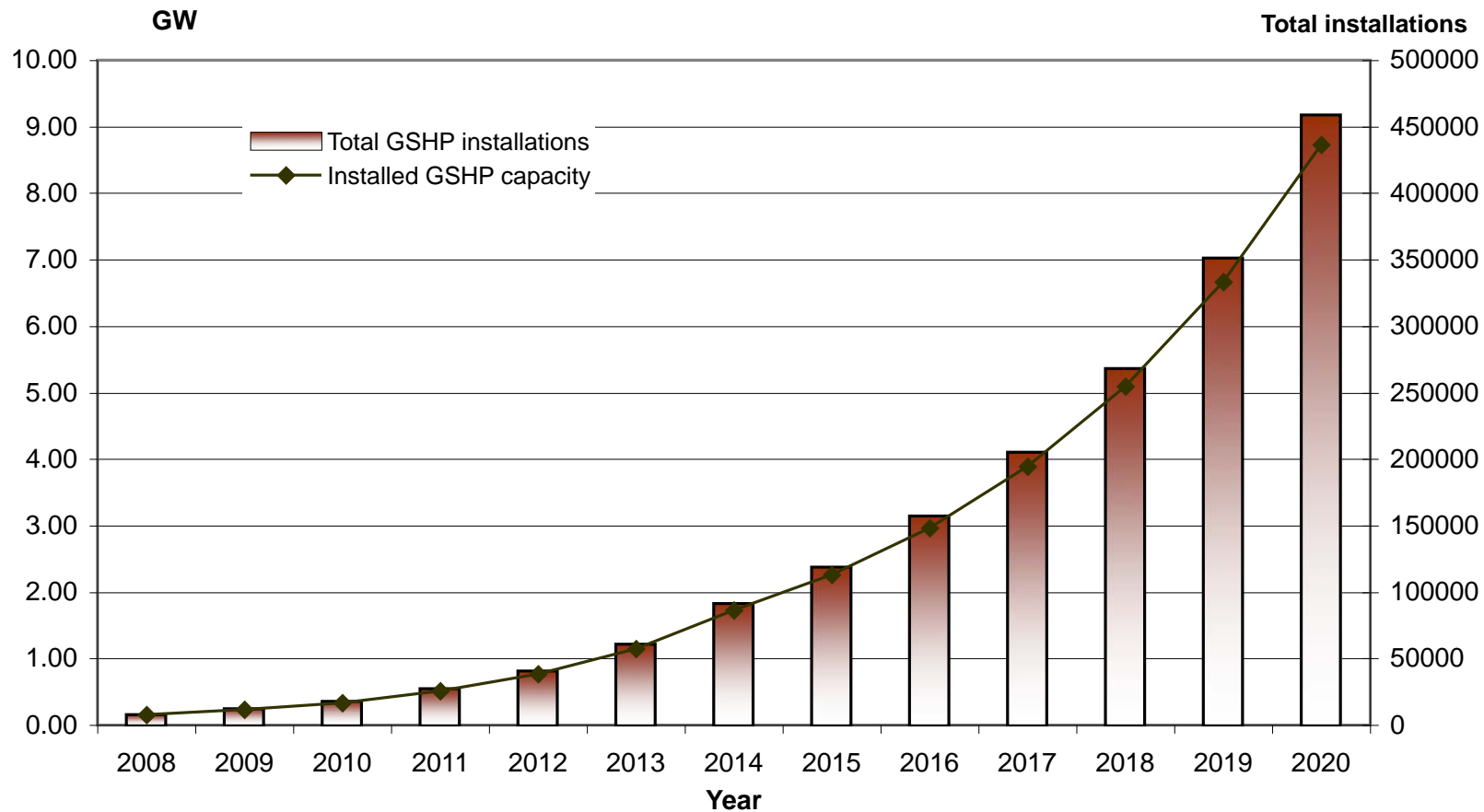




Cannot go on using valuable and increasingly expensive liquid and gaseous fuels to deliver low grade heat.



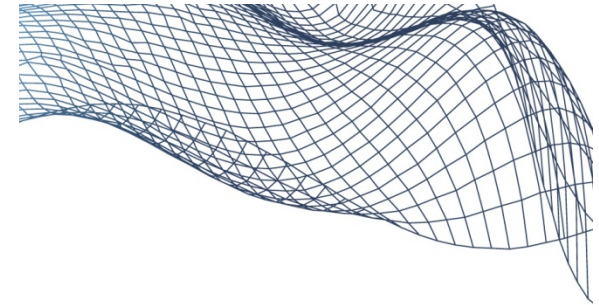
Electric GSHPs from 2008 to 2020



A possible/required growth pattern ?



Published by Ecuity Consulting LLP  
May 2012

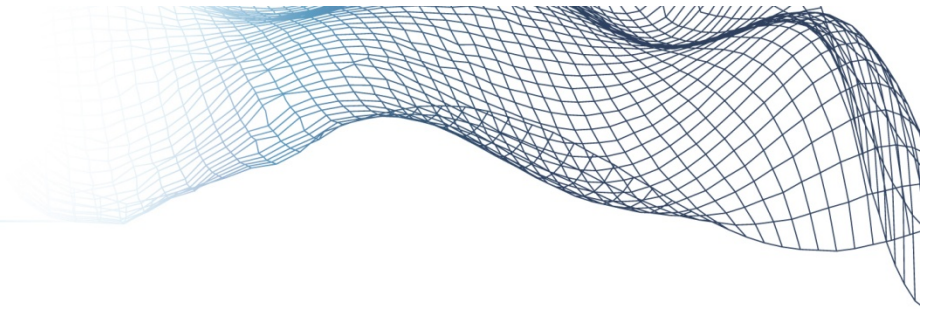


# 6.8 million Heat Pumps by 2030; from Vision to Reality

Meeting the challenge

*A Report by Ecuity Consulting LLP sponsored by:*

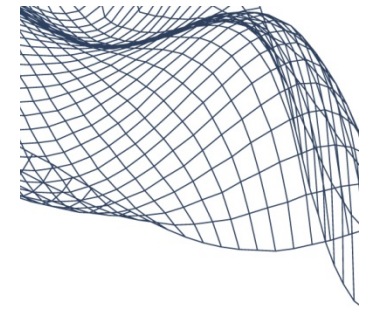
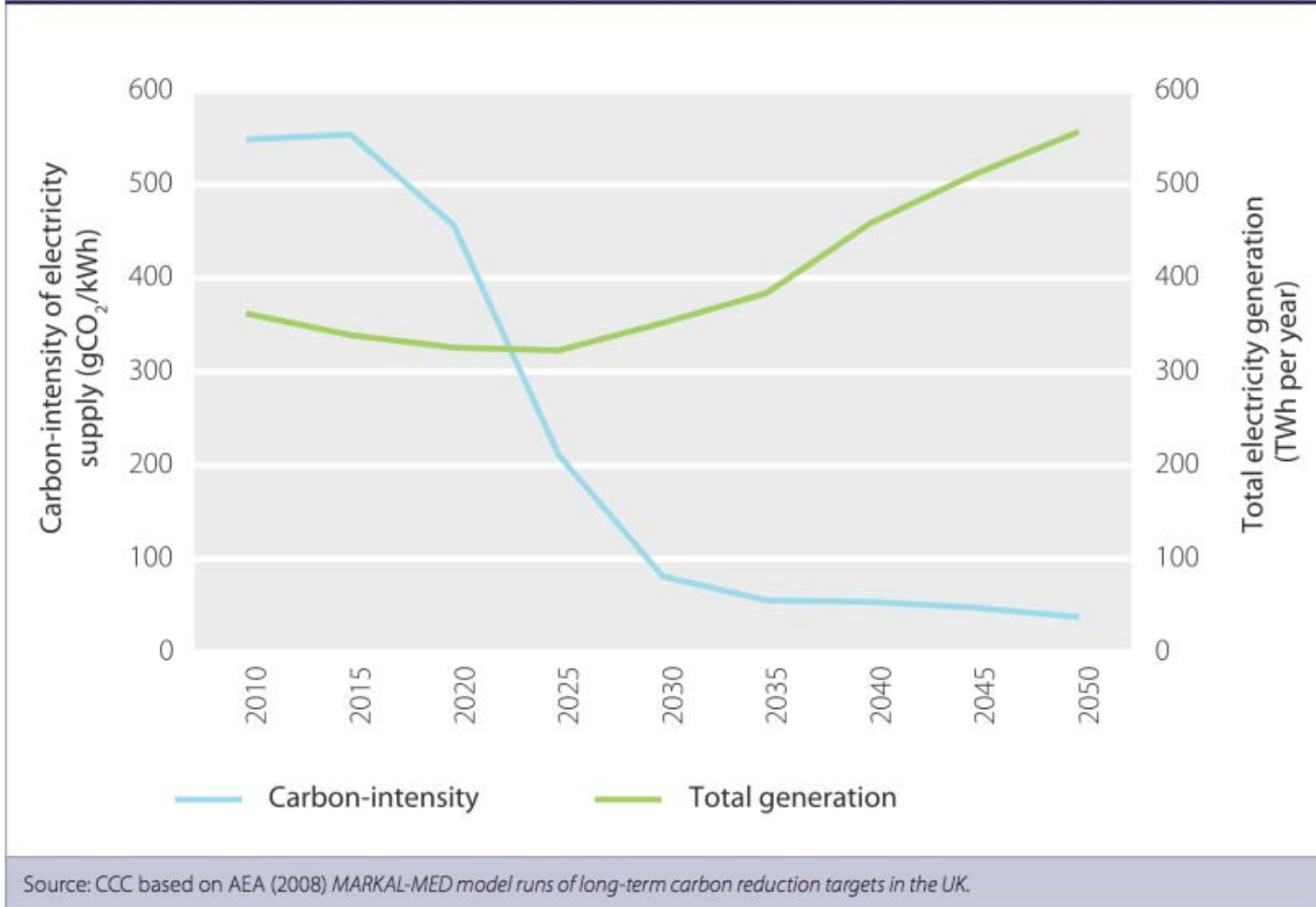




# CO<sub>2</sub> REDUCTION ?

..depends on carbon  
content of grid....

Figure 6 Declining carbon-intensity and increasing generation of electricity to 2050



Decarbonising the grid.....if not we can all pack up now.....  
(currently 0.53 kg/kWhe - was 0.43 – Coal coal coal !!)



## realtime carbon

Carbon now

So what?

About us

Blog

The amount of pollution caused by using a single unit of electricity changes throughout the day.



This is because the "generation mix" on the grid changes. Sometimes there are more coal power stations running, for example. Other times there's more wind power. Also, additional pollution can be caused by the extra back-up supply we need at times when our demand is hard to predict.


**Wouldn't it be better if we could use power when it's greenest?**

Join the [forum](#)

Each unit of UK electricity is currently causing this much CO<sub>2</sub>:

**365** grams per unit\*

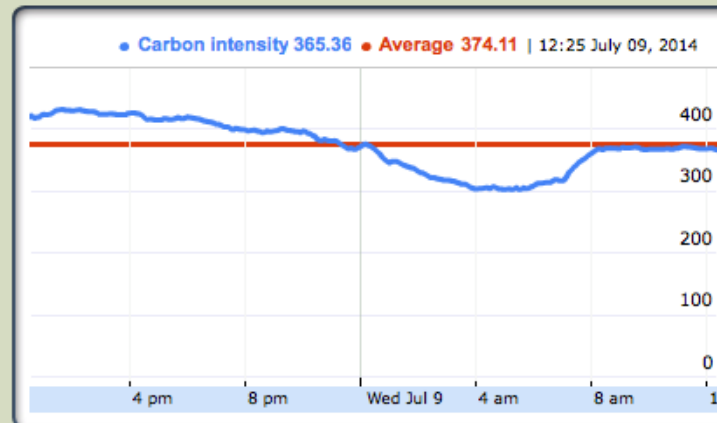
Grid sampled at 12:25 GMT+0100 \*A unit is 1 kWh

 Above average

 Below average

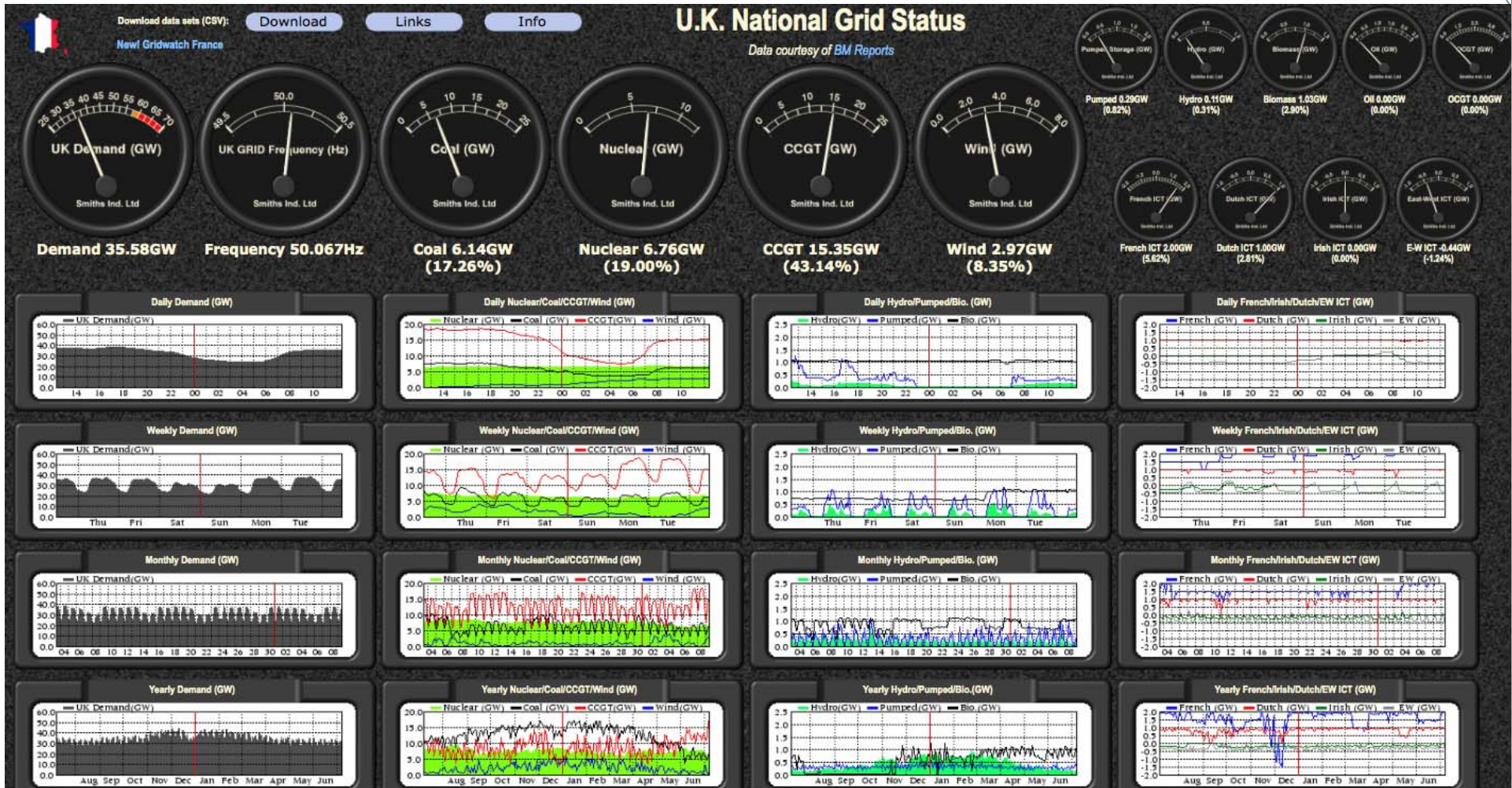
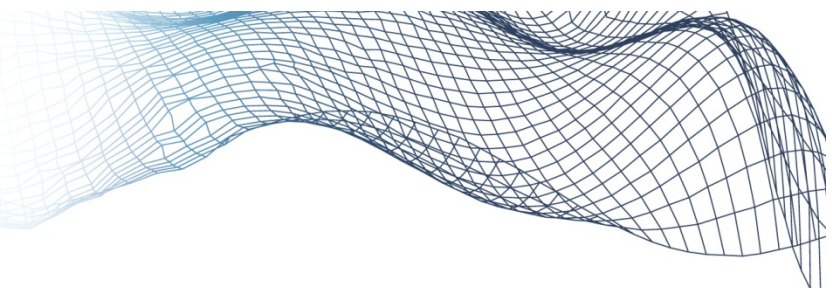
[So, should we turn off?](#)

This is called the "carbon intensity". At the moment it is **lower** than average. You can see how it has been changing over time...

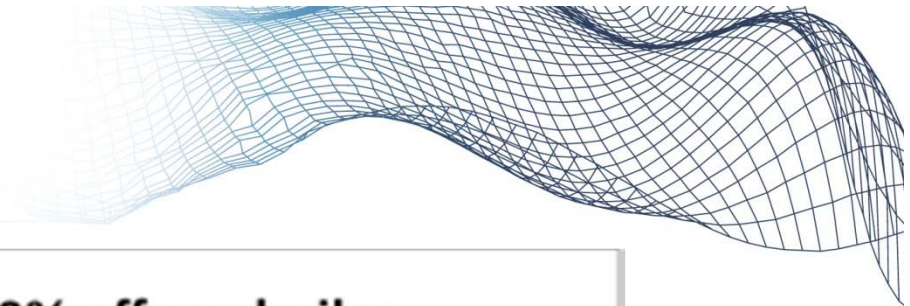


Read the [methodology](#)

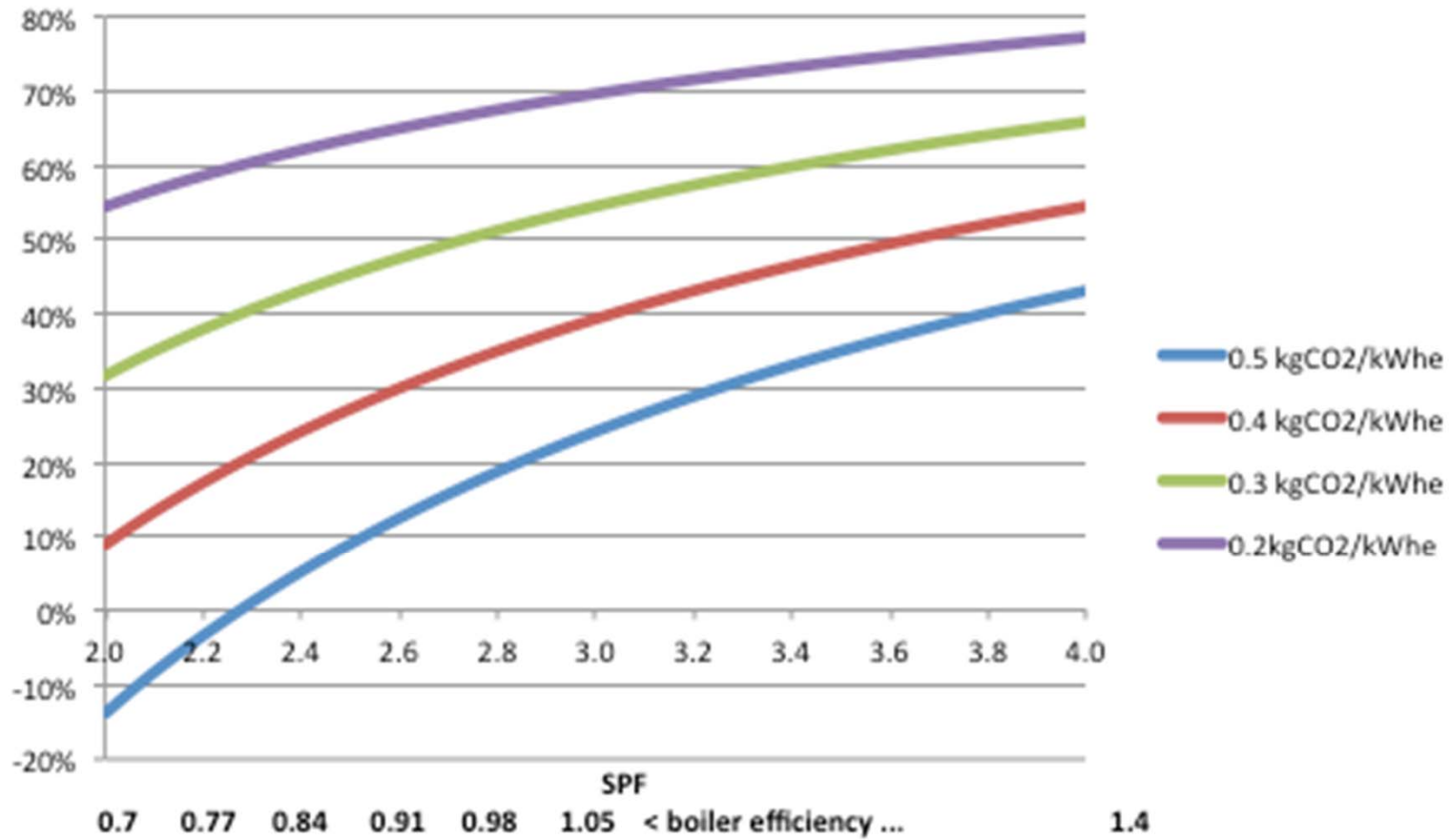
Join the debate

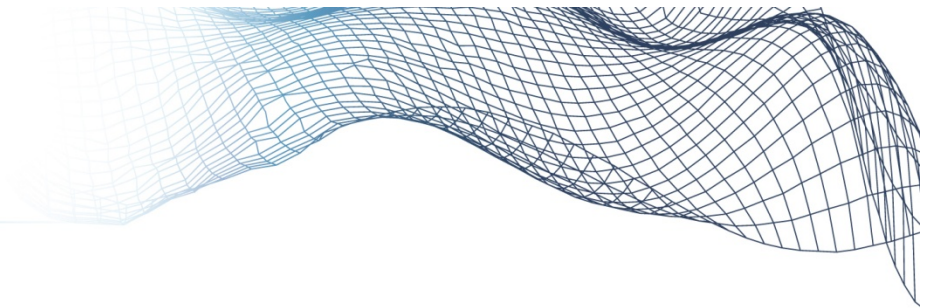






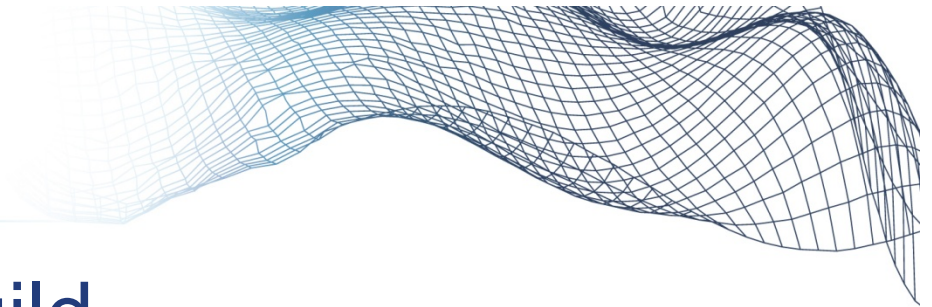
## CO2 reduction compared to 90% eff gas boiler





RHI will only get us up the start.....

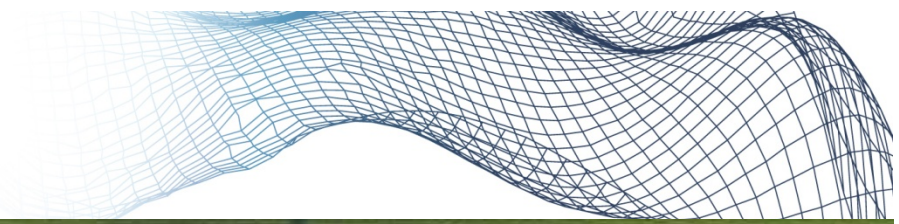
Imperative we get good systems in – for  
the next step.....

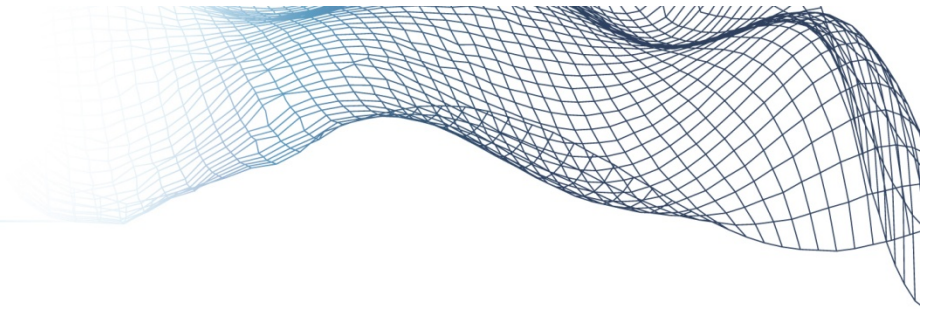


Non domestic – new build

RHI ? Really ?

- Large corporates - internal drivers – CSR etc - eg Unilever,
- and non-corporate – eg NT.
- Planning constraints
- Large horizontals



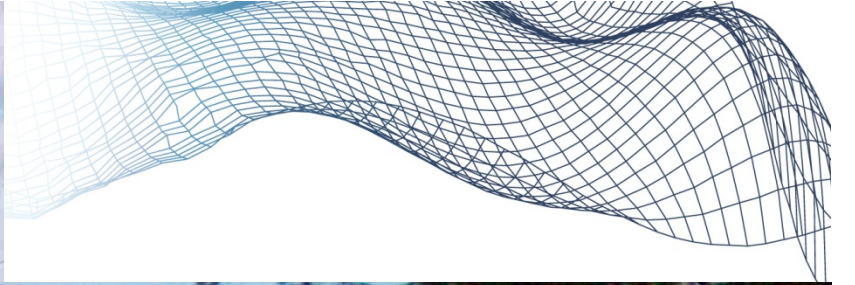


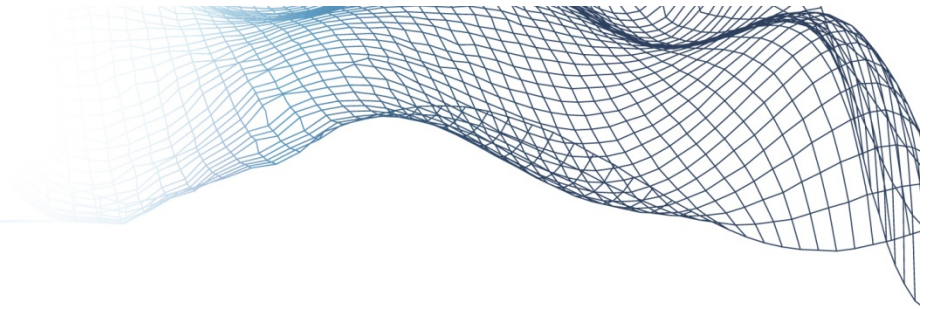
Non – domestic

eg National Trust.

Plas Newydd – sea source

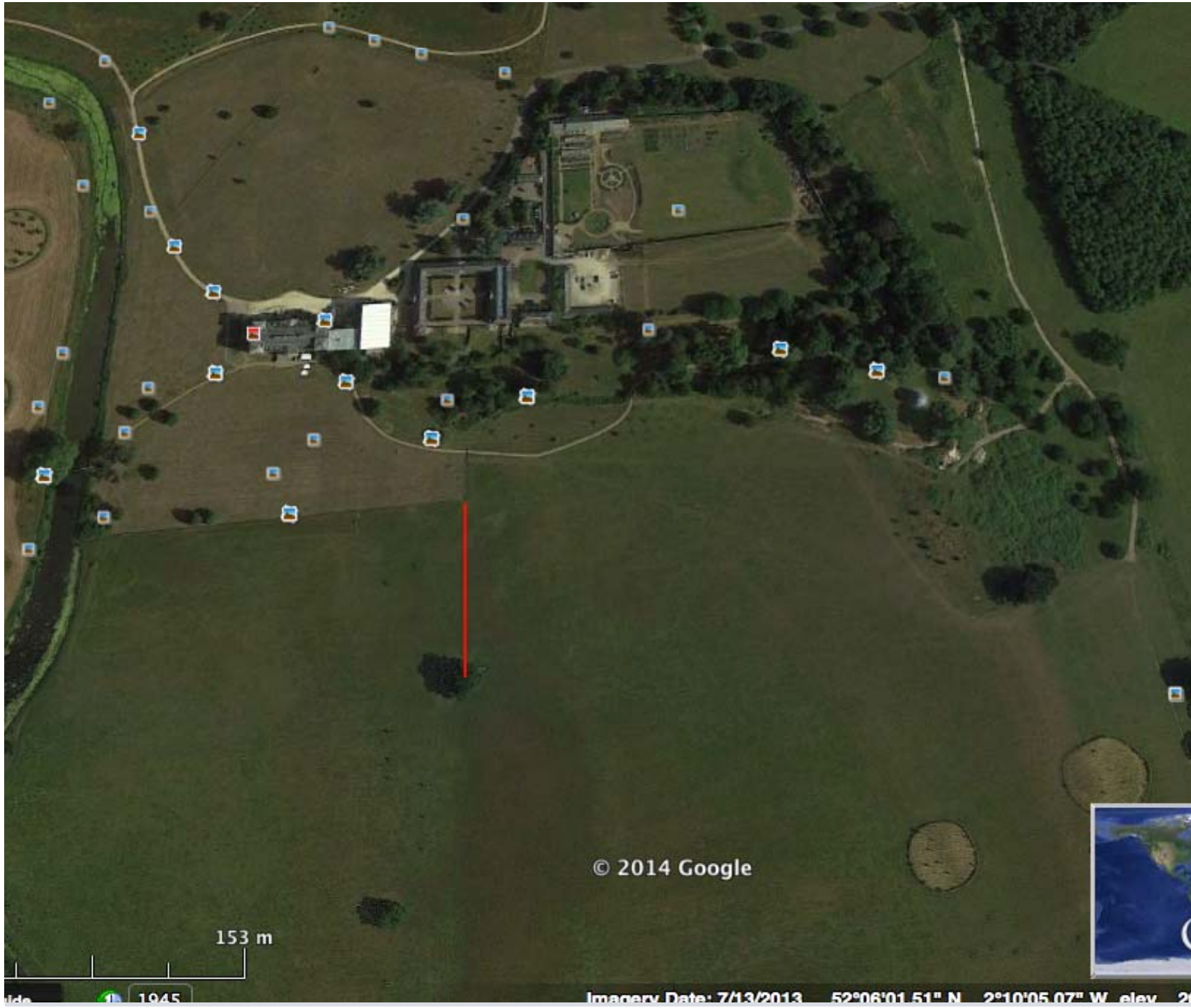
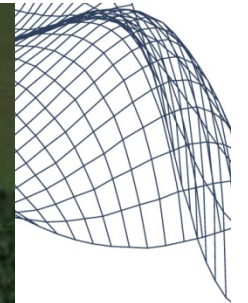
others.....





Non – domestic

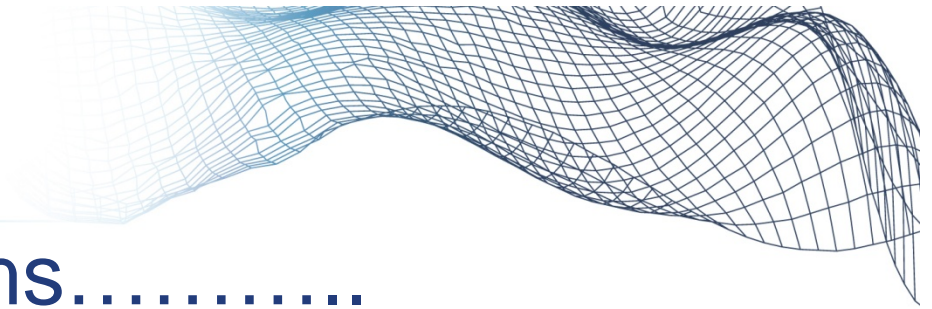
Large horizontal systems.....



© 2014 Google

153 m





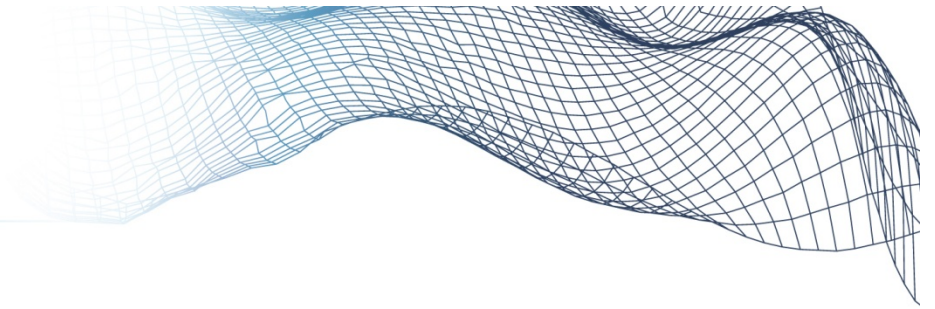
Large horizontal systems.....

MCS limitations –

VDI 4640 limitations

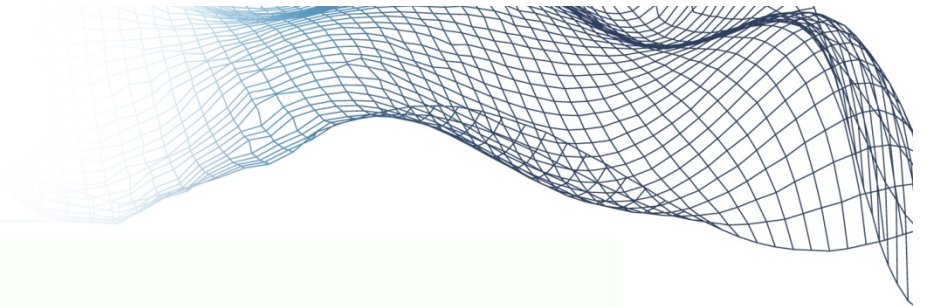
Software limitations

Hydraulics.

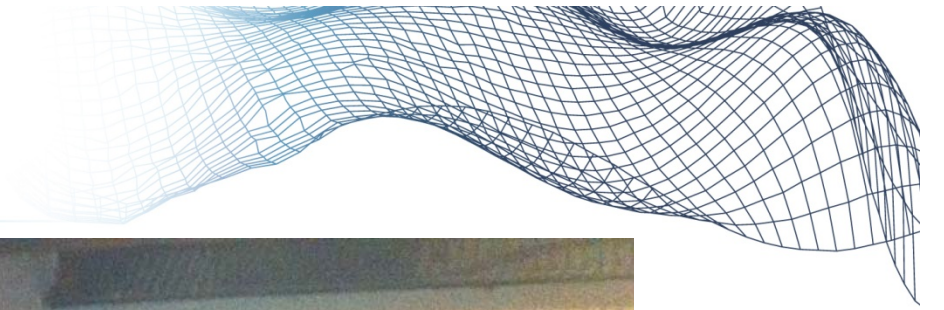


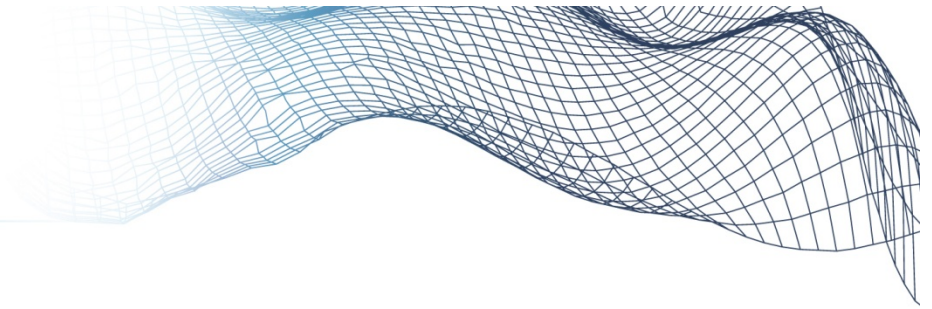
Non – domestic

Planning driven.....London.





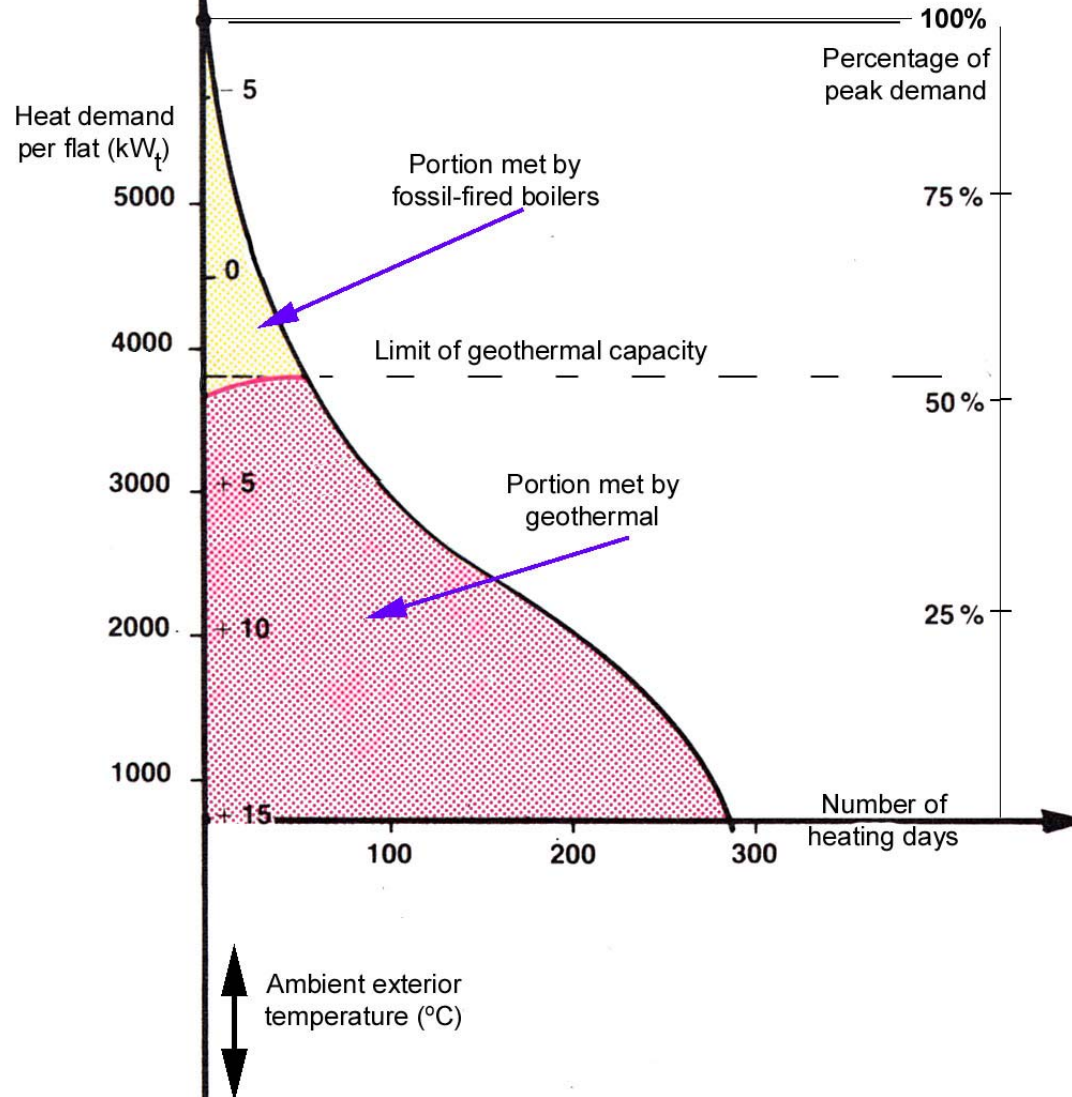
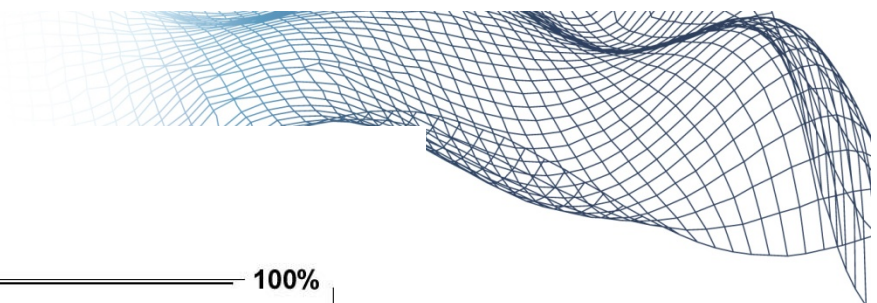




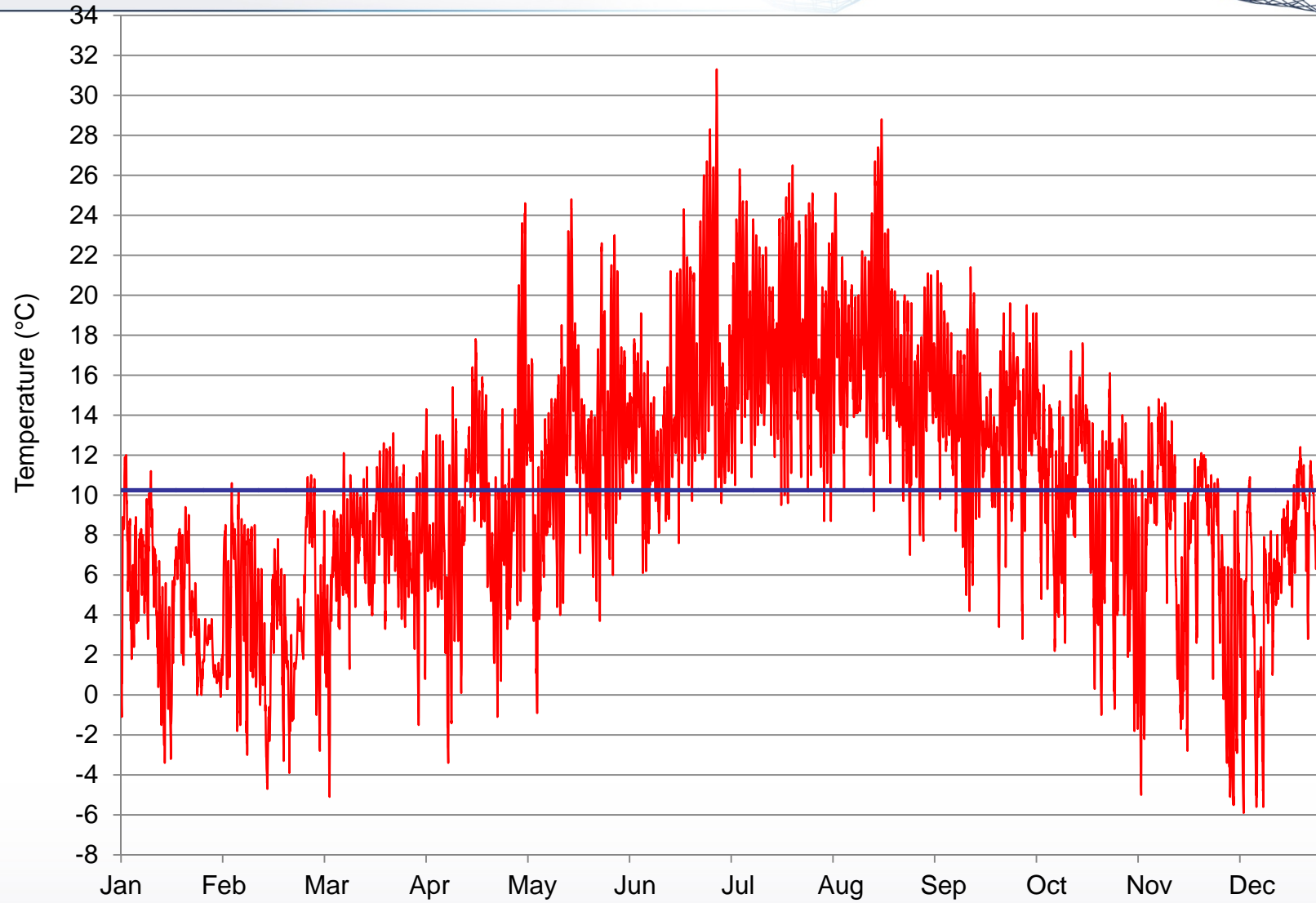
RHI –

Creativity ?

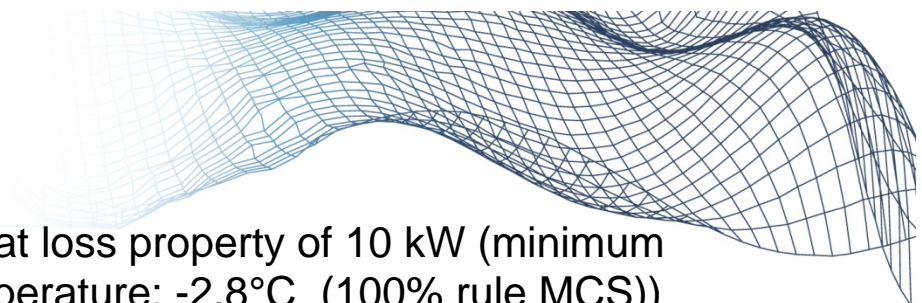
Load duration curves / bi valent systems



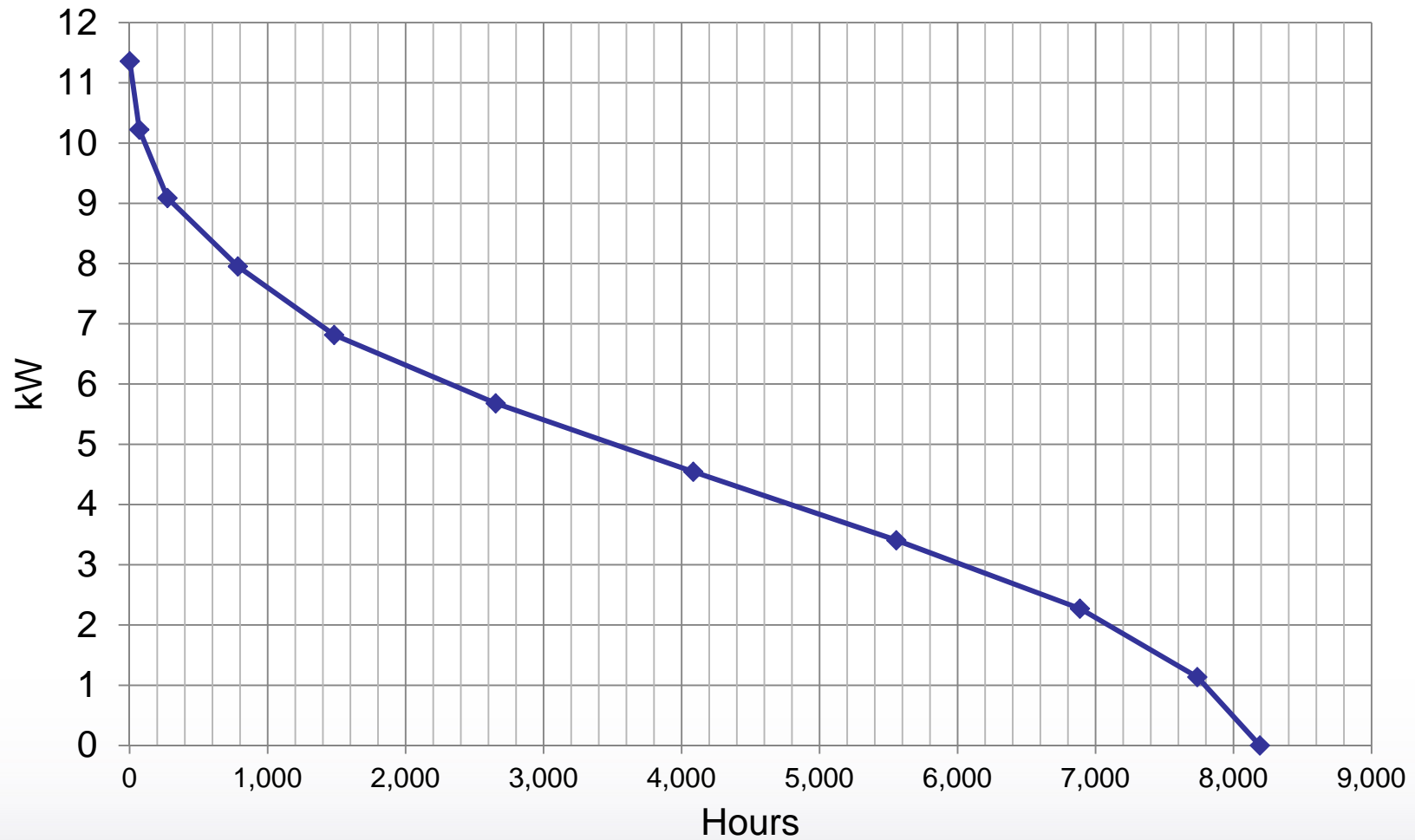
# Hourly dry bulb temperature - EnergyPlus climate tape for Gatwick

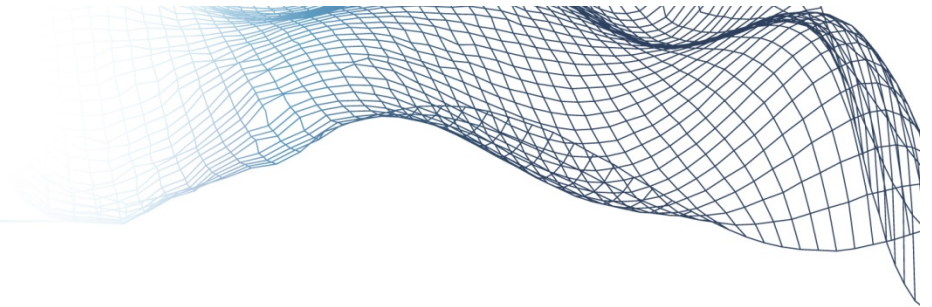






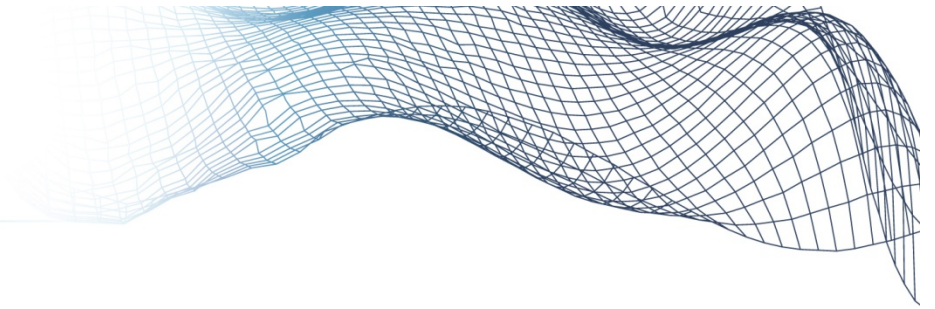
Load - Duration curve for a worst day heat loss property of 10 kW (minimum outside temperature:  $-5.9^{\circ}\text{C}$ , design temperature:  $-2.8^{\circ}\text{C}$  (100% rule MCS))





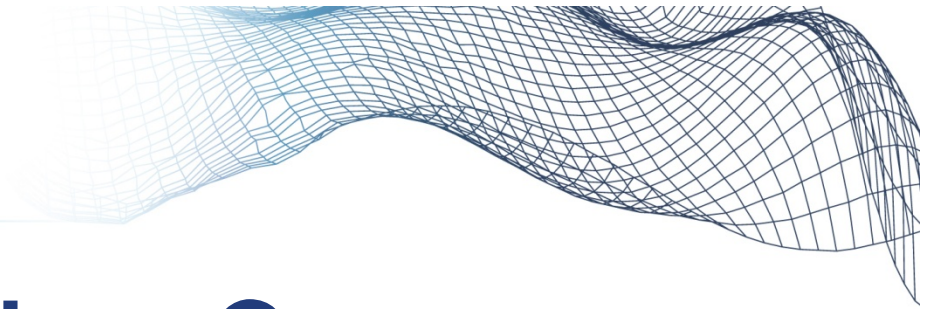
## Load duration chart – 10kW GSHP

<b>kW</b>	<b>Hours</b>	<b>kWh</b>
10	99.0%	99.9%
9	96.5%	99.4%
8	91.3%	98.1%
7	84.7%	95.4%
6	73.3%	90.6%
5	60.5%	83.1%
4	45.6%	72.2%
3	31.1%	58.0%
2	18.5%	40.7%
1	10.9%	21.0%



# Social housing RHI ?



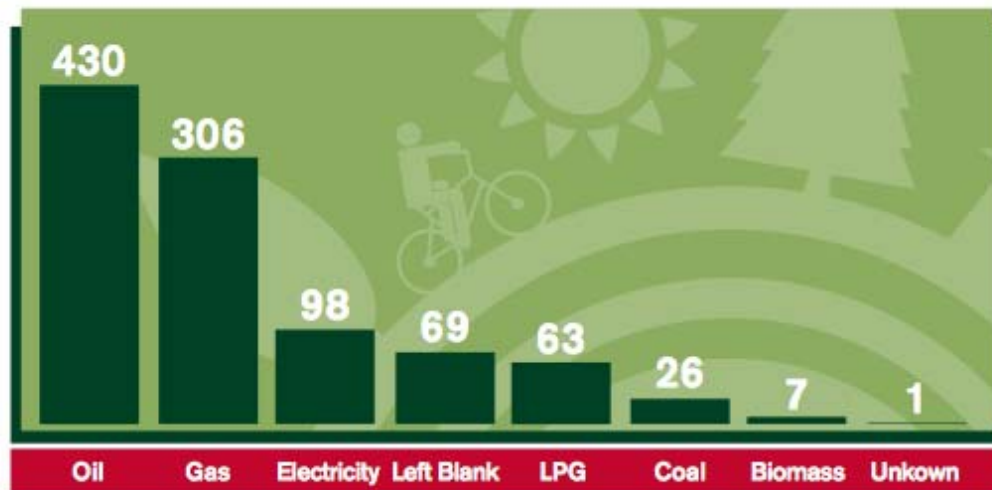


**Social housing?  
RHI -  
innovative approaches –  
communal systems.**



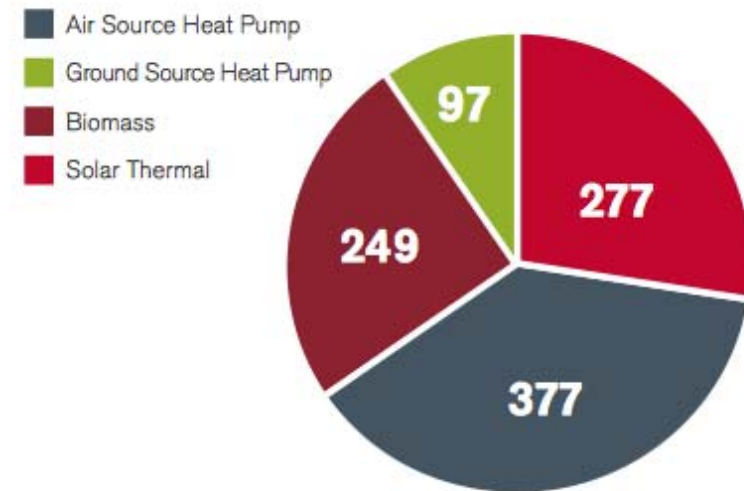
## Facts and figures

### Previous fuel types



The Domestic RHI is open to domestic consumers no matter what type of heating system they are switching from. The graph above shows that the majority of the first thousand participants were using oil, while almost a third were on gas.

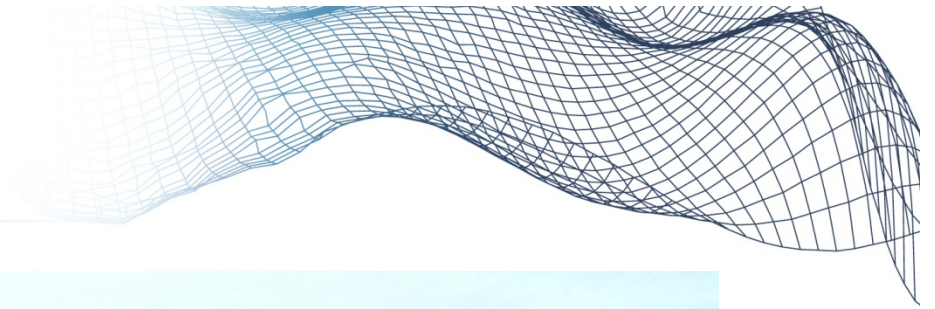
### Technology type



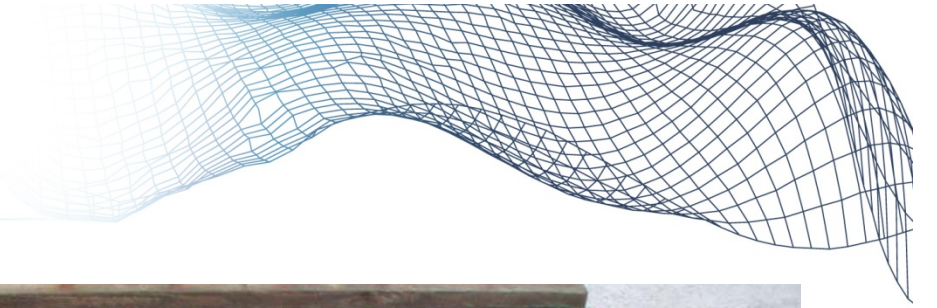
The large majority of the first thousand applicants have installed air source heat pumps, followed by solar thermal hot water systems and biomass stoves or boilers.

<1% .....but remove Solar Thermal > 13%

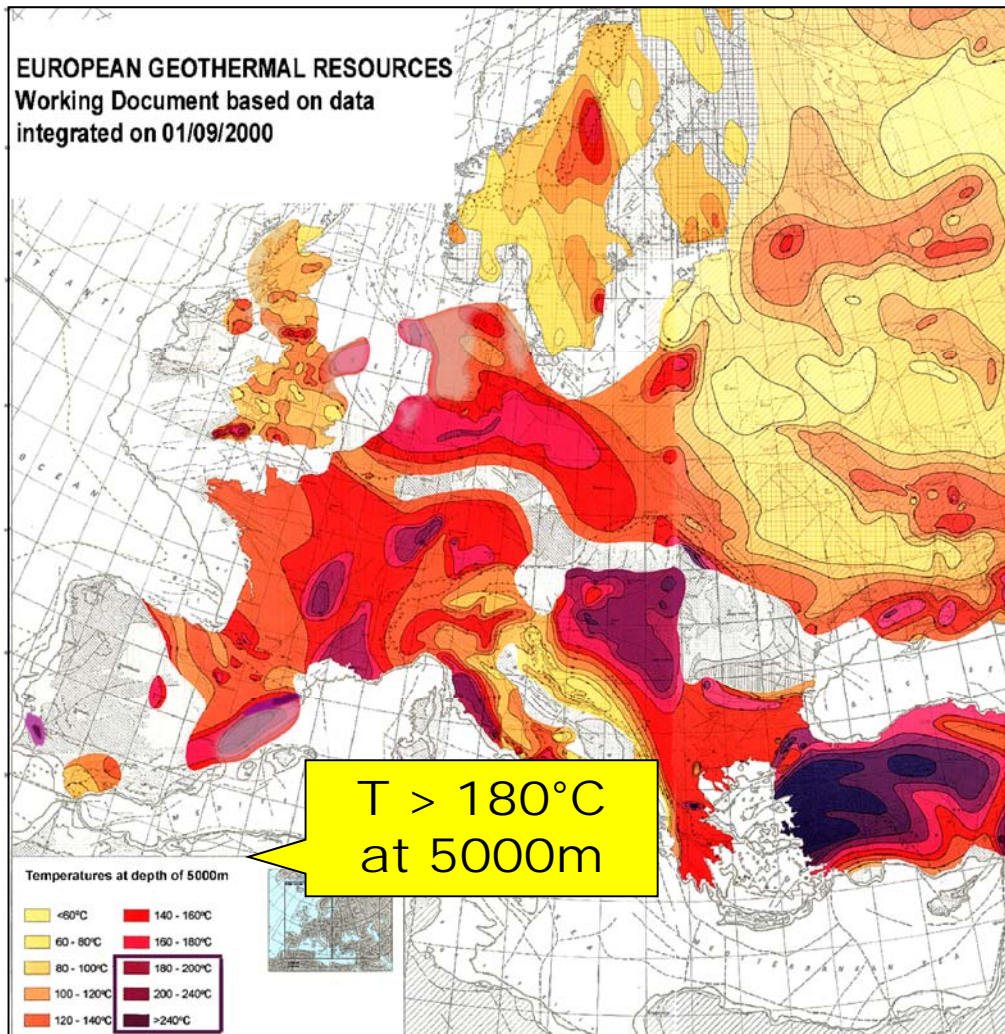








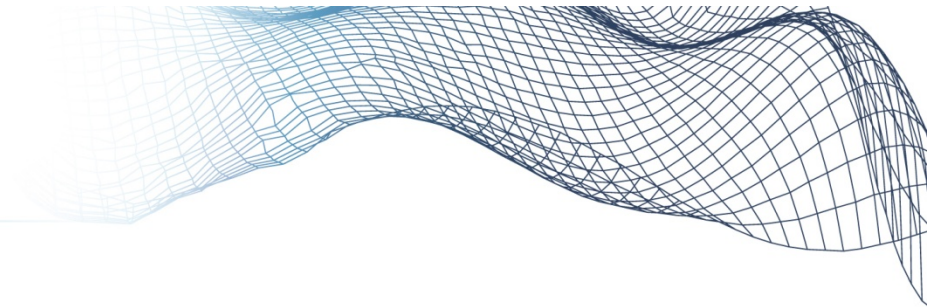
# A VAST EUROPEAN RESOURCE



**1km<sup>3</sup>** of rock (cooling 20° C)  
 ≅ 15,000 GWh (thermal)  
 ≅ **1,275,000 tons of oil**  
 ≅ more than 10 MW(e) base load  
 at 200° C for 20 years

**12,500 km<sup>2</sup>** (x 1km thick) of prime resource  
 ≅ 900TWh / year  
 ≅ *European nuclear energy output (1995)*

**Available resource**  
 ≅ **125,000 km<sup>2</sup> in W.Europe** with > 200° C  
 at ~5000m depth (Shell study)



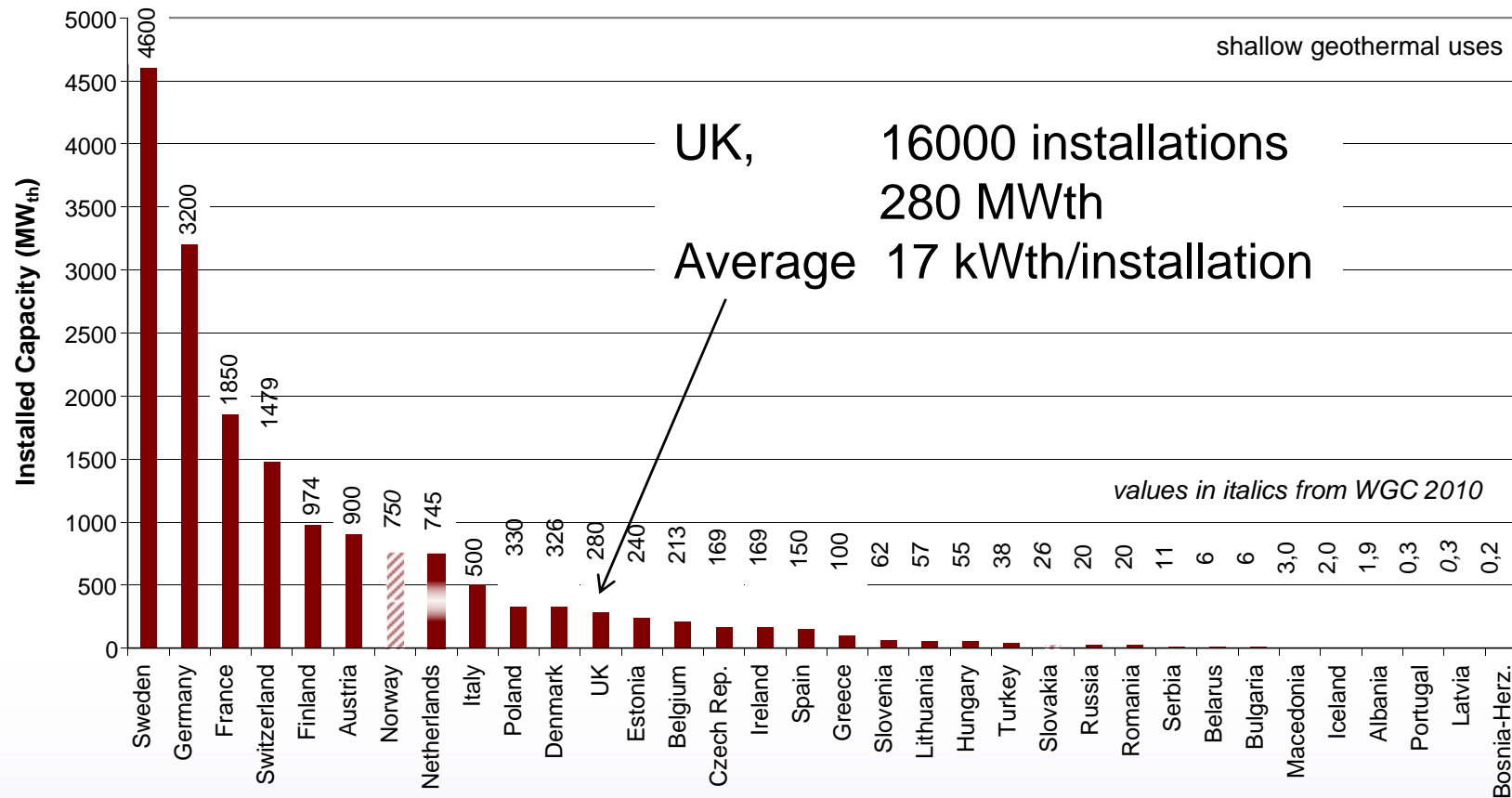
## CONCLUSIONS from Pisa.....

- Geothermal energy scored well in Europe and has an enormous potential.
- Geothermal Power: 1850 Mwe
- Deep Geothermal Resources (direct use): 8000 MWt (50% heating)
- Shallow Geothermal (GSHP, ATES, UTES): 17000 MWt (1.3 Million GSHP installed)



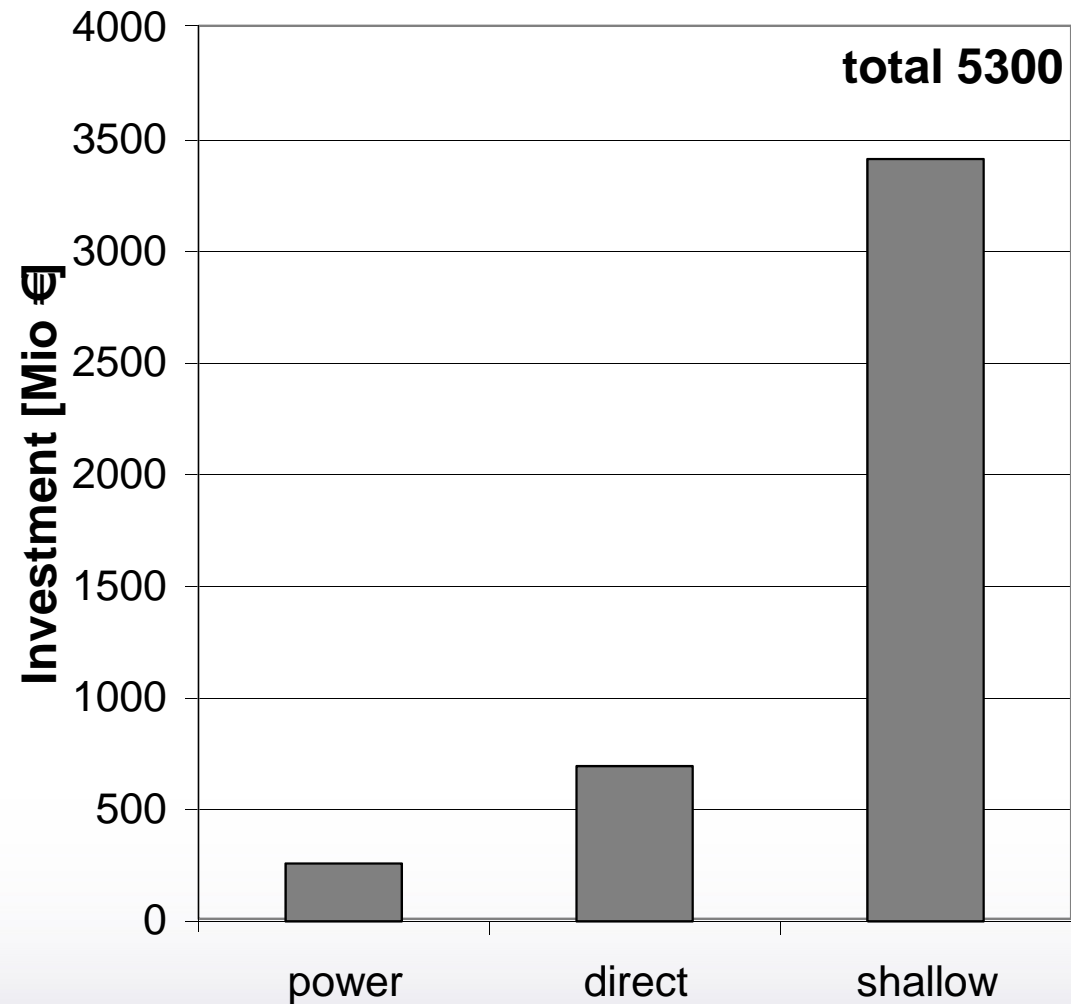
# SHALLOW GEOTHERMAL APPLICATIONS

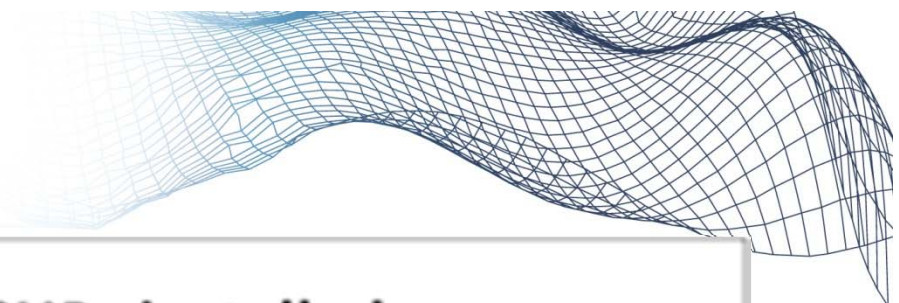
## SHALLOW GEOTHERMAL INSTALLED CAPACITY IN EUROPE 2012, AFTER EGC 2013 COUNTRY UPDATE REPORTS



# MARKET SITUATION

Investment in the different fields of the geothermal sector (only 21 of 33 countries; Germany with 960 Mio € is considered in the total, but not in the sectorial breakdown)





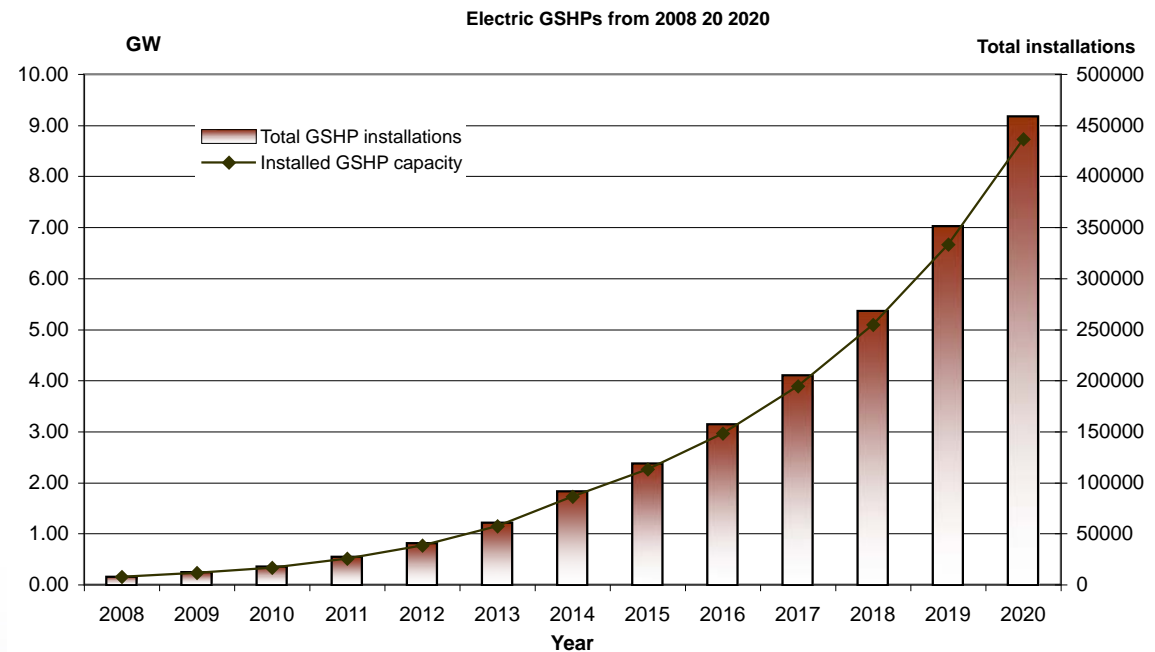
3 orders of magnitude – on the way to four

# UK GSHP Growth



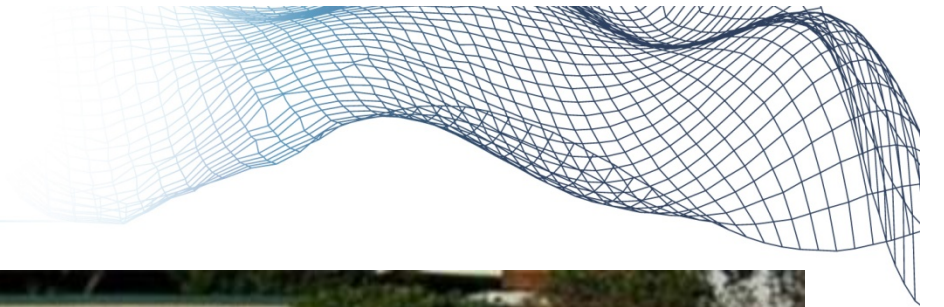


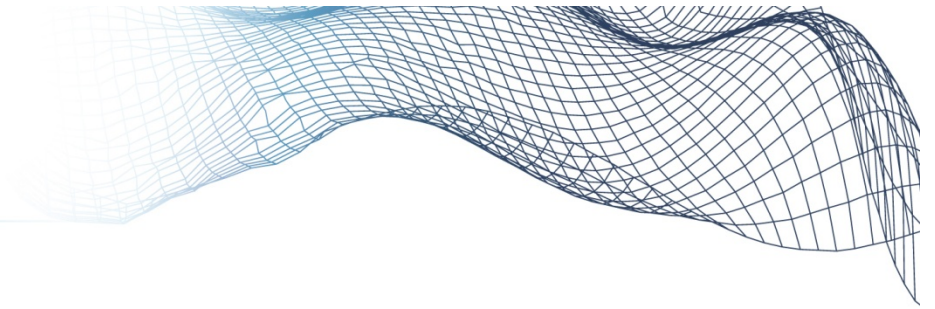
# Let's just get on with it ! (Red Hot Initiative ?)



(lunch that is.....)

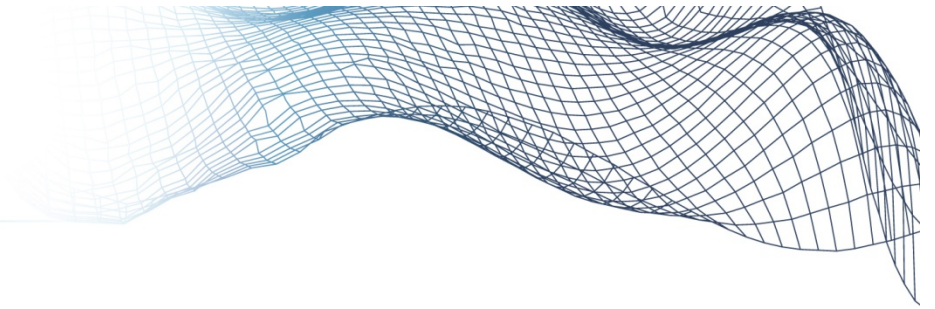




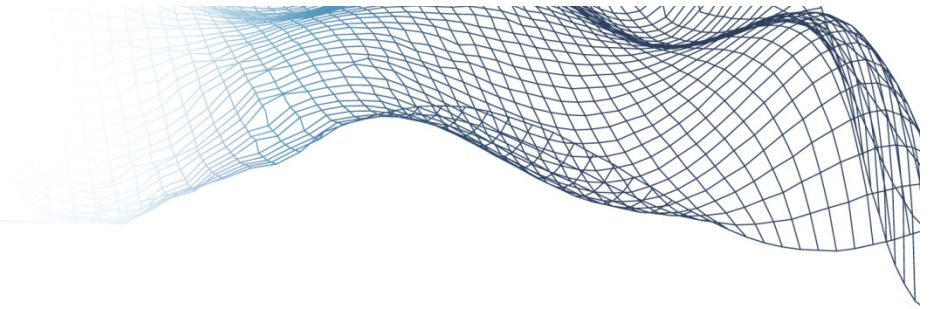


# Hydraulics ?

If at first you don't  
succeed.....

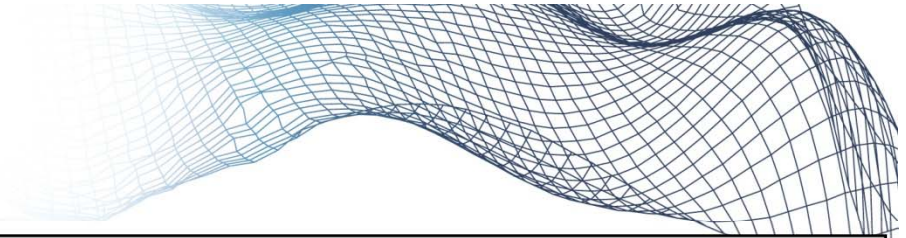


...fit a bigger pump...!



# ..MCS Hydraulics guide

....or you will be down to ASHP performance levels.



### Effect of ground pump on COP

