A case against combined heat and power with district heating

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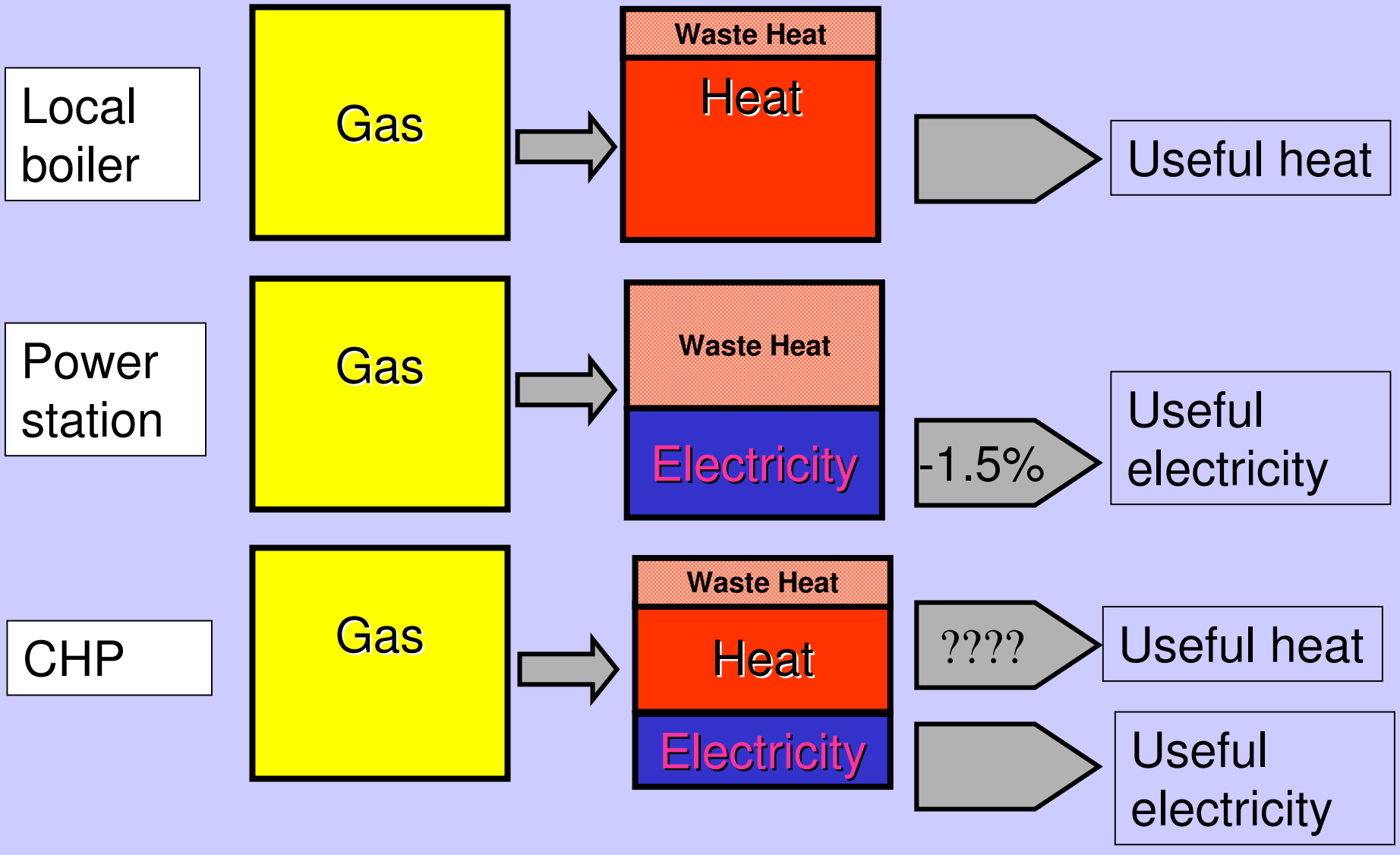
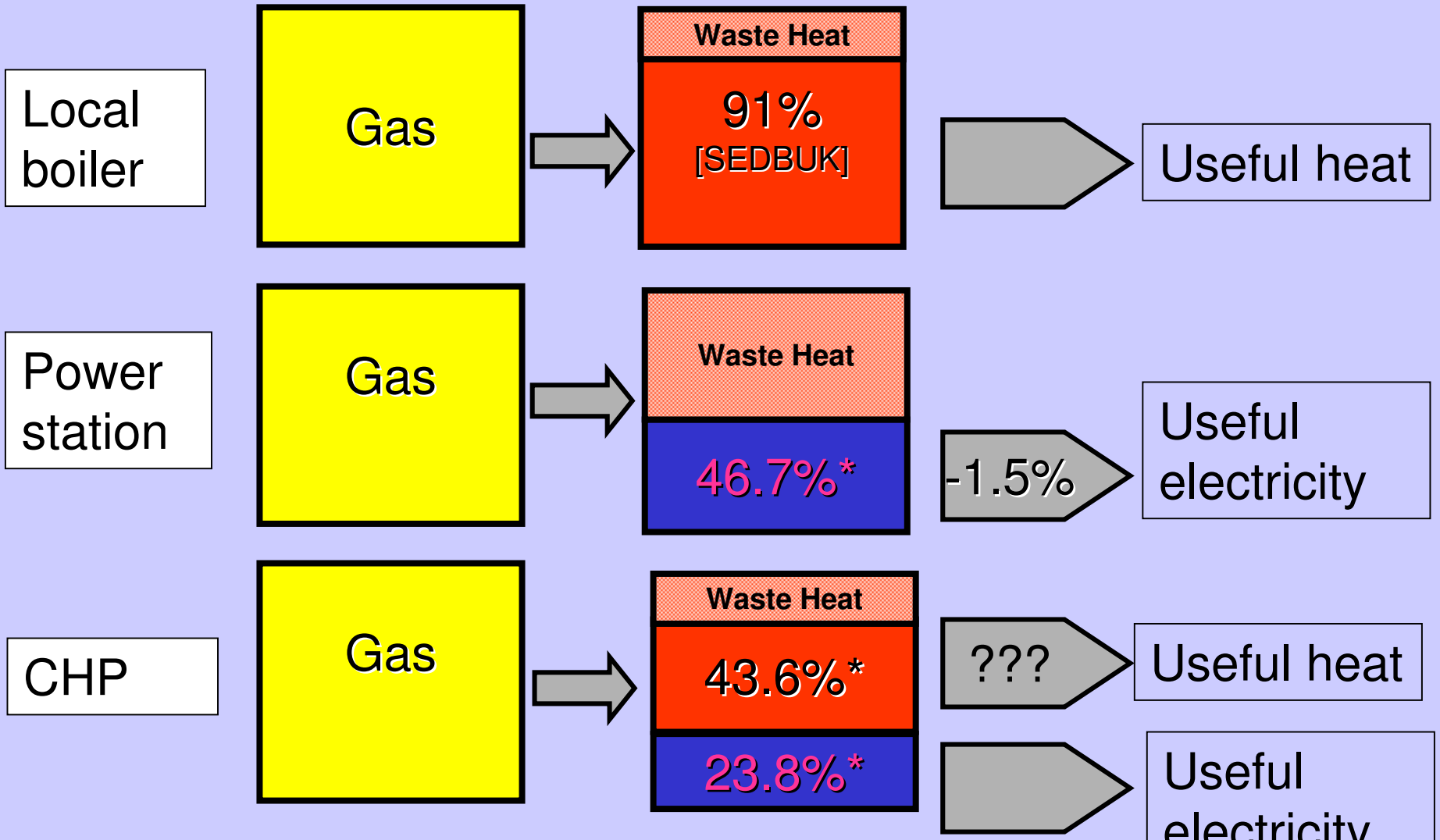
Gas CHP; What are we comparing it to??

Coal	0.88 kg CO_2/kWh
The average electricity grid “Basket” (30% coal)	0.53 kg CO_2/kWh
Gas in CCGT	0.36 kg CO_2/kWh
Decarbonised grid	0 kg CO_2/kWh ?

Getting Heat and electricity from fuel

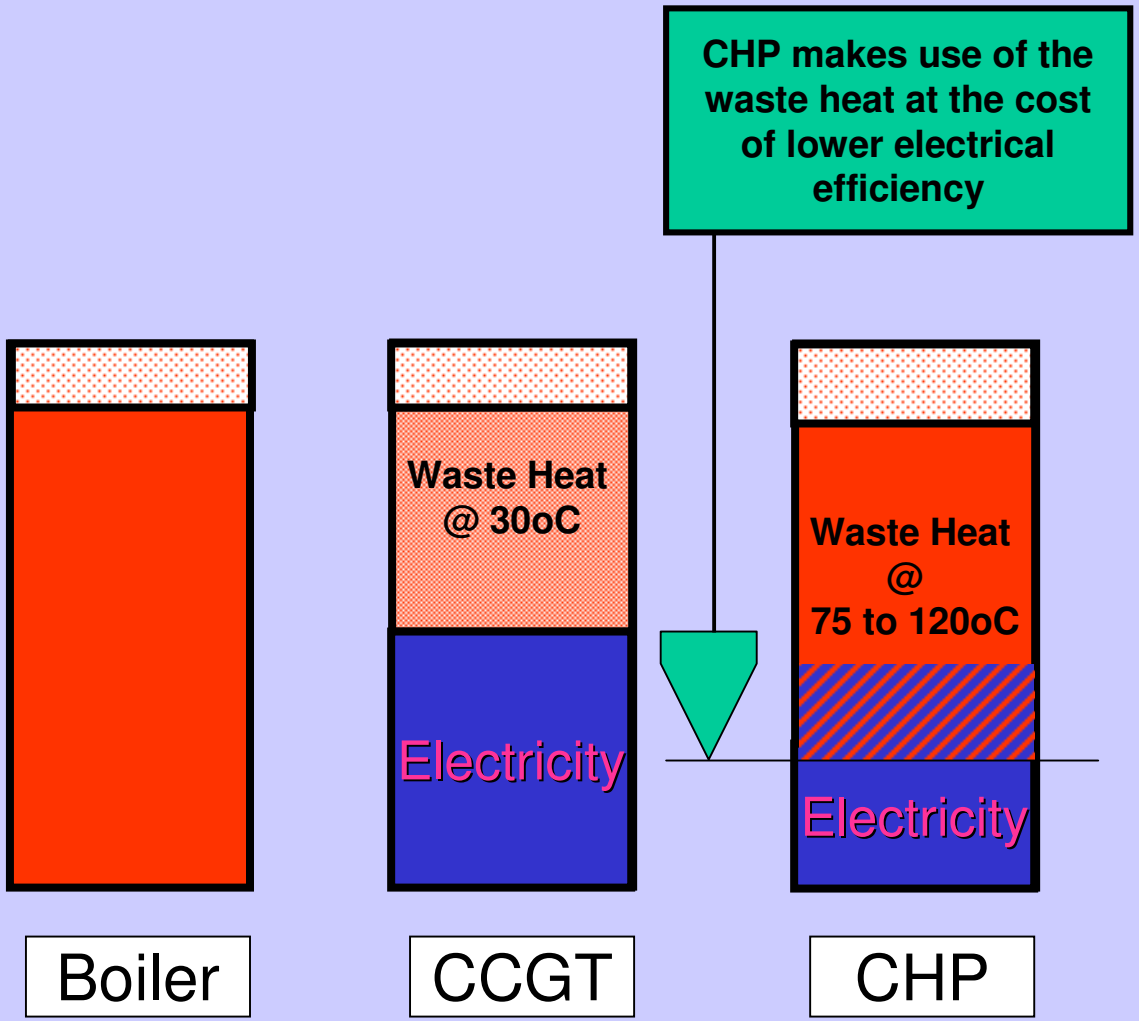


% Efficiencies



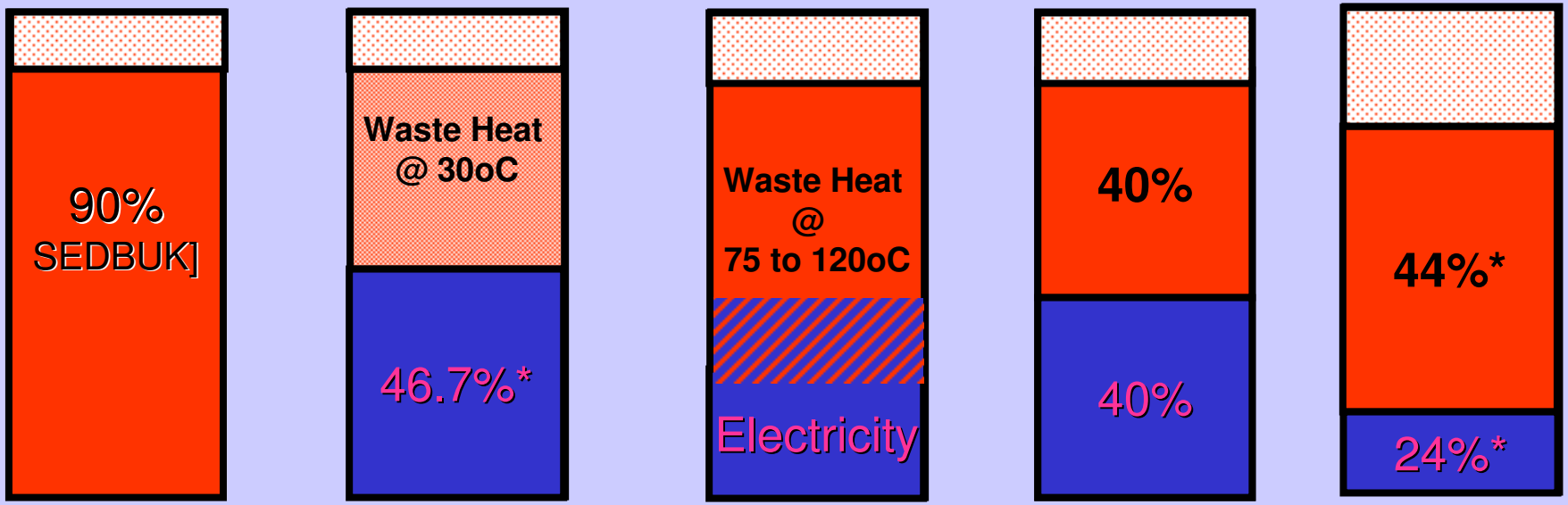
* DUKES=Digest of United Kingdom Energy Statistics 2010

Getting Heat and electricity from fuel



Getting Heat and electricity from fuel

- DUKES=Digest of United Kingdom Energy Statistics 2010
- % At Gross efficiencies



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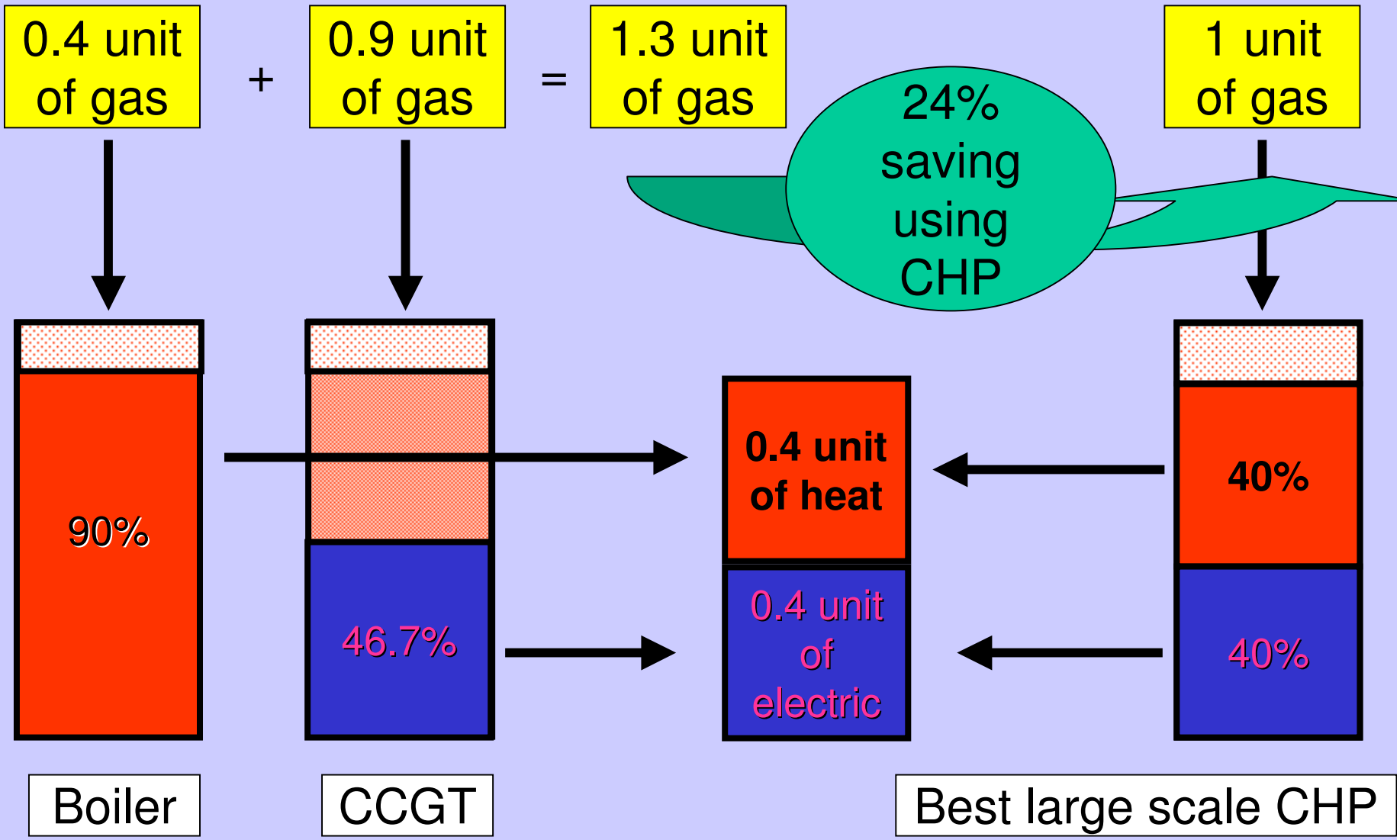

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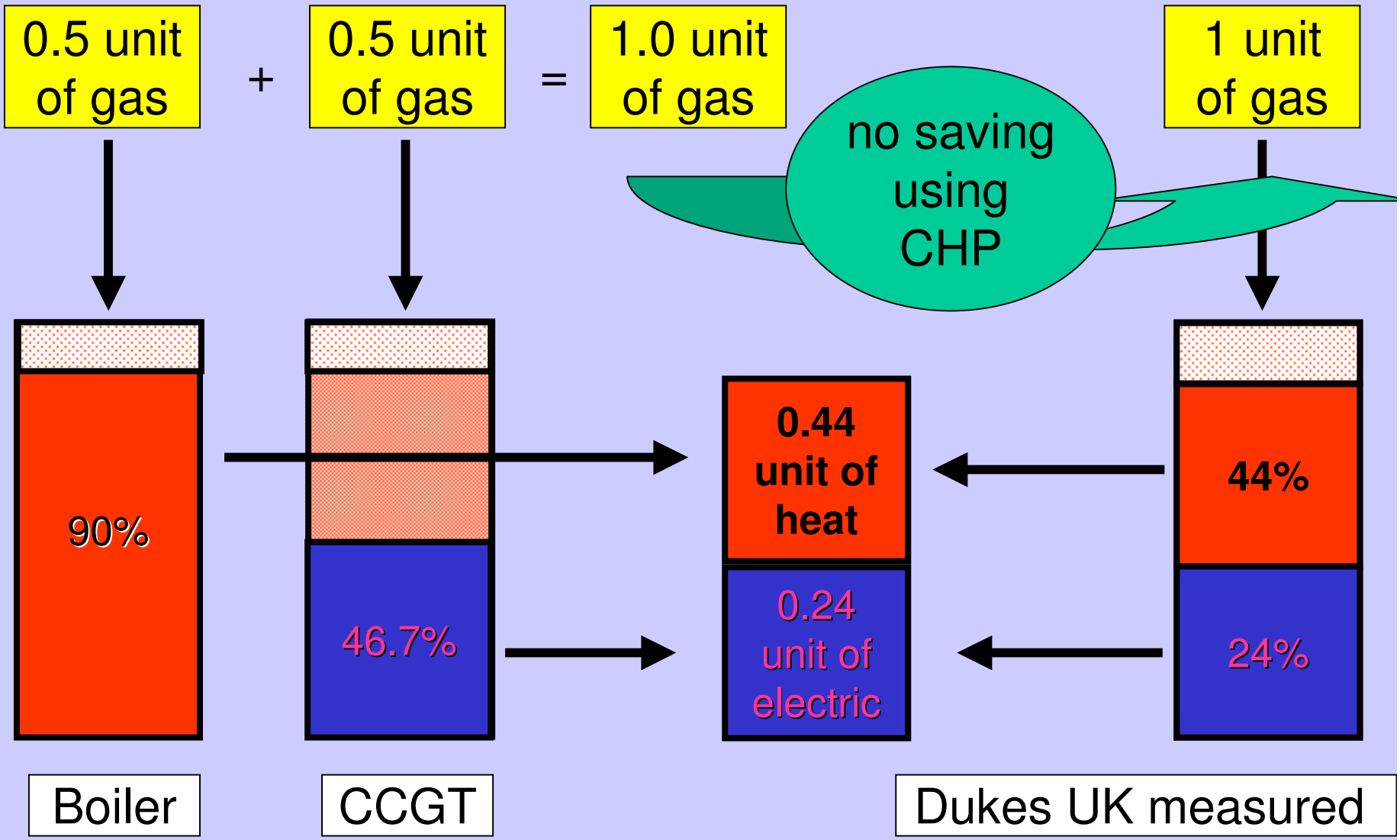
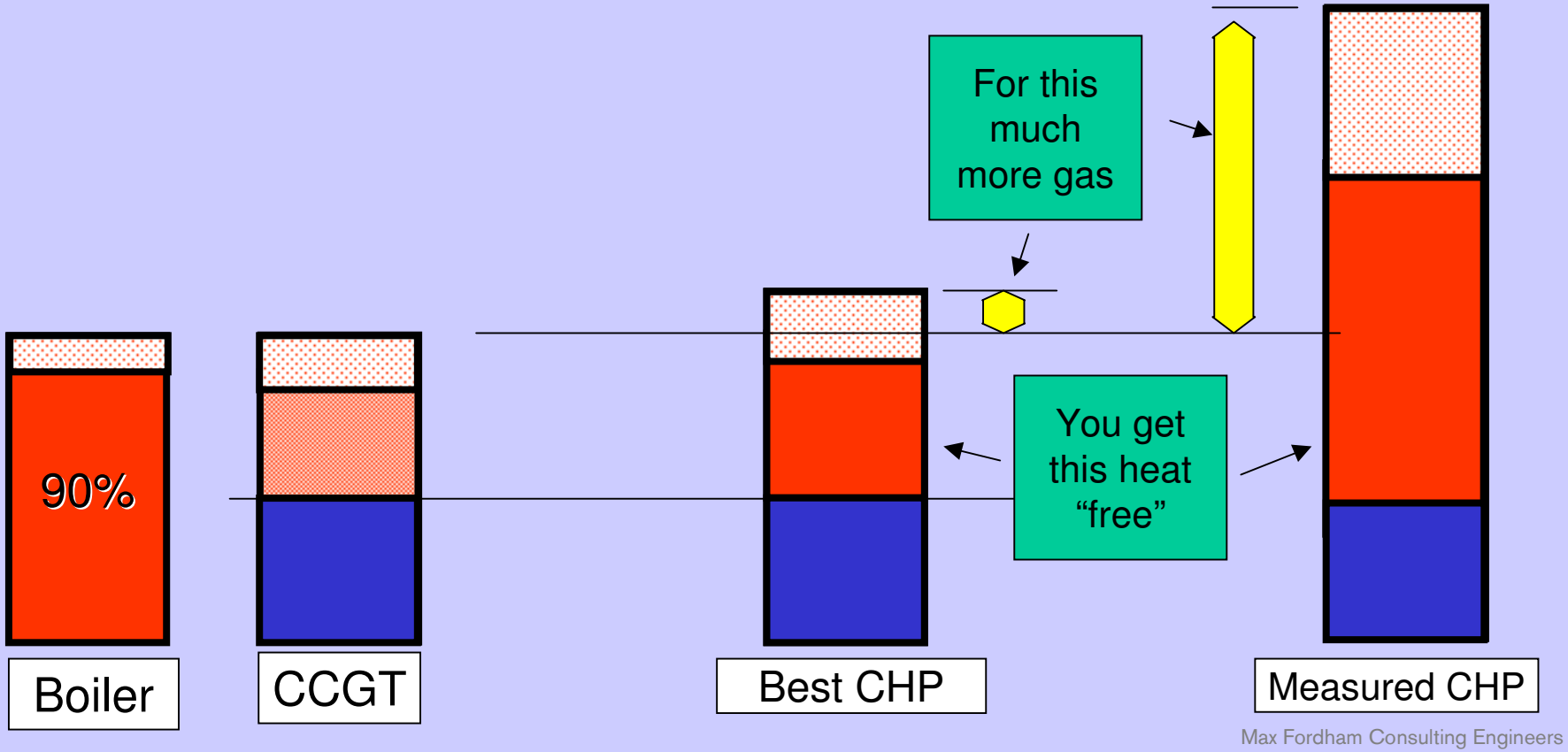
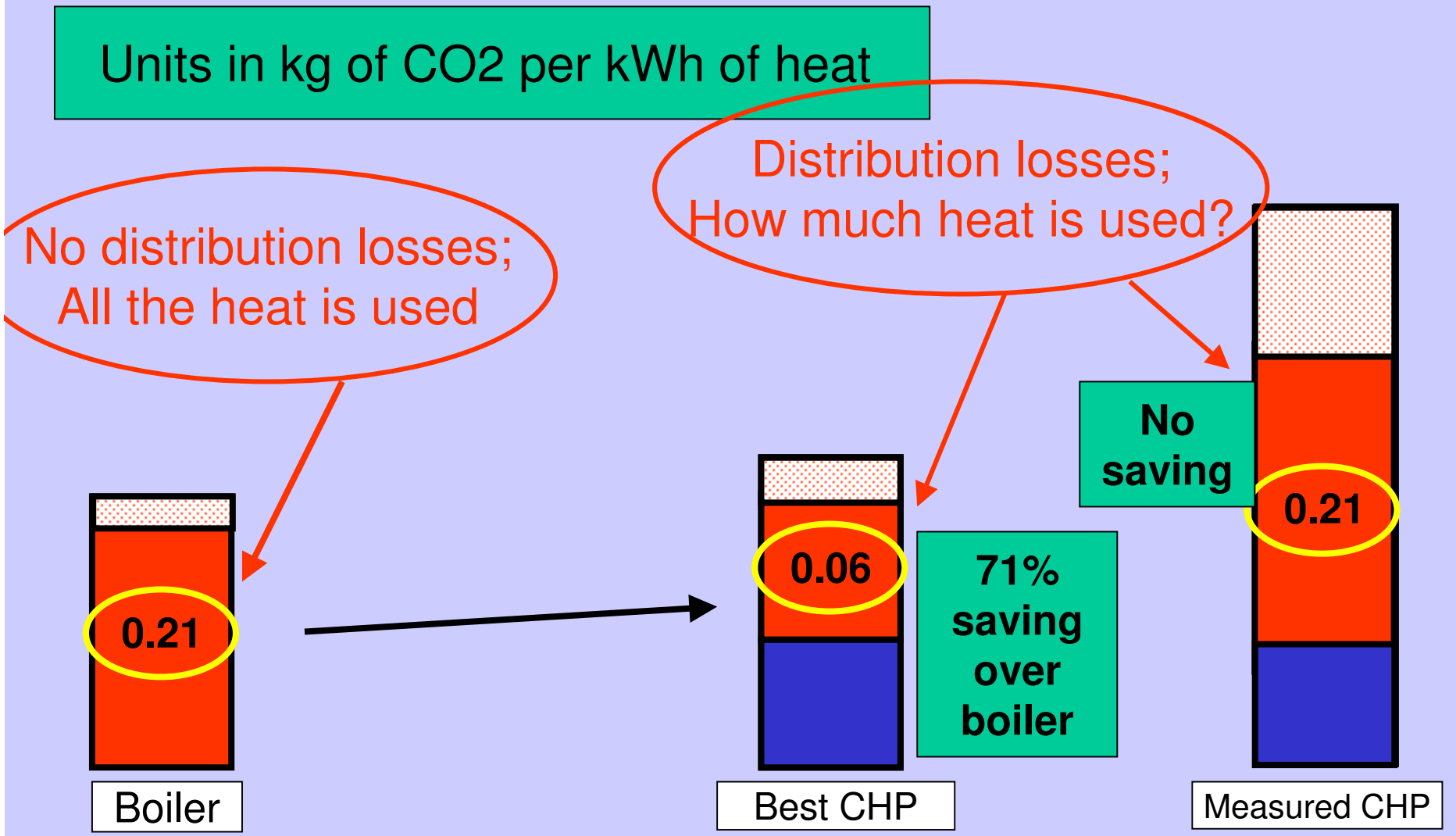


Marginal Gas required to make use of waste Heat

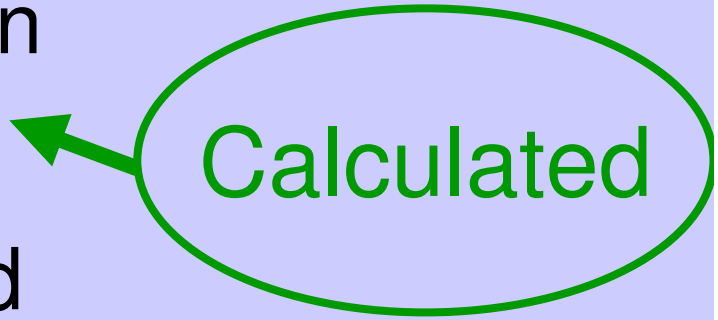


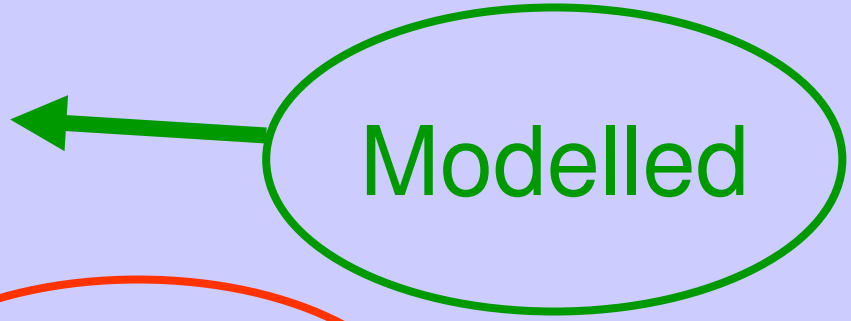
Marginal CO2 content of Heat from CHP

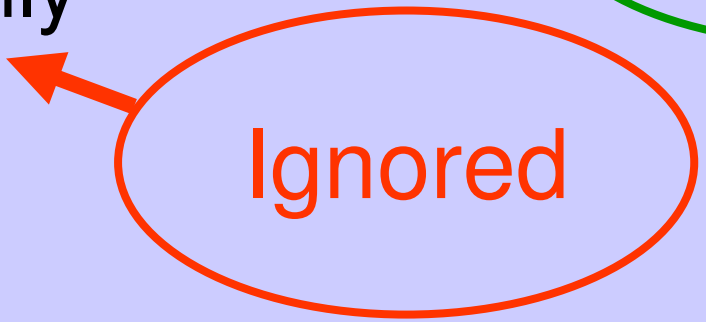


Analysis of CHP with district heating.

- Heat loss in the distribution pipework
- Heating and electrical load mismatch
  - Seasonal
  - Daily







Model of CHP installed.

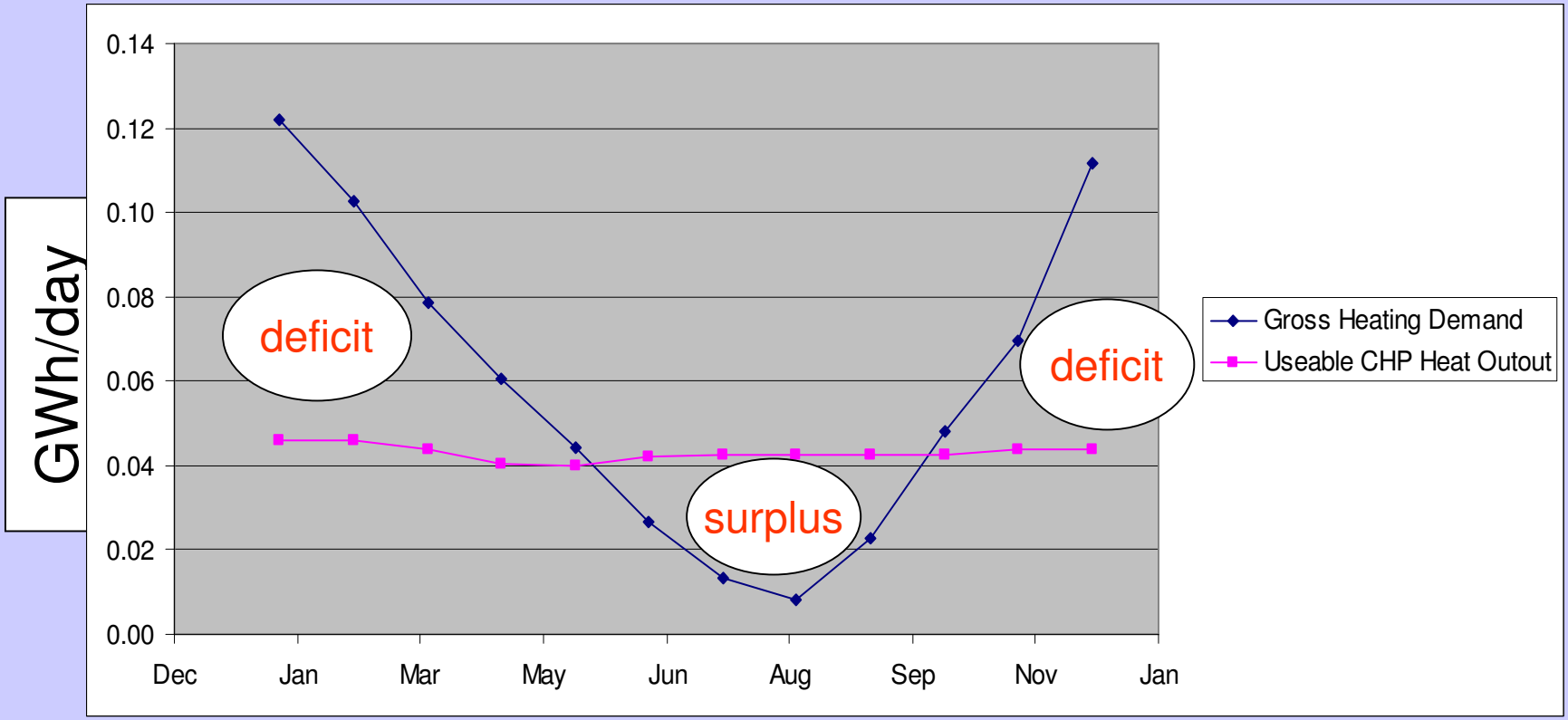
Typical Urban Population with a Heat Density of 3000 kW/km2 (Enfield, Middlesex)

20% UK Population living in areas of heat density greater

The CHP assumptions:

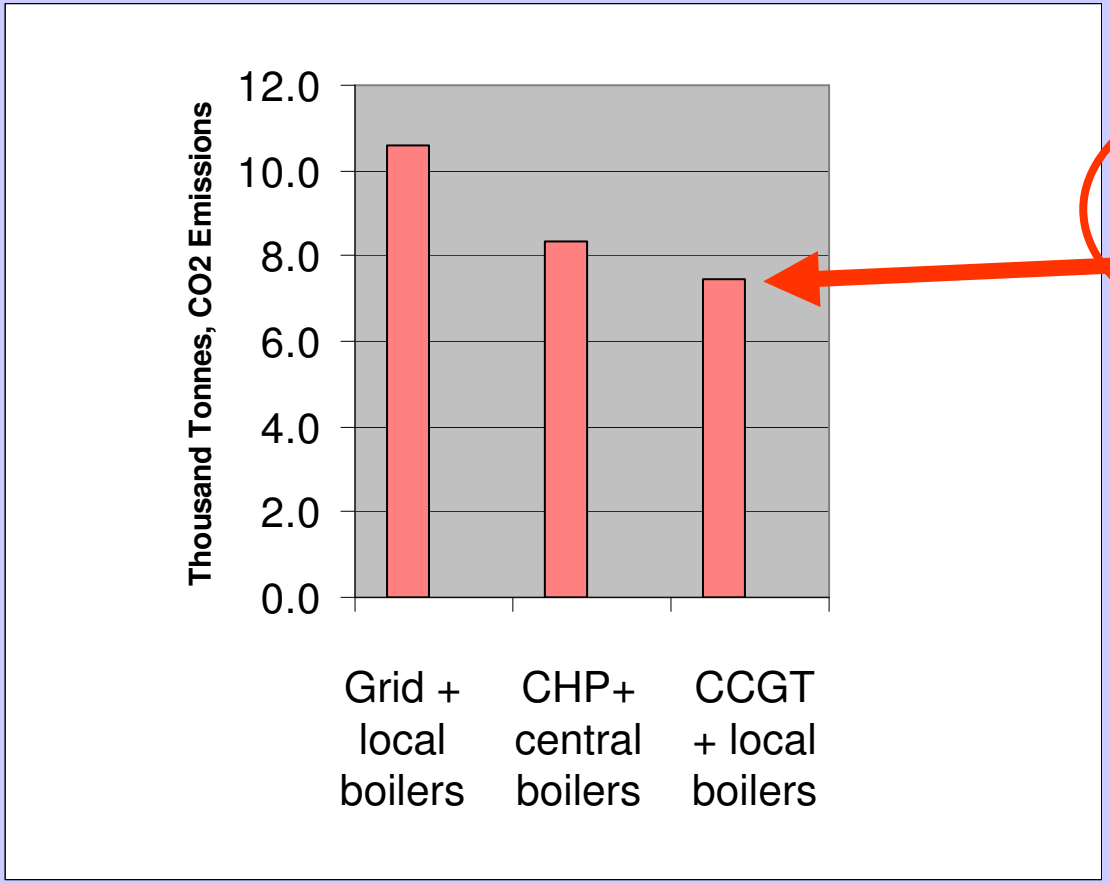
- 29% Electrical + 48% Heat [Gross]
- Sized on electrical load averaged over year
- Excess heat wasted in the summer
- Winter heating shortfall made up with central condensing boilers

Heat produced compared to demand:



District heating and combined heat and power.

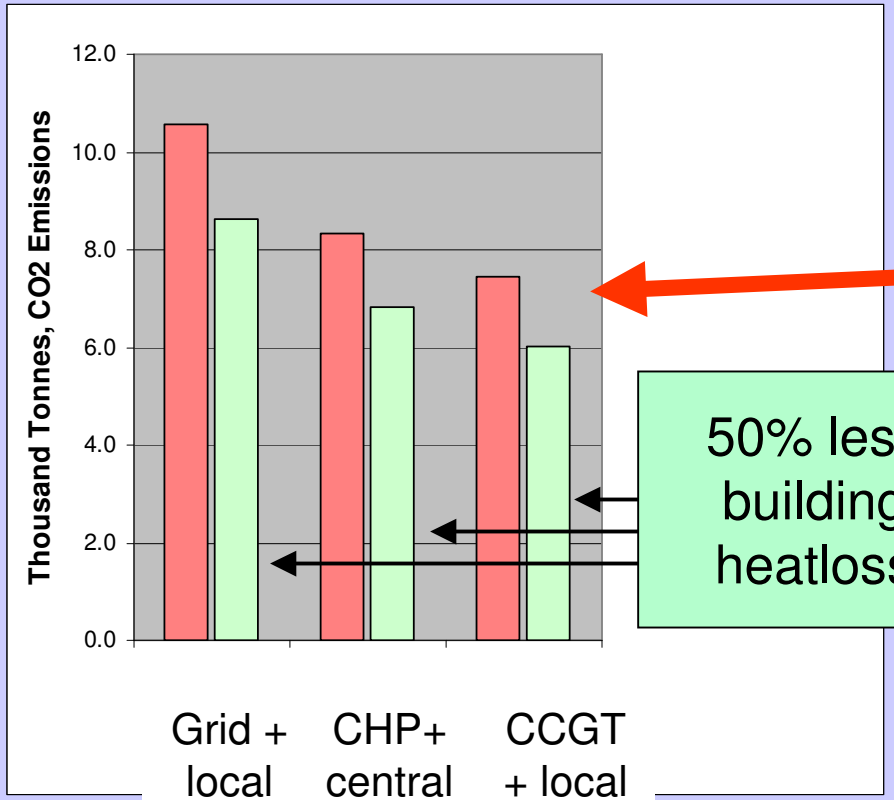
CO2 Emissions at Heat Density of 3000 kW/km2



CCGT + local boiler uses less

District heating and combined heat and power on insulated housing stock.

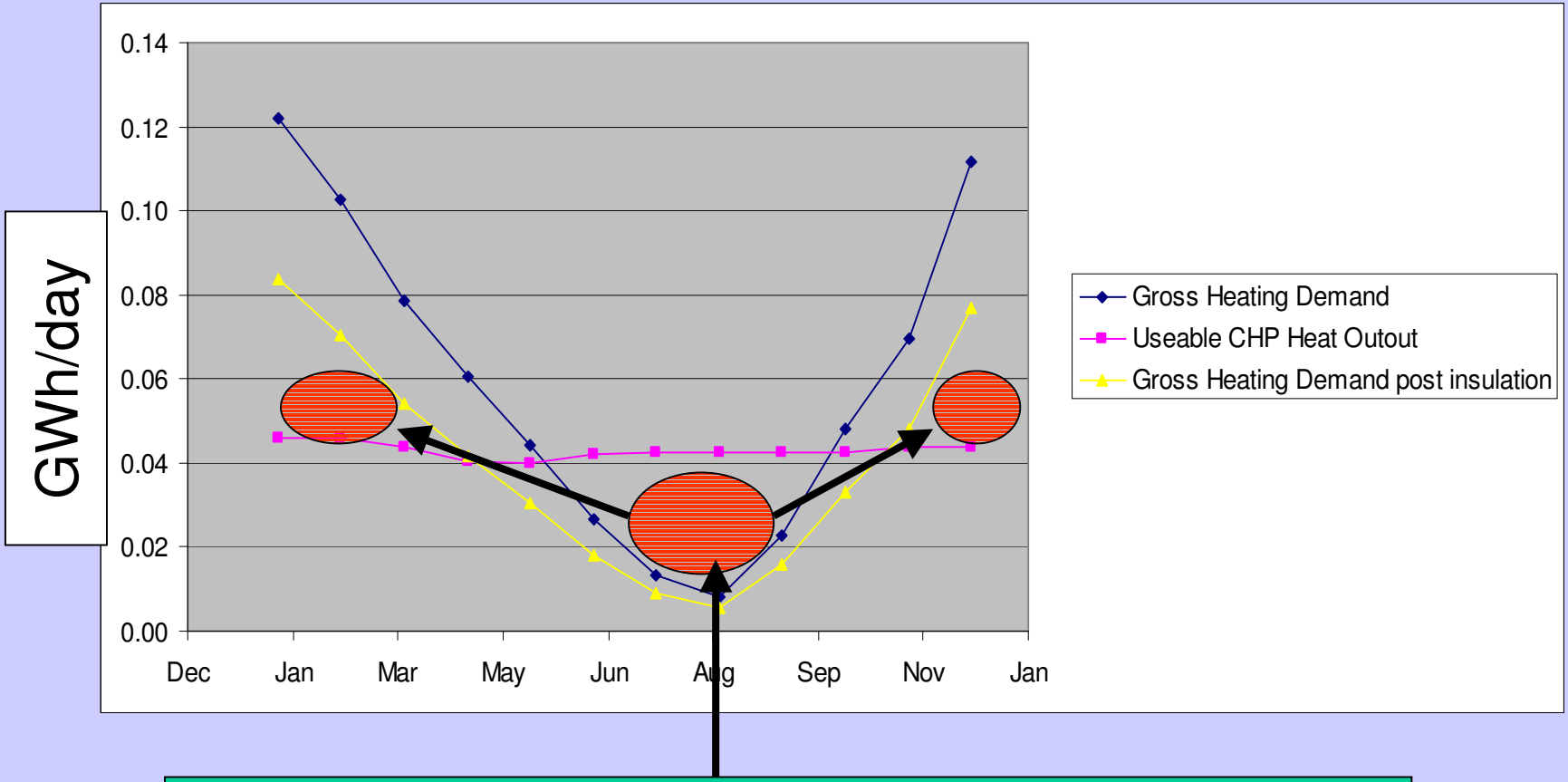
Heat Density of 3000 kW/km2 and then reducing heat loss by 50%



CCGT + local boiler still uses less

50% less building heatloss

Heat produced compared to demand:



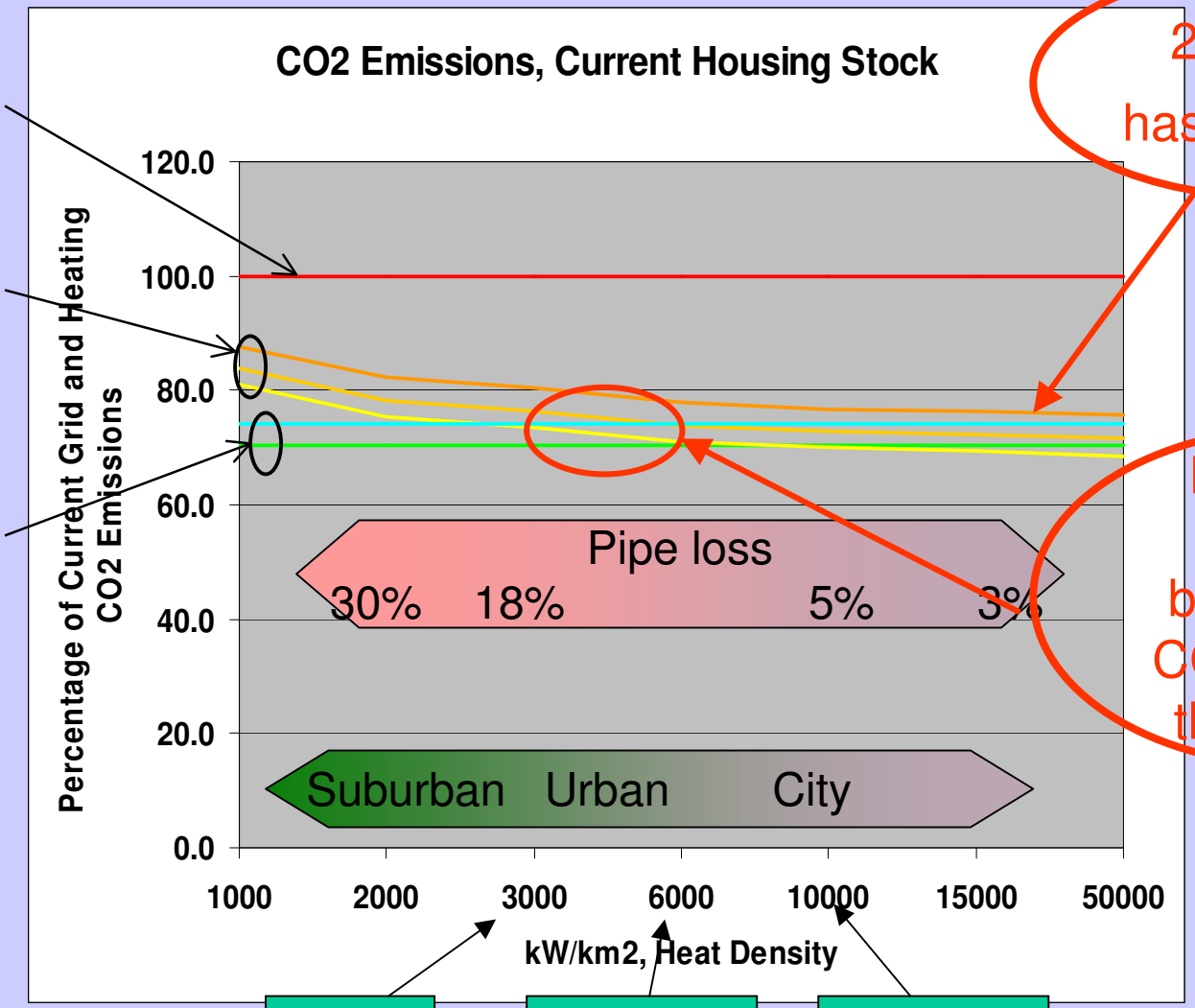
Seasonal storage: Big, Expensive, Hard to do

Vary the Heat density and the CHP efficiency:

Grid base case

CHP from 29% to 38% gross elec.

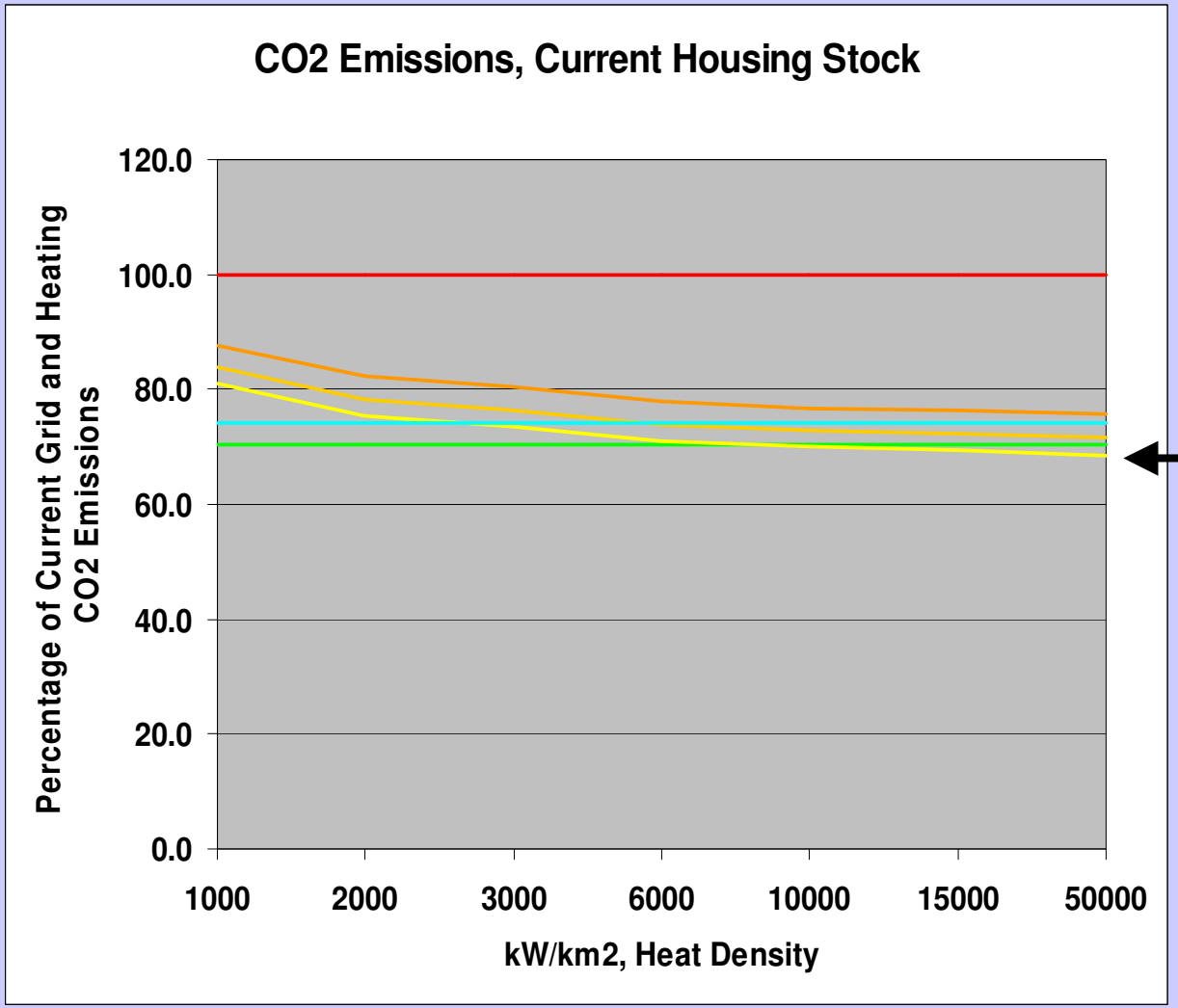
CCGT 47% and 52% Gross.



29% CHP has no benefit

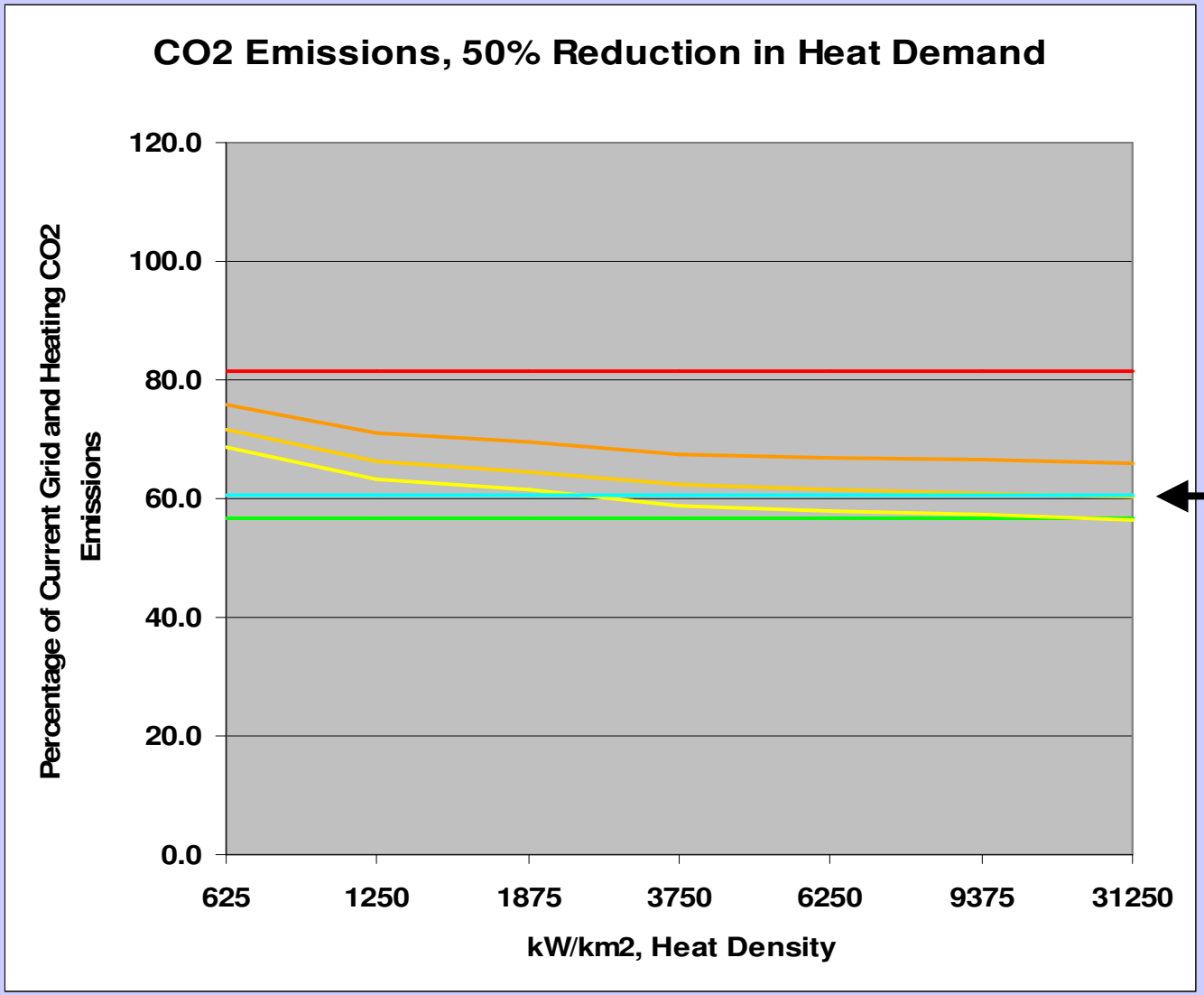
Best CHP starts to benefit over CCGT above this density

Vary the Heat density and the CHP efficiency:



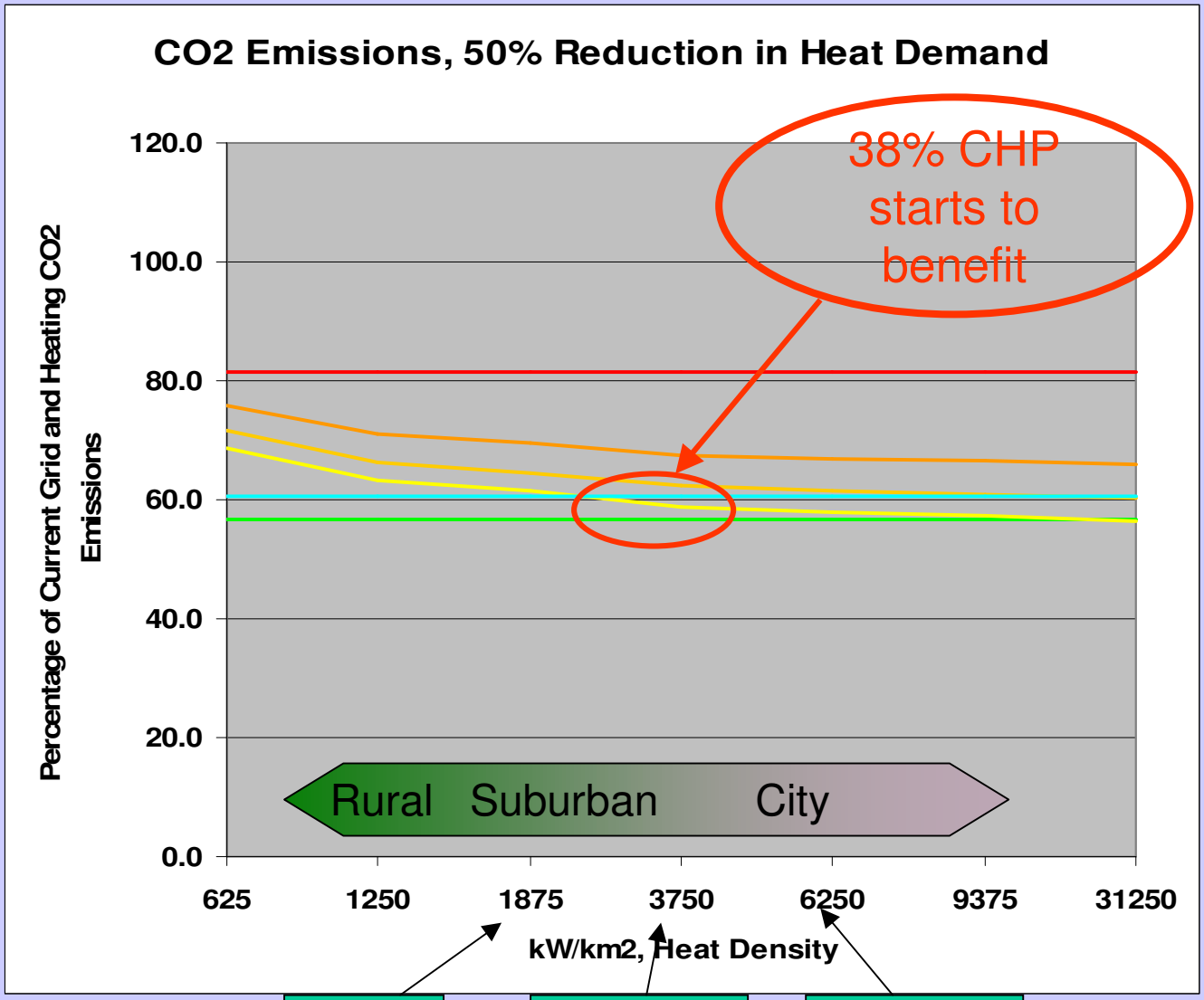
CHP
Best case:
68%

Reduce the fabric heatloss: [still leave hot water load]



CCGT 60%

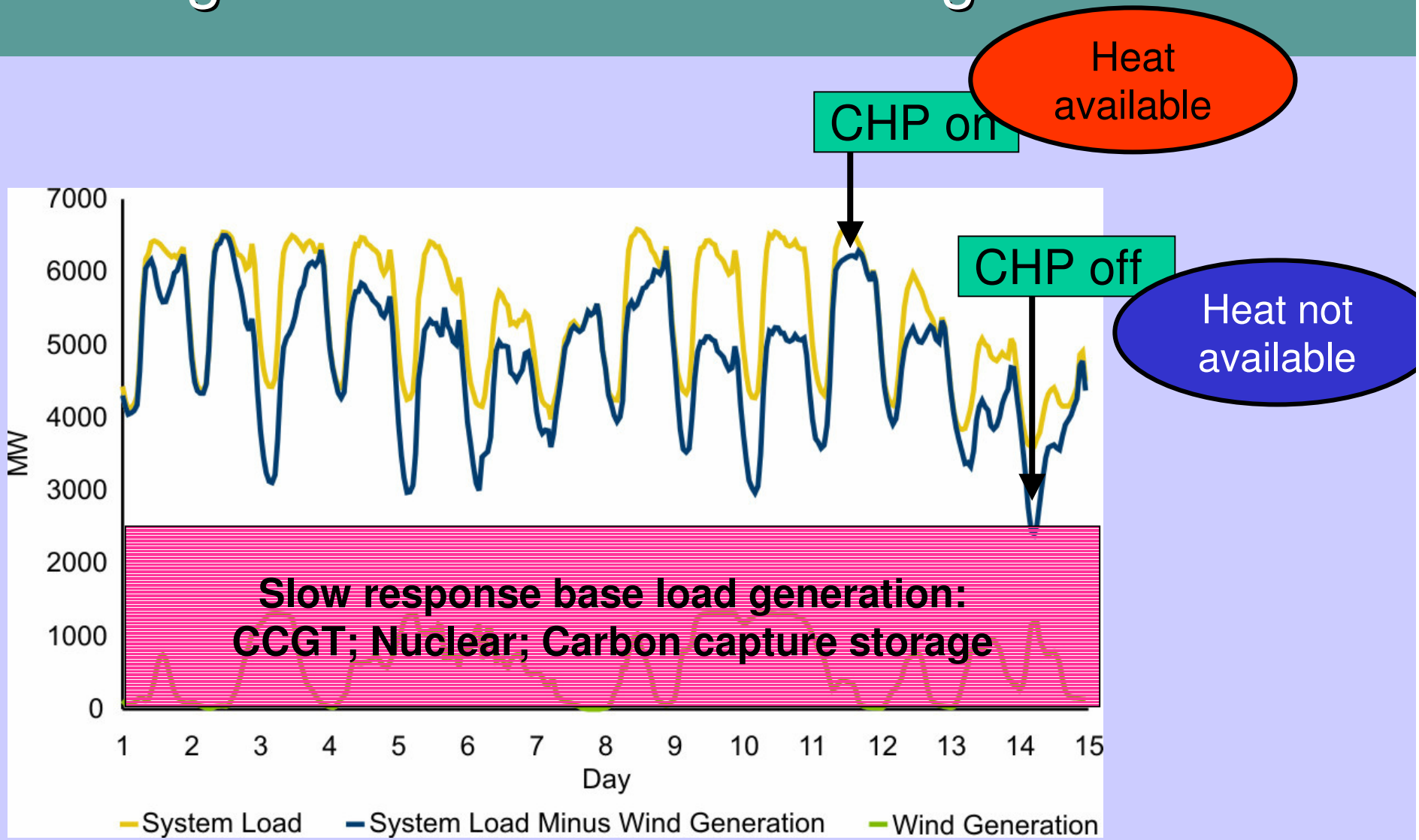
Reduce the fabric heatloss: [still leave hot water load]



Conclusion:

- Insulation does save energy
- CHP can give benefits at high densities.
- The benefits are marginal
- The benefits rely on the efficient use of the heat.

Working with wind and base load generators

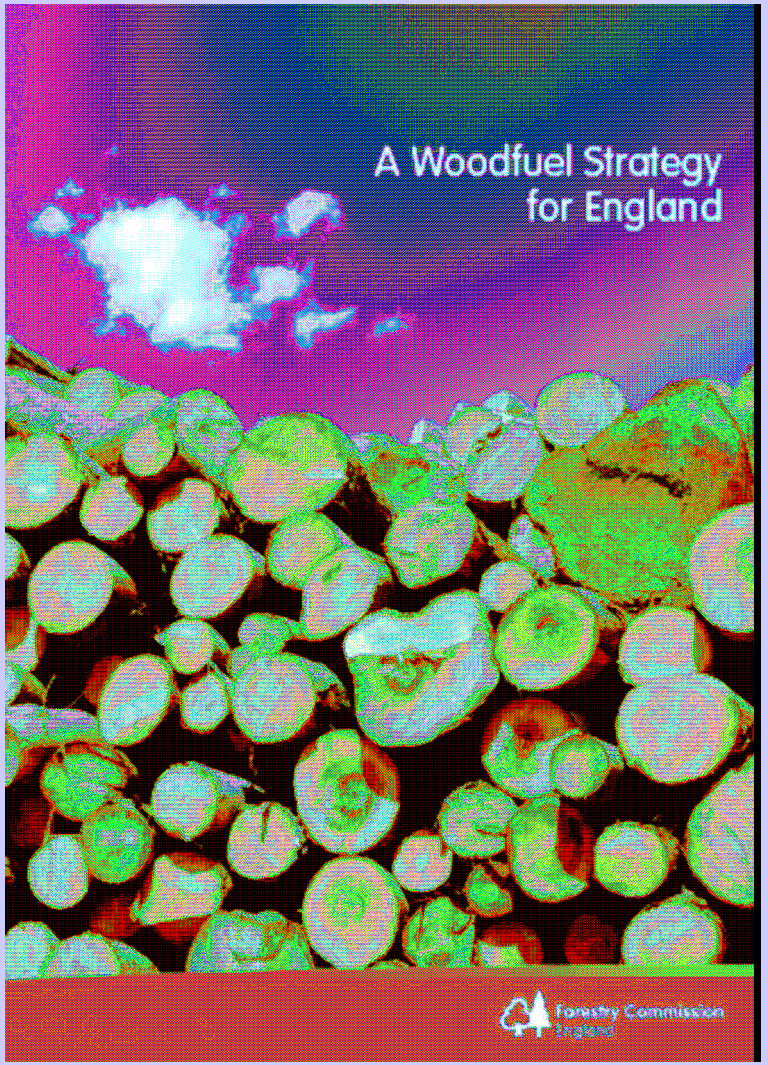


Source:U.S. DOE - "20% Wind Energy by 2030", July 2008; downloaded from:http://www.energyeconomyonline.com/When_the_Wind_Blows.html

Biomass.

4 million tons of wood

2% of household energy



Biomass.

= 4000 hours of operation

Ratclife on Soar
2000 MW
Coal fired power station

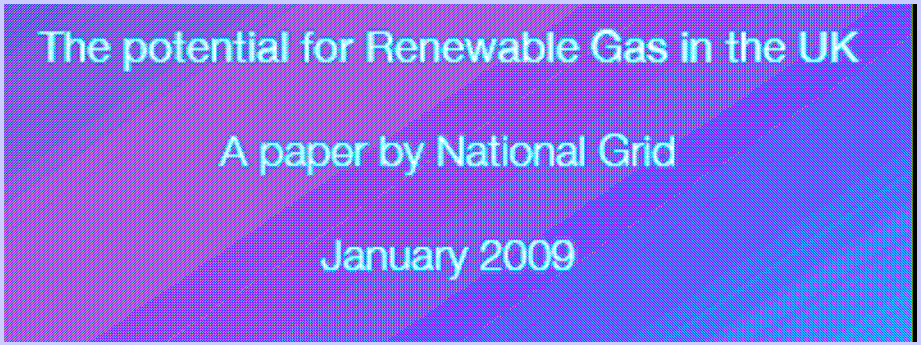
Waste

Transport fuel:

BA using 500,000 tons a year of waste to provide 16 million gallons of jet fuel. (2% of their Heathrow consumption)

UK has 30 million tons of suitable waste

Waste



"….renewable gas could meet up to 50% of the UK residential gas demand. "

nationalgrid
The power of action.

Renewable gas

"….For an extra £10 billion. "

For 20 million dwellings = £500 per dwelling

Community heating =

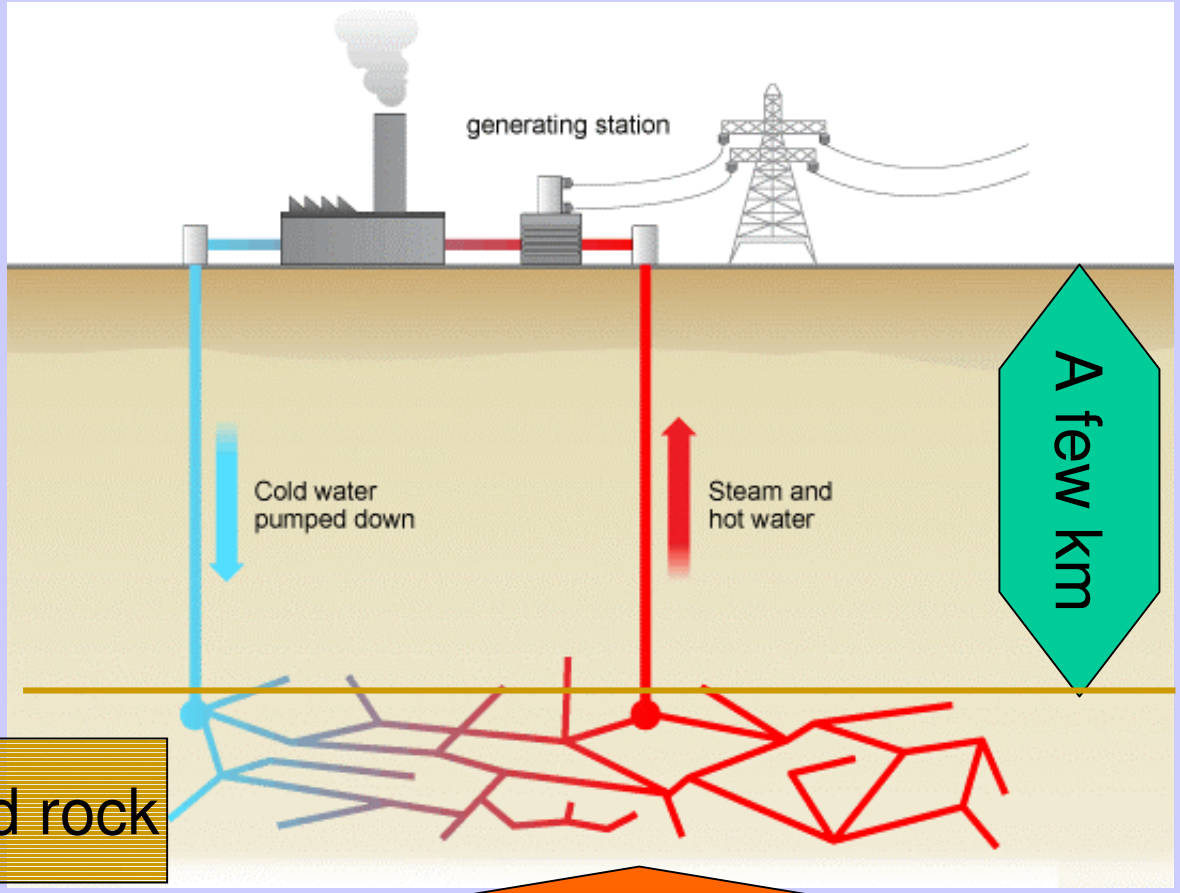
£5,000 to £10,000 per dwelling

nationalgrid
The power of action.

Real Geothermal

Carbon free source of heat and power

- Excellent as long as it is there.
- Limited by geology



Concluding

1. Reduce the demand for heat
2. Make best use of biomass and waste
3. Plan to back up the wind resource
4. CHP and district heating does not have a role in this.

Thank you

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