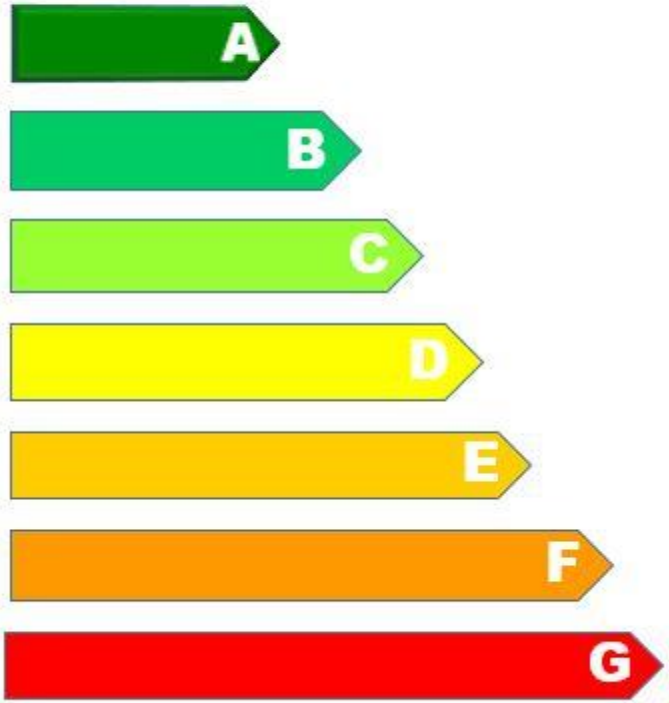
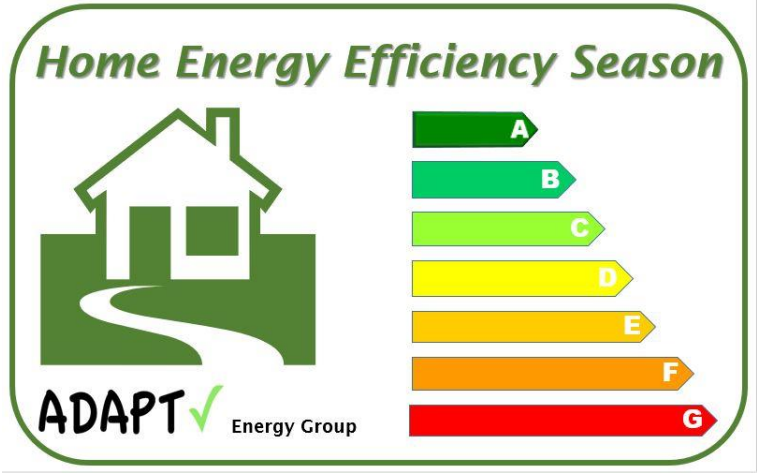
Home Energy Efficiency Season



ADAPT ✓ Energy Group

Event 1 – Buy, use & control energy

- Putting energy into context – Alan Draper
- Home energy conservation – Alan Draper
- Energy controls in the home – Andy Hannah
- Buying energy wisely – Chris Knibbs



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ENERGY EFFICIENCY in THE HOME

Alan Draper

ADAPT Energy Team

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Scope

- energy sources and uses
- appliances ~ variety and loading,
- heating system performance
- energy conservation
- buying energy strategies
- energy management and control

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Factors

- Carbon dioxide rise ~ CO**2**
  - temperature rise
- Climate change
- Vulnerability ~ globally & national
  - severe weather, wind, rain
  - sea levels rising
  - drought
- Global Pollution
- Increasing energy costs
- Foreign political strength
- Taxation and Legislation

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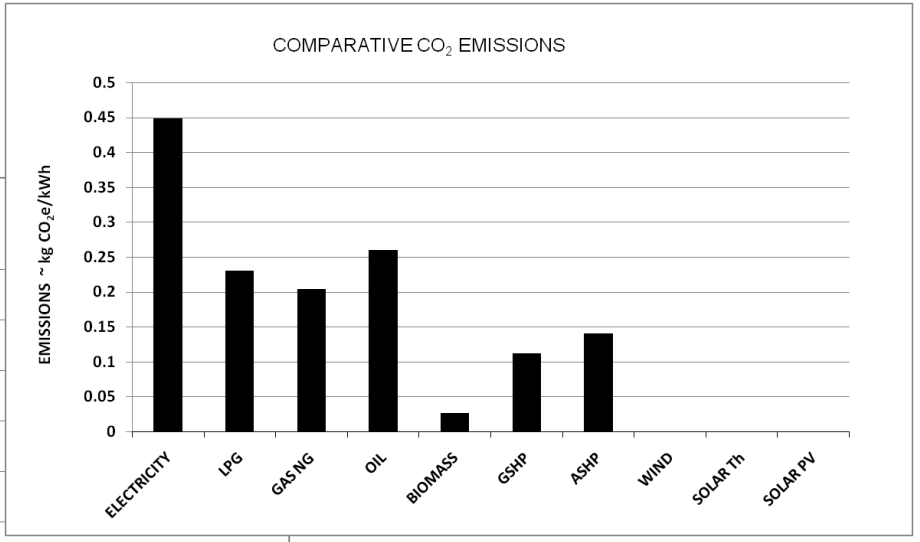
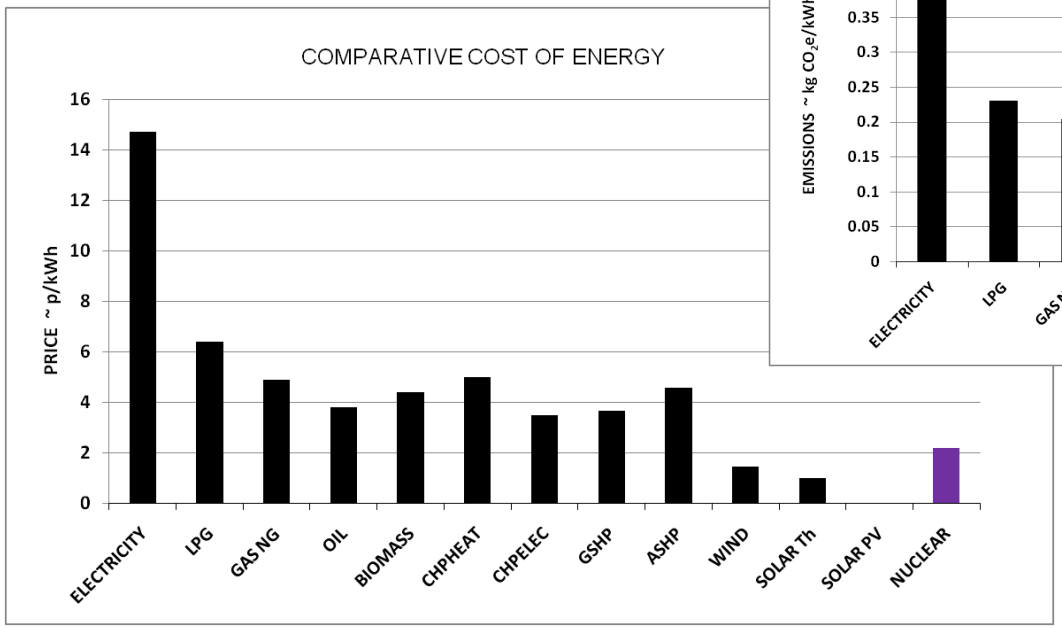
Energy source characteristics





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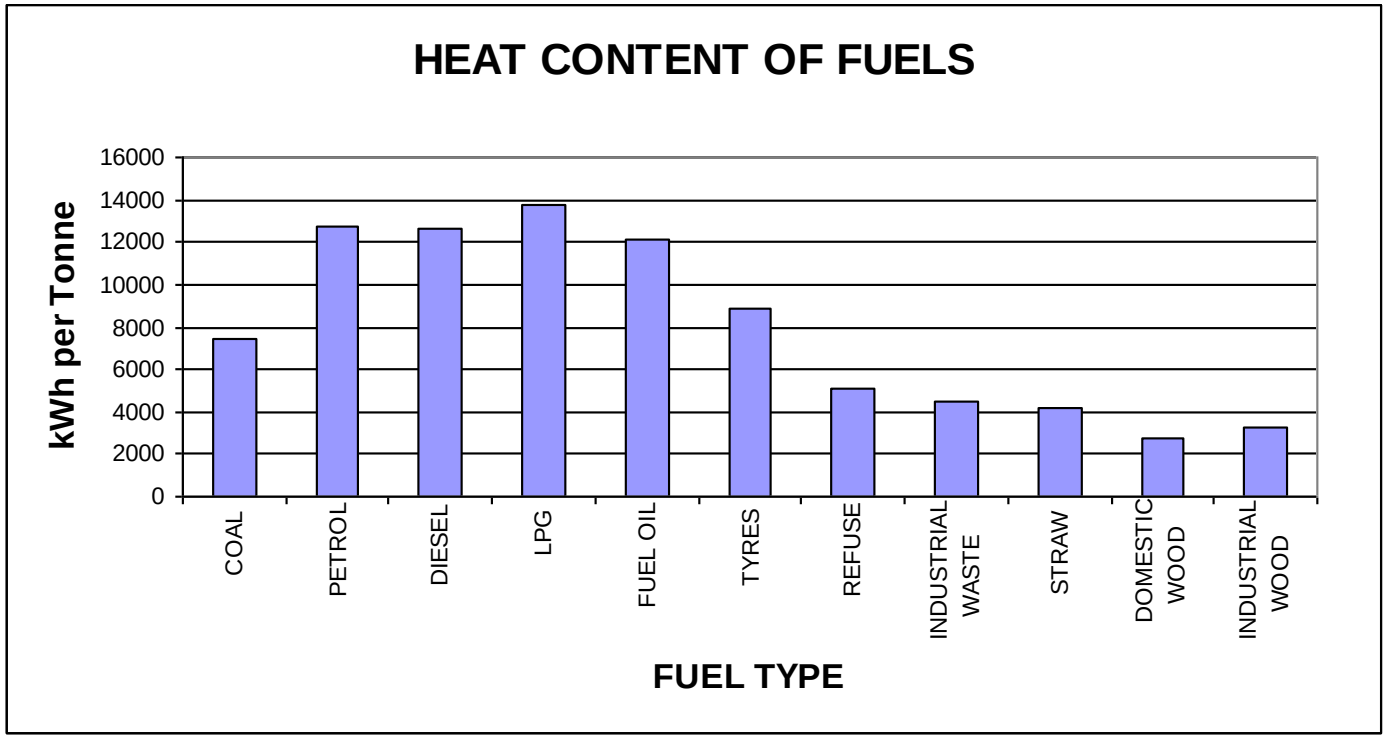
Comparison of Fuel Density



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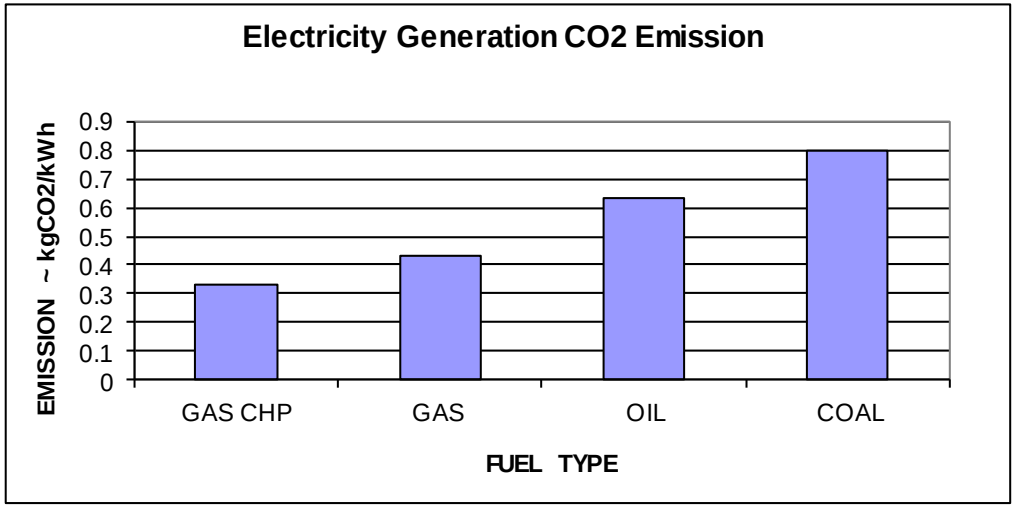
Energy sources



32 kWh
Electricity

100 kWh
Primary
Energy

68 kWh
Waste
Heat

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Energy & proportional usage in the home (usage groups)

- Heating 22600kWh
- Bathing and showers
- Lighting
- Washing & drying
- Cooking & dish washing
- Entertainment (TV, Music, Home Cinema, etc)
- Office work (Computers, Printers, Chargers, etc)
- Other

ELECTRICAL
AVERAGE USAGE
6000kWh

- Appliances ~ relative energy loading .....link

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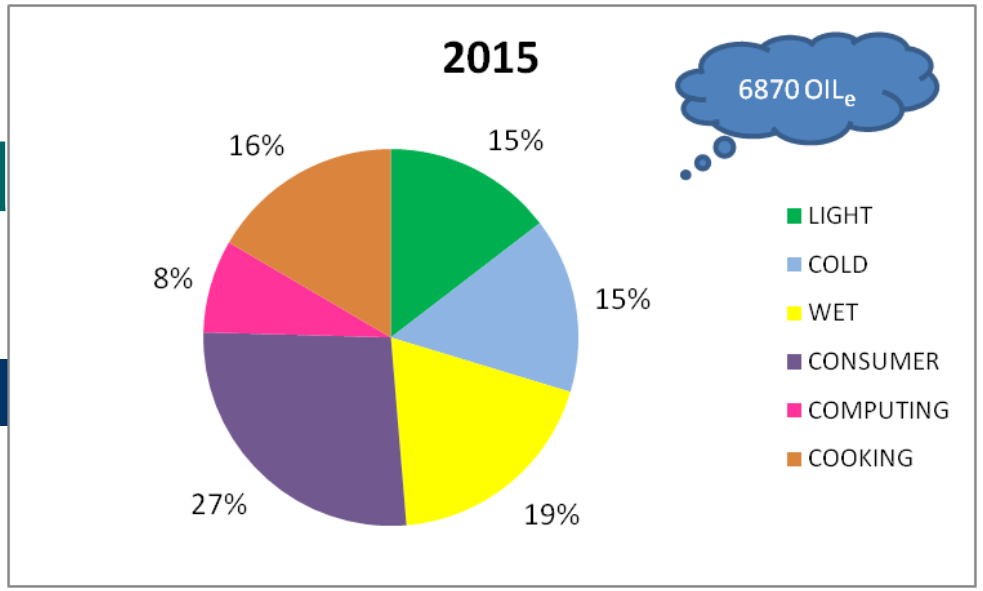
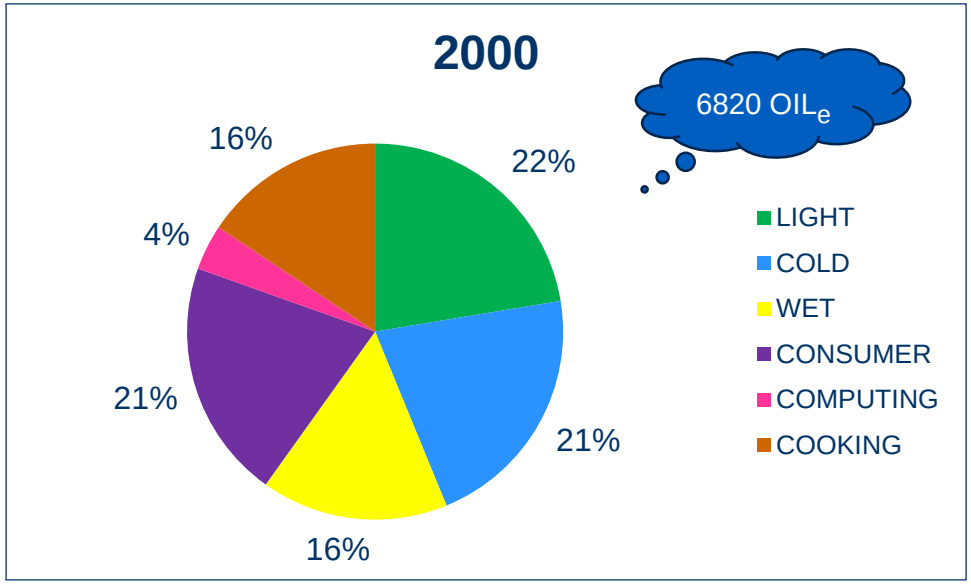
Electricity used in the Home





Reduce consumption

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Heating systems in your home

- Single point heating
  - Wood burners and stoves .....66 – 84% as new
  - Electrical and gas .....100% and 80 – 90% resp.
- Central Heating boilers
  - Gas, oil and wood burning boilers.....80 – 90% as new
- variation in efficiency
  - conventional boiler....non-condensing.....80%
  - condensing boiler.....90%
  - old non-condensing boiler.....58%
- emissions typical
  - non-condensing.....5000kg CO_2
  - condensing.....3000kg CO_2
- other considerations
  - space and installation requirements
  - fuel storage or supply requirements

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Source: Building Services Handbook

Boiler comparison ~ running costs pa

BOILER TYPE	SEMI DETACHED	DETACHED	FLAT	EFFICIENCY
OLD HEAVY UNIT	£1204	£1705	£779	**55%**
OLD LIGHT UNIT	£1019	£1442	£659	**65%**
NEW NON CONDENSING	£849	£1202	£549	**78%**
NEW CONDENSING	£744	£1053	£481	**89%**

Source: SEDBUK

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Boiler savings potential

OLD BOILER RATING	SEMI DETACHED	DETACHED	DETACHED BUNGALOW	MID TERRACE	MID FLOOR FLAT
G (<70%)	£215	£350	£180	£175	£95
F (70 - 74%)	£145	£240	£125	£120	£65
E (74 - 78%)	£115	£190	£95	£95	£50
D (78 - 82%)	£83	£140	£70	£70	£35

Source: Energy Savings Trust

Savings based on upgrading an old boiler

- ‘A’ rated condensing boiler
- Programmer
- Room thermostat
- Radiator TRVs

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Heat Energy

- Energy for heating building space
- Energy for heating water
  - Building fabric losses
  - Insulation ~ home and water tank
  - Air tightness
  - Waste Heat Recovery
  - Mechanical Ventilation Heat Recovery

Eliminate waste ~ Insulate

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Thermal Properties (λ)&(u-value)

- Thermal conductivity
  - the rate at which material will pass heat ~ Watts/mK

- U-value
  - the quantity of heat that will pass through $1m^2$ of material ~ Watts/m^2K

Examples of λ

Steel	60.00
Glass	1.00
Roof tile	1.30
Brick	0.56
Mineral wool	0.037
Celotex PIR	0.022

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Walls ~ thermal properties (λ)

Stone walls 2.3 to 2.5

Brick walls 0.56 to 0.77

Concrete cinder walls	1.21
Thermalite blocks	0.11

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Walls ~ thermal properties (u-value)

Solid brick walls (220mm) 2.19

Cavity brick walls

- no cavity insulation (255mm) 1.50
- with cavity insulation(255mm) 0.60

Example based on 10m^2 of external wall &

An external temperature of minus 5°C

Heat Loss

- Solid brick wall.....547Watts = 4.38kWh *in 8 hour period*
- Cavity wall no insulation .....375Watts = 3.00kWh *in 8 hour period*
- Cavity wall insulated .....150Watts = 1.20kWh *in 8 hour period*

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Windows ~ thermal properties (U)

Single glazing in a steel frame.....	6.02	0%
Single glazing in a wooden frame.....	4.00	33%
Double glazing in a wooden frame 10mm air gap.	2.30	42%
Double glazing in UPVC frame 16mm argon filled gap.....	2.10	8.7%
Triple glazing UPVC argon 16mm/12mm.....	1.90	9.5%

Heat losses

- 150Watts ➡ 100 ➡ 57 ➡ 52 ➡ 47Watts

Based on a 1m by 1m window

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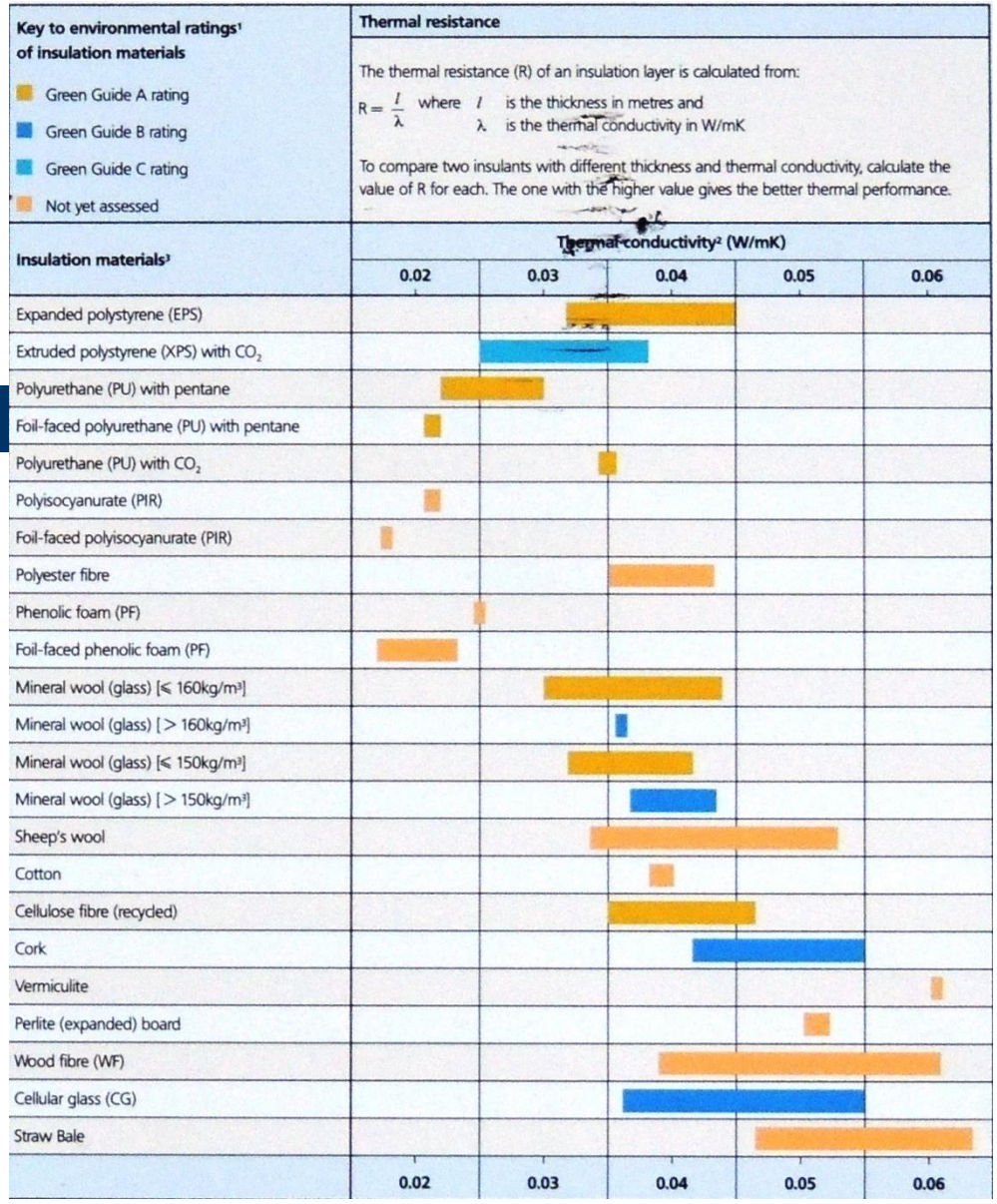
Thermal Performance of Insulation

Source: Energy Saving Trust



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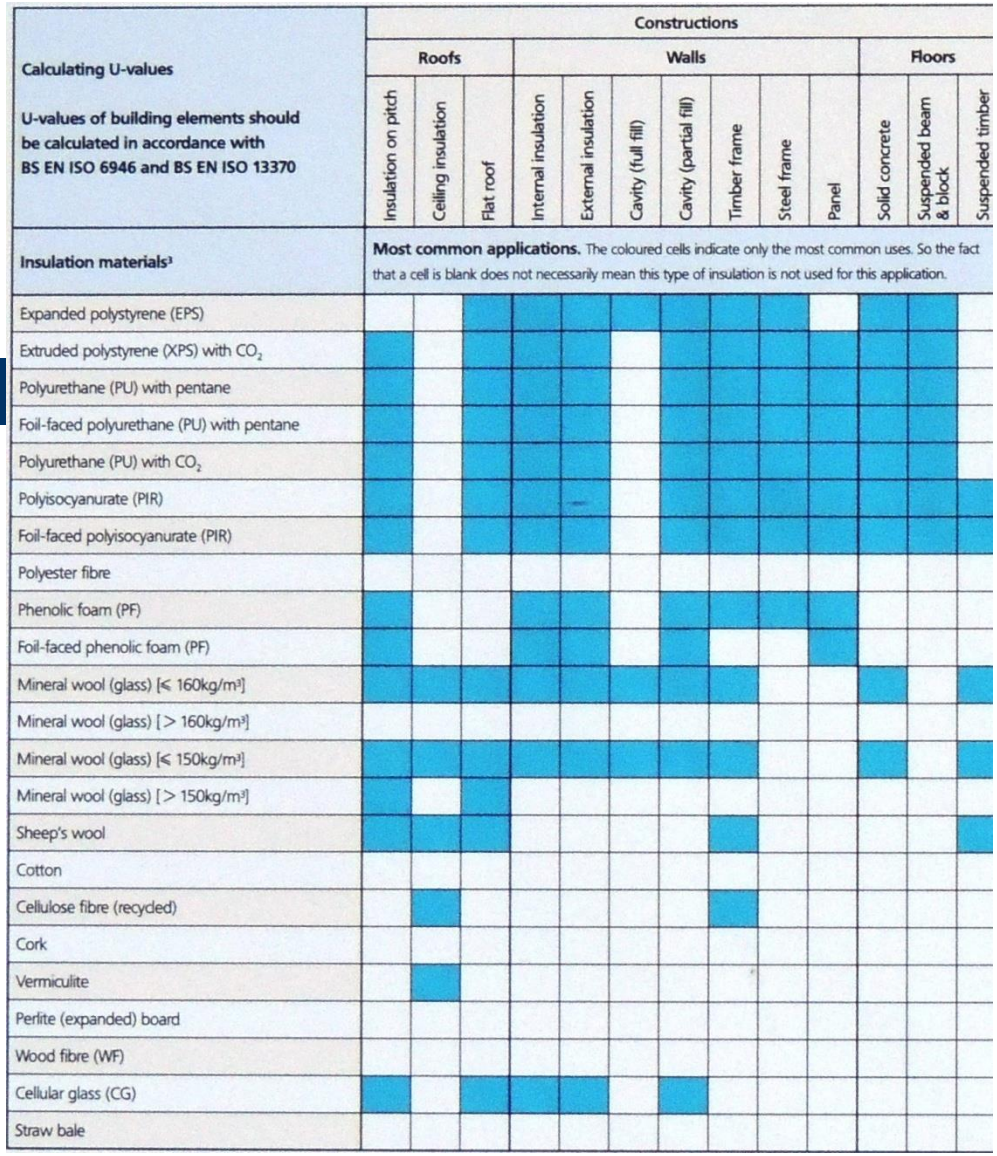
Insulation applications

Information available from
Source: Energy Saving Trust



Calculating U-values U-values of building elements should be calculated in accordance with BS EN ISO 6946 and BS EN ISO 13370	Constructions												
	Roofs			Walls							Floors		
	Insulation on pitch	Ceiling insulation	Flat roof	Internal insulation	External insulation	Cavity (full fill)	Cavity (partial fill)	Timber frame	Steel frame	Panel	Solid concrete	Suspended beam & block	Suspended timber
Insulation materials[3]	**Most common applications.** The coloured cells indicate only the most common uses. So the fact that a cell is blank does not necessarily mean this type of insulation is not used for this application.												
Expanded polystyrene (EPS)			■	■	■	■	■	■	■		■	■	
Extruded polystyrene (XPS) with CO_2	■		■	■	■		■	■	■	■	■	■	
Polyurethane (PU) with pentane	■		■	■	■		■	■	■	■	■	■	
Foil-faced polyurethane (PU) with pentane	■		■	■	■		■	■	■	■	■	■	
Polyurethane (PU) with CO_2	■		■	■	■		■	■	■	■	■	■	
Polyisocyanurate (PIR)	■		■	■			■	■	■	■	■	■	■
Foil-faced polyisocyanurate (PIR)	■		■	■	■		■	■	■	■	■	■	■
Polyester fibre													
Phenolic foam (PF)	■			■	■		■	■	■	■			
Foil-faced phenolic foam (PF)	■			■	■		■			■			
Mineral wool (glass) [⩽ 160kg/m³]	■	■	■	■	■	■	■	■			■		■
Mineral wool (glass) [> 160kg/m³]													
Mineral wool (glass) [⩽ 150kg/m³]	■	■	■	■	■	■	■	■			■		■
Mineral wool (glass) [> 150kg/m³]	■		■										
Sheep's wool	■	■	■					■					■
Cotton													
Cellulose fibre (recycled)		■						■					
Cork													
Vermiculite		■											
Perlite (expanded) board													
Wood fibre (WF)													
Cellular glass (CG)	■		■	■	■		■						
Straw bale													

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Insulation applications

Calculating U-values U-values of building elements should be calculated in accordance with BS EN ISO 6946 and BS EN ISO 13370	Constructions												
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Polyurethane (PU) with pentane	■		■	■	■		■	■	■	■	■	■	
Foil-faced polyurethane (PU) with pentane	■		■	■	■		■	■	■	■	■	■	
Polyurethane (PU) with CO_2	■		■	■	■		■	■	■	■	■	■	
Polyisocyanurate (PIR)	■		■	■	■		■	■	■	■	■	■	■
Foil-faced polyisocyanurate (PIR)	■		■	■	■		■	■	■	■	■	■	■
Polyester fibre													
Phenolic foam (PF)	■			■	■		■	■	■	■			
Foil-faced phenolic foam (PF)	■			■	■		■			■			
Mineral wool (glass) [≤ 160kg/m³]	■	■	■	■	■	■	■	■			■		■

Source: Energy Saving Trust

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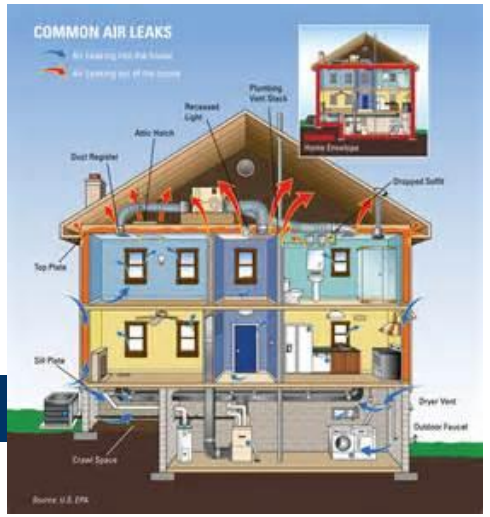
Reducing waste 1



Heat demand in a home is needed to offset losses

i.e. wasted energy/money;

- ventilation controlled and uncontrolled.....20 to 40%
- heat passing through the fabric of buildings ...30 to 70%
- heat passing through windows.....14 to 30%

Example:

A semi detached home 3 bedrooms 160m^2 floor area

Illustrating effects from changes in the 3 areas above.

Ambient temperature minus 5°C (Htg & DHW)

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Thermal Performance of Buildings 1

	HOUSE	WALLS	ROOF	WINDOWS
U -Values	4 Bedroom, 158m^2 modernised	Solid brick	Insulation	Single glazing wood frame
STEP 0	Roof uninsulated	2.19	2.50	4.00
STEP 1	Roof insulation added 100mm	2.19	0.40	4.00
STEP 2	Roof insulation added 300mm	2.19	0.14	4.00
STEP 3	Cavity walls no cavity insulation	1.55	0.14	4.00
STEP 4	Cavity walls with cavity insulation	0.60	0.14	4.00
STEP 5	Windows double glazed UPVC frames	0.60	0.14	2.00

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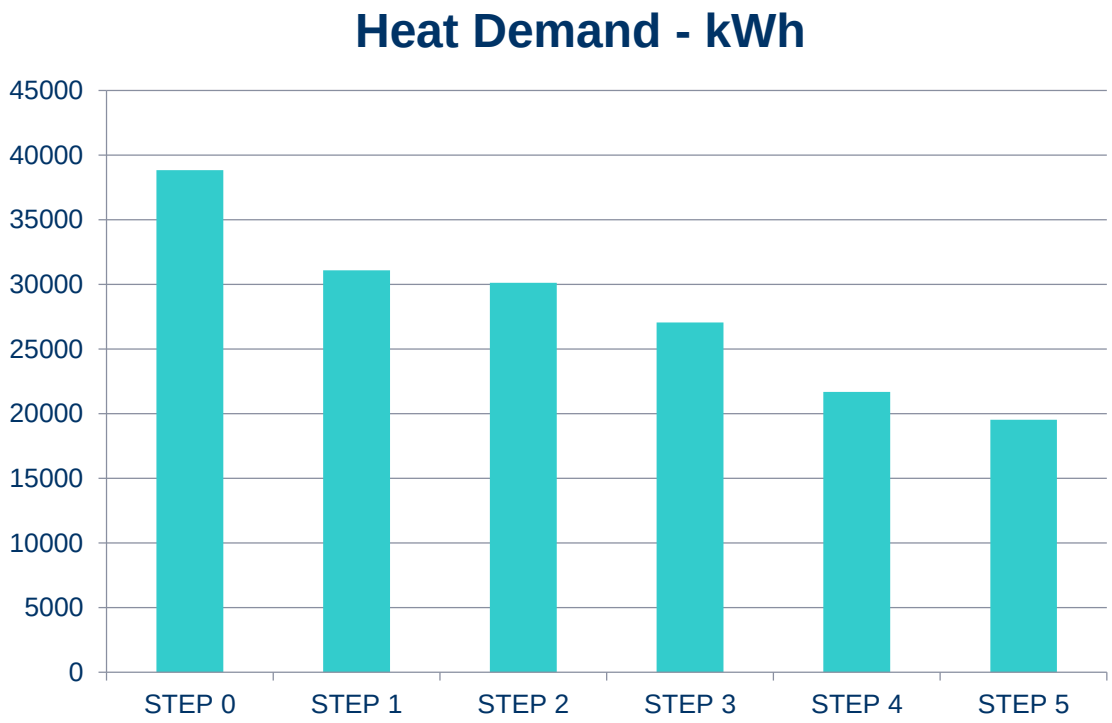
Thermal Performance of Buildings 2



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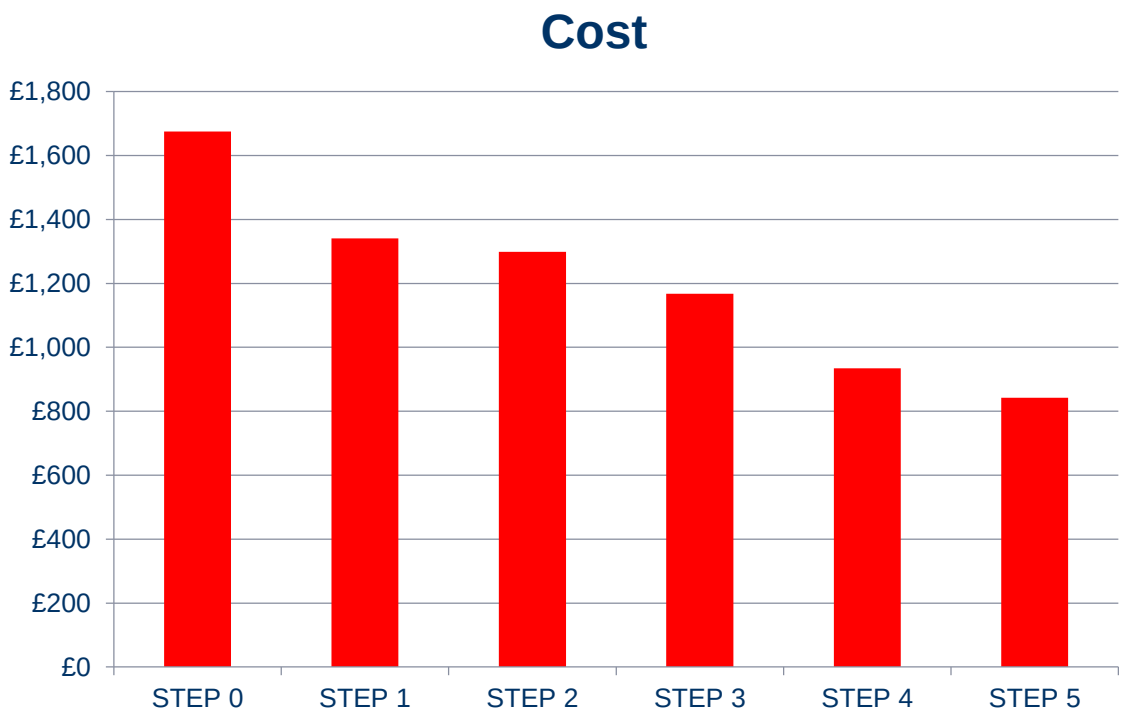
Thermal Performance of Buildings 3



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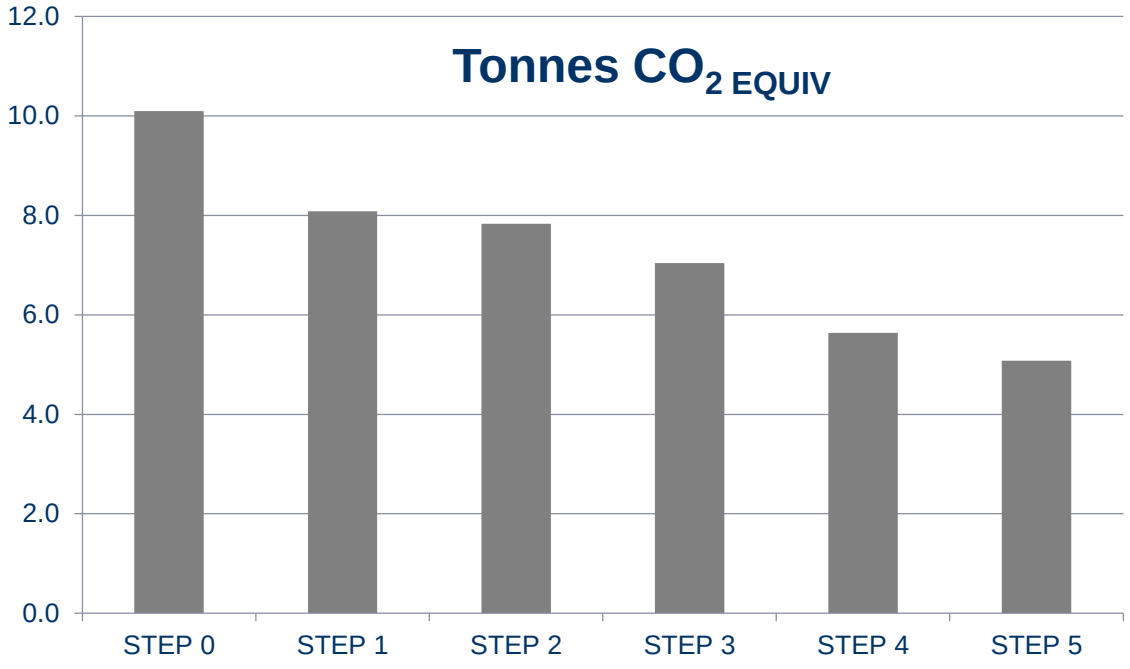
Thermal Performance of Buildings 4



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Human behaviour

Human behaviour is a major influence on consumption

- Use controls proactively to provide comfort levels of heat only when needed; timers, thermostats, radiator valves
- Close doors when temperature differences exist e.g. rooms not in use
- Switch appliances and lighting off, not to stand-by, when not in use
- When replacing appliances & lights buy the most efficient available

Smart meters are not controls

- They enable you to see when you're using the most energy
- They enable you to know how much it's costing you.
- This means you can adapt your energy use and cut down on waste
- It can help you prioritise your purchases

1930's House

- Total annual energy bill typically £1,030
- Total carbon emissions: 6.2 tonnes
- Space Heating 3.7 tonnes
- Hot Water 1.0 tonne
- Heating: 75% of total

New Build Semi-detached

- Typical annual energy bill is £590
- Total carbon emissions: 2.8 tonnes
- Space heating: 0.75 tonnes
- Hot water: 0.55 tonnes
- Heating 50% of total

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SUMMARY PART 1

- Summary statement
  - Select efficient equipment
  - Prevent waste ~ insulation and ventilation
  - Behavioural influences
- Management and control
- Choosing an alternative supplier

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ENERGY EFFICIENCY in THE HOME

Alan Draper

ADAPT Energy Team

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Energy Controls in the home

Andy Hannah

ADAPT Energy Team

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Controlling energy in the home

- More than half the energy use in a typical home is for heating and hot water
- Greatest potential for energy wastage
- Recent technological advances mean that there is an energy efficient control solution which is right for everyone.

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The quickest win – Don't set your controls too high

- Set to the lowest comfortable setting
- Usually 18-21 degrees C.
- Typical saving by turning down 1 degree…

£80-£85 / year*

(* Energy Saving Trust)

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Don’t heat when you don’t need

- Applies to both heating and hot water

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Have the right equipment to allow you to control….

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What's the best system for heating controls?

- There is no single best system for everyone!
- To find the best system for you, you must consider
  - How you use the house
  - How your lifestyle pattern affects your need for heating and hot water
  - How automatic do you want the control of energy to be
- First decide what you need and want, then find a system that does that.

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The basics of building controls

- Three main types of building controls:
  - Time

  - Condition (temperature)

  - Occupancy

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Levels of time and temperature controls for heating

- Whole house control
  - Boiler thermostat and timer
  - Room thermostat and programmer
- Zoning controls (single heating circuit)
  - Temperature –TRVs (thermostatic radiator valves)
  - Time – Programmable TRVs or
    Wireless radiator control valves

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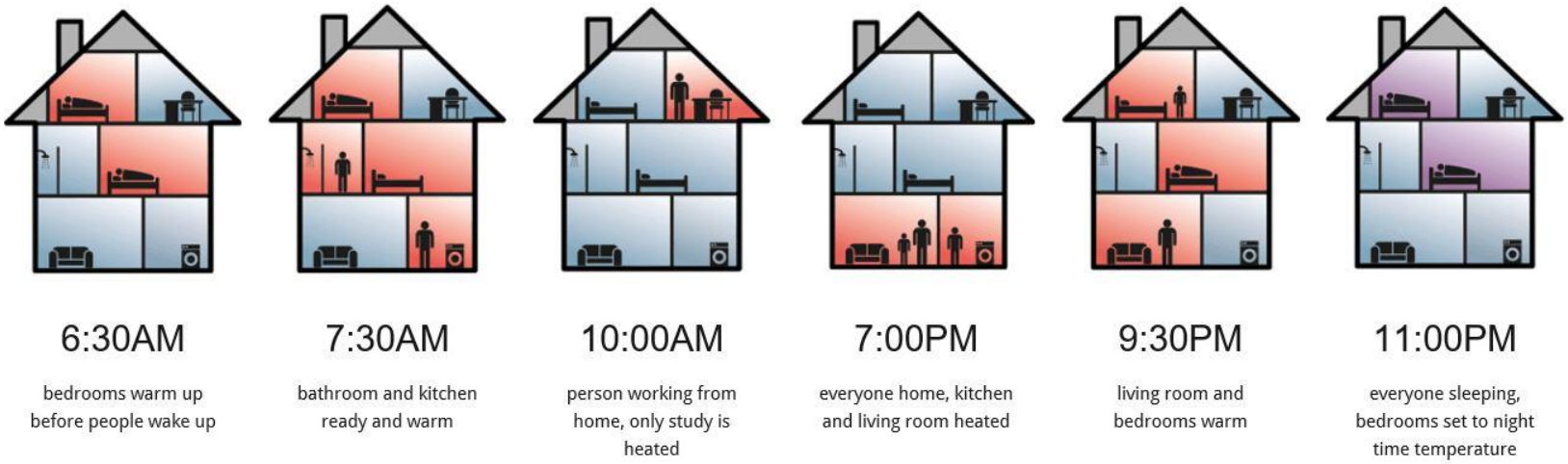
Zone time control

- Do you want central time control of individual rooms?



- Illustration courtesy of Heat Genius.

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Levels of automation

- Manual setting of everything
- Central programming
- Phone / computer setting
  - “The Internet of Things”!

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Occupancy sensing controls

- Would we prefer not to be adjusting the time settings all the time?
- What if we prefer the system to heat only when we are going to be there?
- Occupancy sensing controls
  - Room sensors
  - Phone GPS signal
    (needs reliable phone signal!)

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So, what is the right system for me??

- It depends how we use our home….

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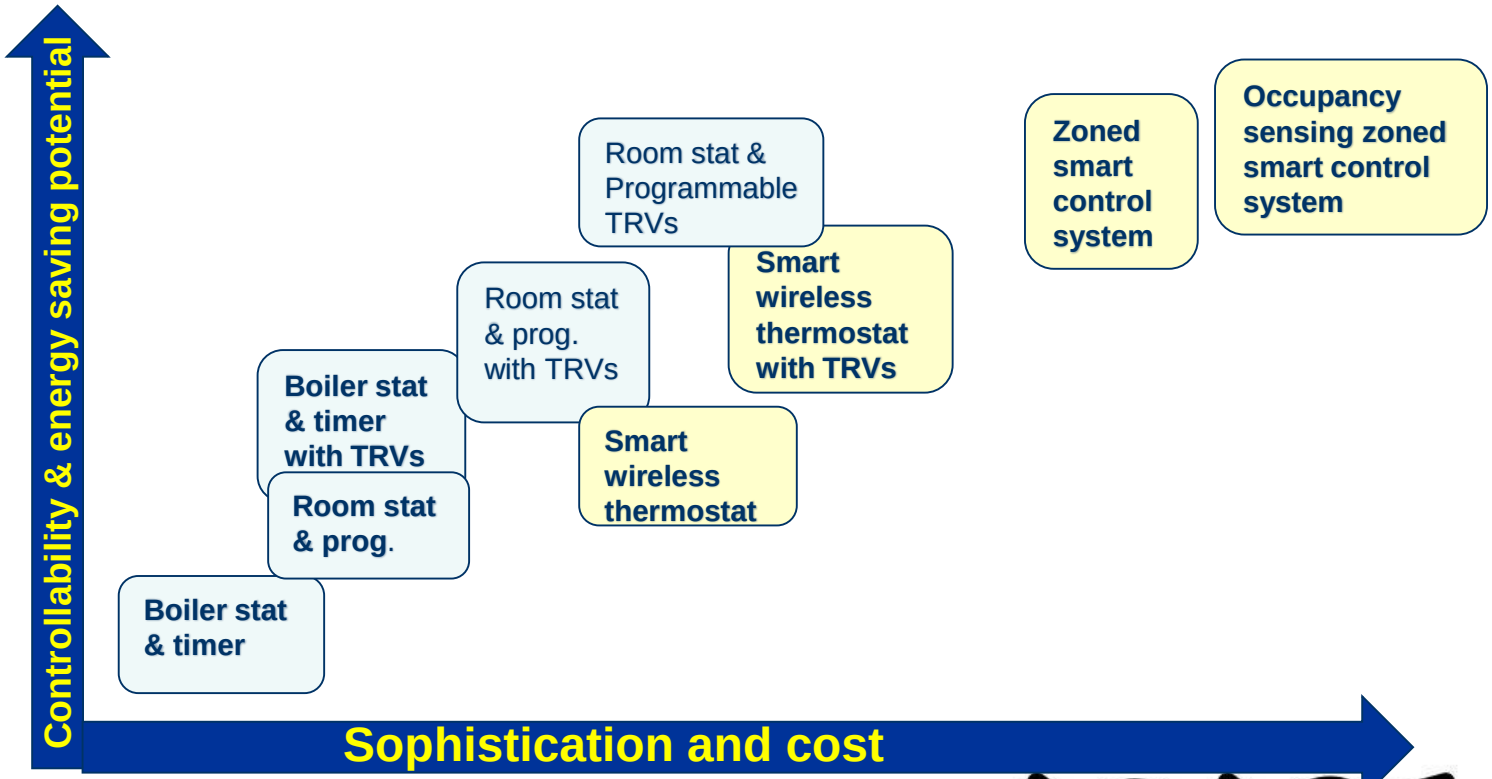
How do we use our home?

- Does the pattern of heating vary by day of the week?
  - If so, programming capability
- Do some rooms get hotter than others?
  - TRVs
- Are there large areas of the home which don't require full heating for long periods?
  - TRVs
- Do you occupy only part of the home during the day, but different areas at different times?
  - Programmable TRVs or Smart zone time controls
- How consistent is the pattern?
  - If very inconsistent, possibly controls by occupancy
- Do you need to make changes often or when away from the home?
  - 'Smart' thermostats and controllers

The market for building controls



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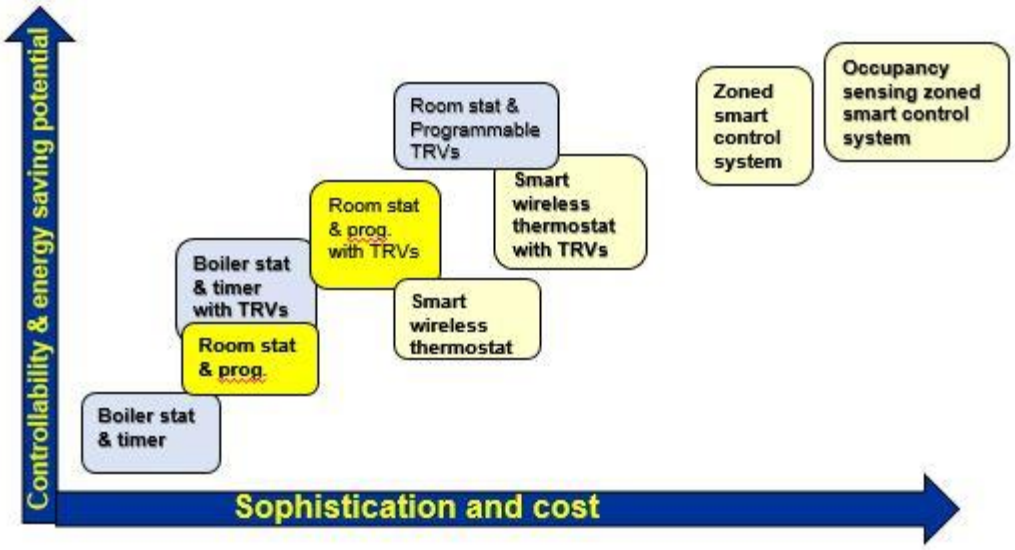
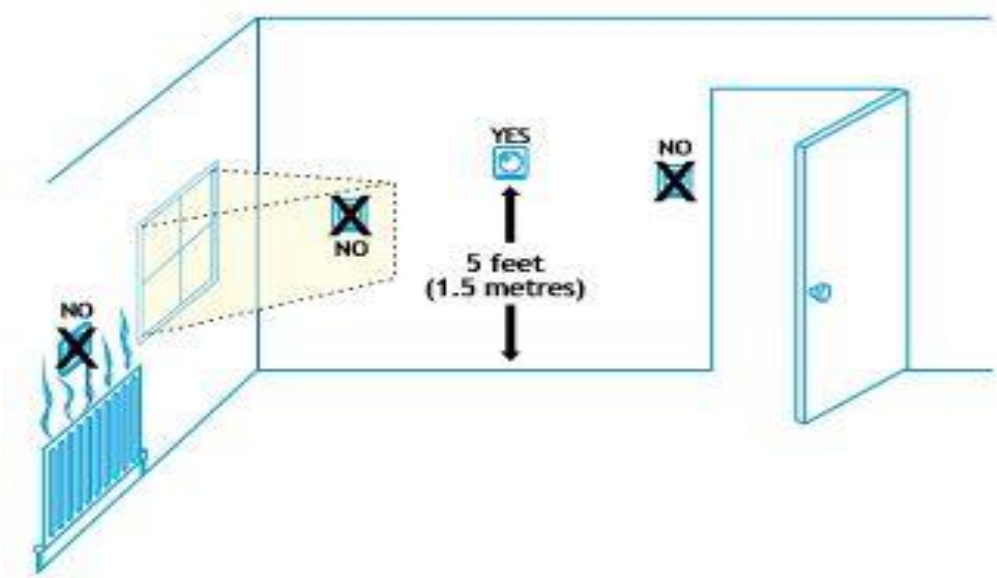
Room thermostats



- Locate them correctly



- Set them correctly (18-21 deg)

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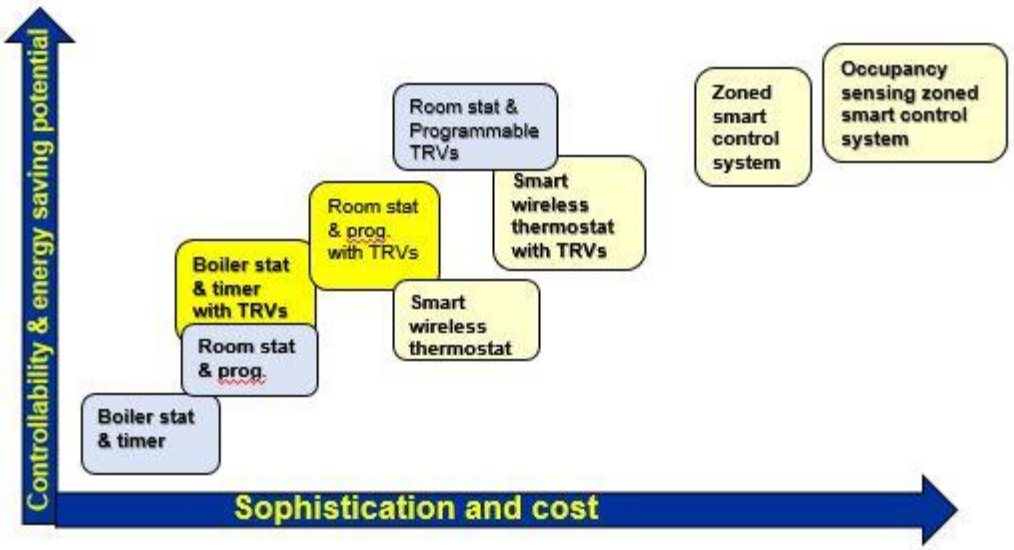
TRVs



- Much more robust than they used to be.
- Cheap (less than £20)
- Very effective at balancing temperature between rooms
- Most effective if you calibrate the settings to room temperature with a digital thermometer (less than £25)
- Allows different temperatures to be maintained in different rooms

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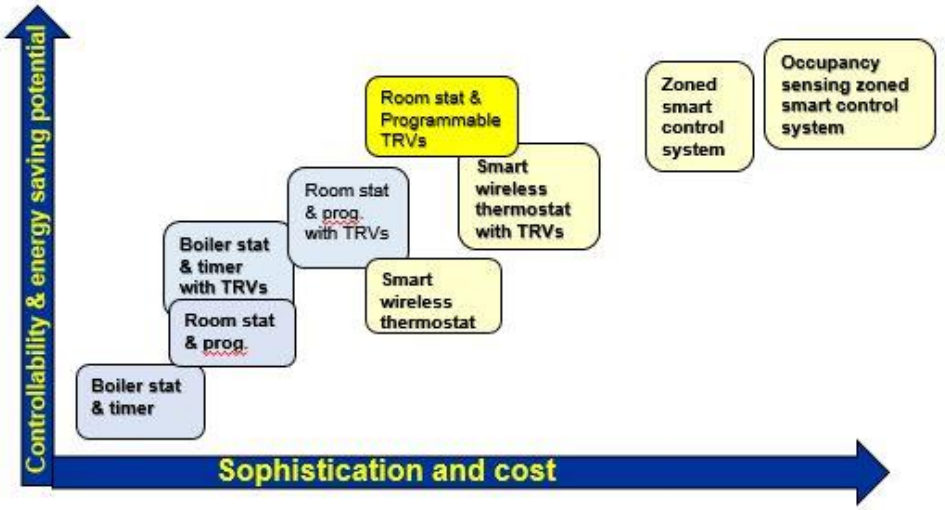
Programmable TRVs



- Individual room time control
- Not centralised
- Can be fiddly to set up
- Not great if frequent changes are required
- Cheap with good savings potential

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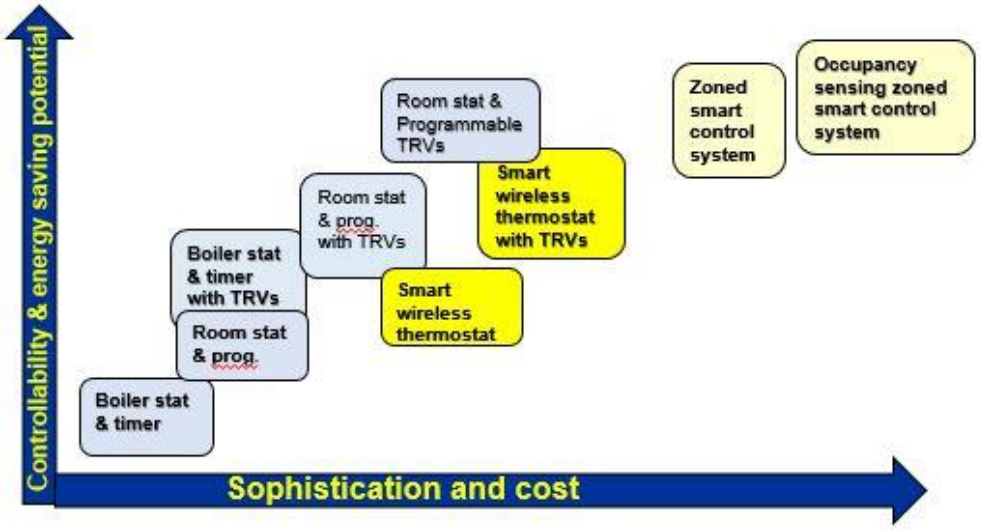
Smart wireless thermostats



- e.g Nest, Hive, Tado etc
- About £200 to £250
- All smartphone based
- Probably the ultimate system for smaller homes
- Capabilities vary considerably
- Great for adjusting away from home
- Some can learn occupancy pattern
- Self learning of occupancy can avoid frequent reprogramming
- Links to other functions
  - Lighting controls, Security, Smoke alarm, Plug in devices
- Some claim to be multi-zone, but rely on the plumbing already being zoned

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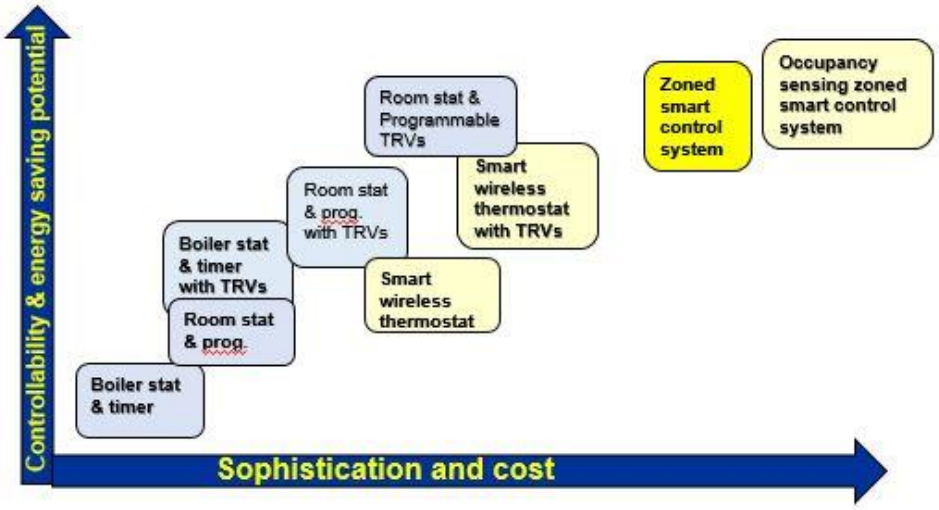
Smart zone control systems



- e.g. Honeywell Evohome, Heat Genius etc.
- Provides the next level of energy efficiency
- Good for larger, more sparsely populated homes
- Quite expensive
- Honeywell version can be operated as a standalone controller without phone / computer interface
- All can be smartphone operated

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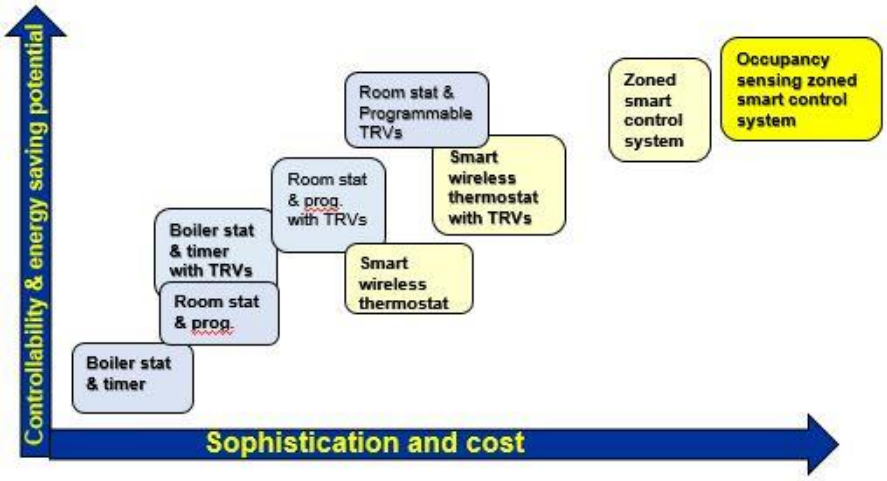
Occupancy sensing smart zone control



- e.g. Heat Genius
- Like smart zone control, but with occupancy sensing and learning capability.
- Most expensive but most sophisticated.
- Most useful in homes with sparse but variable occupancy.

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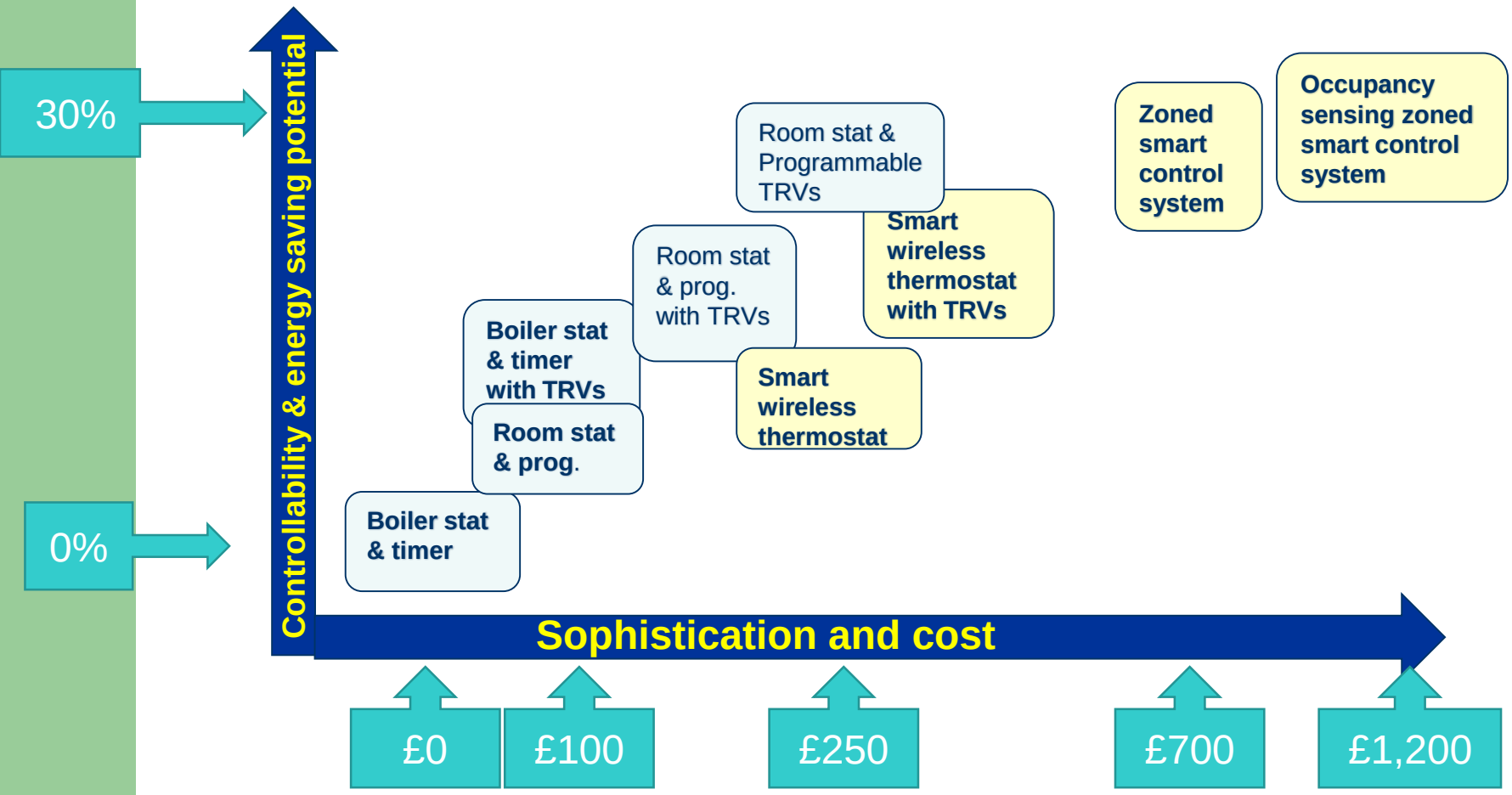
Costs and Savings



Conclusions on heating controls

- Set to the lowest comfortable temperature (usually 18-21 degrees)
- Only heat when you need
- Choose the system that suits your home and how you use it.
- Carefully research the capabilities of ‘smart’ products, and choose the features important to you.
- Savings will depend on your starting point, but the investment in improved control should pay back.

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Controlling hot water

- Always have a control thermostat
- Set at 60-65 degrees C
- A well insulated water tank loses temperature quite slowly
- For constant hot water when you need it, have the hot water heating enabled during the hours of use
- Switch it off outside of the hours of use
- Heating programmers and smart controllers can help with this.
  - Assess usage pattern to establish:
    - How simple or complicated this is
    - Whether the pattern varies a lot

What about lighting and appliance controls?

- For money saving, probably best done manually
- Smart lighting systems and control of plug in devices are an established part of ‘The Internet of Things’
- More about convenience / gadgetry than energy saving
- ADAPT’s next talk showcases the exciting opportunities in LED lighting and electrical appliances

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Controlling your energy use

Andy Hannah

ADAPT Energy Team

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BUYING ENERGY WISELY

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Which Energy

- Wood
- Coal
- Gas
- LPG
- Oil
- Electricity

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Wood

- Condition
- How much per load??
- What is a load??
- Which wood is best??
- How to store

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Wood Tips

- When buying check that it has been stored undercover for at least 6 months
- Buy hardwood
- Guide Price is £75 per 1 Cubic metre bag
- Internal moisture content maximum of 20%
- Store wood bark side down -protect
- Oak takes 2 years to dry out

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Coal

- Local Suppliers or Local Coal
- Open Fires vs Multifuel Stoves
- Smokeless or not
- 20kg-25kg bags
- Buy per kg
- House Coal 25p/kg
- Smokeless 30p/kg

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Coal

- Welsh Anthracite 34p/kg

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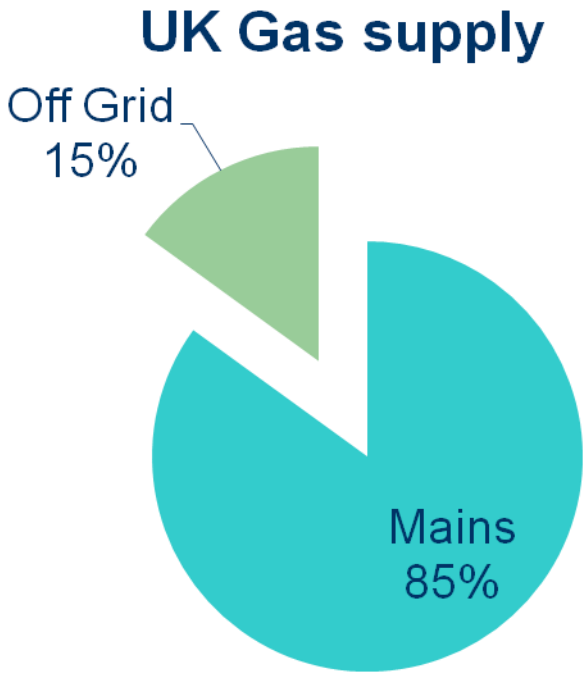
Gas 4Million UK Households –Off Grid



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Gas

- Mains Gas see Dual Tariff with Electricity
- Propane Red 47kg Cylinders or bulk supply
- Many suppliers who deliver locally.
- Calor, Avanti, Flogas

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Gas

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Gas Tips 47kg Cylinder

- £40-45 Refill swap in Telford
- Buy Refill adapter £33 Take bottle to Autogas pump & refill for £44
- Delivered refills from £59
- Delivered new cylinder from £60
- Ring round for best price from Calor, Avanti, Flogas agents

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LPG Tips

- For Heating & Cooking, Tanks installed free
- Calor, Avanti, Flogas Contracts for Bulk Tanks
- Tied into 2 year contracts
- Switch every 2 years
- 35p/litre best rate

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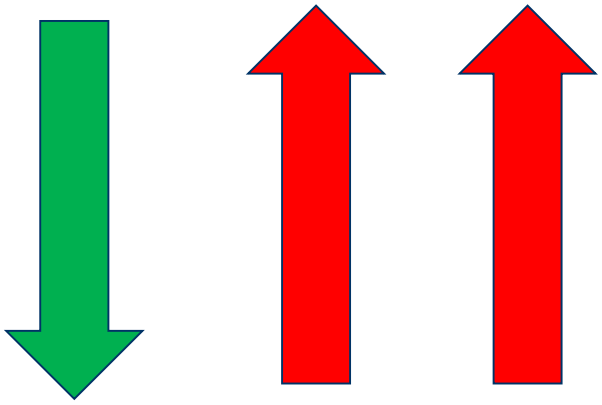
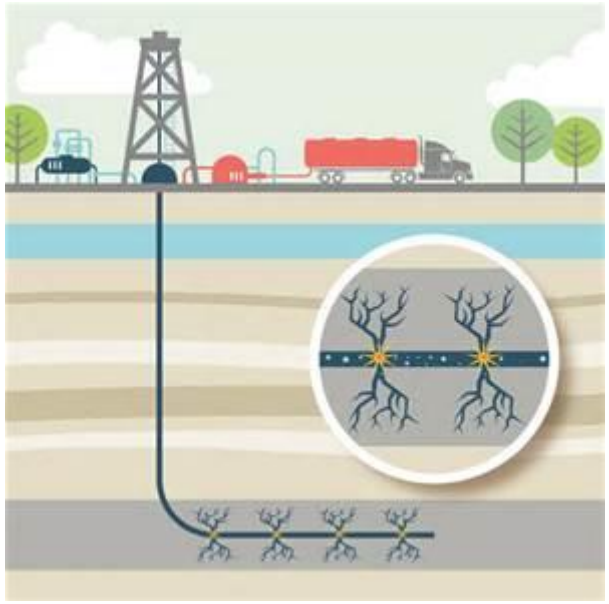
Oil

- Where is the price going?





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Oil

- Oil Baron Syndicate
- 800 local customers order a minimum of 500 litres.
- £12 annual service charge
- Savings £ 20 per delivery are claimed
- Boilerjuice.com comparison check
- Caters for Computer illiterates

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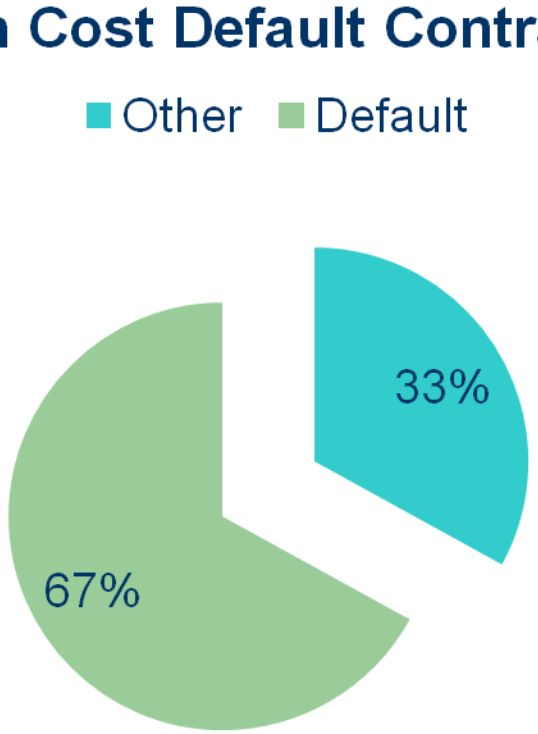
Electricity



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Electricity

- Big Six suppliers monopoly
- British Gas, Npower, SSE, Scottish Power,
- E-on, EDF

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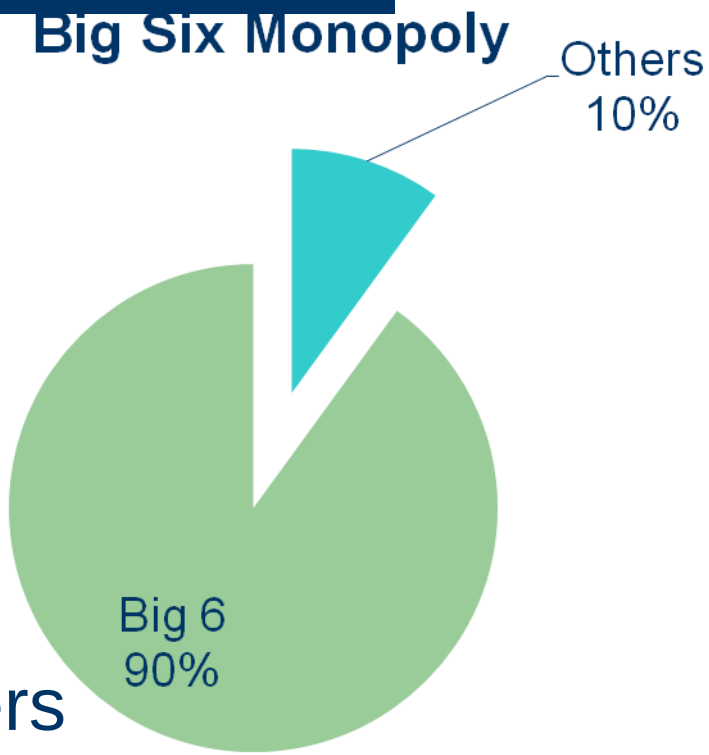
Electricity



- 90% of domestic market
- Profits increased 10 fold.
- Plenty of alternative suppliers

Electricity

- How to change
- Find your last Electricity bill
- Use **All** of the comparison sites
- Fixed or Variable Rates
- Contract or no contract

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Electricity

- Standard meter, Smart meter or pre-pay meter
- Smart meters are coming, UK Gov wants 80% of households fitted by 2020
- Don’t work well in rural areas
- Come with energy monitors
- Use them to reduce energy consumption

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Electricity

- When to change-at least every 12 months!!!!!
- Best Standard Meter rates
- Unit Rates 10.69p. Per KWh
- Standing Charge 17.69p Per Day
- TCR 12.44p (Tariff Comparison Rate)
- Renewable Options from 15.3% higher

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Electricity

- If you were in credit with your previous supplier, ensure you are repaid.
- Diarise your energy supply anniversary.
- If you have a contract, & supplier raises prices– have option to move supplier at no cost.
- Solar contracts not affected by switch
- Switching is easy

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BUYING ENERGY WISELY

Chris Knibbs
ADAPT Energy Team

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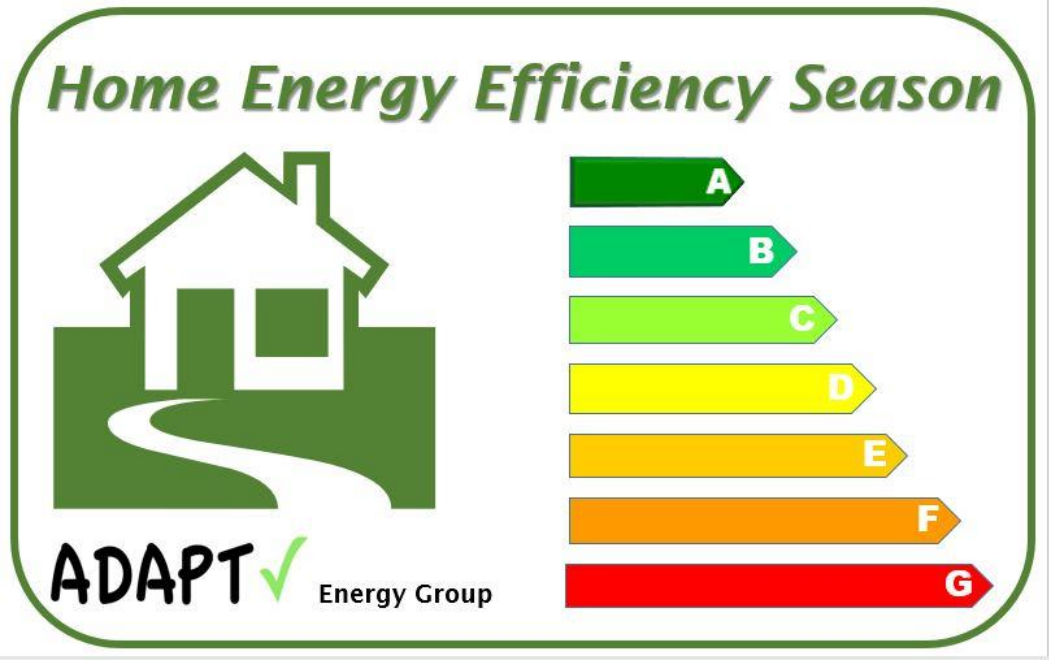
Next time…. 15 November 2016
Event 2 – Appliances and LED lighting

- Appliances– Chris Knibbs
- LED lighting – Andy Hannah



Scout & Guide
Hall
19.45

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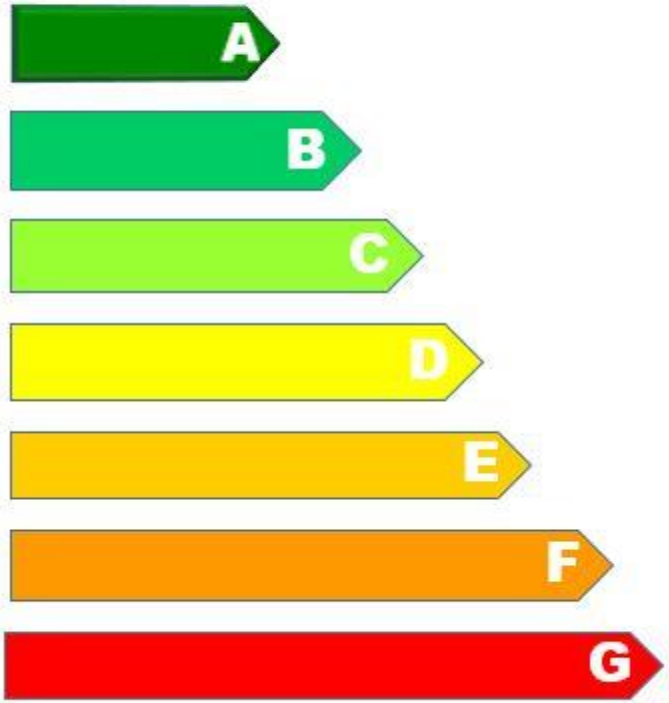
Home Energy Efficiency Season



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