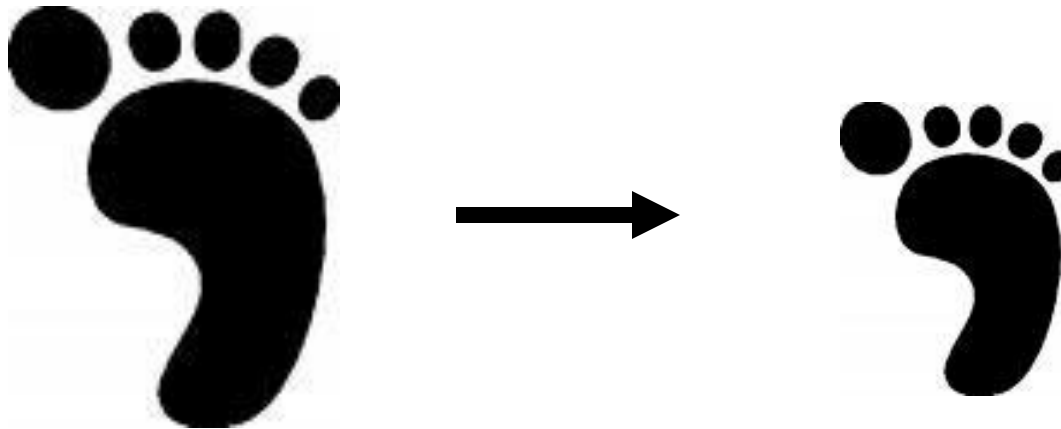




Transition
Haslemere

COST-EFFECTIVE WAYS TO REDUCE YOUR CARBON (CO₂) FOOTPRINT



ENERGY QUESTIONS AND ANSWERS

COST-EFFECTIVE WAYS TO REDUCE YOUR CARBON (CO₂) FOOTPRINT

Why should we reduce CO₂ ?

What causes CO₂?



How can we reduce our “footprint”, and maybe save money at the same time?

Heating

Electricity

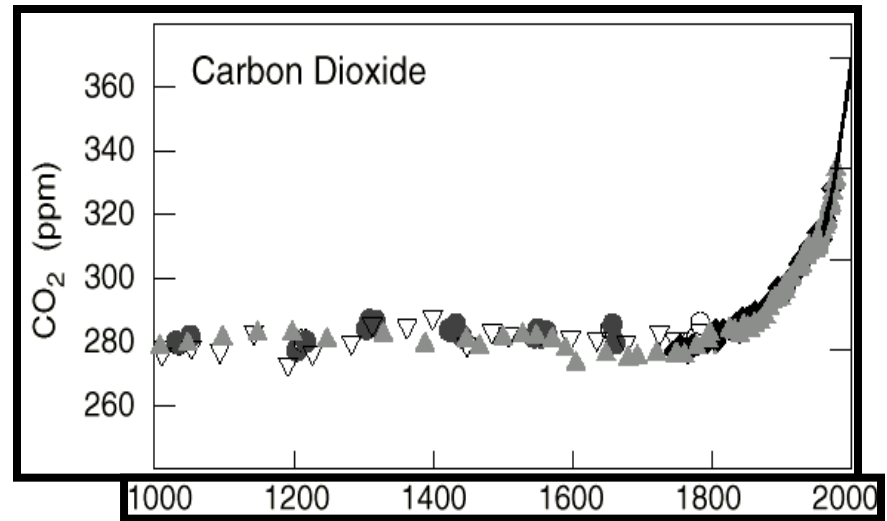
Cars and other travel

Air travel

Eco technologies

Why should we reduce CO₂ ?

And why now?



1. We know CO₂ is increasing. (387 ppm in Oct 2010)
2. We are pretty sure this is due to human activity.
3. Climate change models are (mostly) predicting temperature increases and sea-level changes resulting from CO₂ increases. (Still some debate.)
4. If we just wait and see, irreversible changes may occur.

So, on the “precautionary principle” we should be acting now, to safeguard the world climate for our children and grandchildren.

If we do nothing, then we have no moral (or political) authority to demand that developing countries also curb their emissions.

What causes CO₂?

Nature balances the flows of CO₂ between plants, atmosphere, oceans etc.

Humans are burning millions of years of stored fossil fuels in a few hundred years

This is releasing CO₂ into the atmosphere so rapidly that the natural mechanisms cannot stabilise the levels. (At least not for a thousand years or more)

Chemistry basics:

Fossil fuels contain carbon (C) and hydrogen (H).

Burning them (in Oxygen) produces CO₂ and H₂O

How can we reduce our “footprint”, and save money at the same time?

There are lots of green ideas in the media:

(Solar panels, wind turbines, central heating controls, switching off phone chargers, insulating your loft etc. etc.)

Which ones have a significant effect?

Which ones are cost-effective?

Which ones are reliable?

Which ones adversely affect our lifestyle?

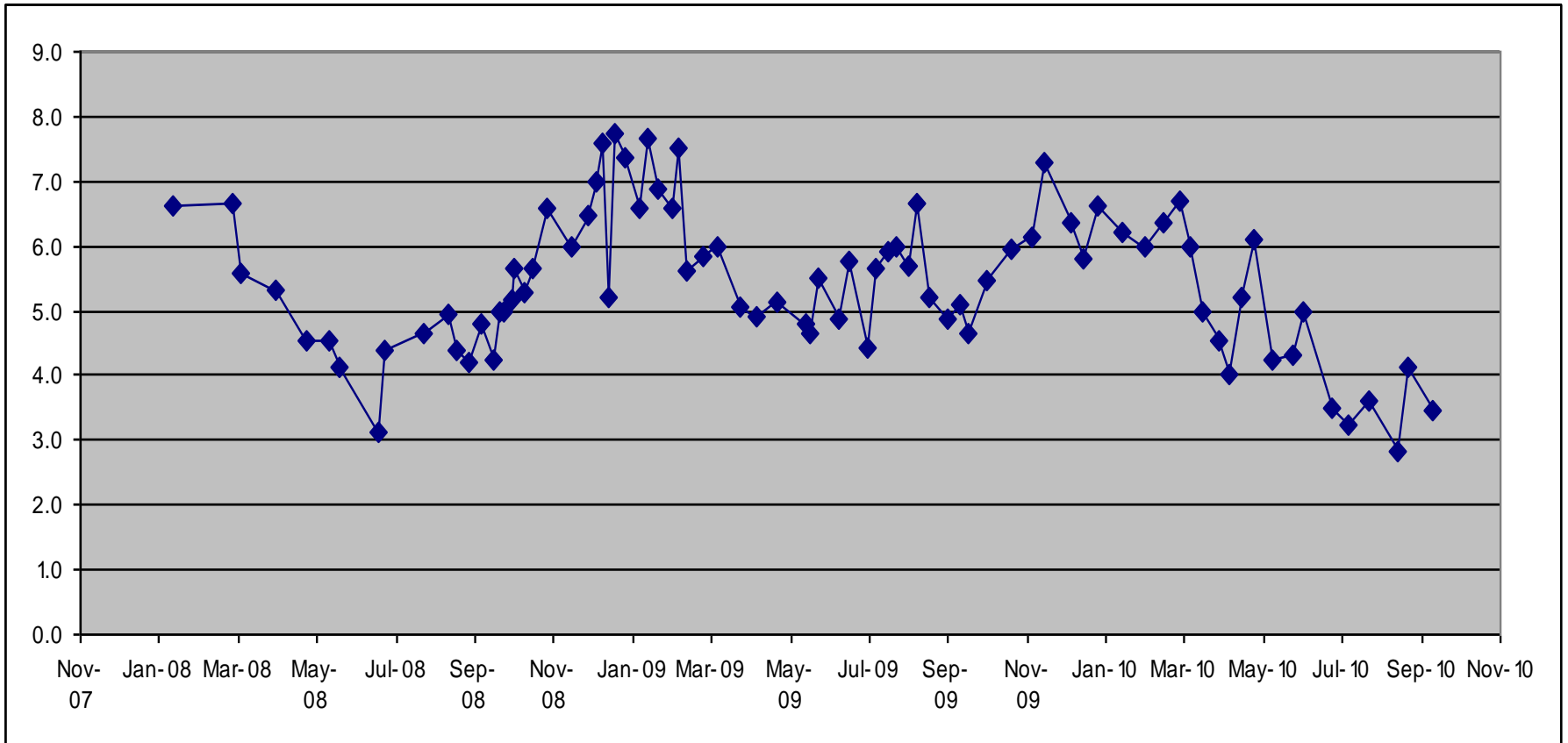


	Consumption	Cost	CO ₂ emissions
Central Heating Gas – average 3-bed semi-detached house	25 000 kWh (800 meter units)	£900	4.8 tonnes
Electricity – average 3-bed semi-detached house	5500 kWh	£700	2.3 tonnes
Car (small) – 10,000 miles per year, 40 mpg average (petrol)	1136 litres (250 gallons)	£1200	2.6 tonnes
Air travel – 2 people, trips to:			
• Spain – say 2000 miles	240 litres		0.8 tonnes
• USA – say 7500 miles.	840 litres		2.6 tonnes

+ our "share" of the CO₂ emissions from government and public services, industry, agriculture etc., which is at least 1 tonne per person, maybe several tonnes, depending on how you calculate it and what your lifestyle is.

Our ELECTRICITY consumption – 2000 kWh/year (40% of average)

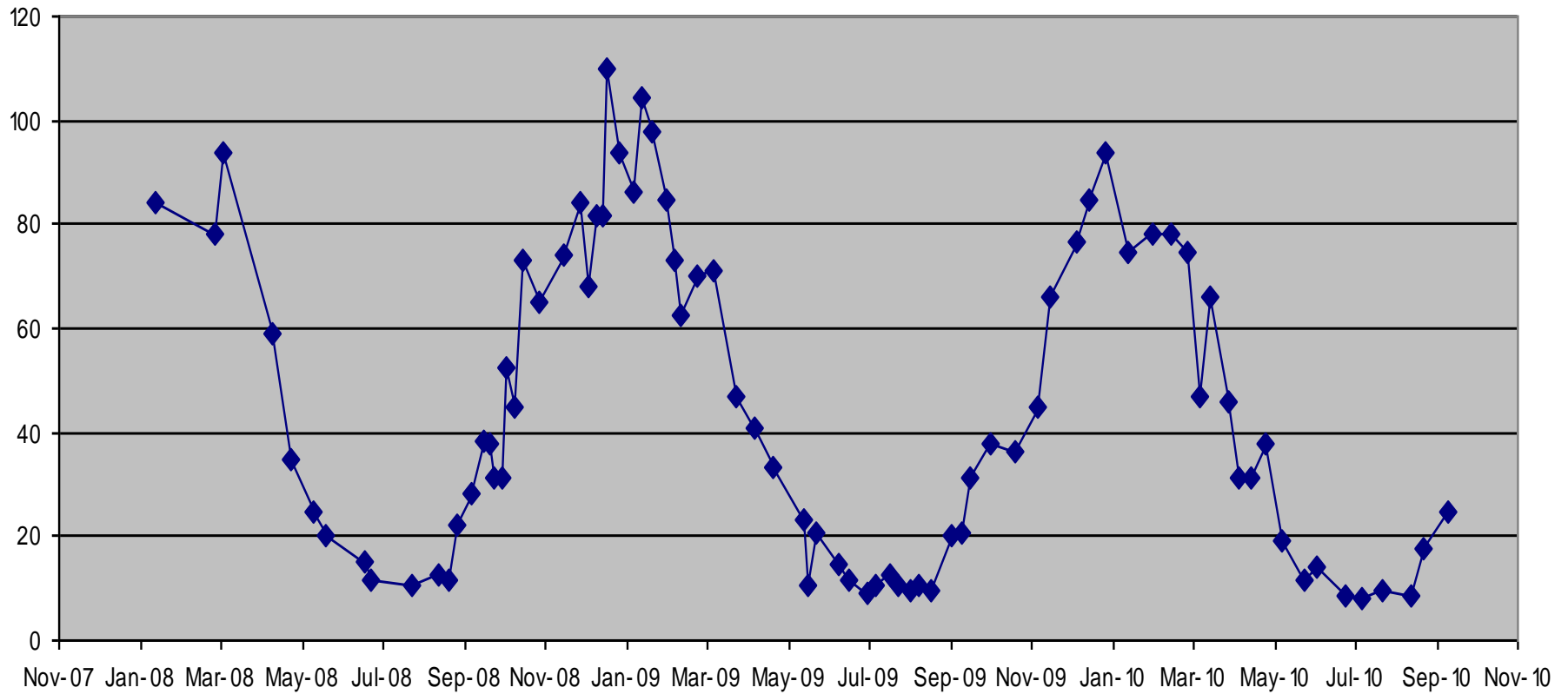
(3 bed detached house, 2 occupants, work from home)



Graph: kWh/day:

Our GAS consumption: 16,000 kWh/year (2009) (65% of average)

3 bed detached house, 2 occupants, well insulated loft, wall cavity insulation, intelligent heating controls, wood stove.



Graph: kWh/day. Reduced consumption approx 20% in 2 years (after adjusting for weather variations)

CENTRAL HEATING: (4.8 tonnes CO₂ average)

LOFT INSULATION – top up to 270mm or more. Payback 1-5 years.
(Payback period depends on how poor your current insulation is).

WALL CAVITY INSULATION – subsidised or free. Payback 2-5 years.

DOUBLE GLAZING – expensive. Energy payback approx 10 years.
(But also adds value to your home, so a worthwhile investment.)

CURTAINS – thick curtains, plus liners, make a substantial difference, even if you have double glazing.

CONSERVATORY – a BIG heat sink. Make sure interconnecting doors to house are CLOSED except when sun is heating conservatory. If no door is fitted, get one.

DRAUGHT SEALING - a modern house (1980s onwards) is usually well sealed. Older houses often very leaky. Big loss of heat, particularly when windy.

CHIMNEYS – unused open fireplaces cause large loss of heat, either hot air going up, or cold air coming down. Block up with newspaper (allows some ventilation).

CENTRAL HEATING CONTROLS – programmable thermostat – cost circa £20 to £60. Payback 1 year or less. (see next slide).

RADIATOR THERMOSTATS – fit to all rooms except room where main thermostat is fitted. Without these, upstairs rooms will tend to be overheated. Turn down to low level in unused or rarely used rooms.



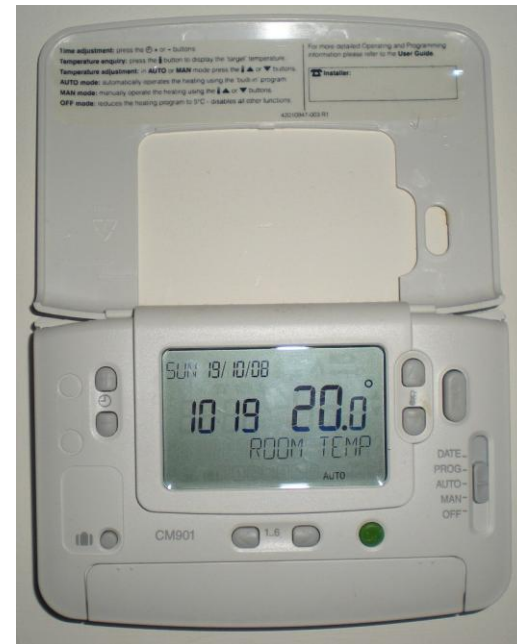
Typical programmable thermostat – cost circa £50.

Flip open lid to access detail programming buttons.

With lid closed, 3 buttons only – temp+, temp-, display options.

Replaces normal thermostat, no rewiring. DIY job.

Payback 1 year or less.



Typical radiator thermostat – cost circa £10 to £15. (Plus fitting)



HOT WATER TANK – usually these are foam insulated. But the foam still feels warm on the outside! Add an extra insulating jacket. Payback 1-2 years.

HOT WATER TEMPERATURE – the tank should have a thermostat (“Tank-stat”). If not, get one!
Set to about 60 deg C, no higher. Higher temperature wastes energy.

IMMERSION HEATER – avoid using this whenever possible. Water heating from your gas central heating is more energy-efficient and cost-efficient.

BOILER – TEMPERATURE SETTING – your boiler will have a temperature setting dial. Typically this has settings 1 to 5. Use settings 4 or 5 in winter
But in spring, autumn and summer, a lower setting (2 – 3) is more efficient.



CONDENSING BOILERS

These are about 20% more efficient than conventional boilers.

Early versions were unreliable, but the indications are that the reliability (and corrosion?) problems have now been solved.

A condensing boiler will add value to your house (or rather, not having one will detract from its value.)

Worth considering, even if your existing boiler is not very old.

WOOD BURNING STOVES

If you have an open fireplace, fit a wood-burning stove. Use it as often as possible on cold days and evenings, to reduce your central heating gas consumption.

A wood stove is about twice as efficient as an open fire. It also effectively blocks the chimney to stop wasteful heat loss when not in use.

Wood is an “eco” fuel, on the basis that the CO₂ produced is absorbed by growth of new trees in a relatively short timescale (short compared to fossil fuels that is.).

In the Surrey / Sussex border area, firewood is available cheaply, sometimes free.

ELECTRICITY: (2.3 tonnes CO₂ average)

LIGHTING

INCANDESCENT BULBS - very inefficient
(over 90% of the energy is wasted as heat)



HALOGEN BULBS - slightly better - 20% saving. But usually over-powered, so e using more energy than conventional bi (change 50W to 35W or 20W)



“LOW ENERGY” COMPACT FLUORESCENT (CFL) BULBS – 70 to 80% energy saving.

Early ones were bulky, poor light quality.
Now vastly improved.

Lots of shapes available, to suit many light fittings. (Including reflector bulbs)

Payback less than 1 year.



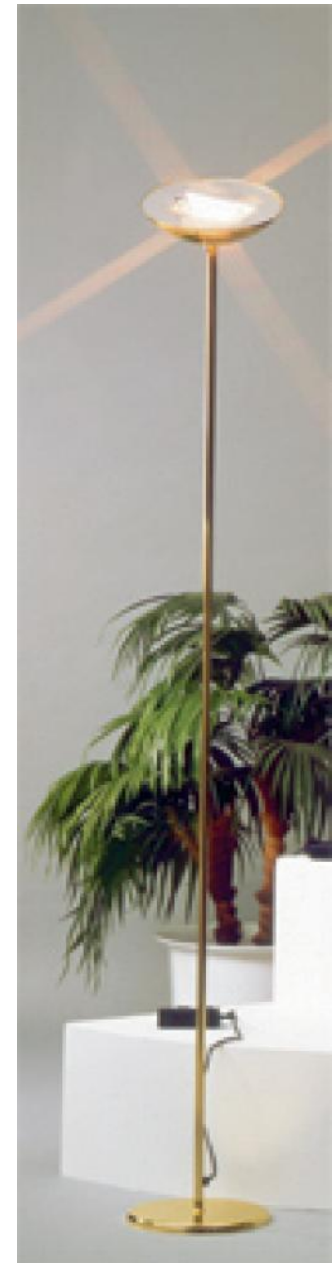
LIGHTING - continued

HALOGEN UPLIGHTERS - often have very high power bulb (300 W), plus dimmer. Very Wasteful. Fit lower power bulb, or throw away!

HALOGEN DOWNLIGHTERS - mostly bulbs fitted. Try reducing to 20W.

CFL GU10 fitting bulbs now available.
“GU10 CFL Energy Saving Light Bulb 11W
Ebay: £4 each approx.

LED lamps: similar efficiency to CFL lamps, but current models low output. Wait till next year (2010 / 2011) for high power versions at sensible prices. Currently £15 each.



APPLIANCES

FRIDGES & FREEZERS – choose A (or AA or AAA) rated when buying new. Buy the size you need, not bigger.



WASHING MACHINES – run at 30 deg cycle when possible.

If buying new, pick versions which fill with mixed hot and cold water. (Some only use hot water for high temperature cycles, and heat cold water electrically for lower temperature cycles. Some are cold-fill only.)



TUMBLE DRYERS – use as little as possible.

Or hang clothes on a rack and dry with a dehumidifier positioned close by. (Yes, it works!)



GADGETS AND APPLIANCES – STANDBY POWER

Computers, Printers
TVs, Videos, Set-top boxes
Broadband wireless routers
Microwave ovens,
Phone chargers,
Washing machines,
Dishwashers,
Power showers,
Anything with a transformer power supply!
etc. etc.

Some consume less than 1W – negligible.

Some consume 10 to 20 W – costing £10 to £20 per year.

Measure each device. Power and energy meter:
(Amazon, Ebay, Maplins, £15 or less, or borrow one!)

High consumption devices – remember to switch off at mains, or fit a cheap timer (less than £5) to switch off overnight.





smart meter



switched extension leads

TRAVEL – CARS ETC

Calculations based on 10,000 miles per year



Small / medium car - petrol	40 mpg	2.6 tonnes CO ₂
Small / medium car - Diesel	50 mpg	2.4 tonnes CO ₂
Small / medium car – LPG converted	35 mpg - and a very clean exhaust	2.4 tonnes CO ₂
Small economy car - Diesel	70 mpg (VW Polo Blue Motion)	1.7 tonnes CO ₂
Hybrid car – petrol/electric	60 mpg?? (Toyota Prius)	1.7 tonnes CO ₂

Drive less, and walk, bus or train more. Share car journeys. Combine trips to reduce mileage:

Drive 20 miles less per week and save 1/4 tonne of CO₂ per year!

TRAVEL – ALL METHODS

CAR - 1000 miles = 250 kg CO₂ (car total)



TRAIN or BUS - 1000 miles = 80 kg CO₂ (per seat)



AEROPLANE - 1000 miles = 200 kg CO₂ (per seat).

(BUT flying releases CO₂ and other pollutants high in the atmosphere. Impact is estimated to be 2x to 4x greater, say 400 to 800 kg CO₂ equivalent.



So driving has much less impact than flying.

Also, if there are 2 people in the car, the CO₂ per seat is almost halved.

MYTH: *“The plane is going there anyway, so my flight makes no difference.”*

Not true. In the short term, an empty seat means more airfreight is carried. In the medium term, if demand drops, the airlines fly less, or swap to smaller planes. And the less load in the plane, the less fuel is used.

ECO TECHNOLOGIES

Technology	Cost (allowing for grants etc.)	Cost saving per year	CO ₂ saving per year	Financial payback period
Photovoltaic cells 2 kW	£6000	£160	0.9 tonnes	37 years
Wind turbine 1.5 kW	£3000	£200 ?? (claimed)	1.1 ?? tonnes	15 ?? years
Solar water heating 3.3 m ²	£2500	£100 (optimisti cally)	0.6 tonnes	25 years
Ground source heat pump 10 kW unit.	£8800	???	1.3 tonnes	?? years
Wood pellet boiler 20 kW unit.	£3500 +	none	2.6 tonnes	never

PHOTOVOLTAIC CELLS

Produce electricity direct from sunlight.

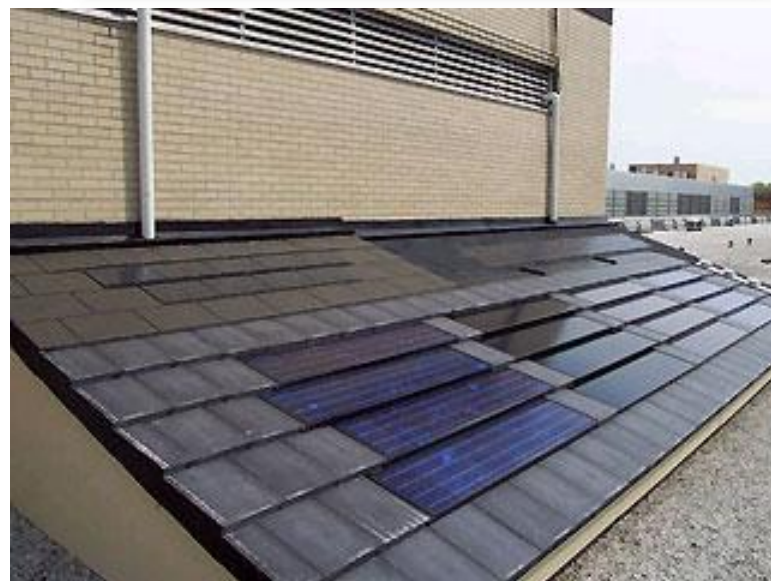
Very expensive.

Relatively poor output in UK.

Very long basic payback time (37 years), probably longer than life of cells.

Better in hot sunny countries.

The new FIT (feed-in-tariff) structure makes PV profitable, subsidised by everybody else's electricity bills. Controversial!



SMALL WIND TURBINES

Rooftop small wind turbines are NOT cost-effective at present.

Quoted outputs are based on 6 m/s windspeed. Winds are usually lower than this , 4-5 m/s average. Output is halved.

Payback then becomes approx 30 years. Will the machine last this long?



LARGE WIND TURBINES

These ARE cost-effective , even without subsidies.

They recoup all their initial energy cost in a few months. After that they are net savers of CO₂.

A useful contribution to the overall UK energy supply, realistically 20 to 30% maximum.

Offshore wind turbines have negligible visual impact.



SOLAR WATER HEATING

Great in hot countries. (Simple system, lots of sun)

UK systems are lower output, and more complex, to cope with freezing.

Payback (UK) ; optimistically 25 years. (Will it last that long?)

Better value if installed as part of new build.
(Cheaper than retrofitting).

Beware of salesmen and extravagant payback claims!



HEAT PUMPS (GROUND-SOURCE OR AIR-SOURCE)

An air conditioning unit in reverse!

Air conditioning takes heat from your house and pumps it into the outside air. Heat pumps use the same sort of technology to pump heat from outside into your house.

Ground source units take the heat from underground. Air-source units take the heat from the outside air.

They use electricity. For every 1 kW of electricity, they give up to 3 kW of heat. (Magic!)

Unfortunately, in UK, power stations use gas and coal to produce electricity. For every kW of electricity in your house, they use about 2.5 kW of fuel energy.

So the nett effect is : 2.5 kW of fuel at the power station gives you 3 kW of heat at your house. Still a positive gain on **CO₂**, but not much.

Also, electricity is more than 3 x the price of gas, so the running costs are higher.

Heat pumps are a good technology, and when we have more green, renewable electricity, they will be a very good option for UK. But they are not yet cost-effective compared with gas central heating.

WOOD PELLET (or woodchip) BOILERS

A sustainable source of fuel.

Quick drying, easily transported, easily handled (compared to logs).

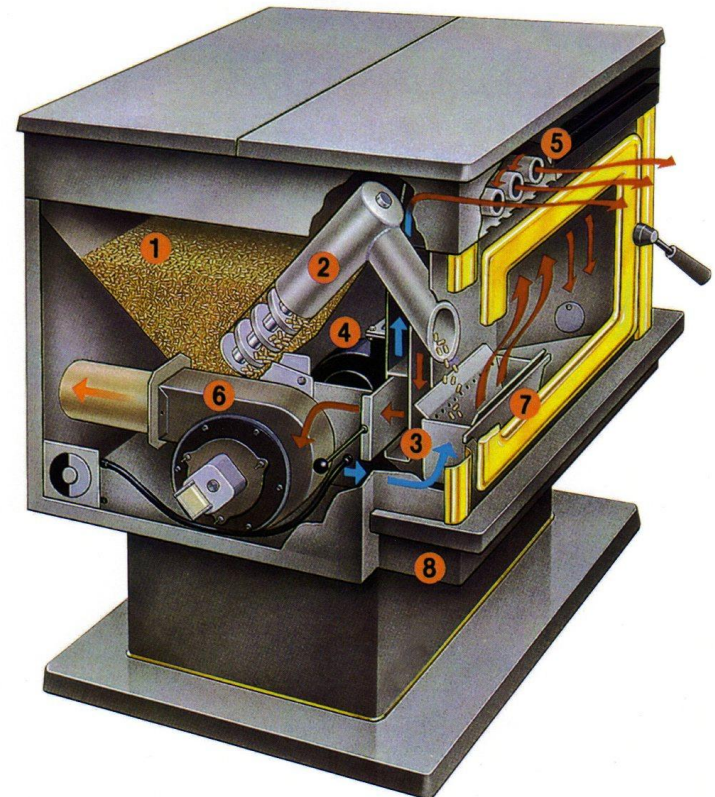
Complex boilers with feed mechanism and ash removal mechanism. Plus bulk storage hopper.

Currently no cheaper than gas to run. (But in the future, who knows?).

Worth considering for larger buildings, and new build, particularly if not on mains gas.

For most smaller properties, a wood stove to supplement central heating is cheaper and easier.

NOTE: there is not enough woodland to sustainably heat even a small fraction of UK homes, so wood is NOT a long term gas replacement for the whole country.



OTHER ALTERNATIVES?

Small-scale renewable energy is rarely cost-effective, so an alternative is to:
INVEST IN LARGER SCALE ENERGY SCHEMES , E.G. WINDFARMS

Unfortunately, most wind farms are owned by big utilities, with no opportunity for the individual investors. See: www.energy4all.co.uk , which covers a number of small wind farms.

BUY GREEN ELECTRICITY – you may pay a bit more, but you will be (hopefully) reducing CO₂. Please check tariff details, some are a bit of a scam. See www.greenelectricity.org/domestic.php for the green credentials of the various schemes.

TRAVEL – this is the area where many people can have the greatest personal impact. Travel greener, travel less often. Combine journeys to reduce your mileage. Slower travel (e.g. train instead of plane) is often more relaxing and more enjoyable.

If you think (as many do) that this is all irrelevant in your lifetime, then consider your children and grandchildren's lifetimes!