What is the truth about climate change?

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john.midwinter@btopenworld.com

Copies of my slides can be seen on
www.greatbealings.co.uk
under Parish Council

Lecture 3

What can be done about it at the personal level? Can one save money and the planet?

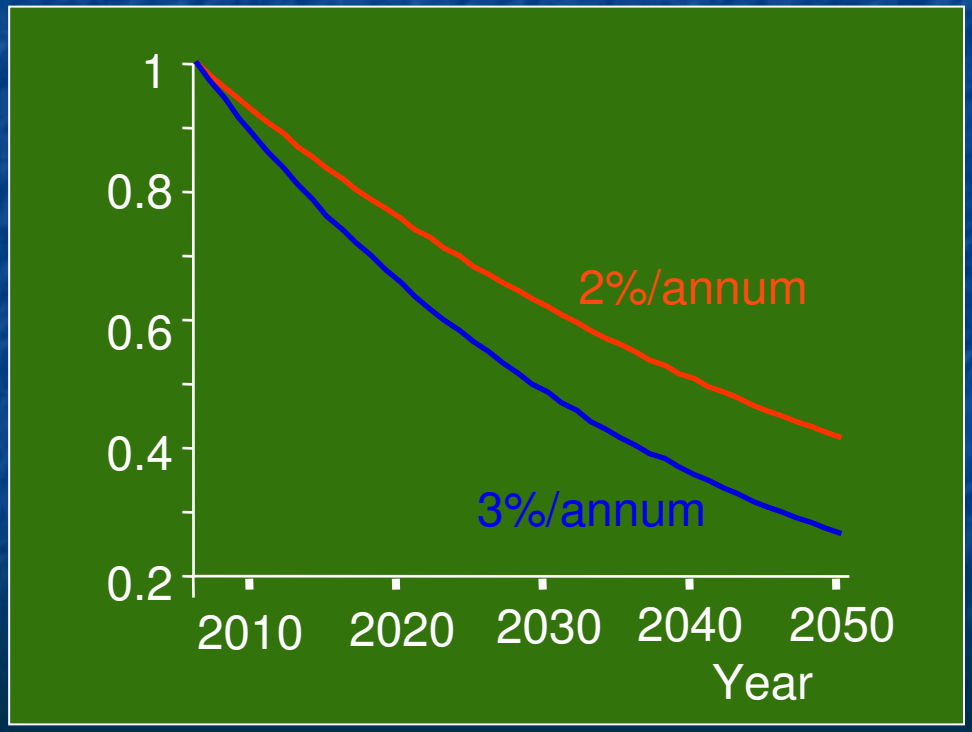
Bealings Village Hall

13th February 2008

IPCC target to avoid worst effects requires just 2-3% per annum reduction.

e.g. reduce global CO2 emissions by 60+% by 2050

This is eminently possible (technically)!

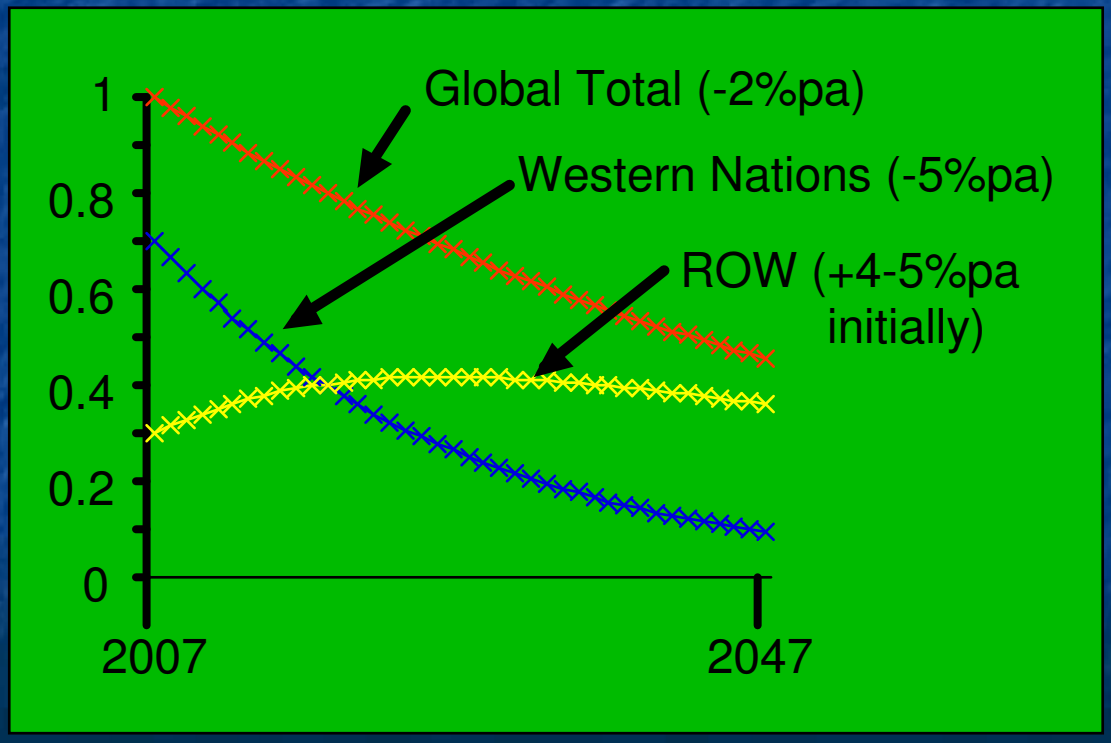


We need to allow RoW to grow!

Assume "West" reduces by 5%pa

RoW can now grow - it is the least we should do!

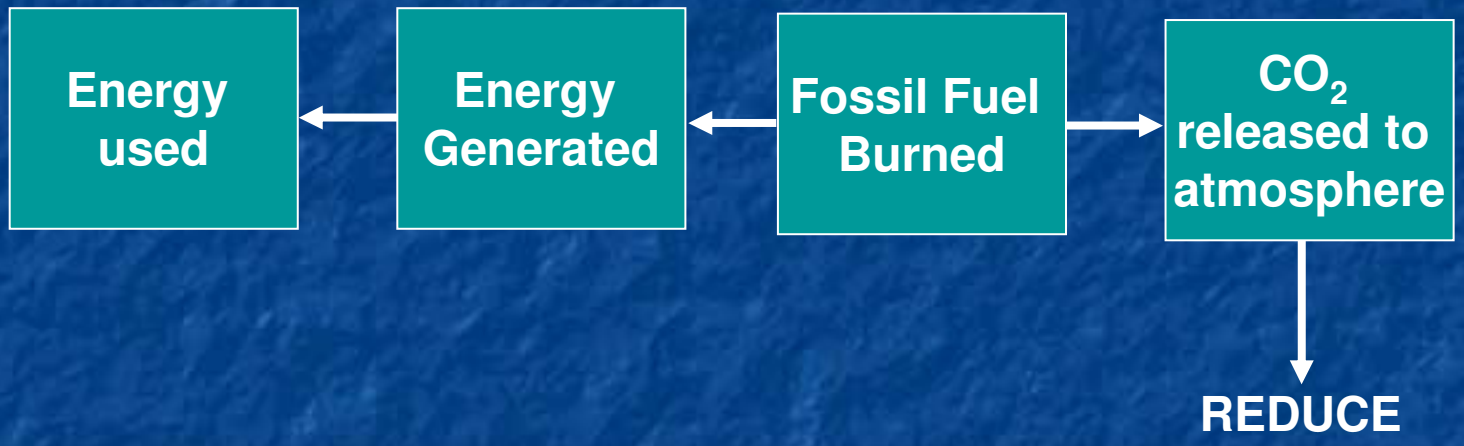
BUT HOW could we do it?



Implies 90% Cut by West!

RoW = Rest of World!

Approaches to reducing our carbon footprint.



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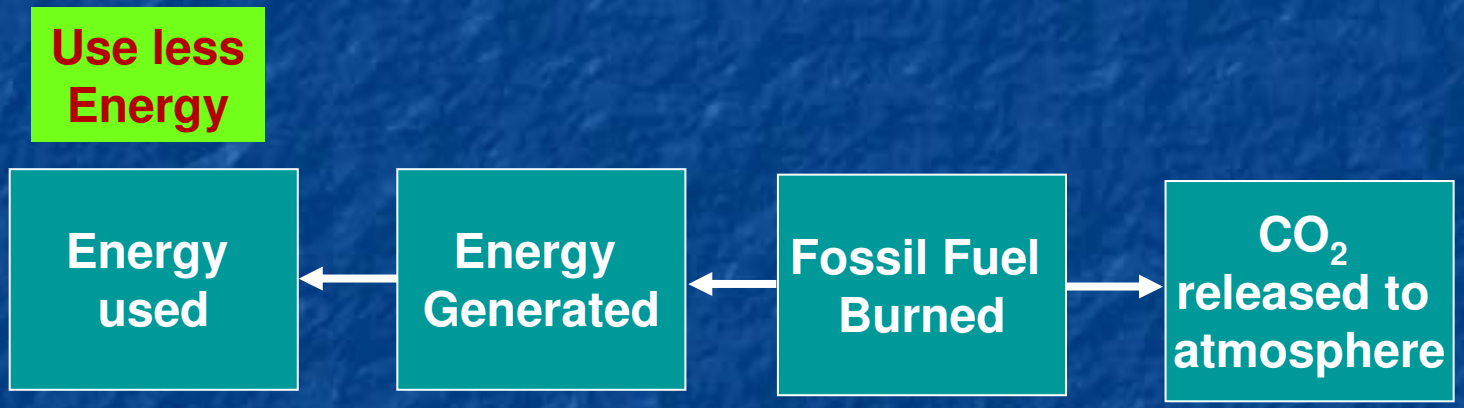

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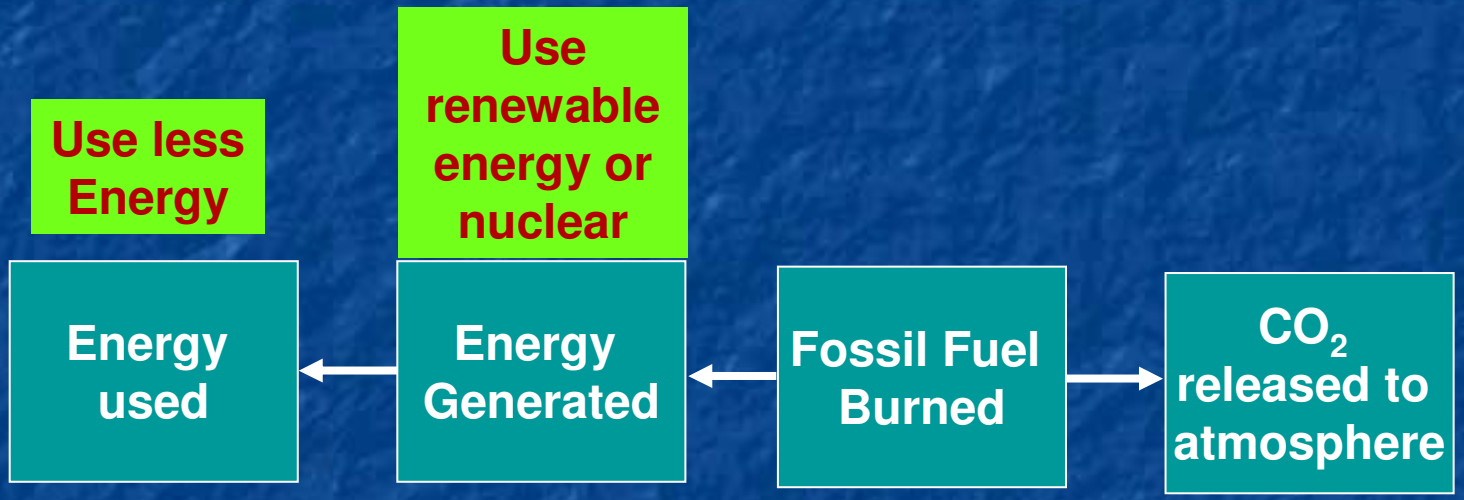

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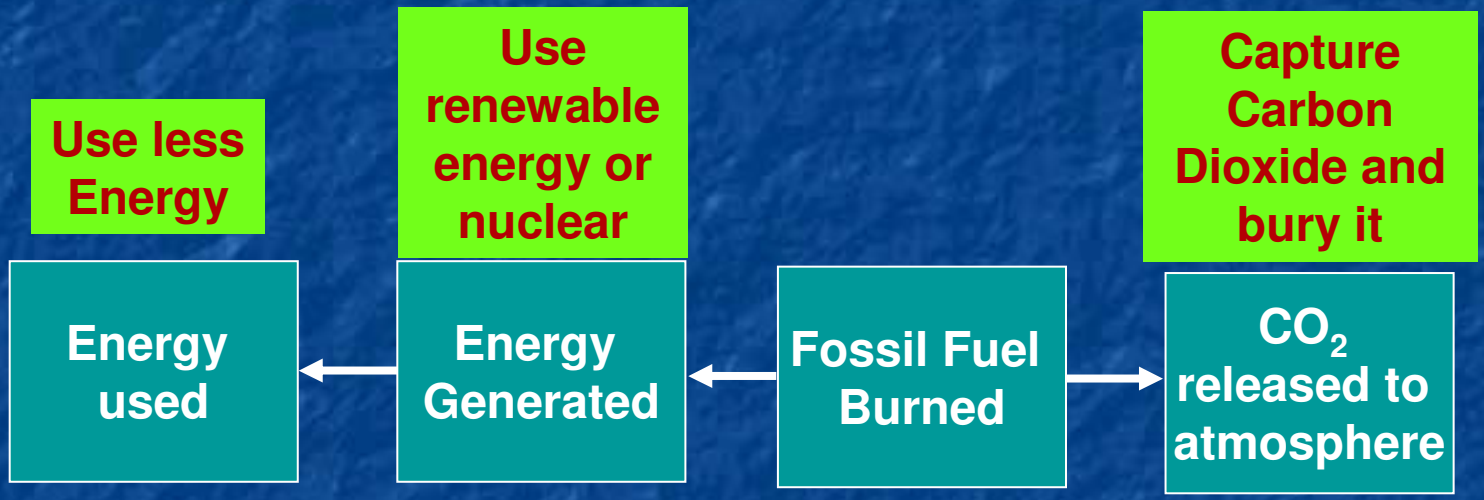
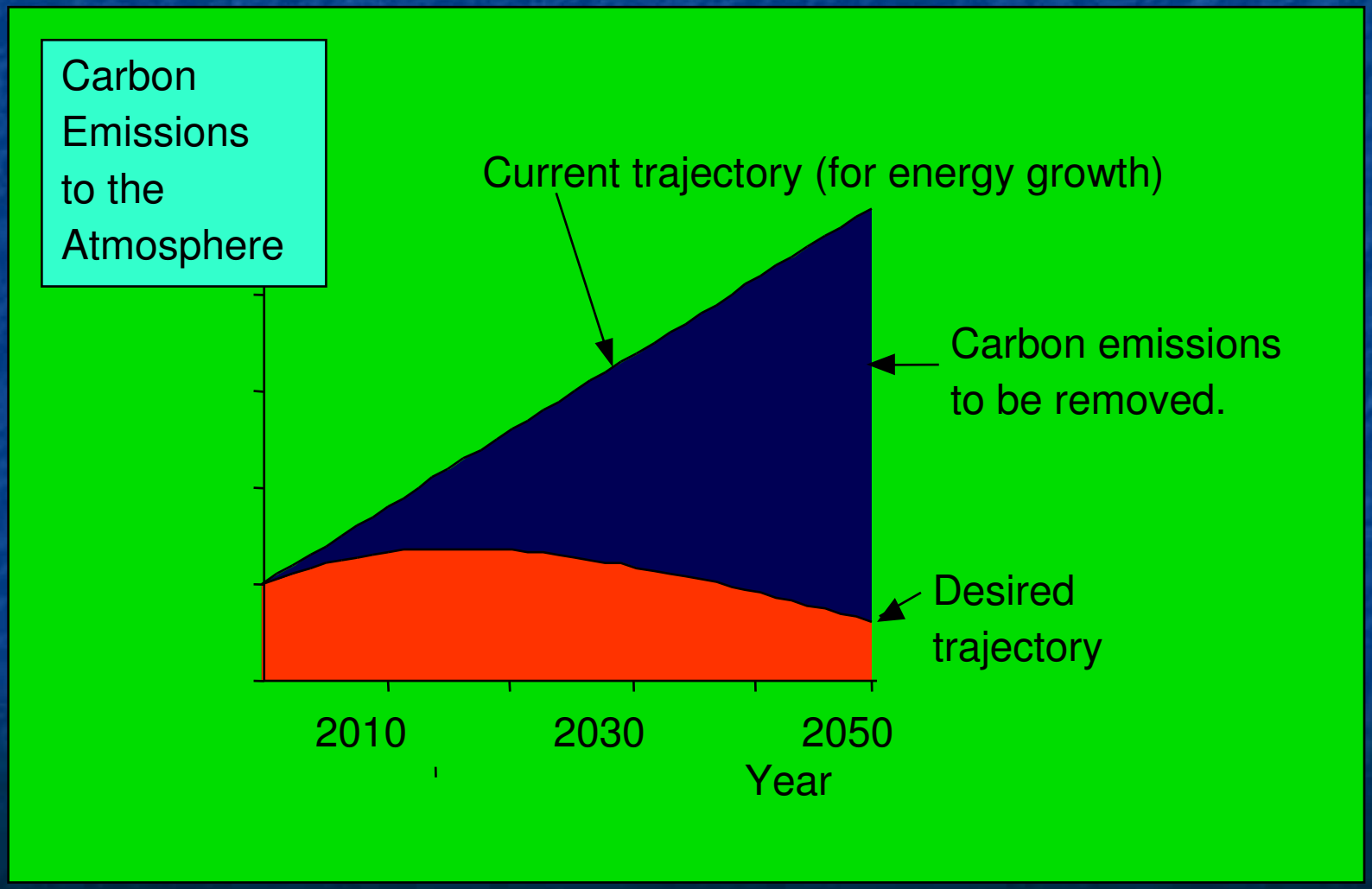


The nature of the global problem

60-80% reduction from CURRENT levels by 2050



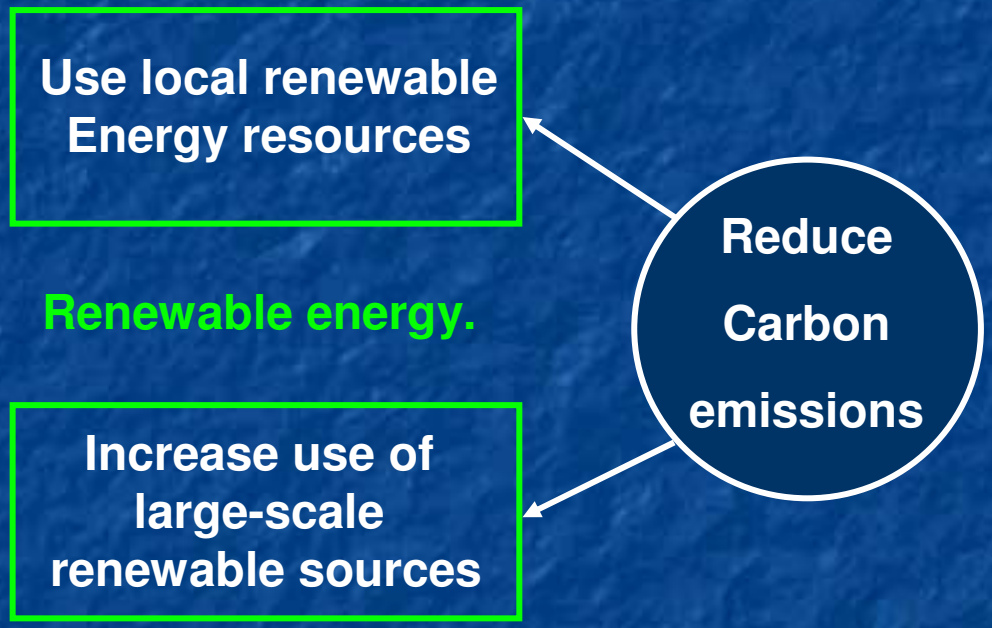
Routes forward!

Reduce Carbon emissions

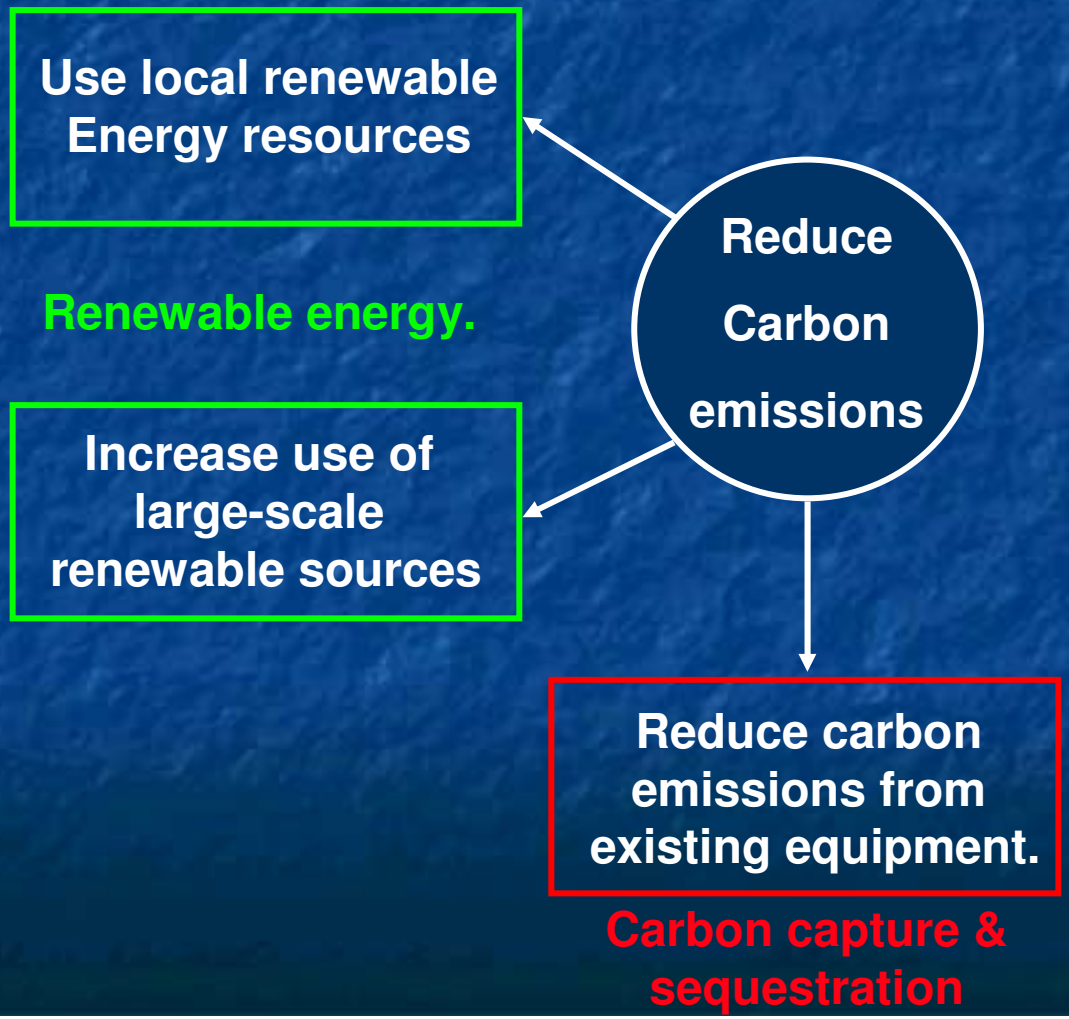
No quick fix

But lots of partial fixes!

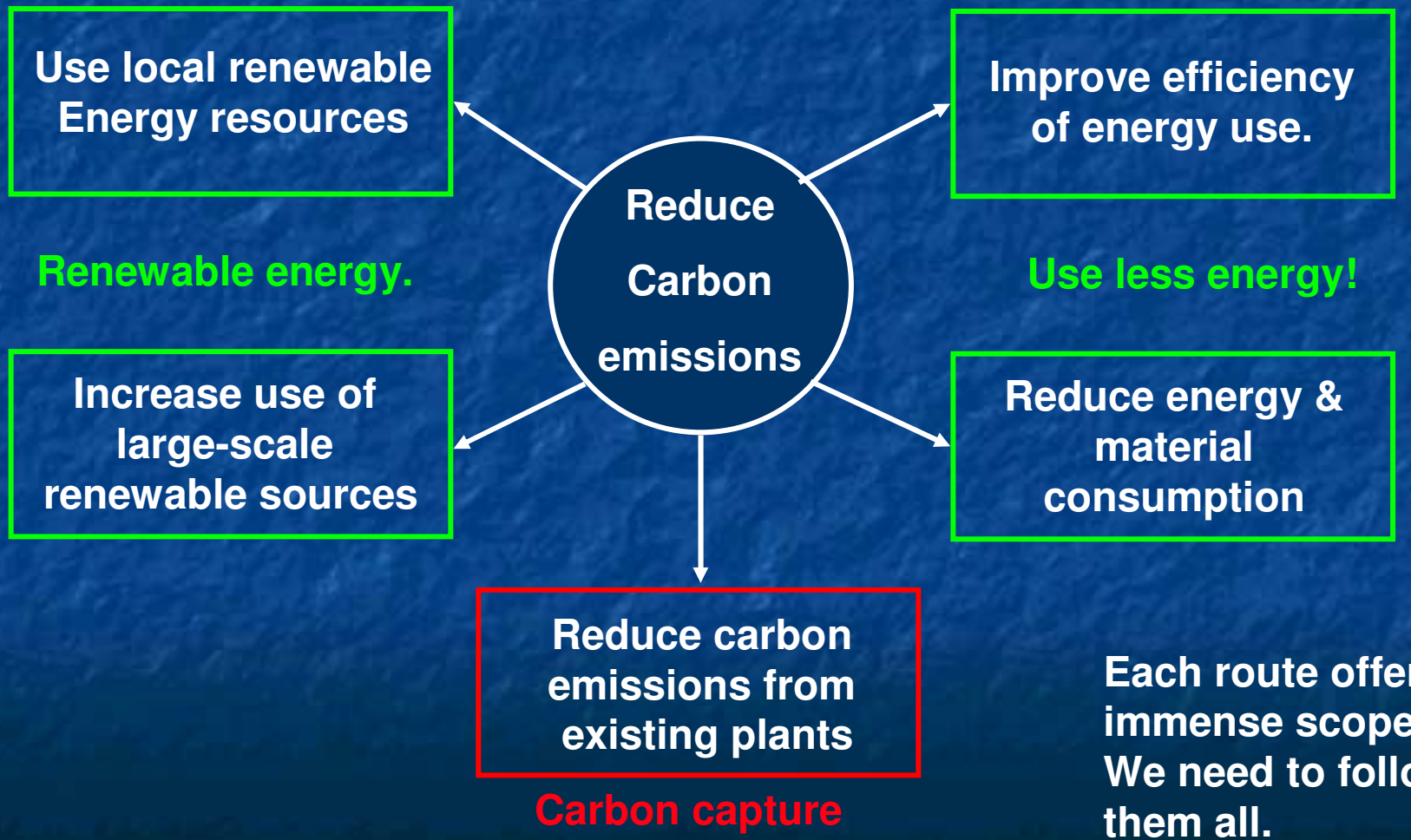
Routes forward!



Routes forward!

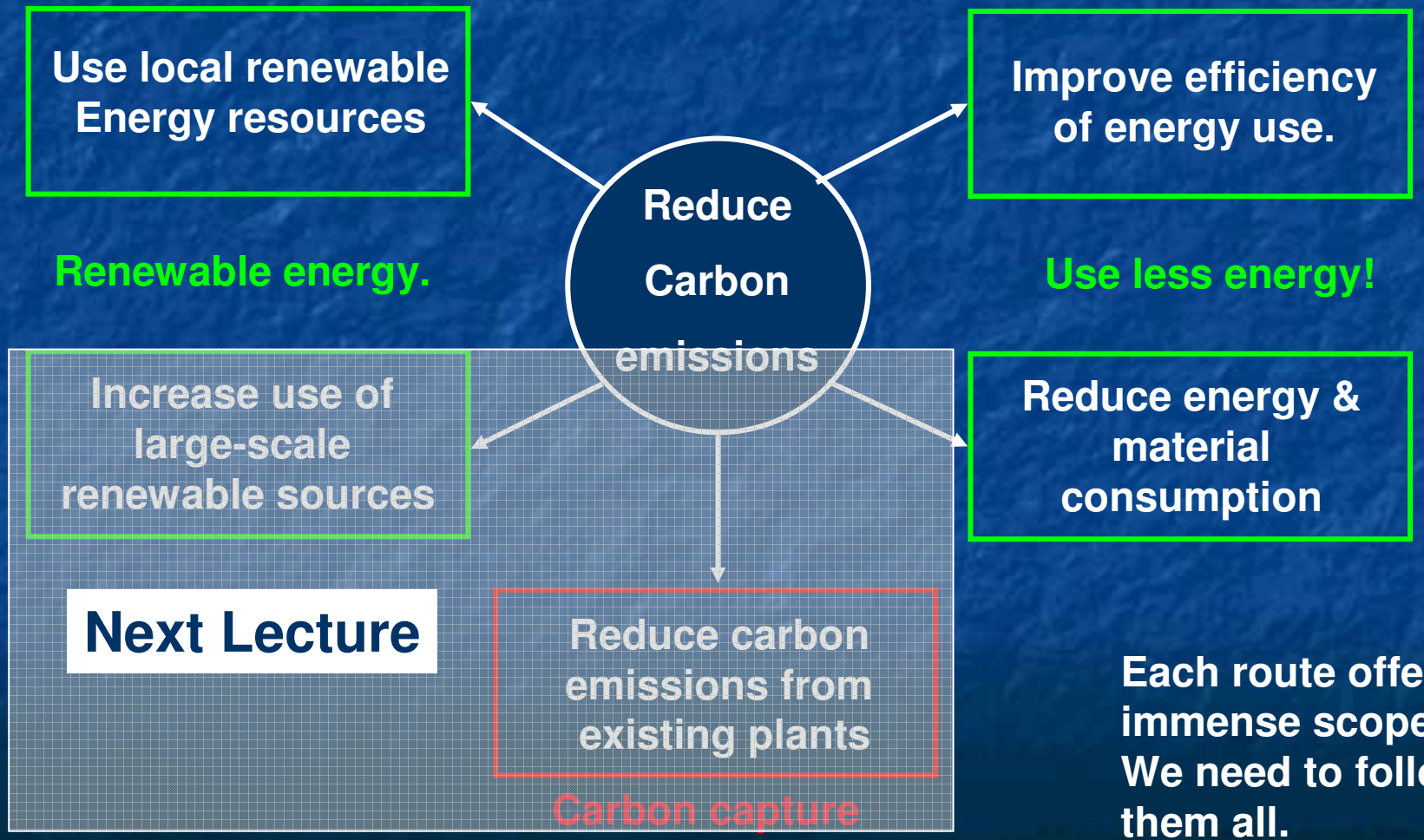


Routes forward!



Each route offers immense scope. We need to follow them all.

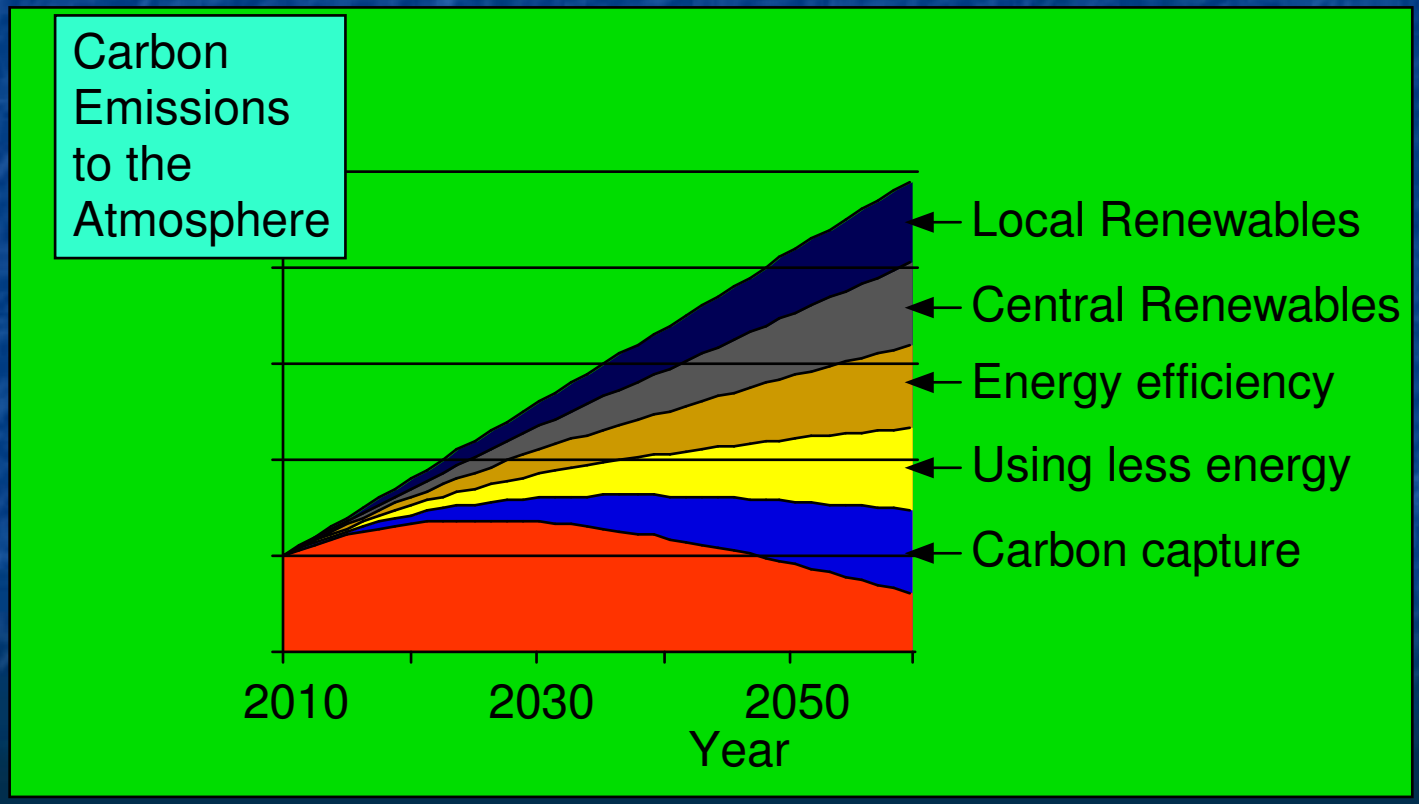
Routes forward!



Each route offers immense scope. We need to follow them all.

How to start thinking about the problem -

split desired total savings into wedges and plan each separately!



My own energy consumption in 2005-06

MWh*	%	Fuel	Use
8.6	12	Electricity	Cooking, appliances, lighting
25.7	36	Heating Oil	Water & Space Heating
37	52	Petrol/Diesel	Transport
71.3	100	Total	

*** Equivalent energy at source!**

My own energy consumption in 2005-06

MWh*	%	Fuel	Use
8.6	12	Electricity	Cooking, appliances, lighting
25.7	36	Heating Oil	Water & Space Heating
37	52	Petrol/Diesel	Transport
71.3	100	Total	

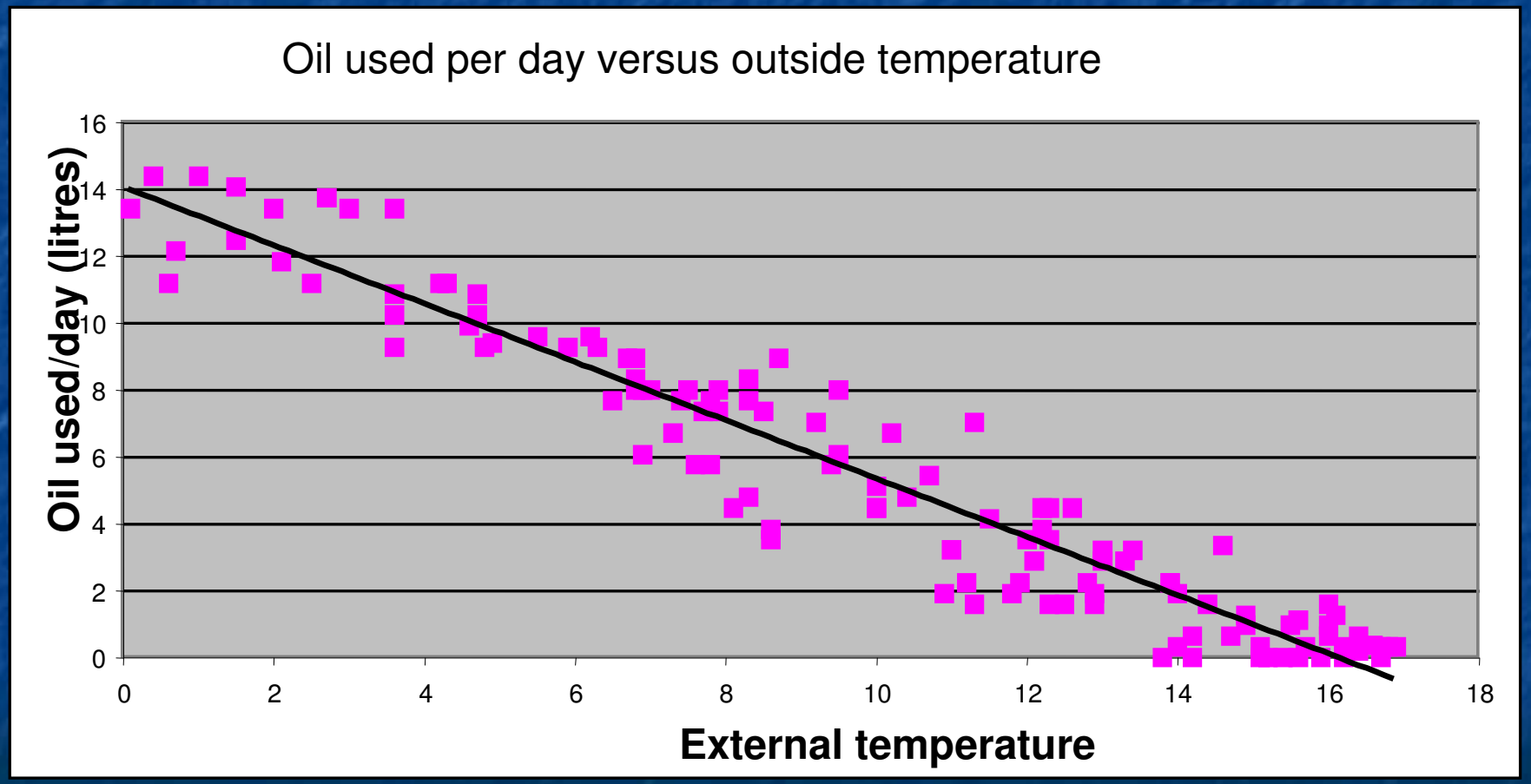
Corresponds to 8 single-bar 1kW electric fires burning continuously night & day all year.

*** Equivalent energy at source!**

Reducing energy consumption in home.

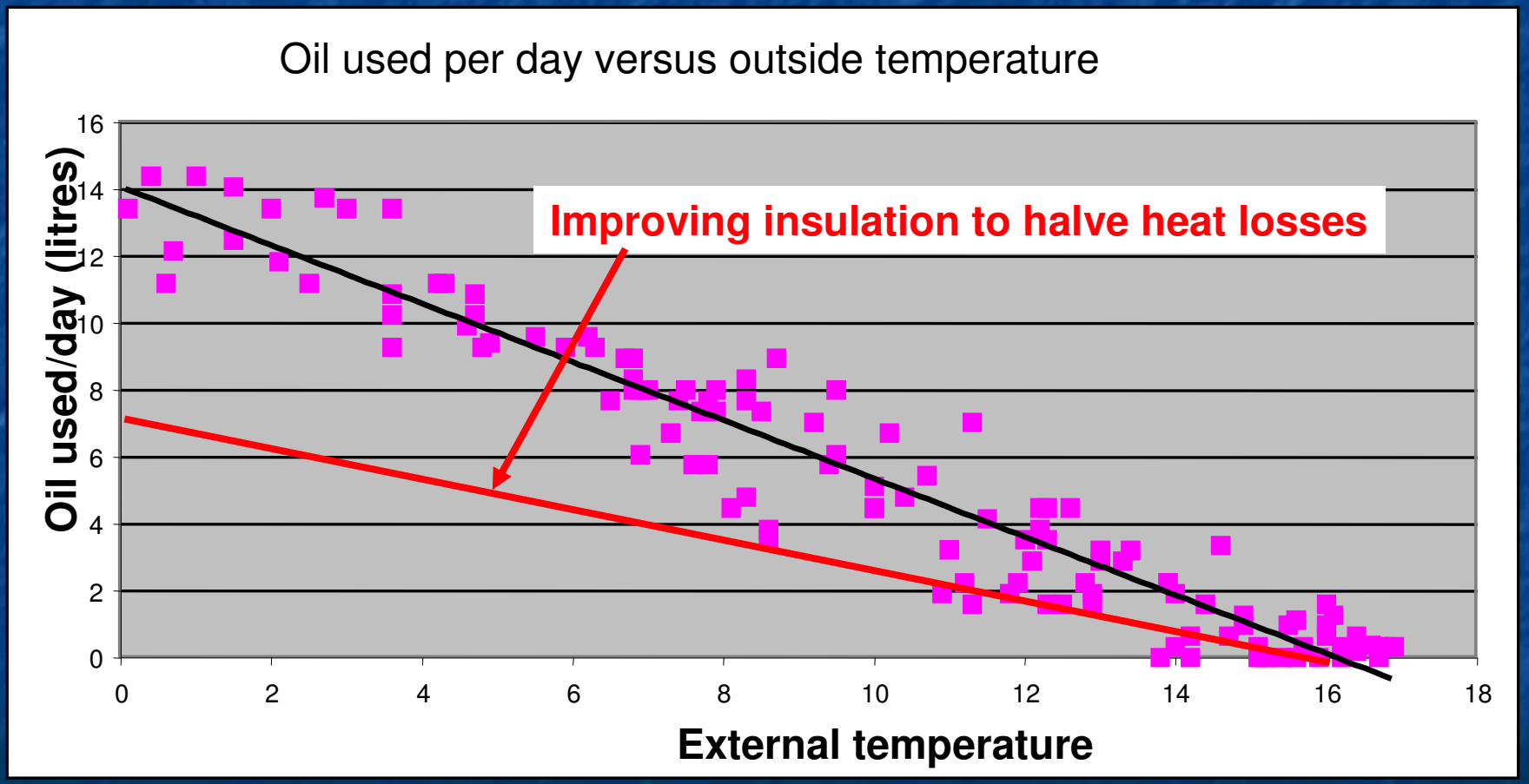
- Turn down thermostat (& put on pullover!)
- Double glaze & seal windows
- Draught excluders on doors, chimney seals etc
- Cavity wall filling with insulation
- Solid wall cladding (external or internal)
- Loft insulation
  - 200-270 mm or 10” or more!
- Active heat-exchanger ventilation-systems
- Low energy light bulbs
- Energy efficient appliances
- Just think (and act) on “energy consumption”

Heating energy consumption in a home versus outside temperature.



Data from Phil Holmes

Reducing energy consumption in home.



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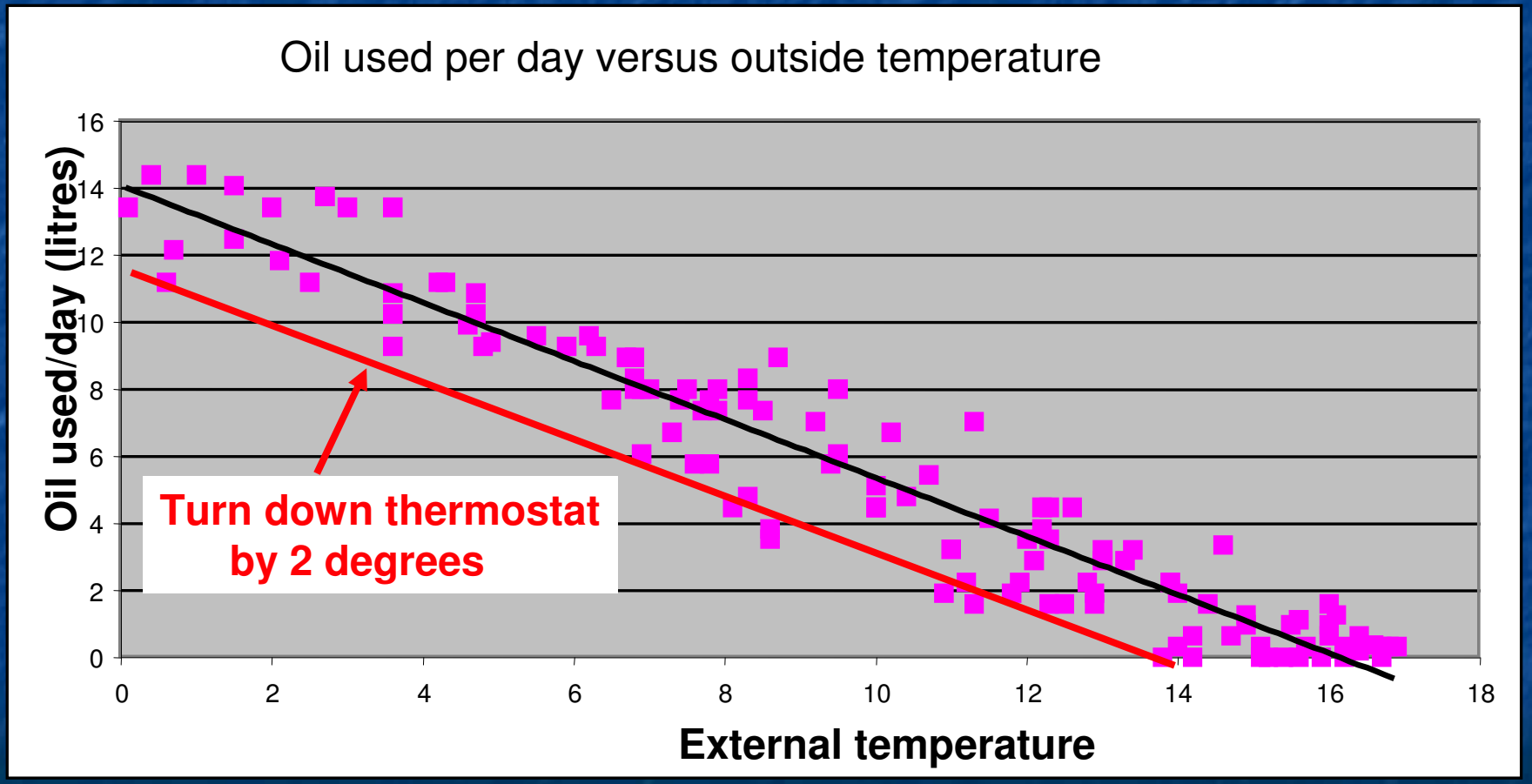
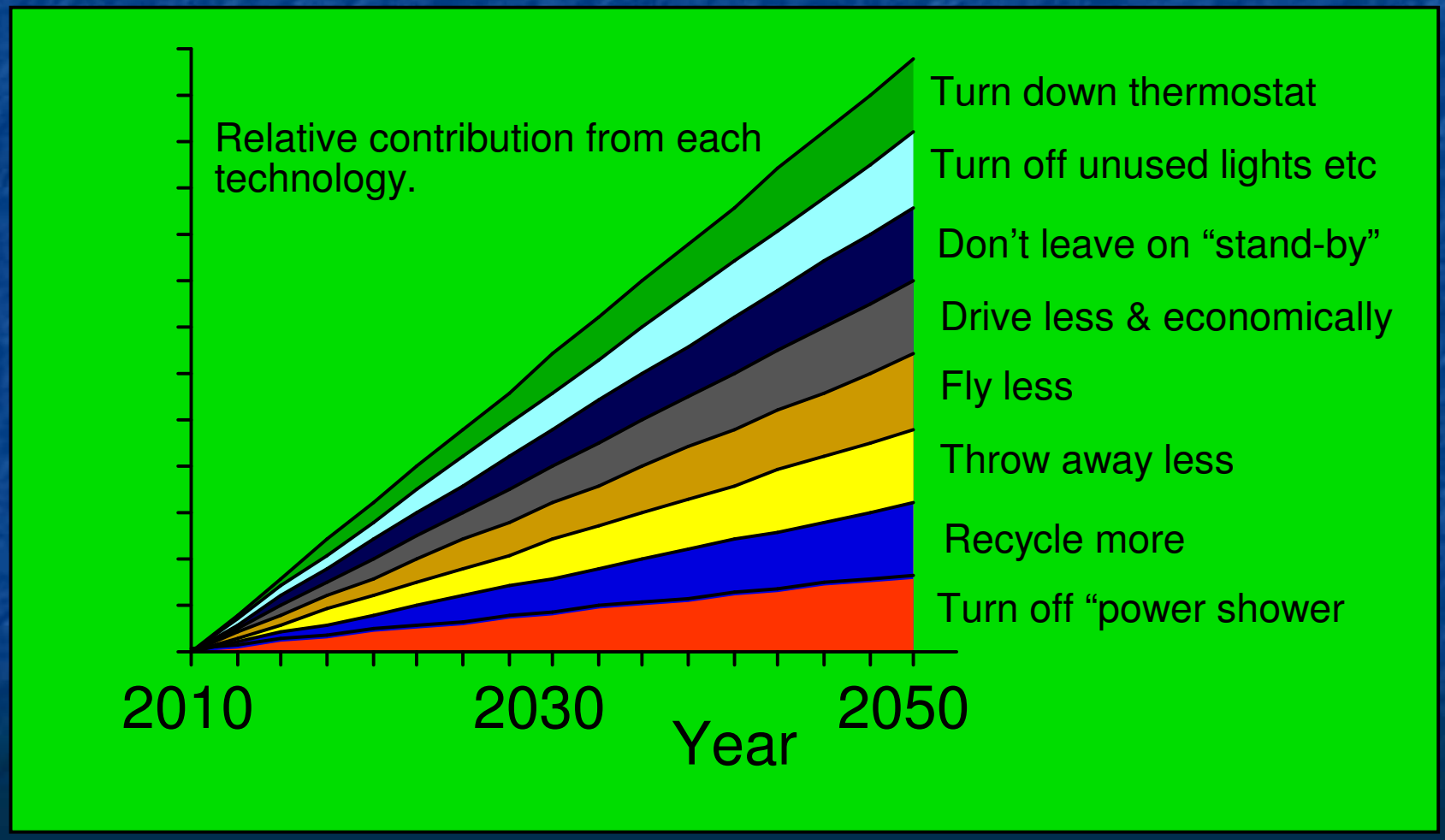


Data from Phil Holmes

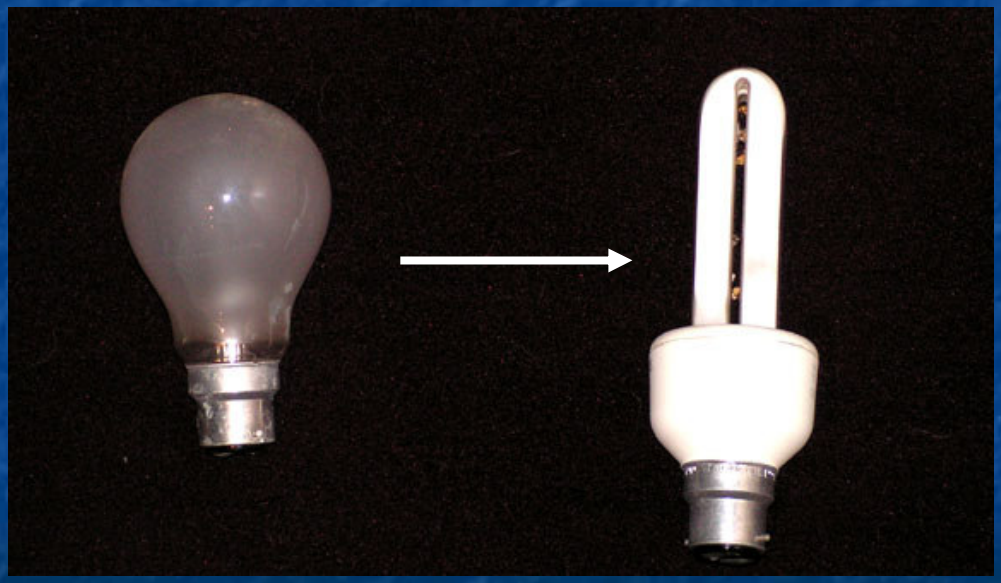
The Reducing Energy Consumption wedge



75%

Improving Energy Efficiency

- Small changes add up :-



75% less Energy used for the same light.

60%

Improve energy efficiency -

better home insulation!

My 140 year old home with solid walls

+

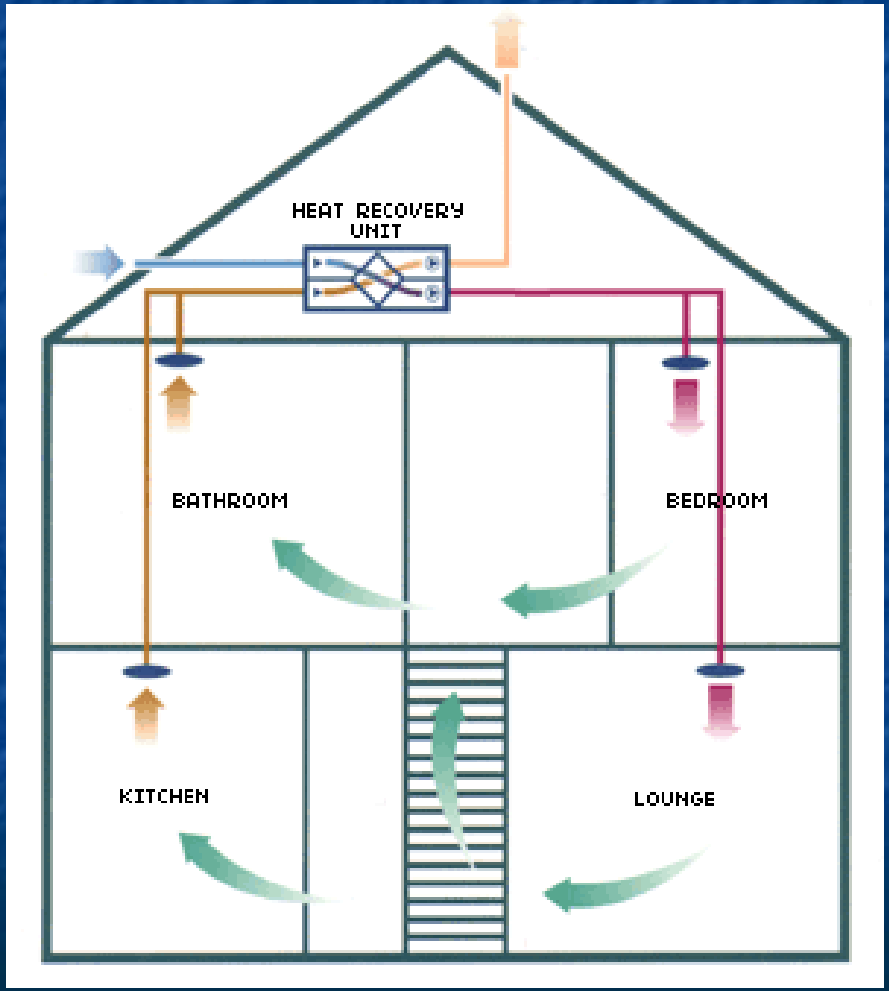
Rockshield

= 60% heating reduction (calculated)!

75% Heat recovery ventilation systems.

Installed in 90% of new Swedish homes!

Approx. 75% heat recovery from ventilated air.

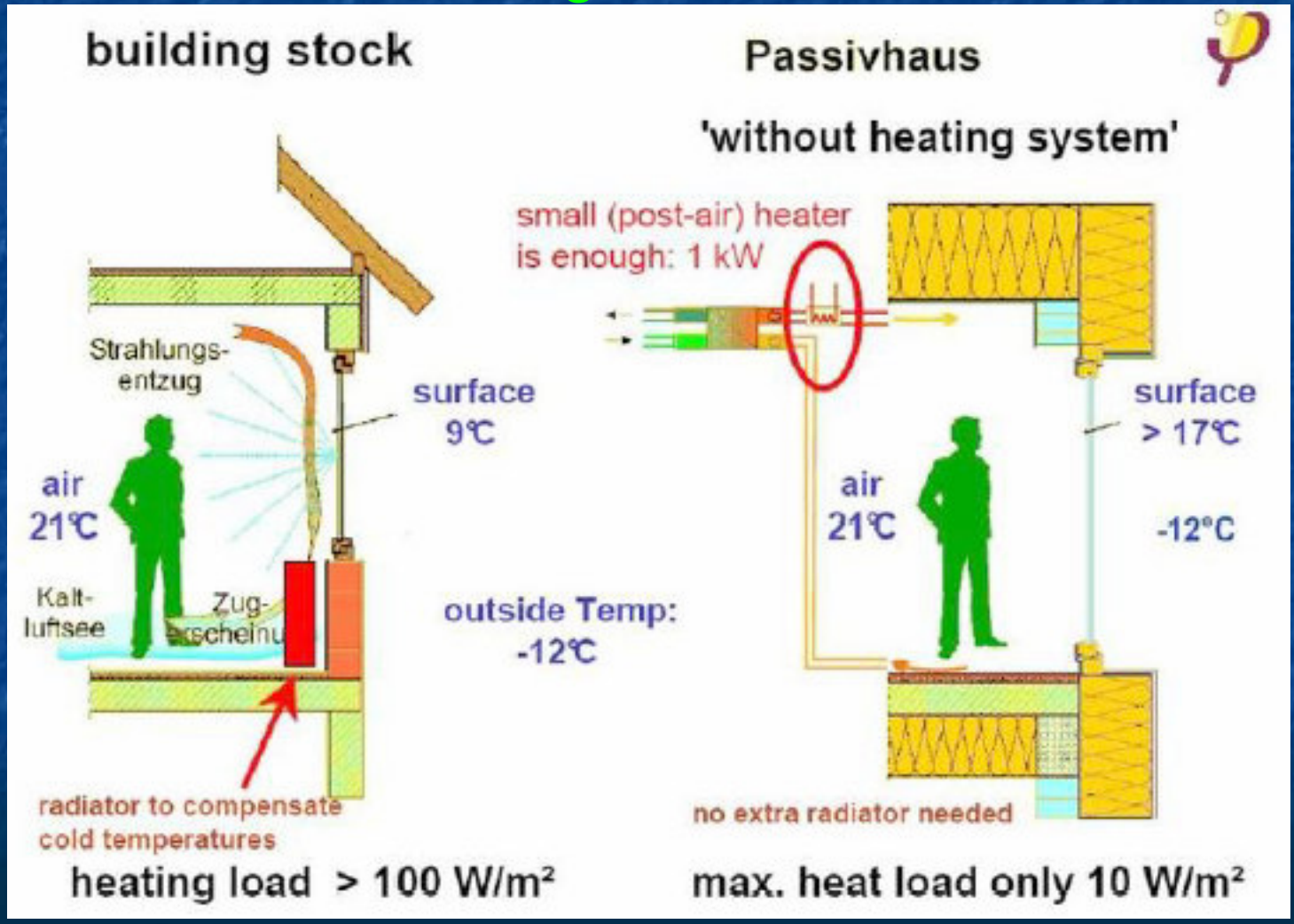


Source - www.villavent.co.uk

90%

Passiv-haus comparison

90% reduction from most modern British homes. UK target for 2016.



See www.passiv.de

50+%

More fuel efficient vehicles.

Lexus IS300 Sportcross 265gm/km
(My vehicle to 22/9/07)

45%

Audi-A4-Avant 2.7 TDI 165gm/km
(My vehicle from 22/9/07)

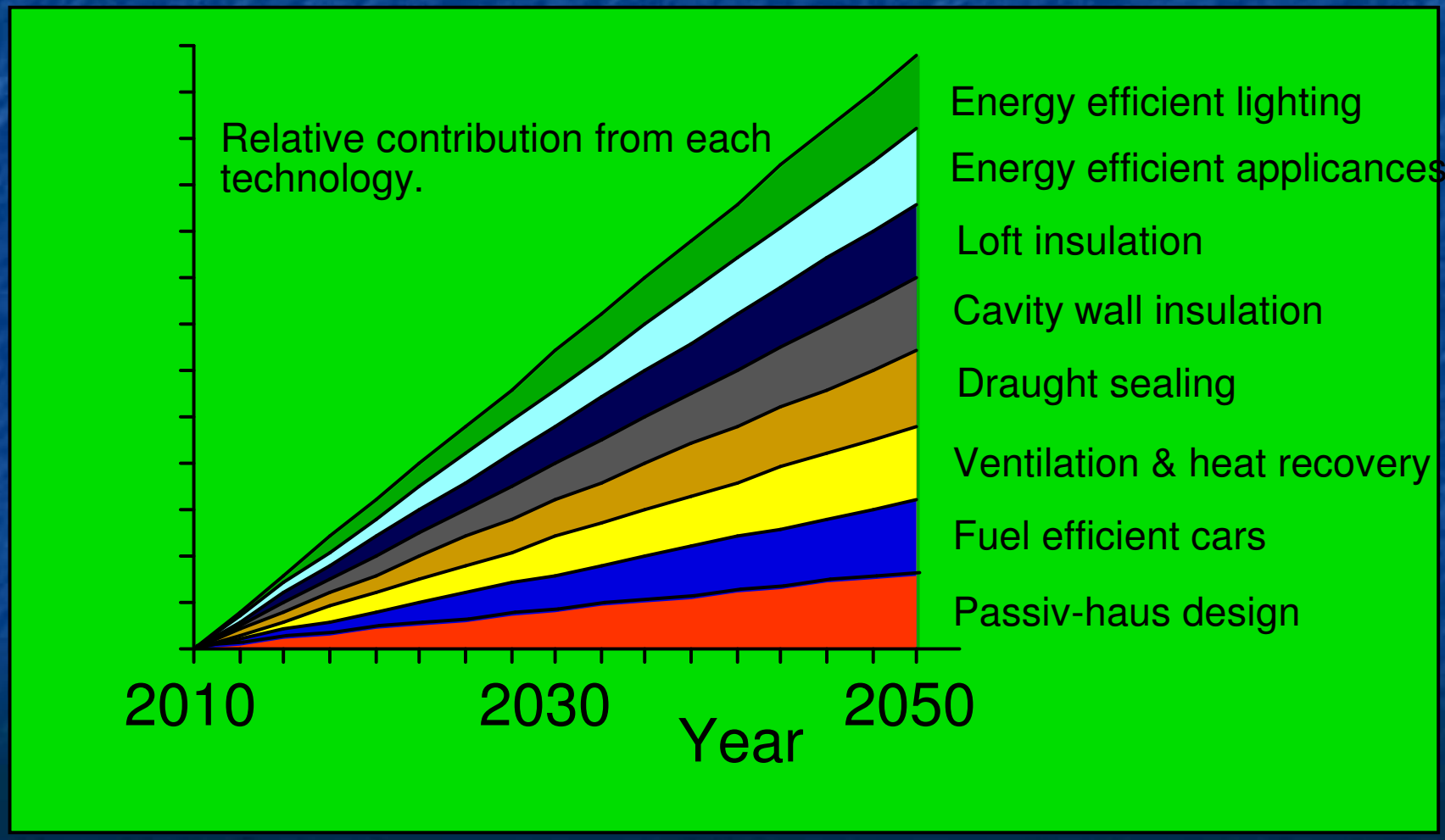
85%

60%

Loremo 40-70 gm/km

Toyota Prius Hybrid 104 gm/km

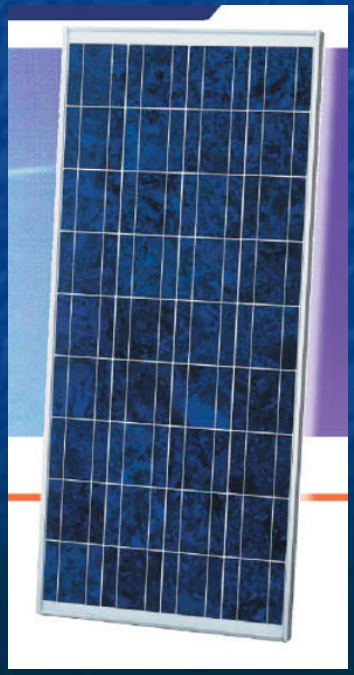
The Energy Conservation wedge



Some Micro Renewables

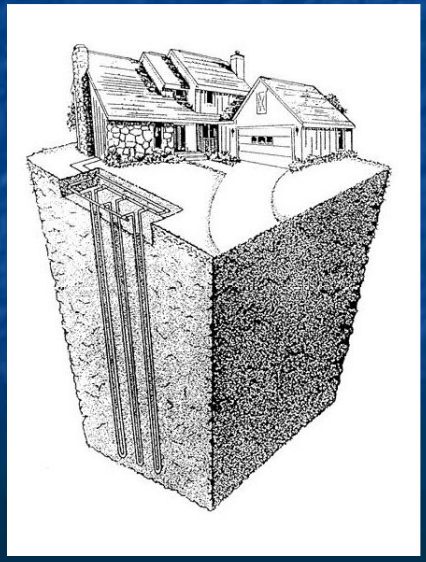
Solar Water - generates hot water

Micro-wind - generates Electricity.



Solar Photovoltaic Cells - generate electricity from sunlight.

Ground Source Heat Pump - heats home by cooling garden.



Solar Water Heating

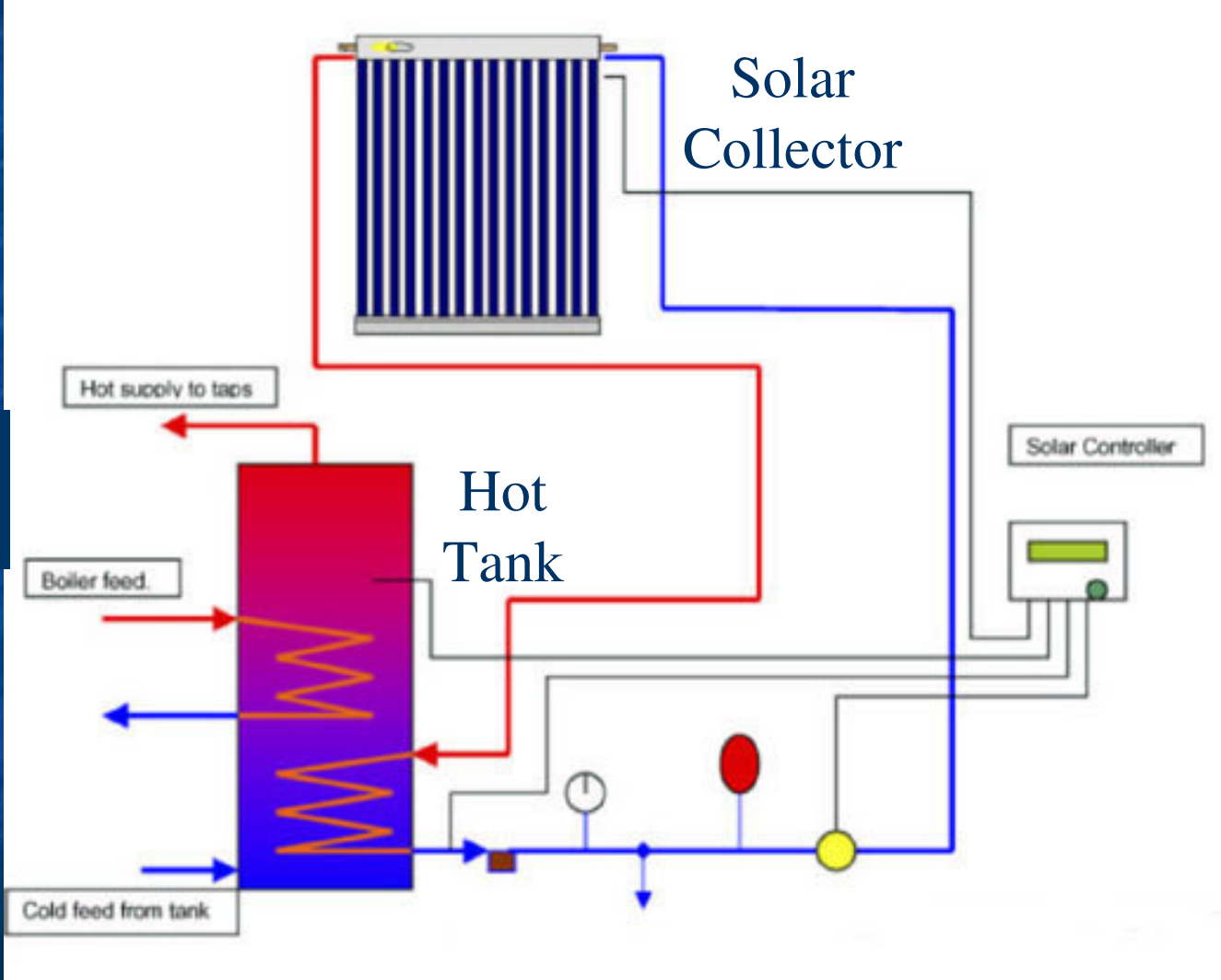
Needs ~ south facing roof for mounting.

Typically provides all hot water for 6-7 months of year, some benefit for rest of year.

(solar collectors being installed on my garage roof)

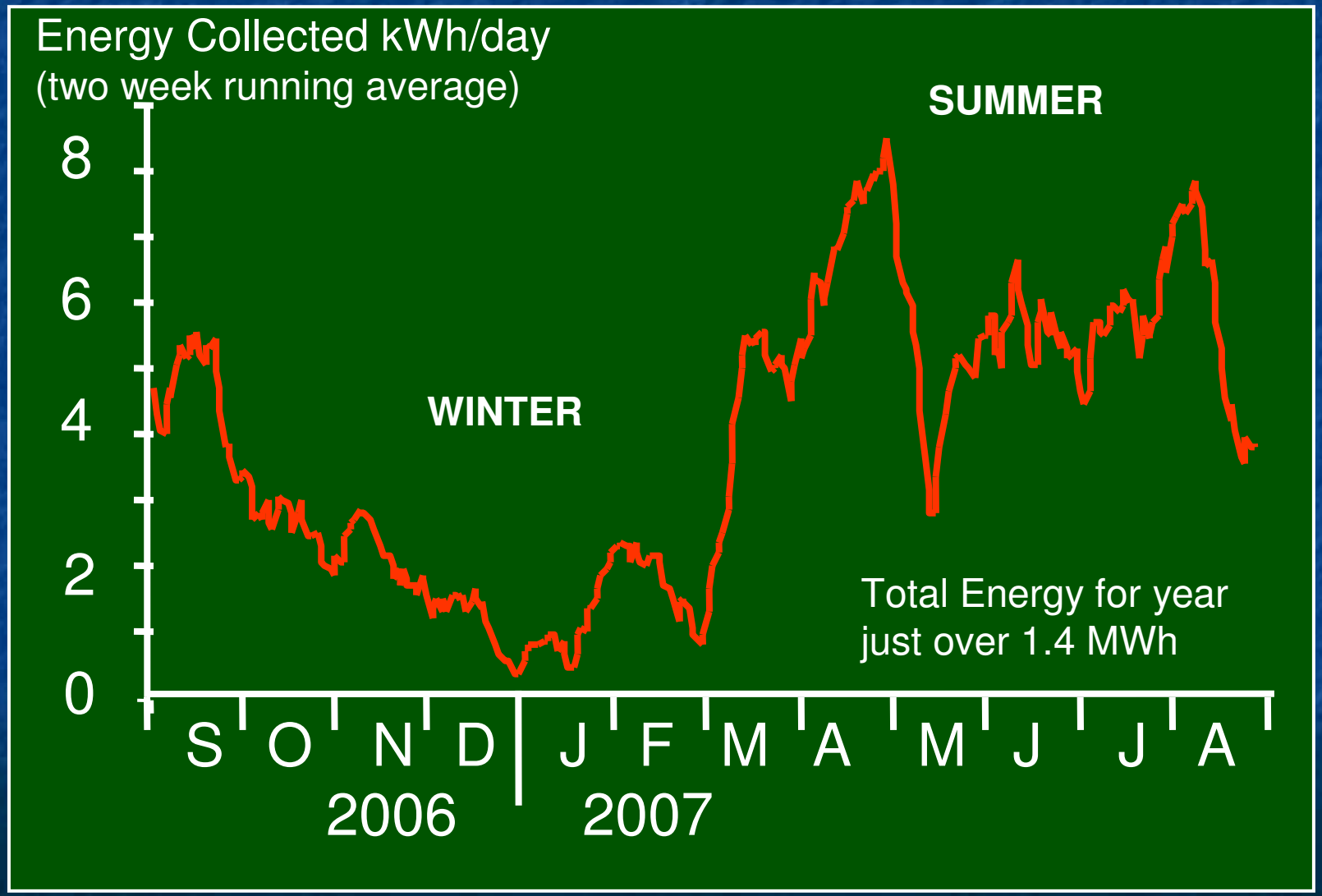
Solar Water Installation

Input from boiler



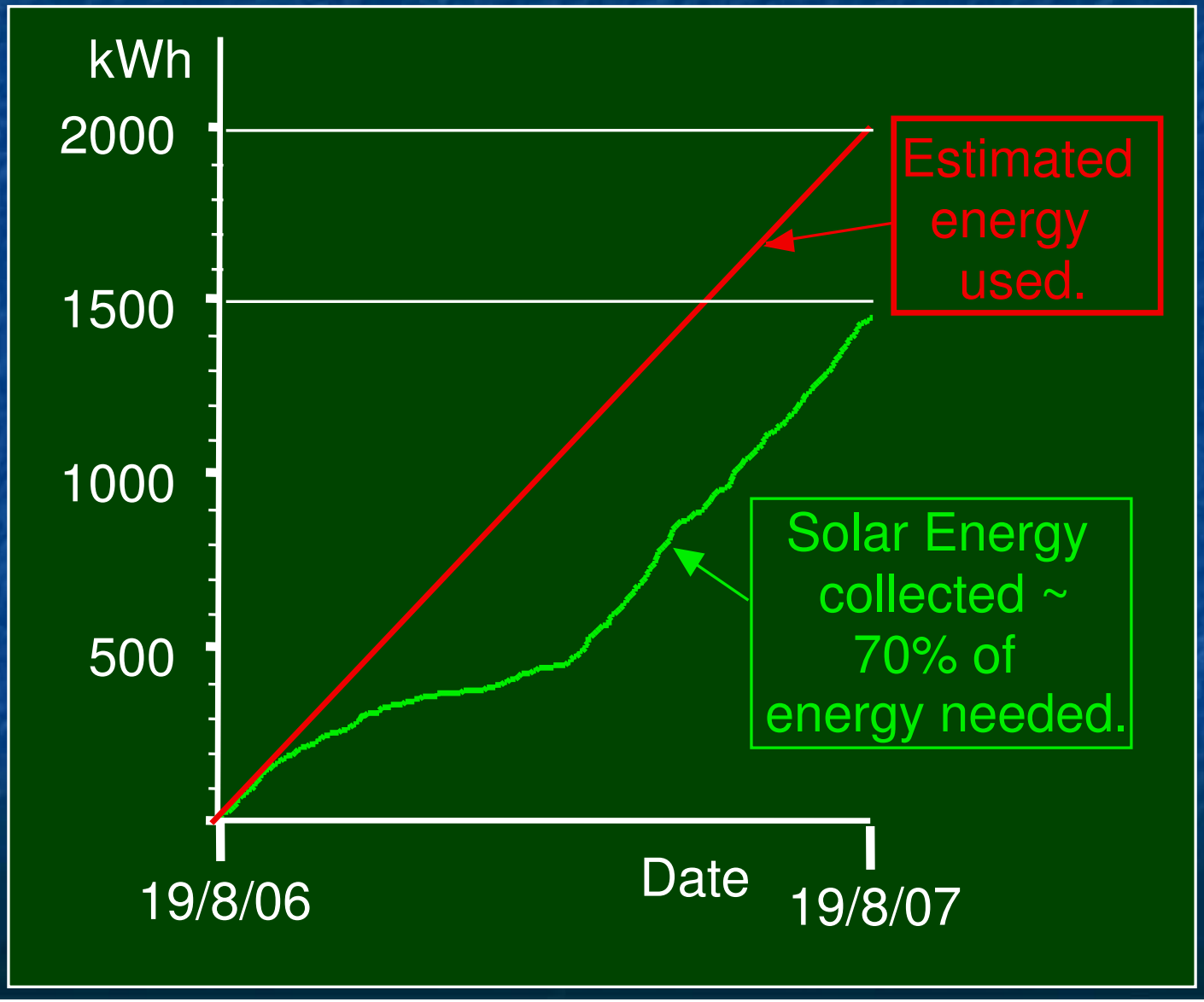
My Solar Water Installation

Energy collected per day (2 week running average).



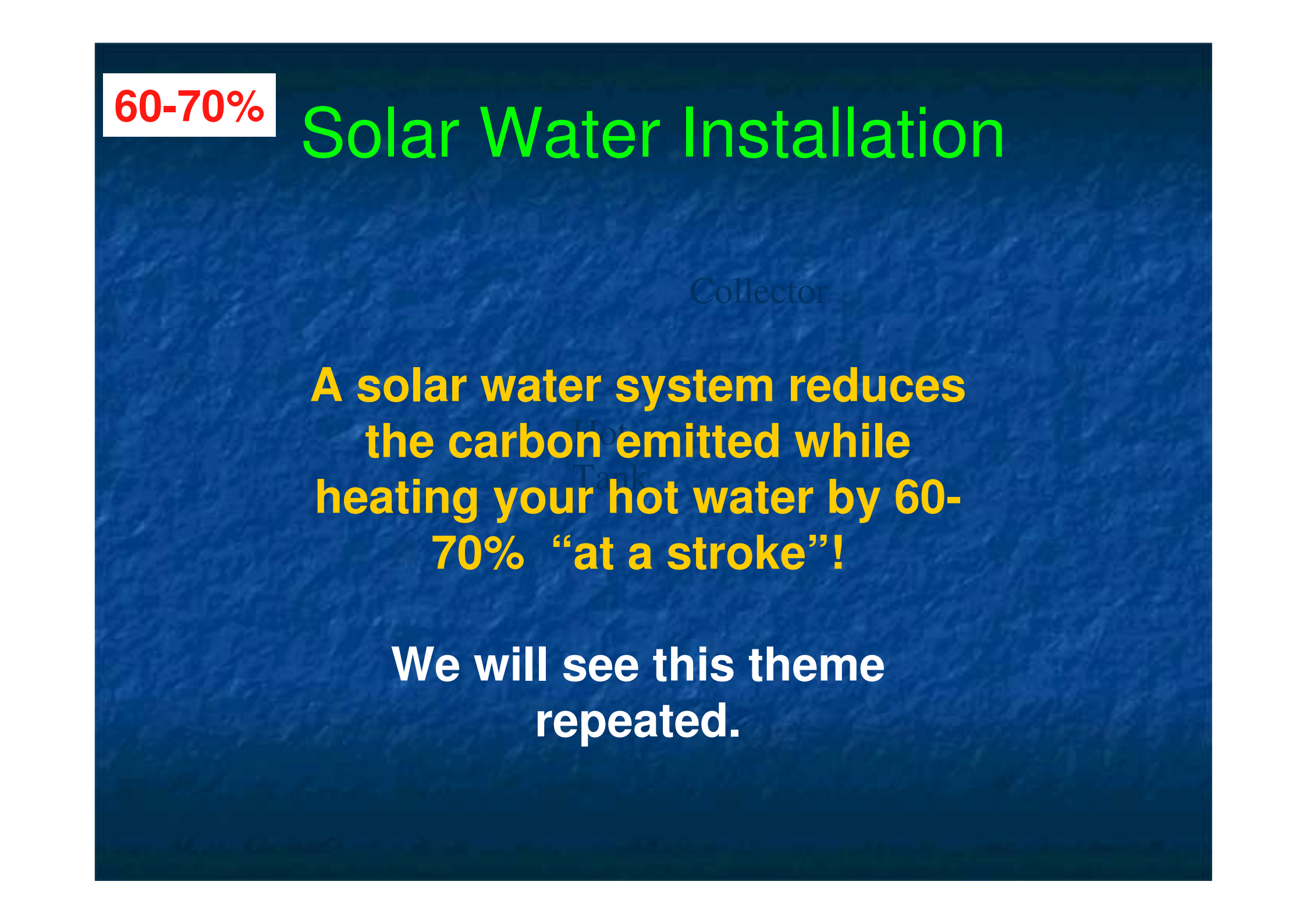
My Solar Water Installation

Energy collected over one year.



60-70%

Solar Water Installation



A solar water system reduces the carbon emitted while heating your hot water by 60-70% "at a stroke"!

We will see this theme repeated.

Micro-wind generators

- an excellent technology when used properly
- more commonly, next to useless.

Proven Energy generators

www.provenenergy.com

2.5 kWp generator
(kWp = kilowatt peak)

Source - Proven Energy

“Proven” equipment

“Proven” Wind Turbine’s 2.5 kWp power
(3.5m or 11.4 feet diameter rotors)

Up to 5 MWh/annum with 5m/s average windspeed.
(which is typical for E.Anglia on an open site with no wind screening or turbulence).

Mounted on 6.5 or 11 m high tower. Weight = 190kg .

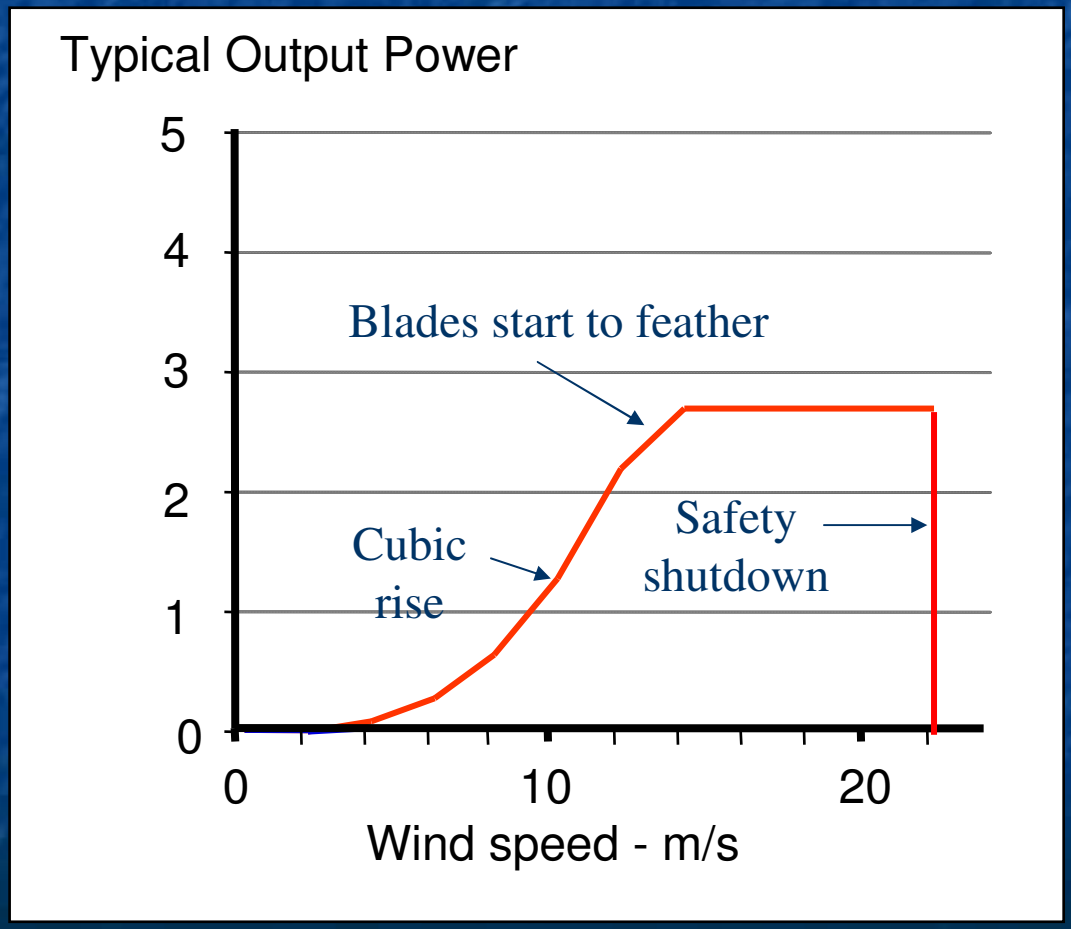
Self feathering blades in gale conditions.

**** My home electricity consumption is about 4 MWh/annum. Ergo - this generator could give a 125% reduction on mains useage or 25% export)**

This looked very promising so why didn’t we go ahead?

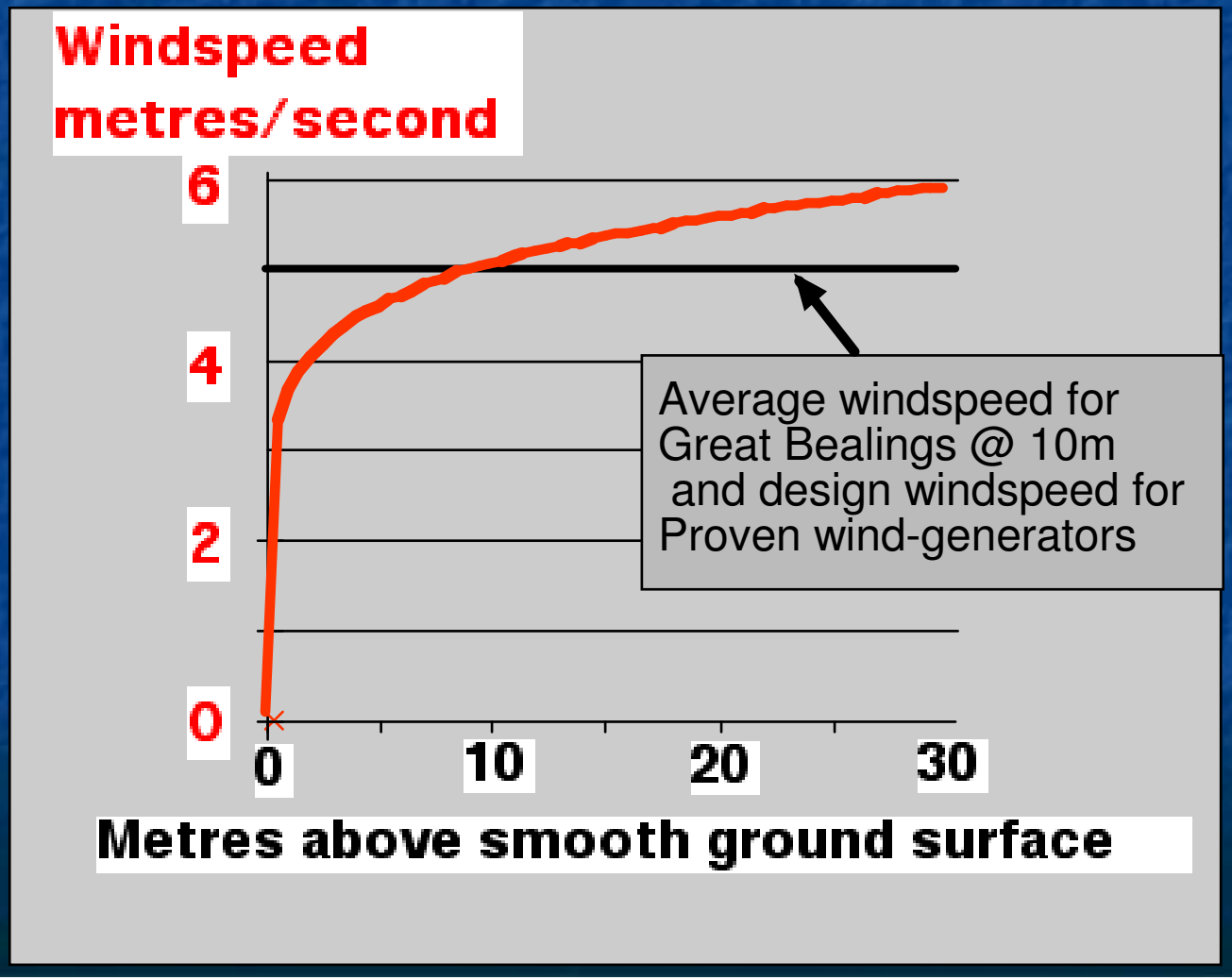
Typical Generator Power versus Windspeed

Power rises as cube of windspeed until limiter kicks in.



Note - 10 m/s = 22 mph

Wind speed statistics for Great Bealings - (ideal site).



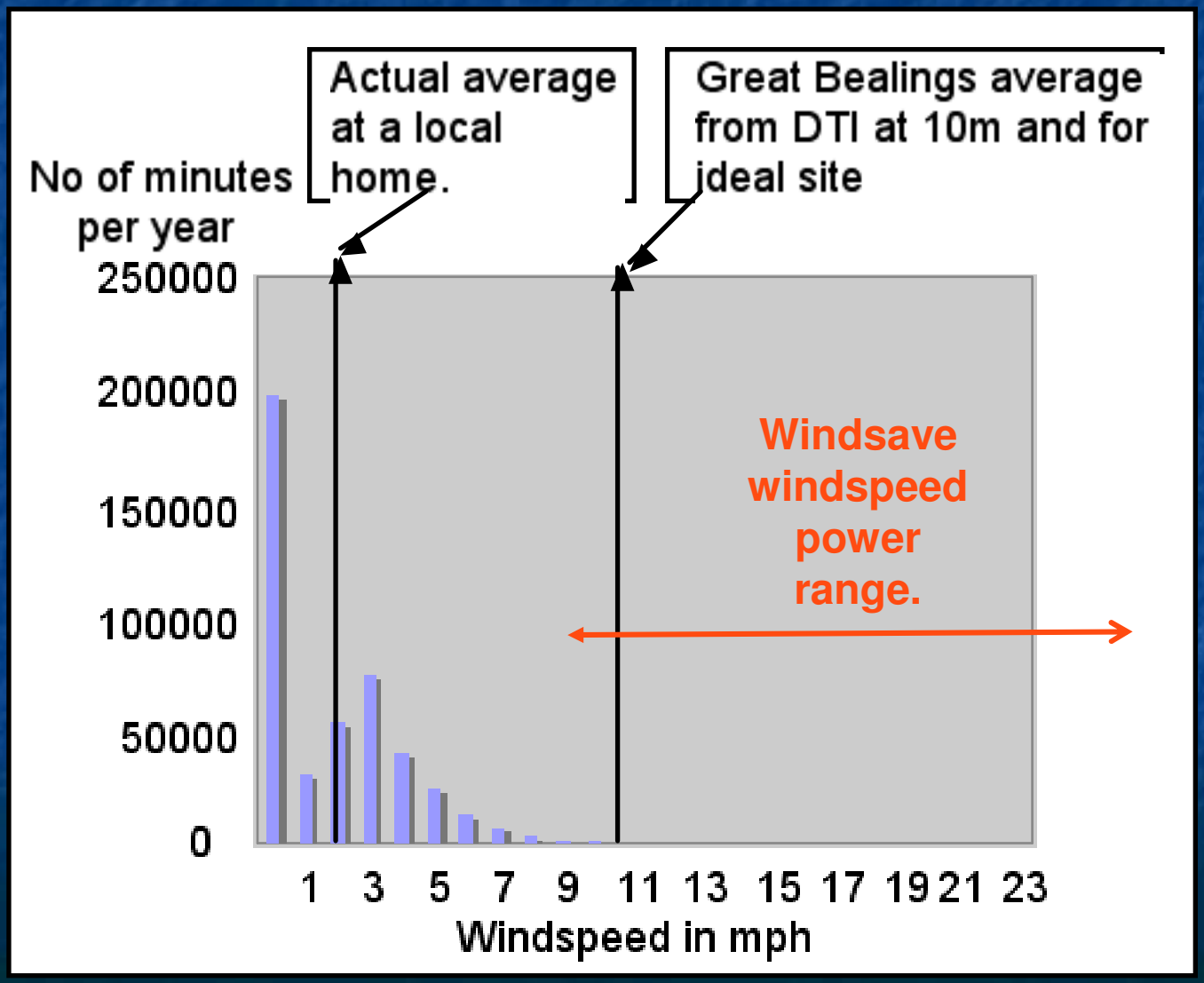
British Wind Energy Association - mounting recommendations.

- At least 9m above any obstruction within a 100m horizontal distance
- Sited to avoid any turbulence
  - e.g clear of buildings, trees etc
- Ideally on a tall mast standing on a flat open exposed site.
- Typically should then supply on average 1/3rd of the generator's peak power rating per annum (with manufacturer's recommended average windspeed).

Windsave 1 kWp
(Sold @ B&Q)

Seems to be a perfect example
of how NOT to mount
a wind generator.

Some Bealings wind data at roof level and a Windsave generator.



Wind data from Phil Holmes

100%?

Micro-wind generators - buyer beware!

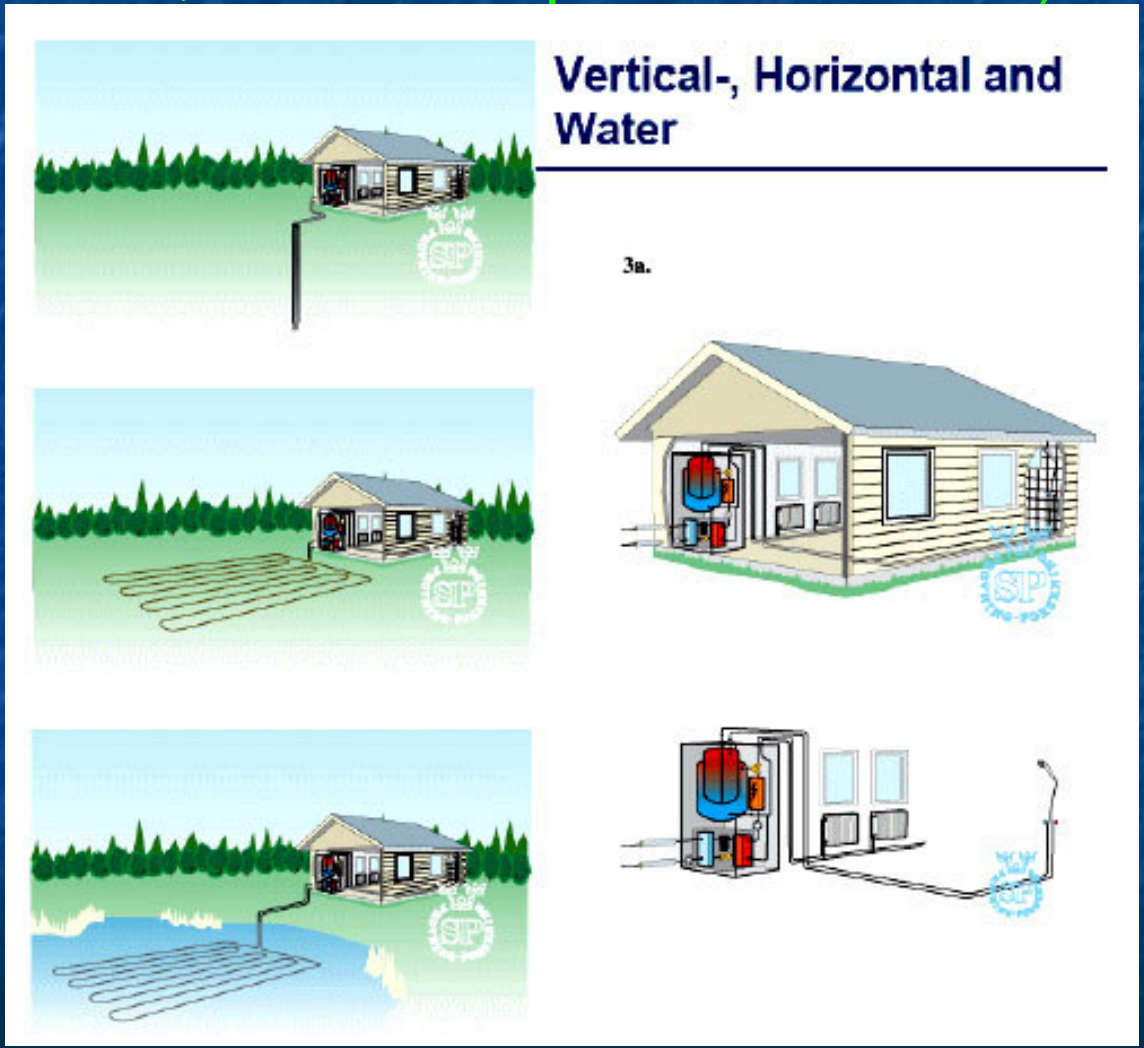
- On the right site (e.g. very exposed) they can be very cost effective
- And lead to valuable savings in carbon emissions
- But for most people in UK, they appear to me to be a complete waste of money.

Ground Source Heat Pump

(for new build home, office or apartment block)

About 70,000 units sold in Sweden just in 2004.

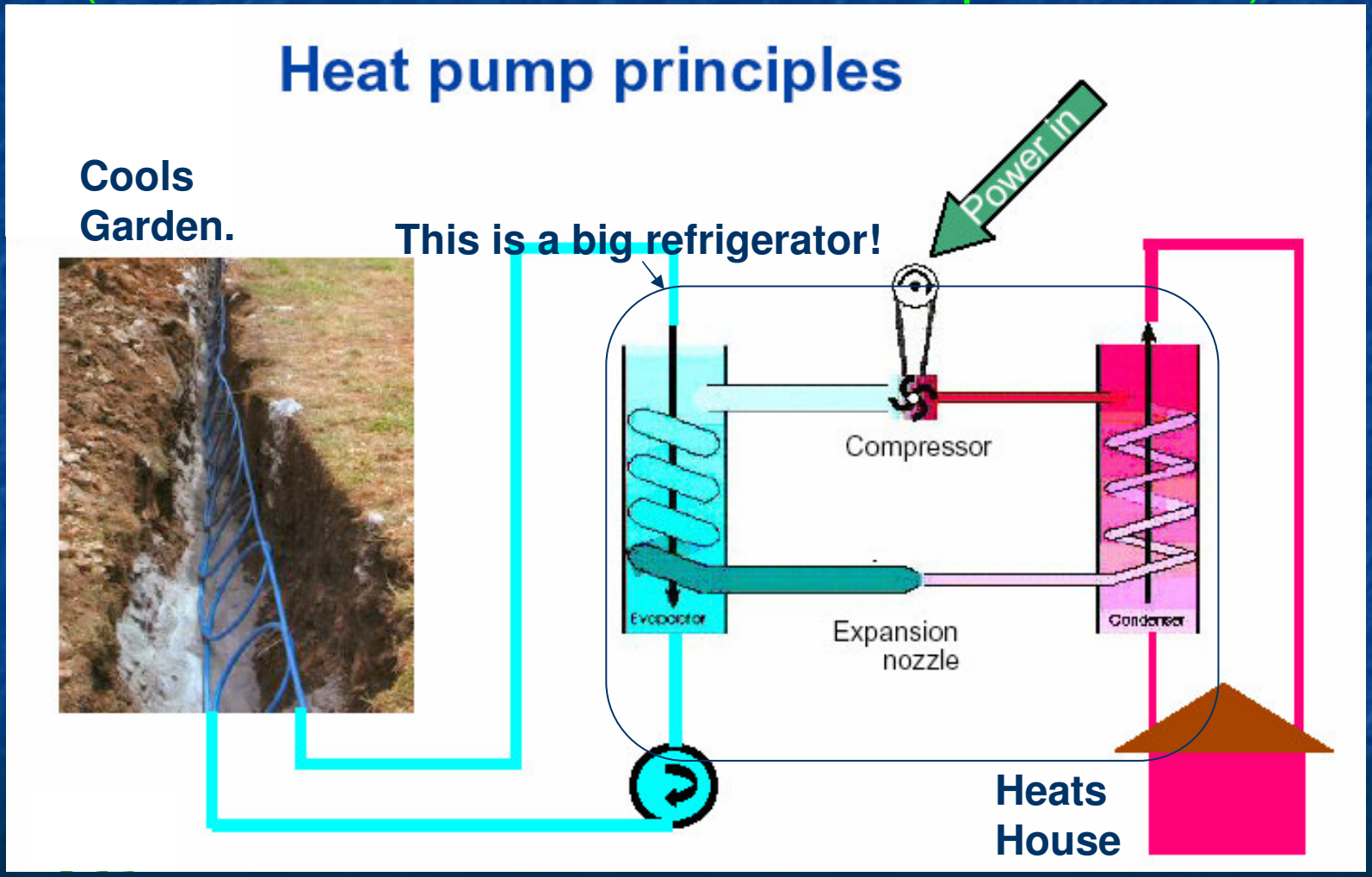
A few thousand sold in UK in total.



Source - Towards Zero-carbon Housing - DTI/CIRIA Mission to Europe

Ground Source Heat Pump

(for new build home, office or apartments)



Source - Towards Zero-carbon Housing - DTI/CIRIA Mission to Europe

60%

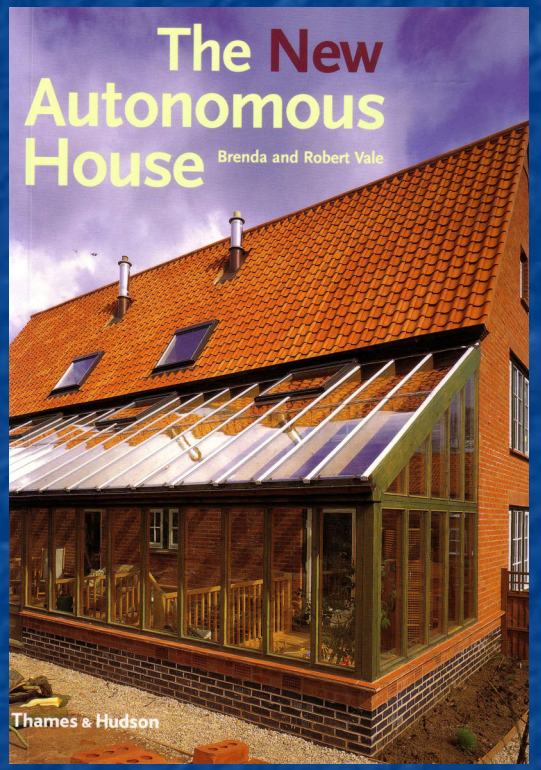
Ground Source Heat Pump

- Basic drive comes from mains electricity
- Each 1kW used generates 3-4 kW of useful heat.
- Ergo 60-70% reduction in fossil fuel used.

?%

Passive Solar Collectors

My 140 year old home with "passive solar collector" - extra insulation, extra space and heating to boot.



A better designed Passive Solar collector!

Biomass in the home.

- Log burning stoves
  - Space & water heating
  - But need regular stoking
- Wood pellet burners
  - Automatic fuel feed from large hopper
  - But need specially prepared wood pellet fuel
  - Costs similar to oil fired heating
- But both are essentially carbon neutral
  - ~ 100% reduction in net fossil carbon emissions.

60%

Using my own renewable biomass!

Average 4kW output points to :-

~ 100 kWh/day

~ 700 kWh/week

~ 2.8 MWh/month

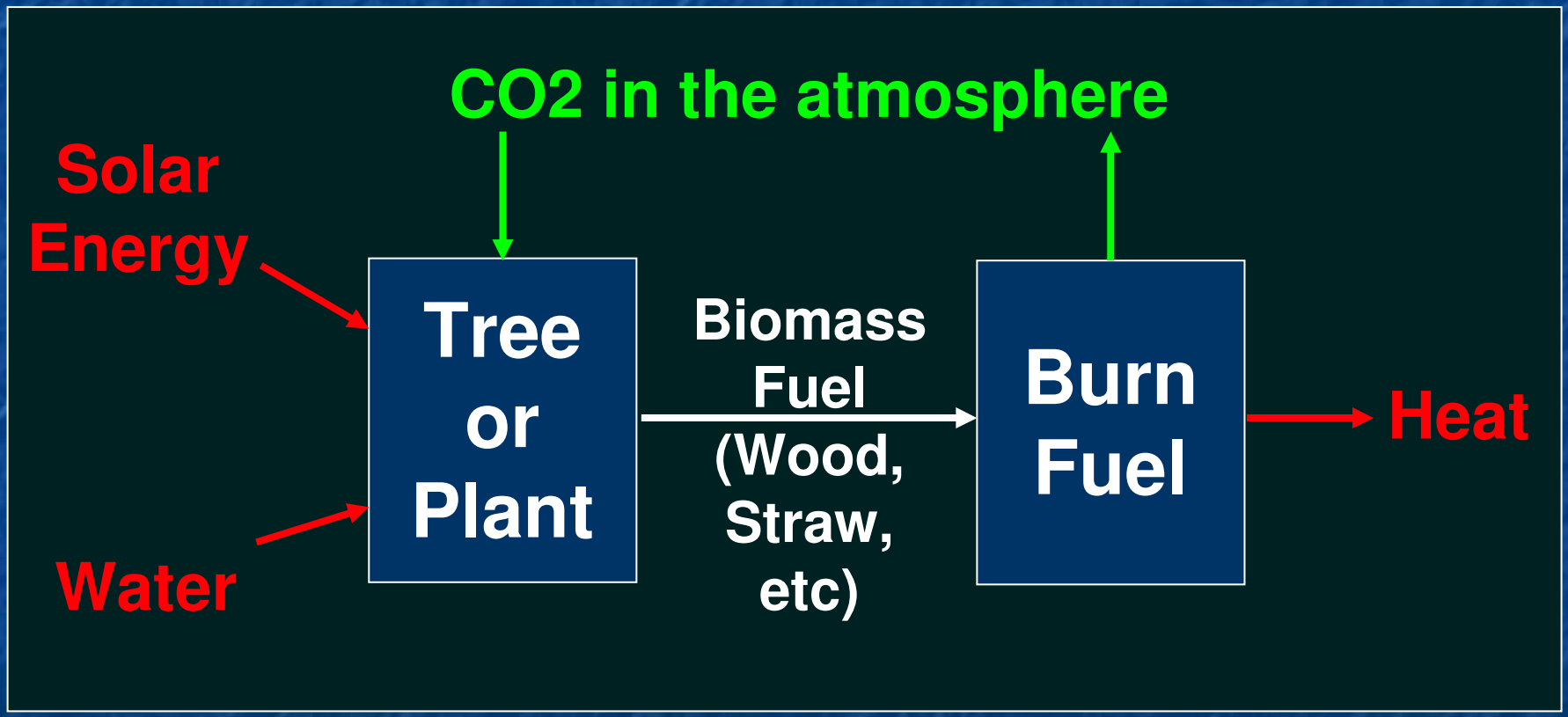
~ 11 MWh/4 months

Current oil ~ 17 MWh over 12 months.

Ergo 60+% reduction in oil for heating?

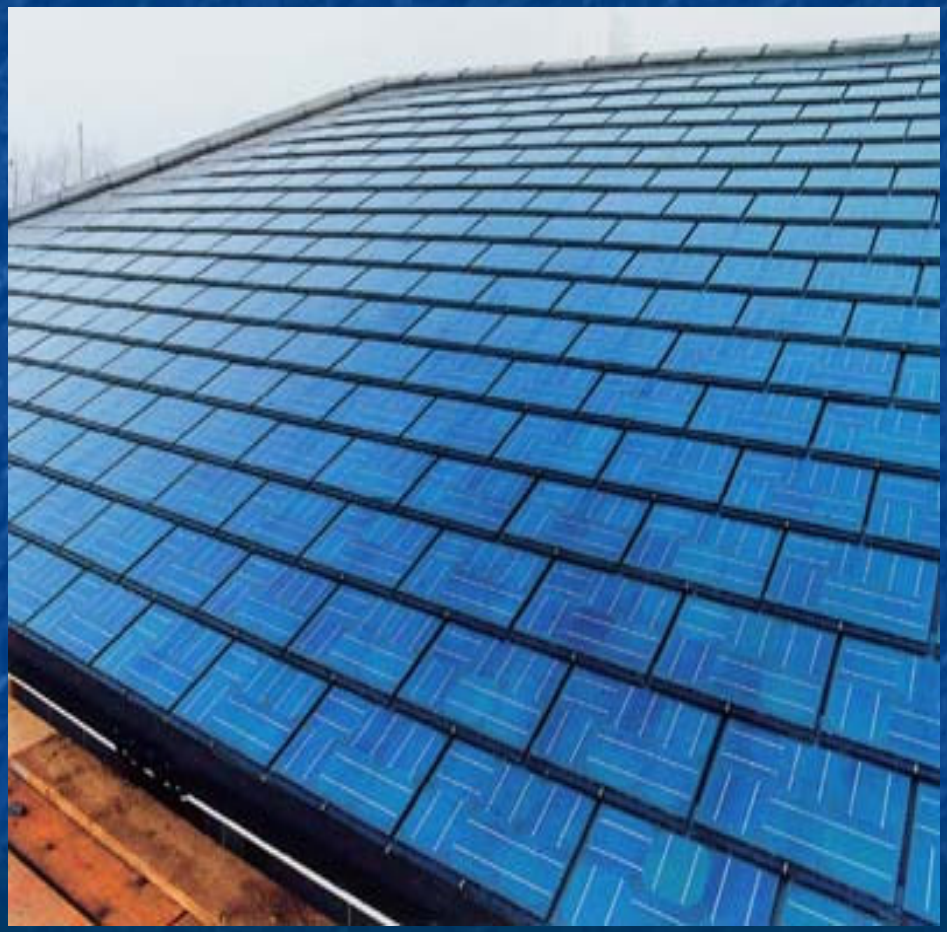
6-8 kW Jotul stove

Biomass fuel & CO_2



100%? Solar Photovoltaic Cells

Electricity from sunlight



Innovative SunSlates installation by

Solar Century for Laing Homes

Solar Photo-Voltaic Power

- Power available about 0.9 MWh/m^2.annum
- Efficiency 15-20%
- So generate ~ 150 kWh/m^2.annum
  - my home would need about 33 m^2 collectors
- Current cost ~ £600 sq.m.
  - my home would need ~ £20,000 of PV cells.
- But costs projected to fall by 5-10 soon
  - E.g. capital cost of £2000 to £4000
  - For electricity costing ~ £900

Micro-generation Rankings

(data from DTI website)

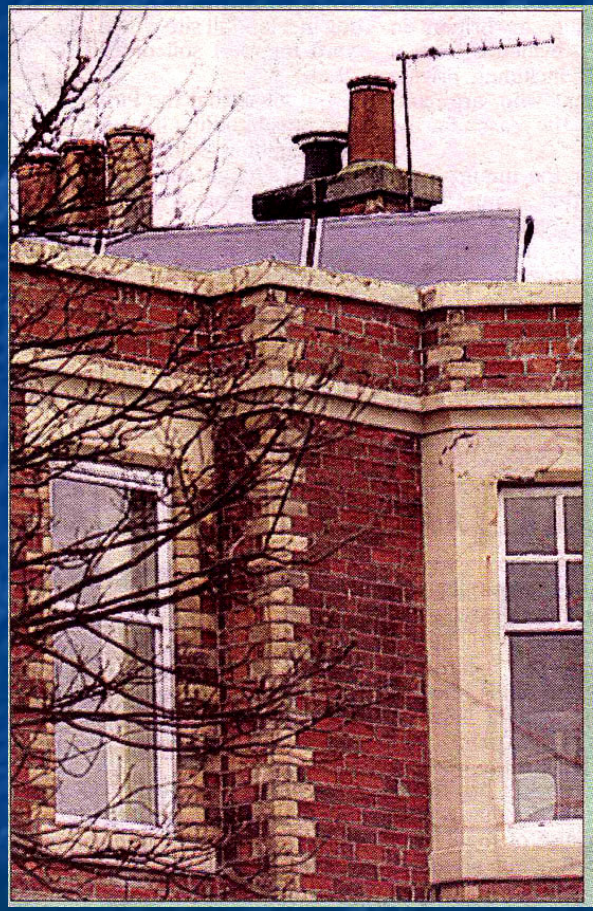
Type of Micro-generation	ROI %/annum	Tons CO_2/annum per £1000	LCBP Grant
Solar Photovoltaic	1.0 *	0.07	**£3000**
Microwind	3.1	0.20	**£2500**
Solar Water	7.7	0.38	**£400**
GSHP	8.2	0.33	**£1200**
Biomass Heat	**Fuel cost?**	0.56	**£1500**

Note - LCBP grant seems disconnected from carbon dioxide reduction
- is this a sensible use of tax-payers money?

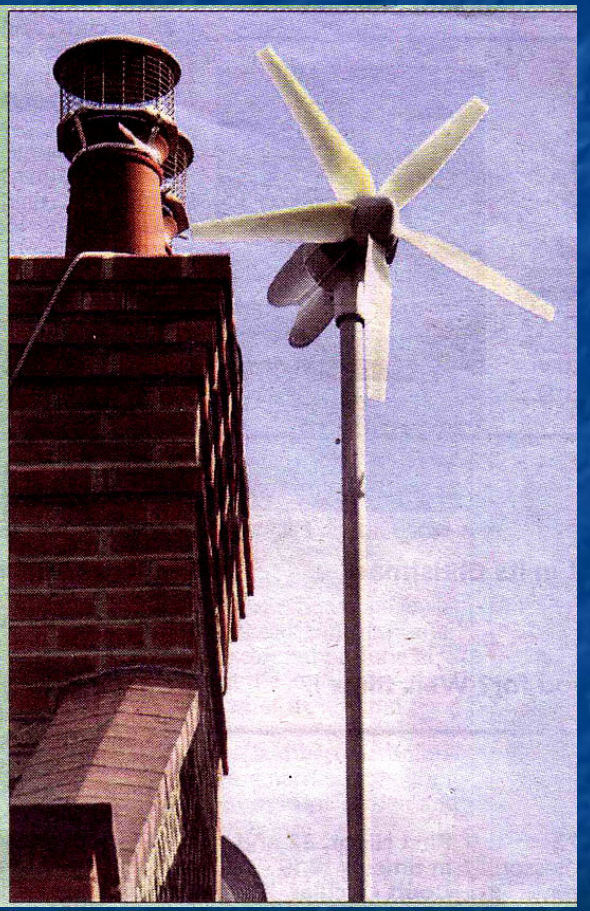
* Cost reducing fast?

LCBP = Low Carbon Buildings Programme (follows on from Clearskies)

Our Leader's example!



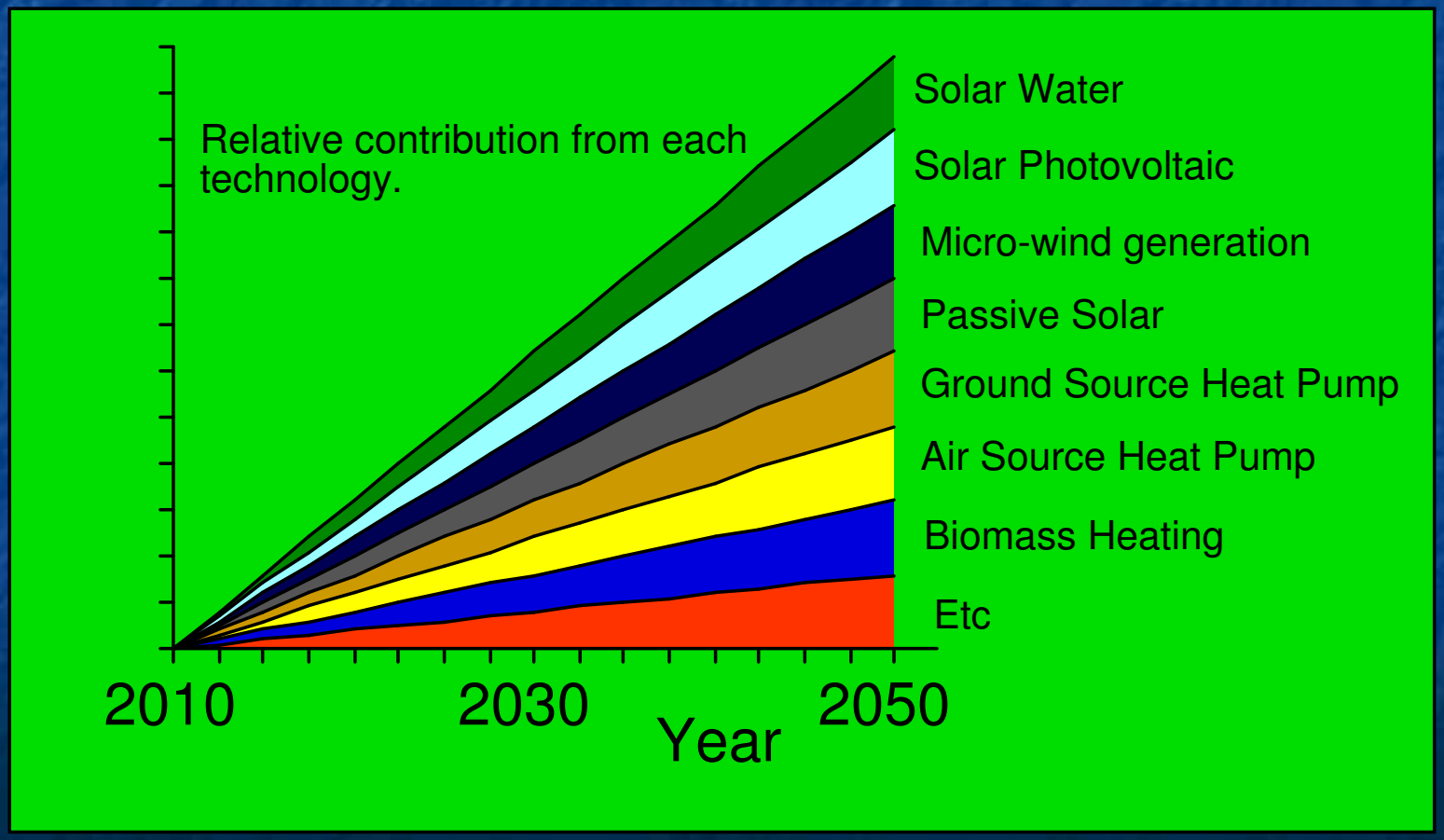
Gordon Brown's Solar Photo-Voltaic Cells



David Cameron;s Wind Generator

Source - The Times

The Local Renewables wedge!



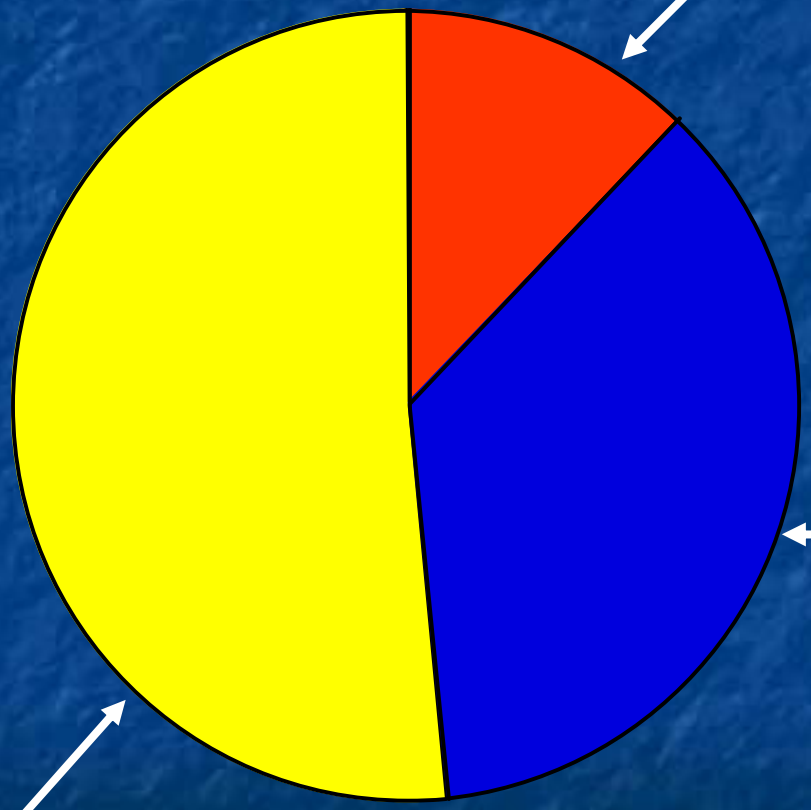
Data on our own move away from fossil fuels!

- On fossil fuel purchased directly as “energy” e.g._
  - Fuel for two cars (petrol/diesel)
  - Fuel for home heating & hot water (oil)
  - Electricity for home appliances, lighting etc
- Comparison between :-
  - Oct.2004-Sept.2005 vs
  - Oct.2007-Sept.2008

A note on Energy units

- 1 kilowatt.hour (kWh) =
  - A single bar electric fire running for 1 hour
- 1 Megawatt.hour (MW) =
  - 1000 single bar electric fires for 1 hour
  - Or 1 such fire for 1000 hours (42 days).

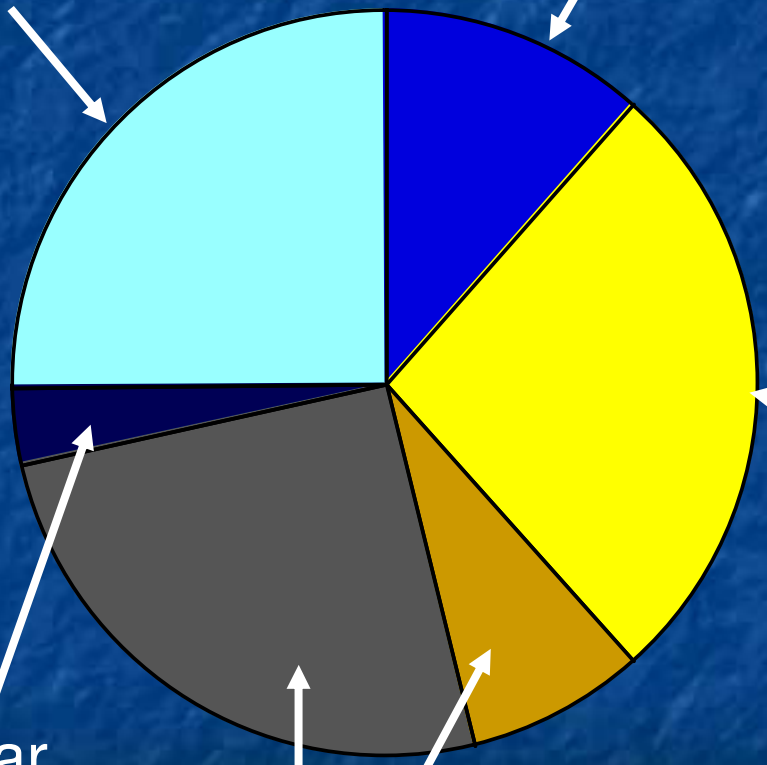
Figures for 12 months to Sept.2005
100% fossil fuel used.



Total Energy 71 MWh
All from Fossil Sources

64%

Estimated figures for 12 months to Sept.2008

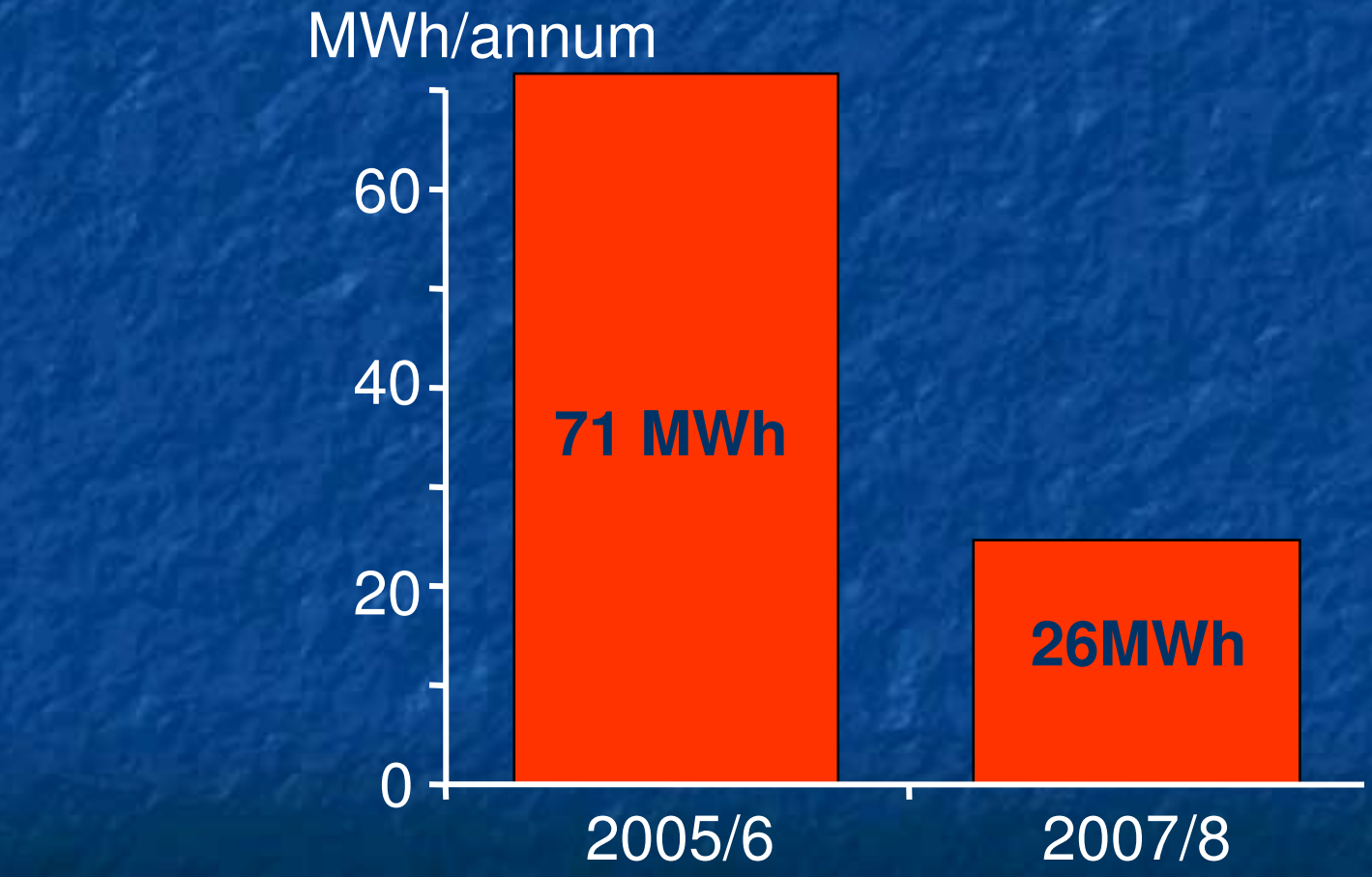


Total Energy 43 MWh
From Fossil Sources = 25.8MWh

40% less energy
64% less carbon

Relative Fossil Fuel usage!

(estimated figures for 2007/8)



Some overriding messages!

- There are many ways to cut fossil energy consumption by 60% or more
- But also:-
  - At today's energy prices
  - And with today's technology
  - It can make good economic sense to do so.
- This is why many big businesses are already making great strides in this direction.
  - See Rocky Mountain Institute www.rmi.org for further data.

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Finis - part 3.