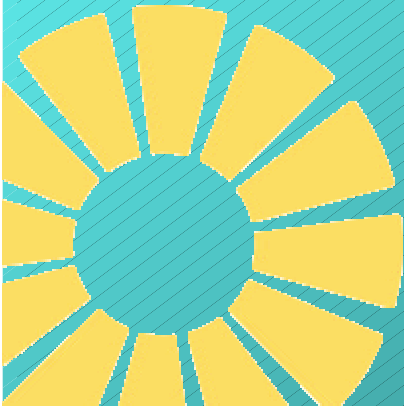


Status of Renewable & Energy Conservation Technologies

Rob Gwillim.

Centre for Alternative Technology

www.cat.org.uk



INFORSE-Europe Pan-European Seminar
September 30 - October 4 2003, CAT, UK.

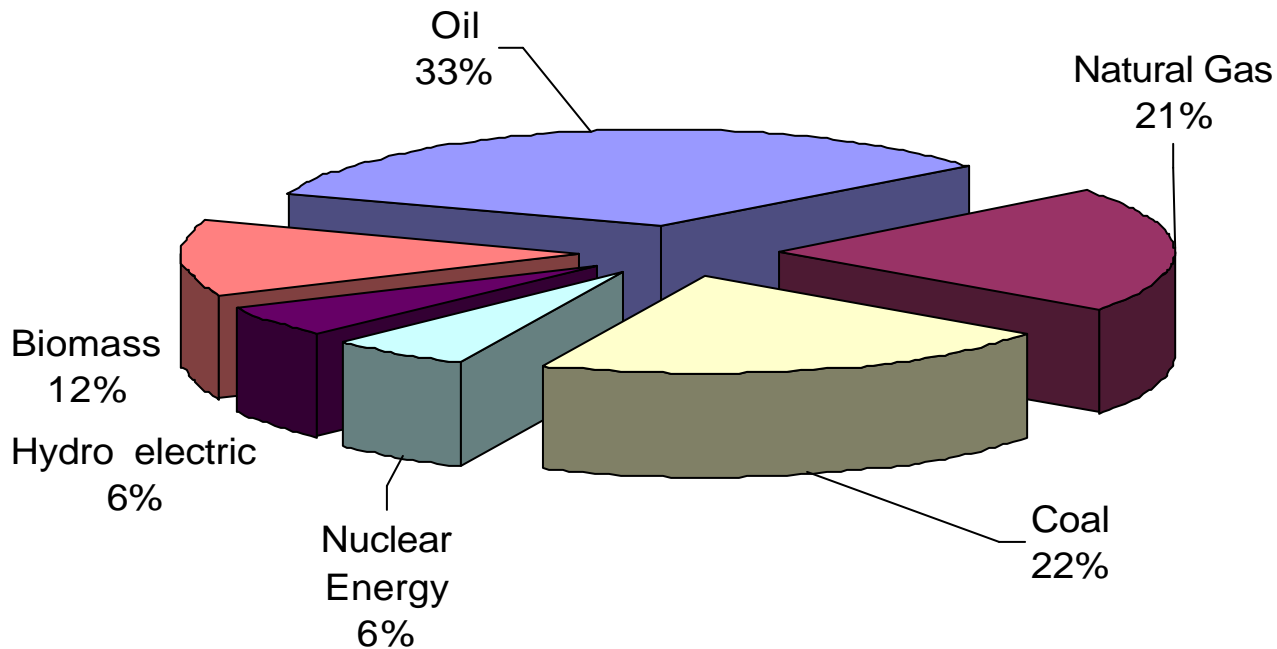
Status of Renewable & Energy Conservation Technologies

- Energy Consumption
- CO₂ Emissions
- Energy Conservation Strategies
- RE technologies

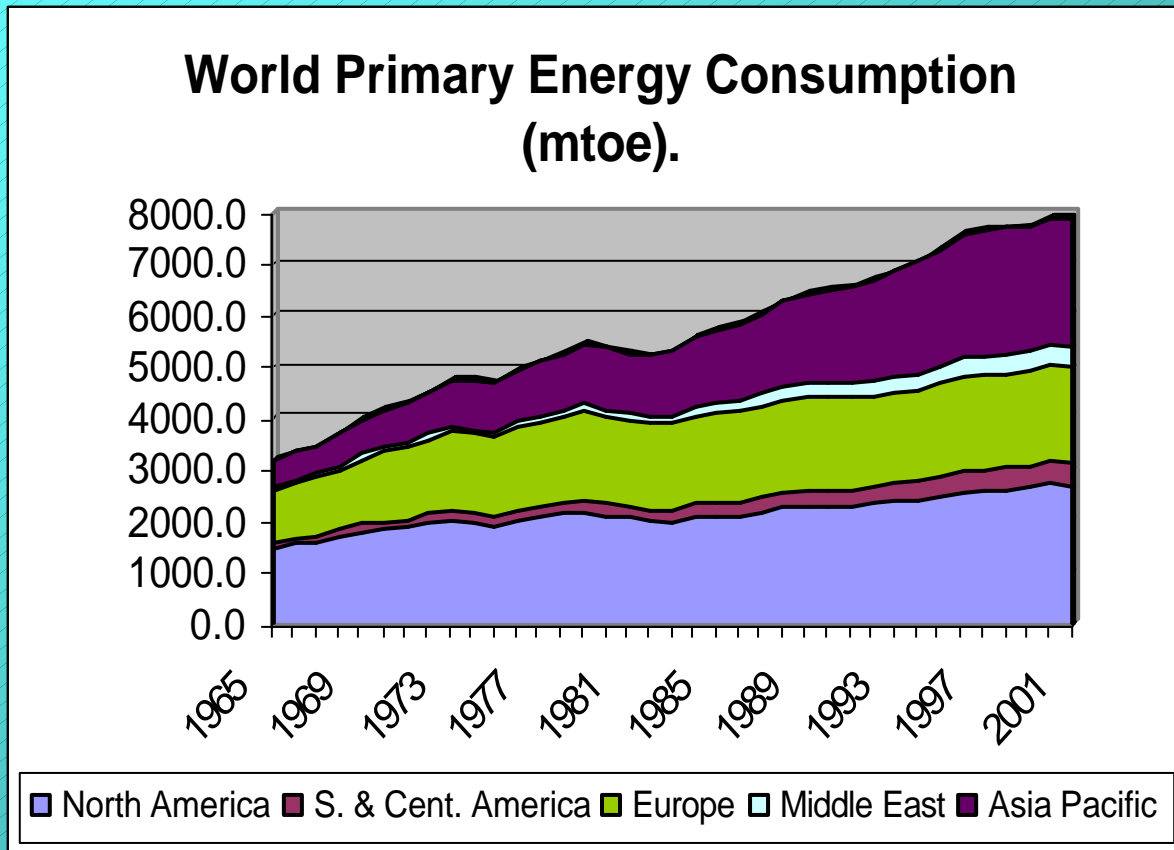
Where Our Energy Comes From?

World Primary Energy Consumption 2001

Excluding Biomass (Approx 445EJ).

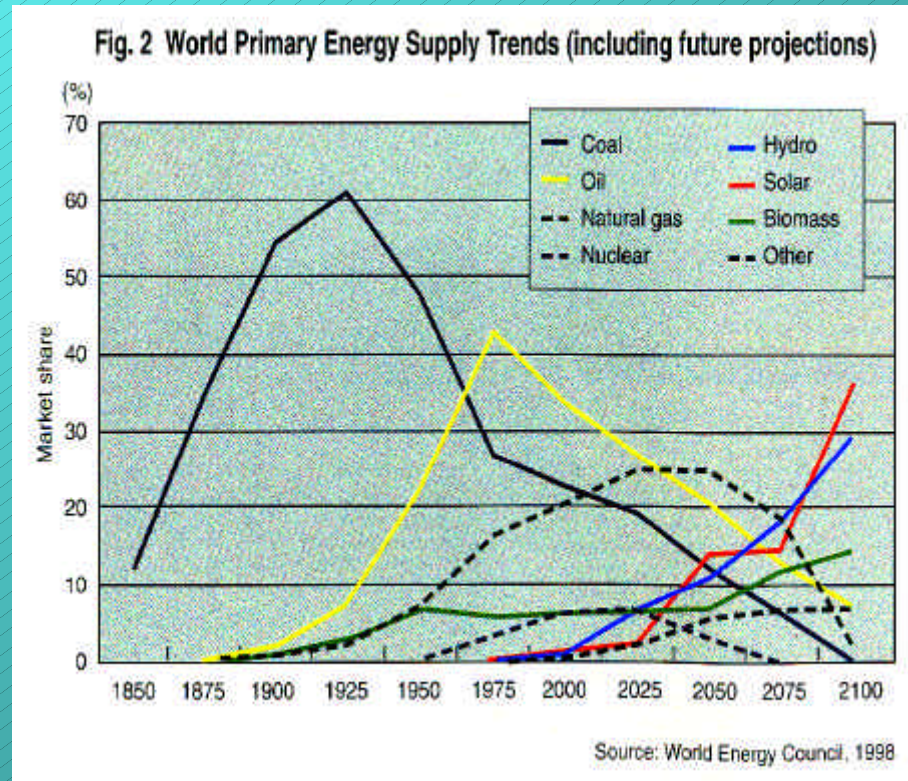


World Energy Consumption



The Need for Change

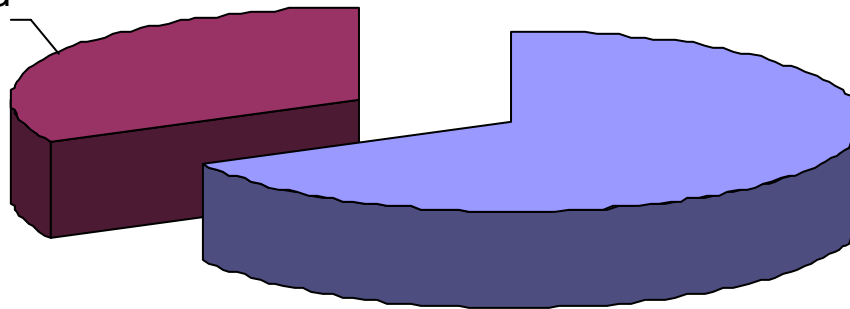
- World resources are finite and will not last for ever.



Who Uses Our The Energy

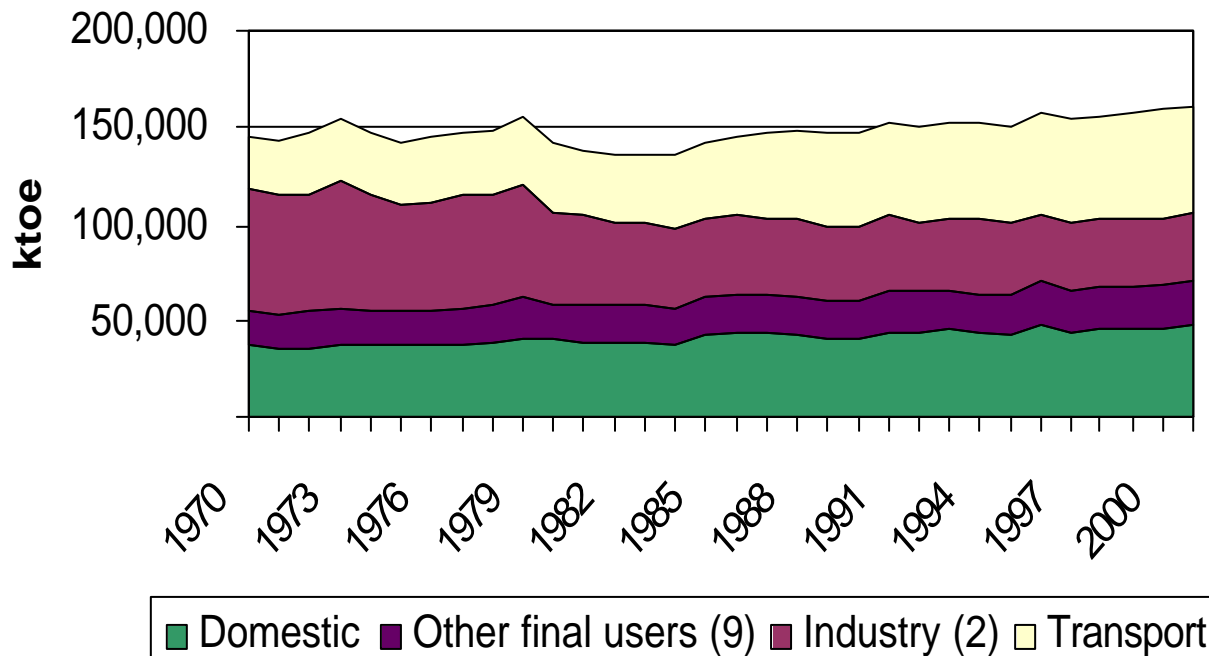
**Energy Consumption Developed/developing 2001
(9124mtoe)**

Developing World
33%



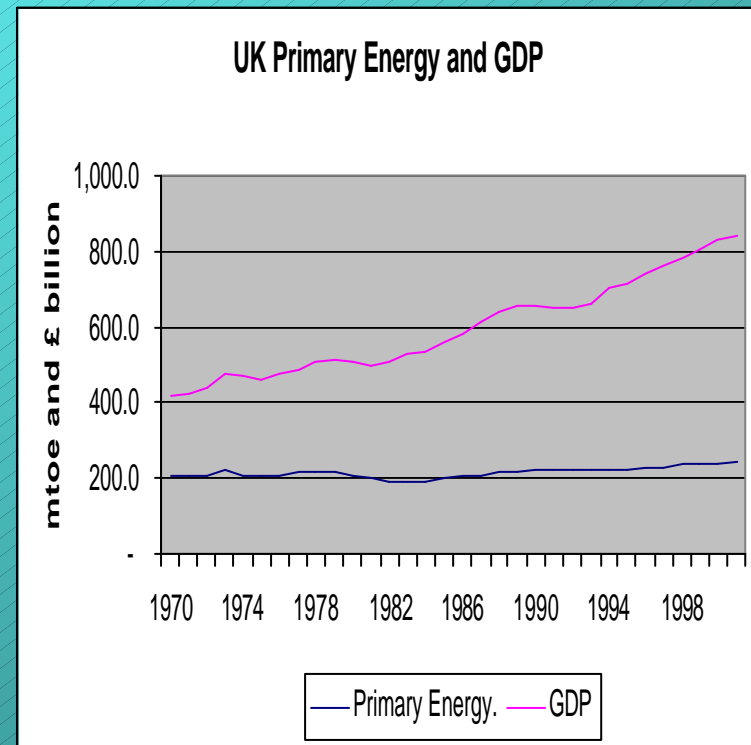
Developed World
67%

UK Energy Consumption By Sector 1971- 2001

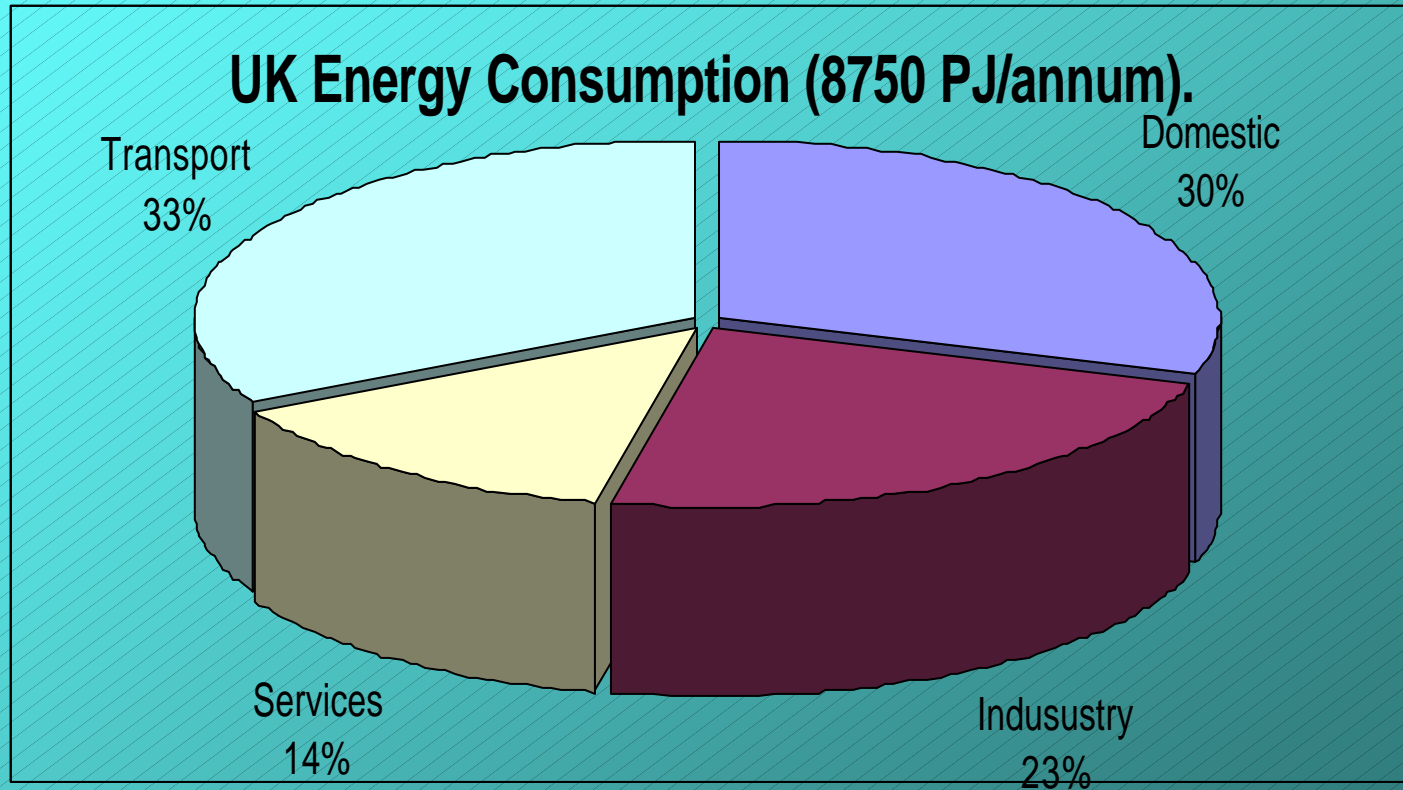


The Need for Change

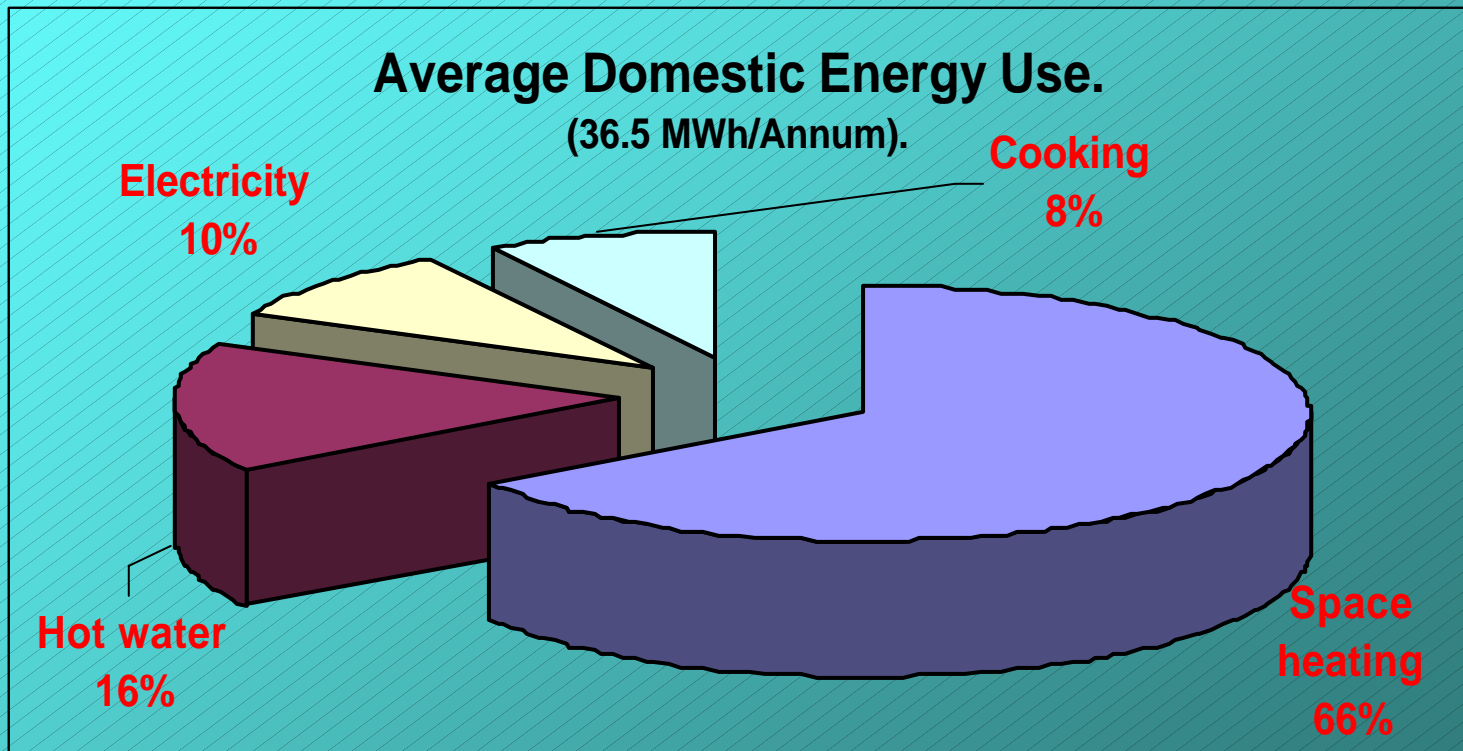
- Standard of living is associated with energy use
- Developing countries will need more energy (50% increase by 2020)



Where We Use Our Energy



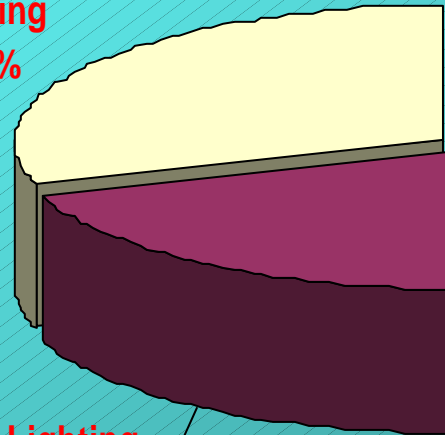
In The Home



Commercial Sector

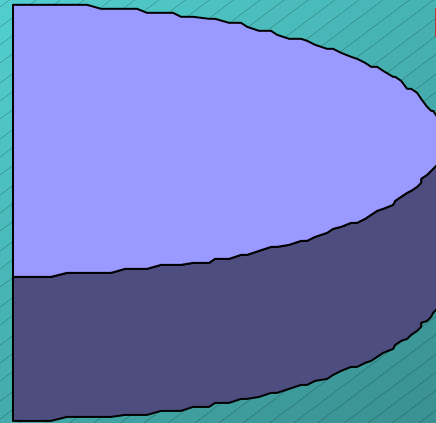
Commercial Energy Use.

Ventilation and
Cooling
30%



Lighting
20%

Space and Water
Heating
50%



UK CO₂ Emissions

Chart 1: Overall CO₂ emissions

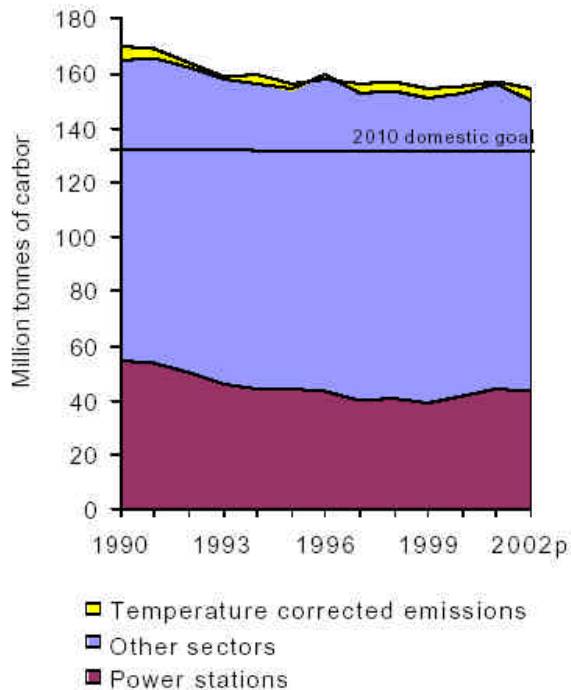
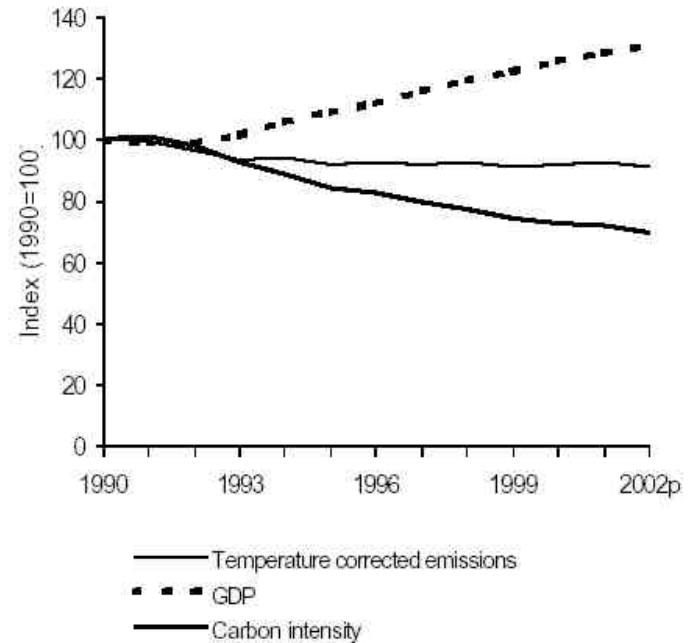
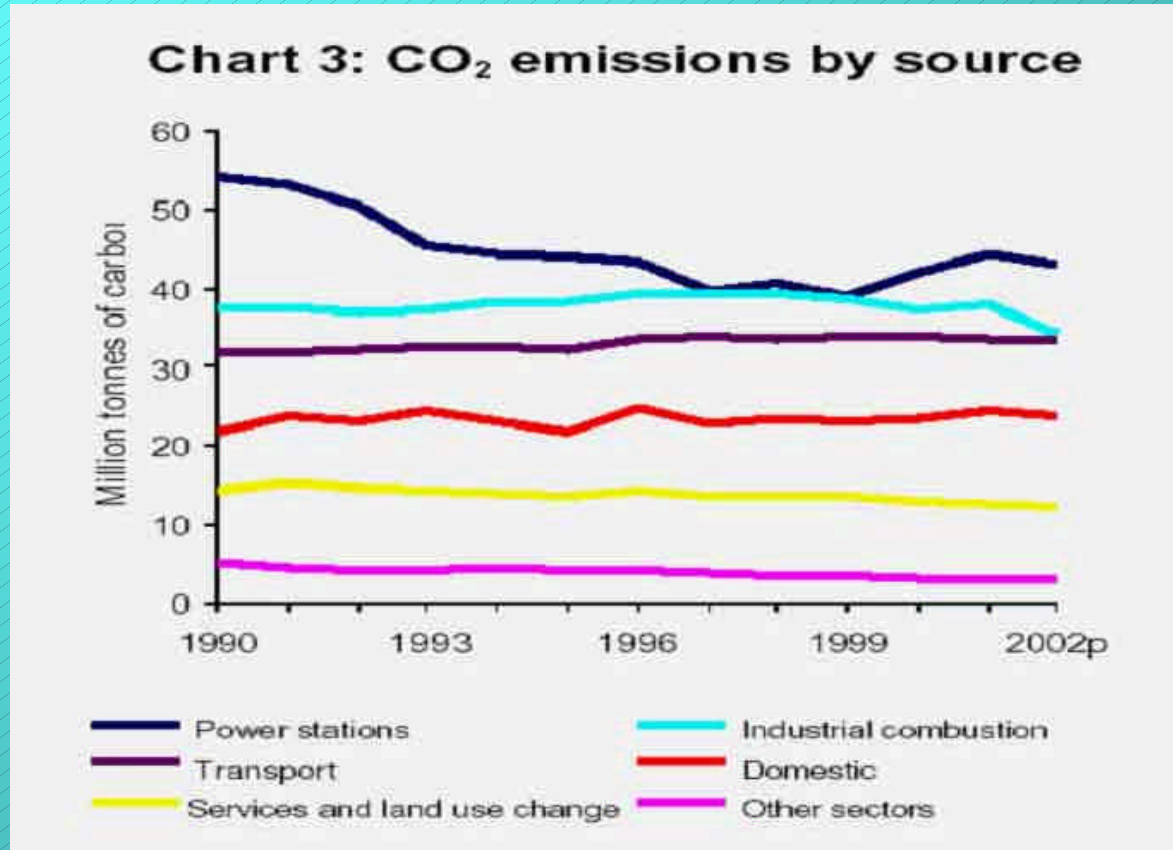


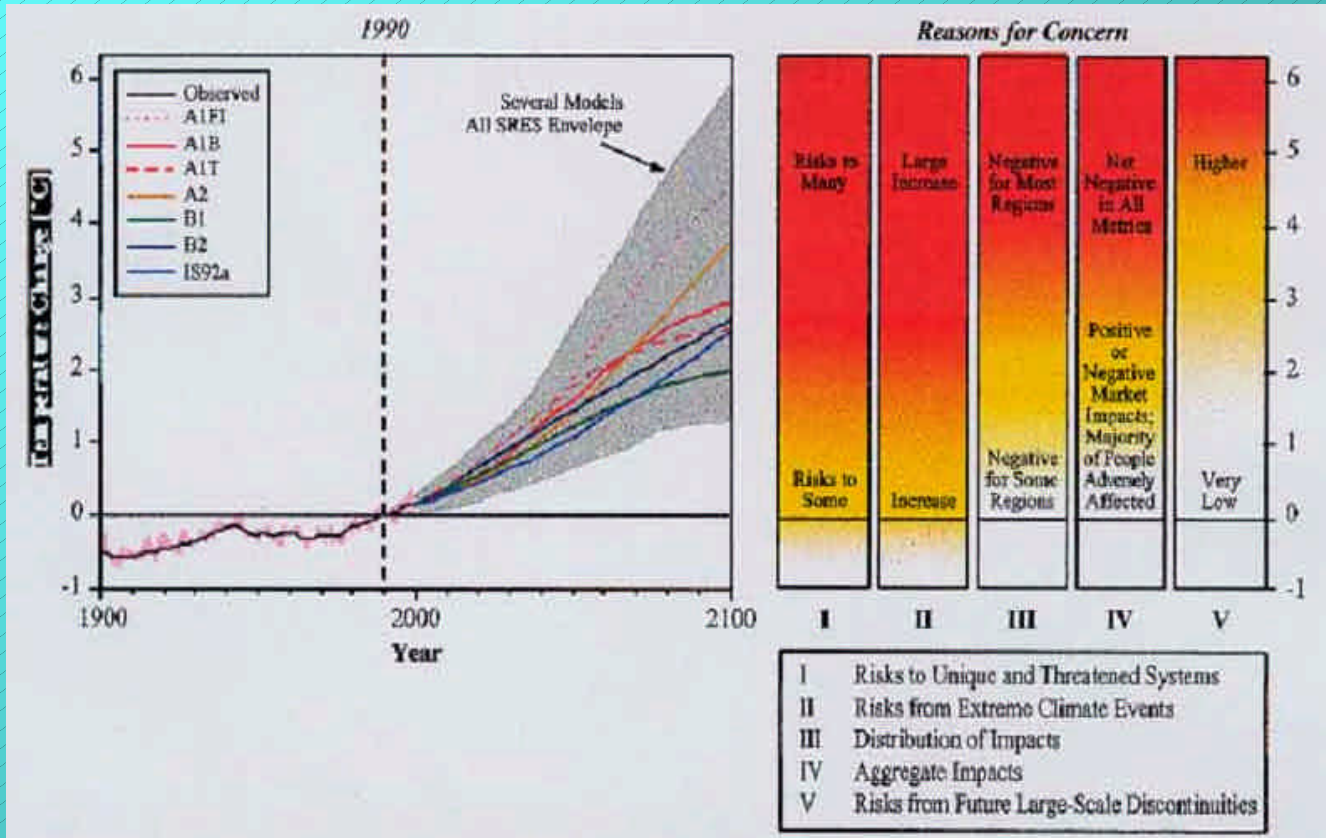
Chart 2: Carbon intensity



CO₂ Sources in the UK.



Global Warming



Energy Conservation the First Renewable

- It is almost always cheaper to conserve than to generate.
- The UK could reduce its energy consumption by 60% using existing technologies and strategies.

UK Mechanisms

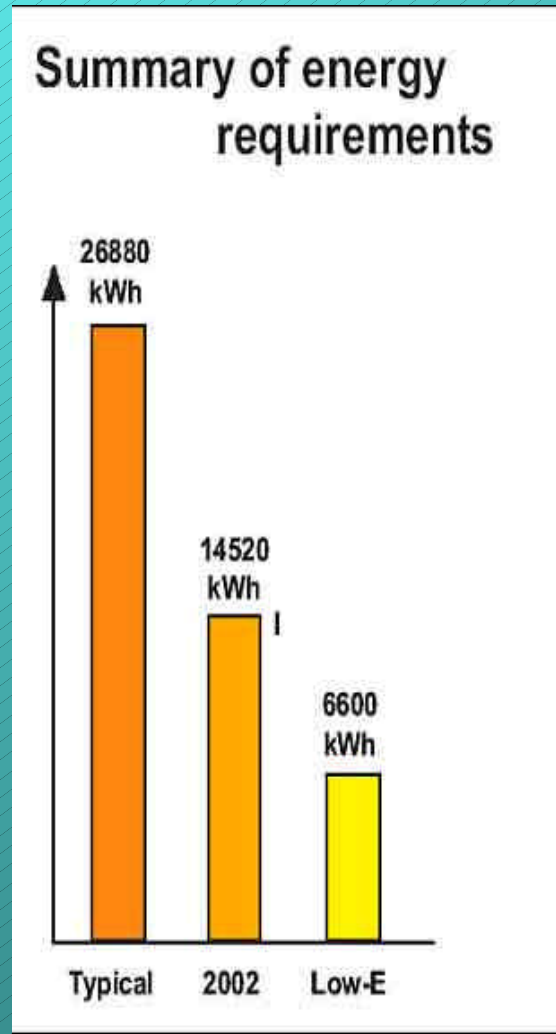
- Carbon Levy
- Building Regulations
- HECA
- Energy Advice

Climate Change Levy

- Tax on energy used by nearly all non-domestic consumers
- Electricity 0.43p/kWh
- Gas and Coal 0.15p/kWh
- LPG 0.07p/kWh
- Industry can get up to 80% discount in return for agreed energy savings

Building Regulations

- Now apply to building extensions and conversions
- Moving towards assessing carbon emissions



Home Energy Conservation Act

- Places obligation on local authorities to reduce energy consumption
- A 30% reduction was considered achievable by 2008
- By 2002 figures of varying between 1-20% for different authorities

Energy Advice

- Energy Advice Centres
- Action Energy
- Energy Saving Trust

Government Support for Renewable Energy

- Renewable Obligation Certificates (ROC's)
- 1MWh/ month minimum
- Levy Exemption Certificates (LEC's)
- 10MWh minimum
- Capital Grants for emerging technologies

Conventional Hydroelectric

- Large Commercial Resource (1240TWh/annum).
- Only 50% harnessed world wide to date. Most potential in developing countries
- Low electricity cost in long term
- European resource already utilised (70%)



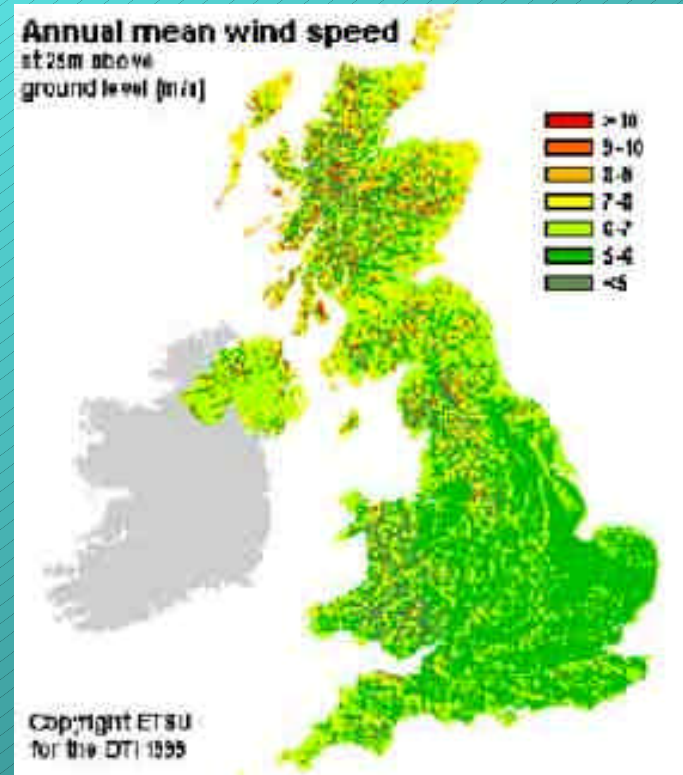
Micro-Hydro

- UK could double existing hydro production
- Produce Electricity at 0.045-0.06 Euro/kWh
- Run of river so intermittent supply.
- Small and distributed generation. 1-1000kw



Wind

- Large Resource
1200TW world wide
- UK has best European
resource 3 times UK
electricity requirement



Onshore Wind

- Very low impact.
- Produce Electricity at 0.029-0.038 Euro/kWh
- One of the fastest growing sectors of the generation market
- Much misinformation from objectors

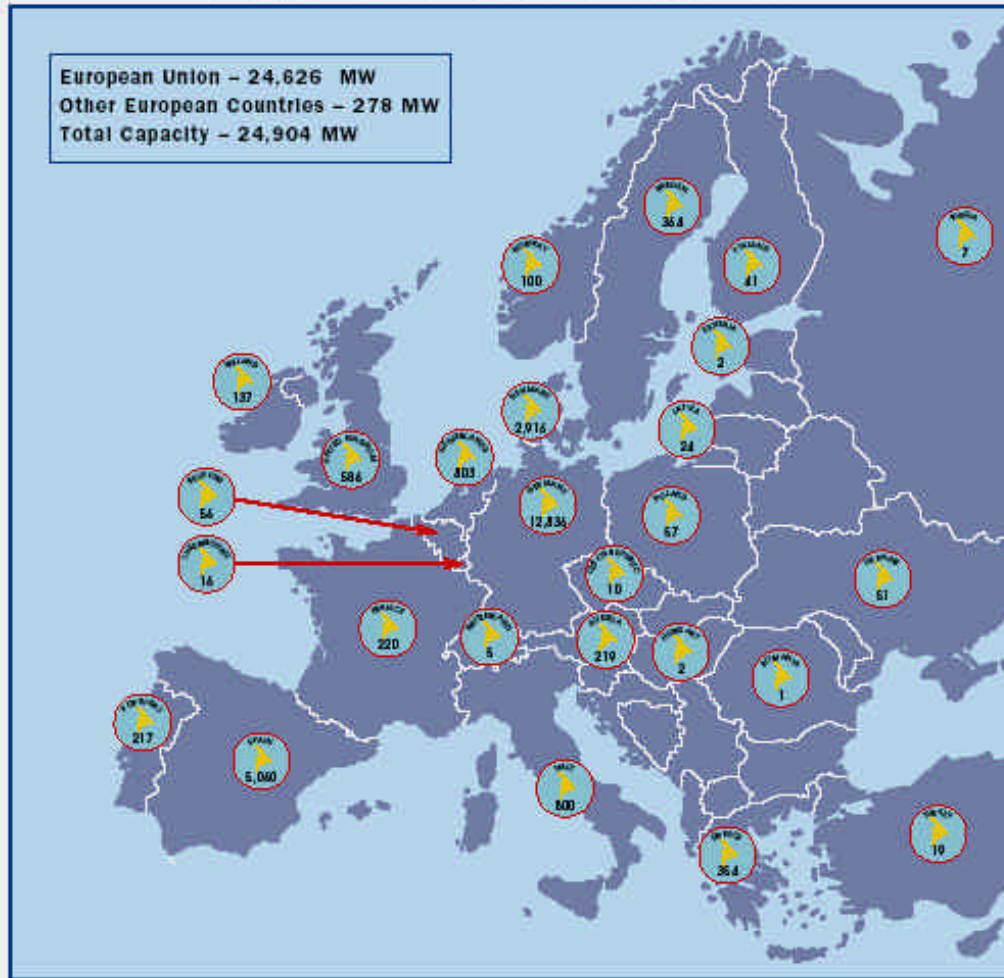


UK Windfarm Sites

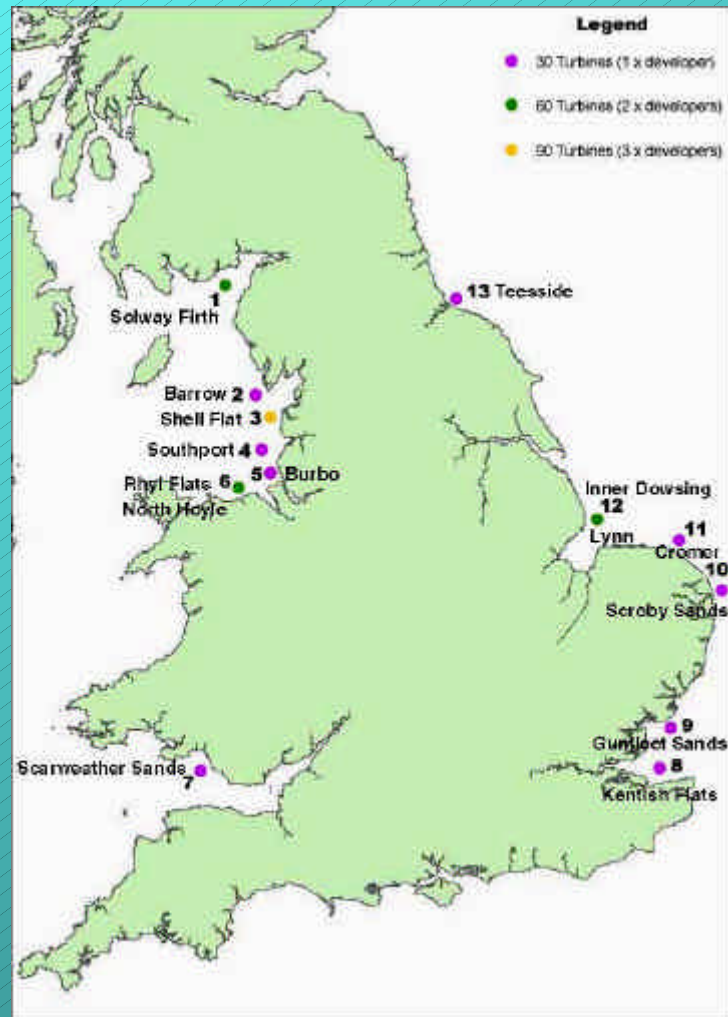


Europe's Wind Capacity – June 2003

European Union – 24,626 MW
Other European Countries – 278 MW
Total Capacity – 24,904 MW



UK Offshore Sites

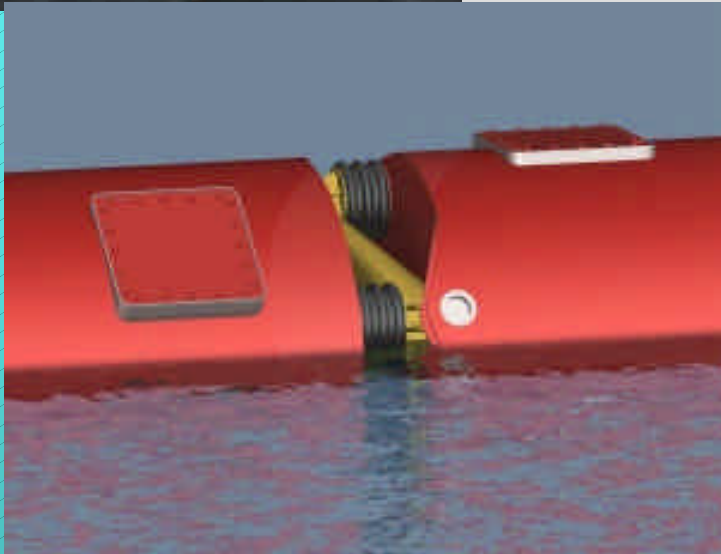
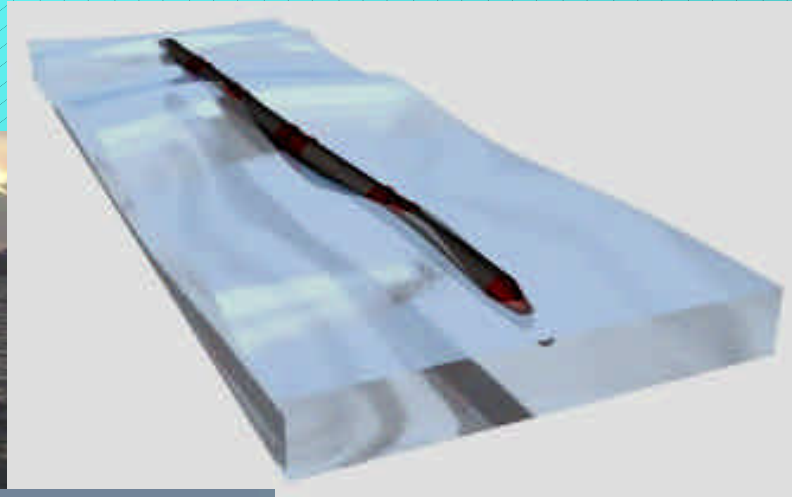


Wave Power

- Large resource
- UK 24-70 kW/m of wave
- New technology
- Intermittent Supply
- Becoming commercially viable.



Pelamis



Tidal Current

- Limited Site Availability
- New technology maturing over next 10 years.
- Reasonable economics when sites available.



Stingray

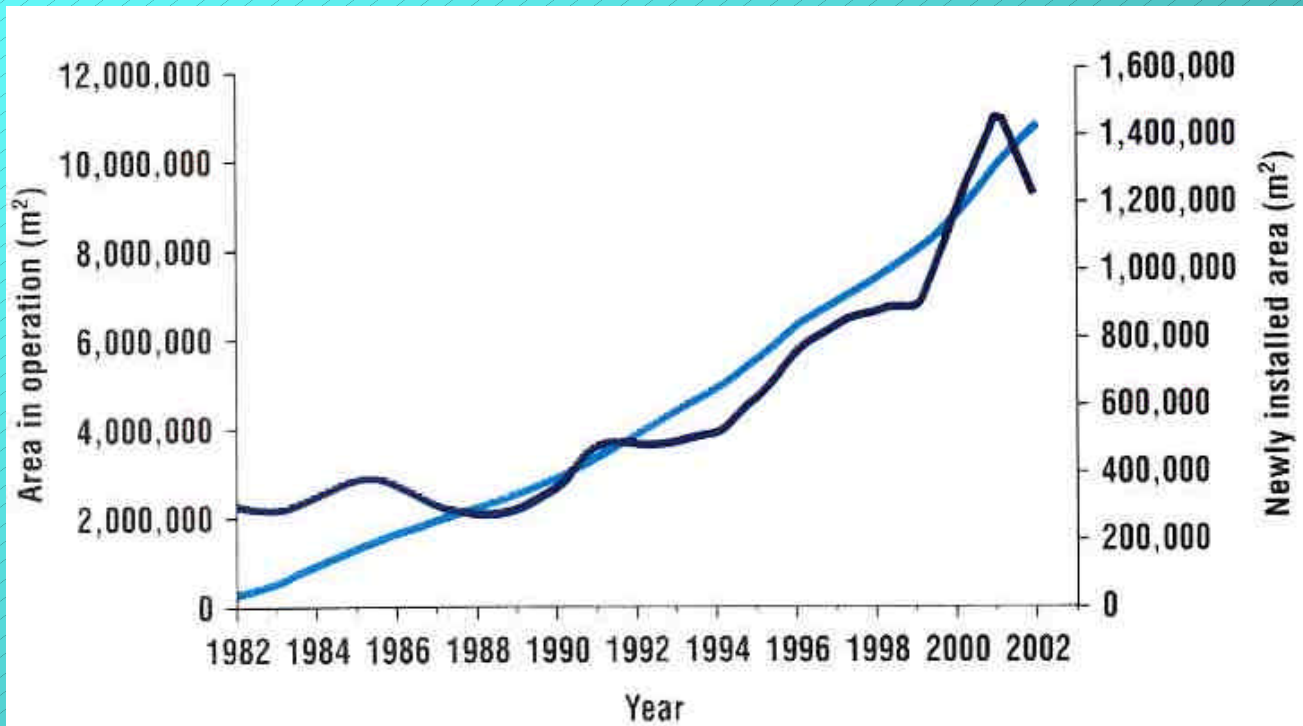


Solar Thermal (Domestic Hot Water)

- Provides up to 60% of domestic hot water supply in U.K conditions.
- Many different types to suit most applications and sites
- Target temperatures range from 25°C (swimming pool)- 60°C+(domestic hot water and industry)



Flat Plate Production in Europe



Flat Plate Production in Europe

TABLE 2. Market growth in selected countries

	Newly installed 1995 (m ²)	Newly installed 2000 (m ²)	Average annual growth 1995–2000
Spain	9,800	40,487	33%
Germany	193,000	620,000	26%
France	7,700	23,500	25%
Italy	17,850	45,249	20%
Netherlands	12,706	27,661	17%
United Kingdom	7,596	11,850	9%
Greece	169,000	181,000	1%
Austria	160,660	152,944	-1%

UK Absolute Potential 233million m²

Solar Thermal (Electric)

- Requires concentrator to achieve temperatures over 100°C
- Appropriate in clear climates such as deserts



Solar Photovoltaic

- Usable resource approximately 266TWh in UK
- Small installation size (10W-100kW_p).
- Energy Payback in 3-5 years.
- Easily building integrated

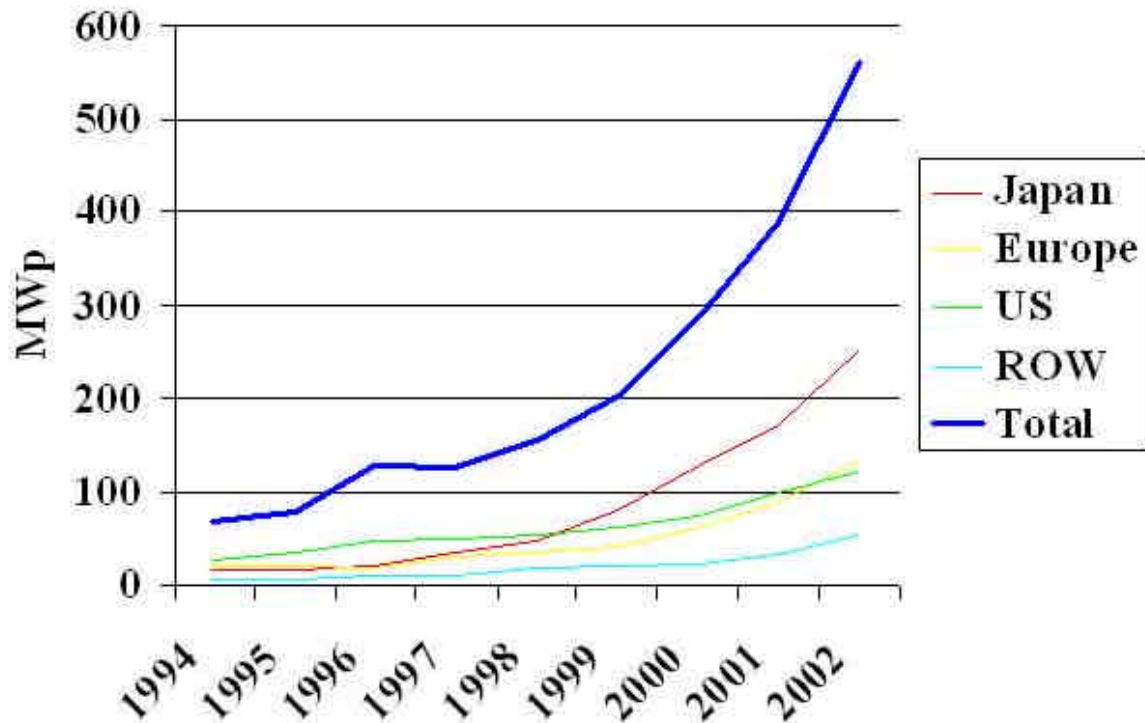


Solar Photovoltaic

- Low efficiency 5-15%
- High Costs £5/W
- Two technological generations away from a low cost high efficiency module

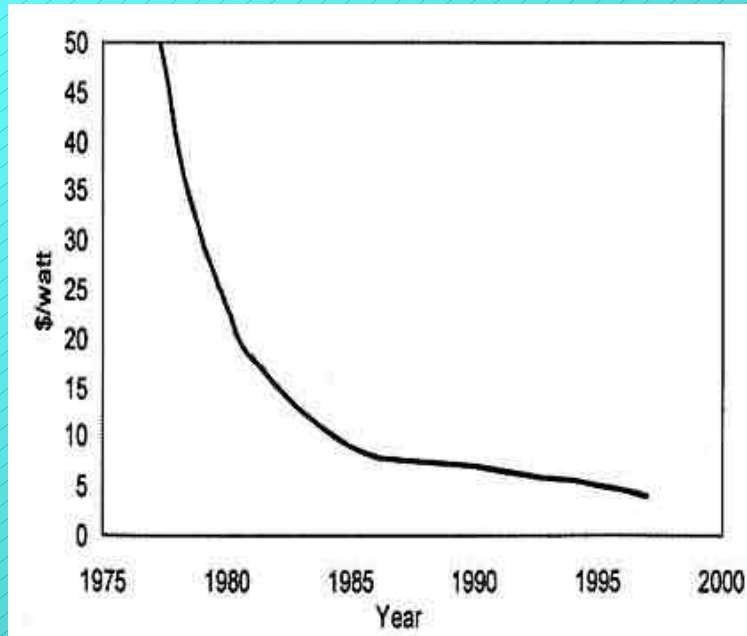


World PV Manufacture



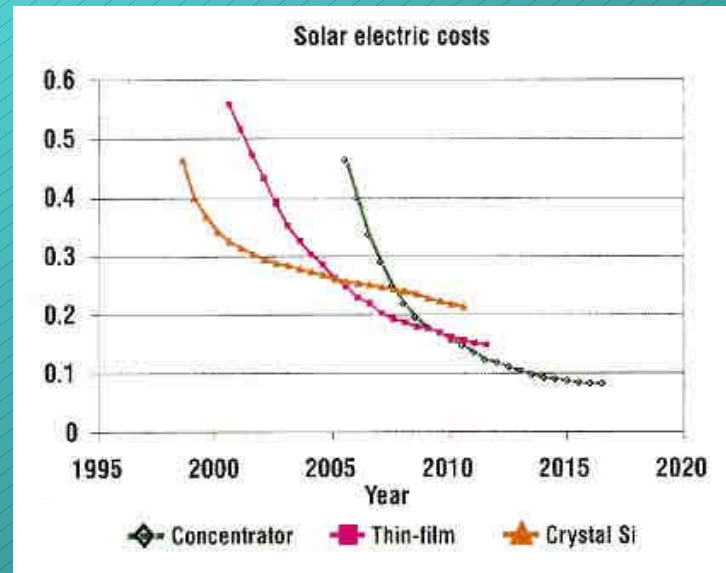
Cost of PV Panels

Source Messenger and Ventre



- Costs fallen to \$3-4/W_p
- Electricity Cost \$0.30-0.50/kWh

Source Renewable Energy World

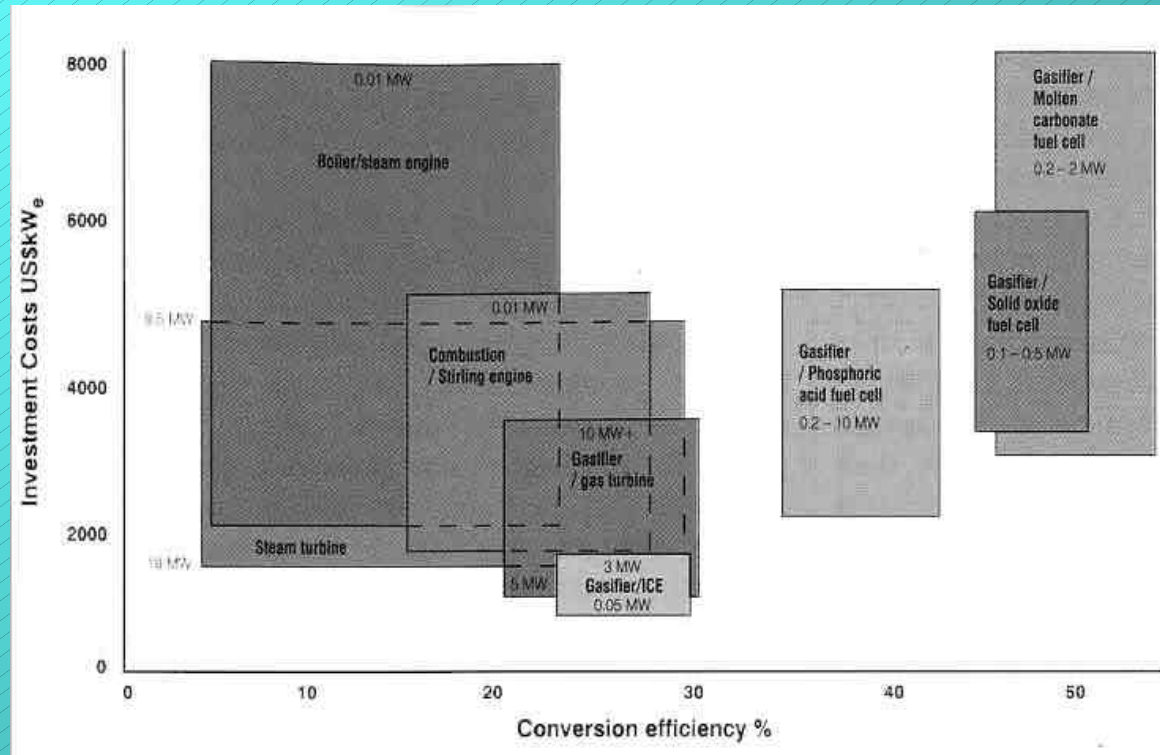


Biomass (Combustion)

- Fuels in the UK include: forest residue, woodchip, pellets, short rotation coppice (SRC), straw.
- UK potential largely untapped
- Lack infrastructure



Biomass (Costs And Efficiency)



Biomass (Anaerobic digestion)

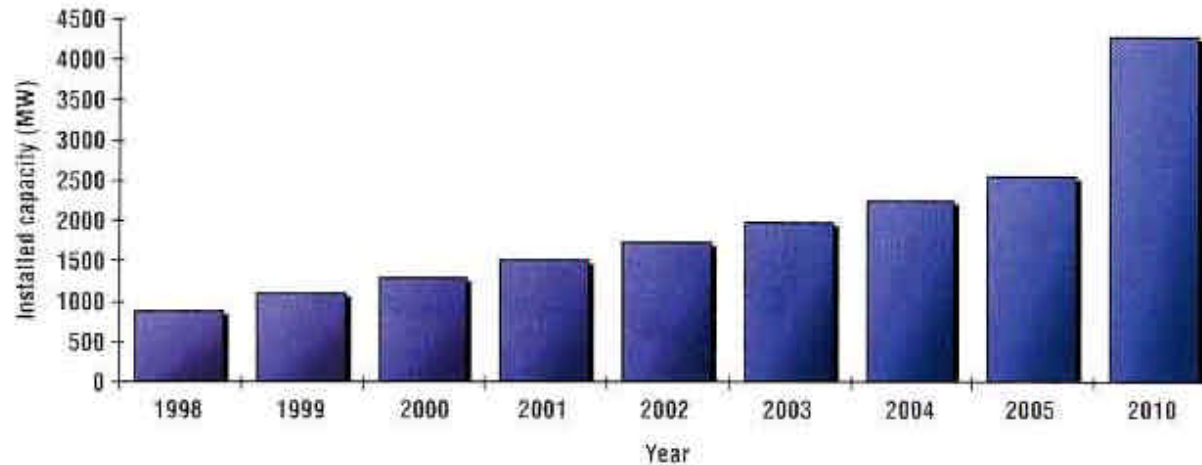


FIGURE 1. Installed capacity forecast for total European biogas energy market (landfill, wastewater treatment, agriculture and the industry), 1998-2010. Source: Frost & Sullivan

Country	Share of biogas capacity by sector (%)				Total
	Wastewater treatment	Agriculture	Industry	Landfill	
Germany	29.1	62.4	27.3	24.4	35.5
UK	22.9	3.6	11.4	35.3	18.3
Italy	17.3	12.7	25.0	8.0	15.8
Denmark	6.1	15.2	11.4	1.6	8.5

Conclusions

- The potential is huge
- Progress in RE and Energy Conservation is not progressing quickly enough
- RE supplies are often intermittent
- New strategies will be required for distribution and demand management in the future