

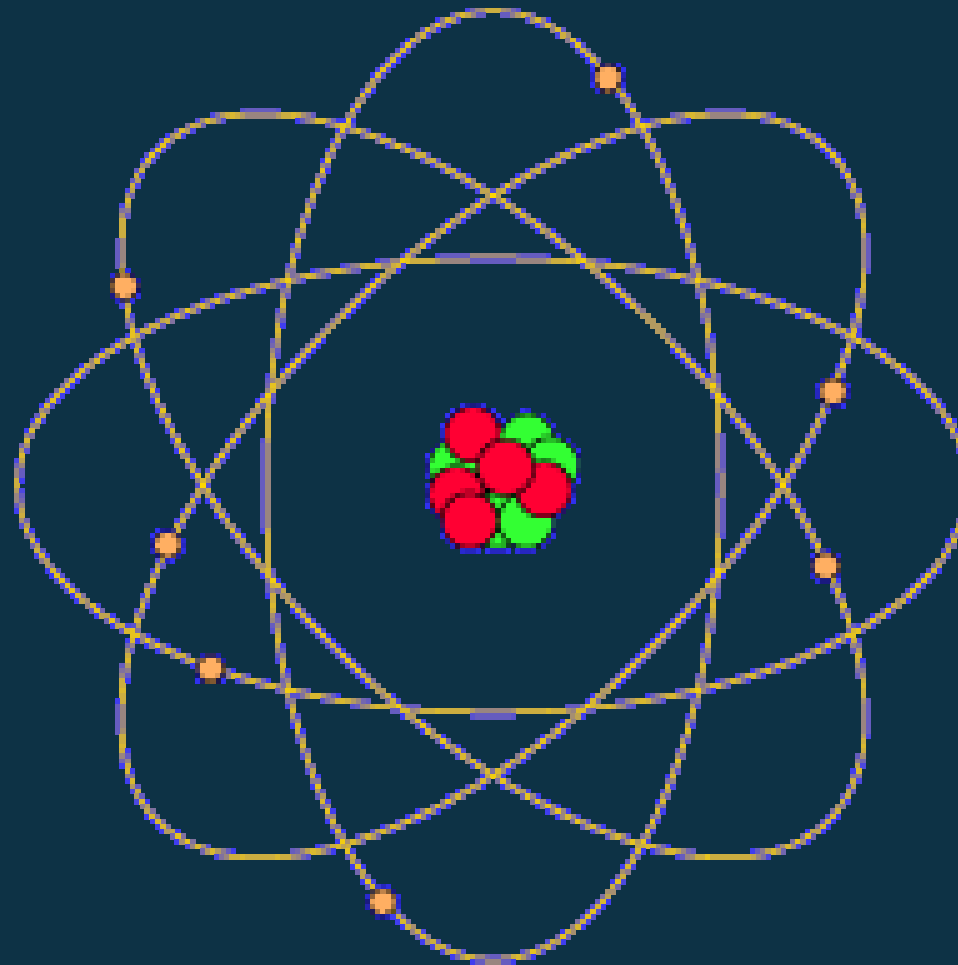


The Nuclear Option

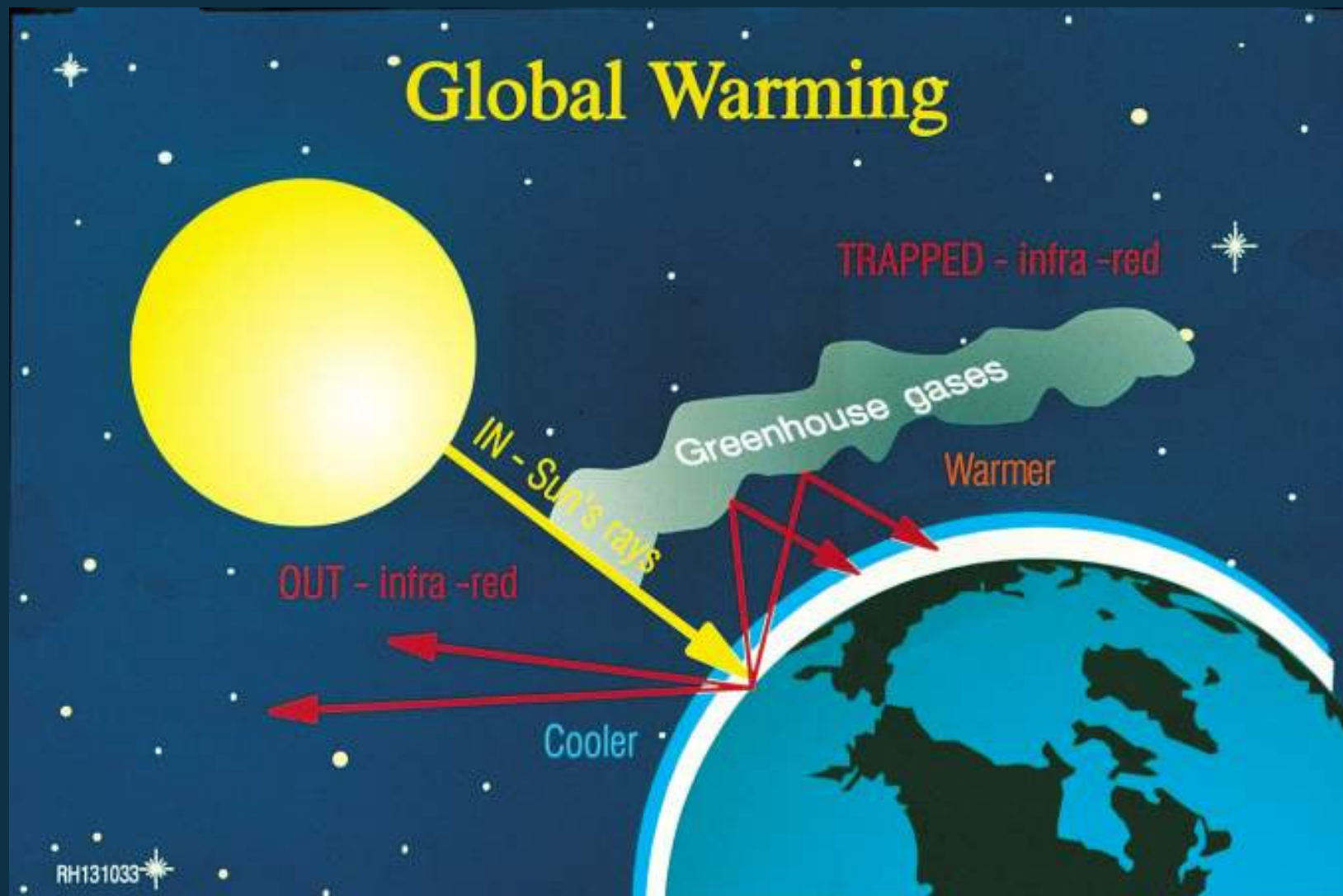
Dr Robert Hawley
CBE, FRSE, FREng



Why Nuclear?



Global Warming

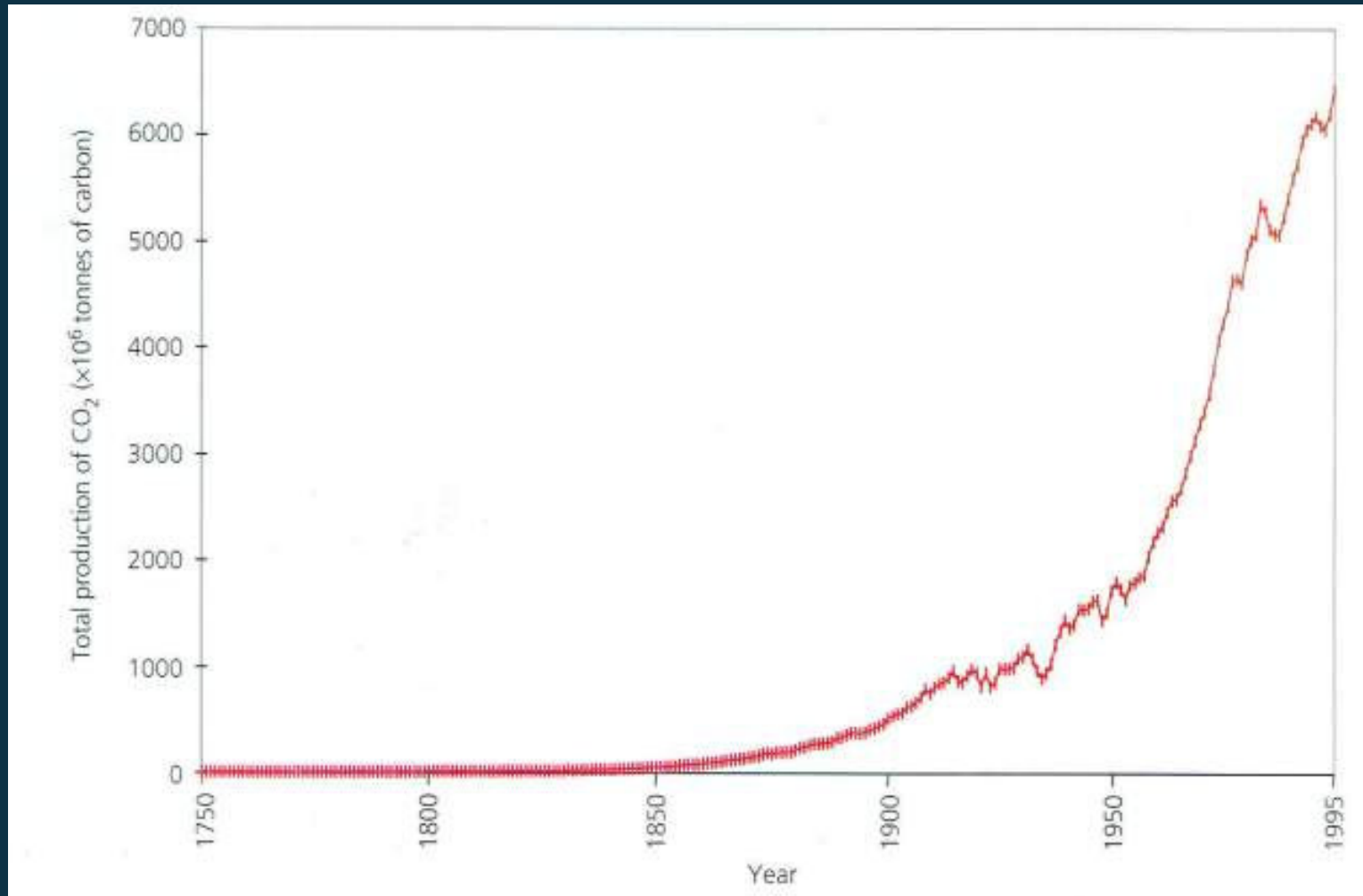


The Contribution Of Greenhouse Gases To Global Warming

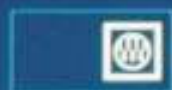




Industrial Emissions of Carbon Dioxide



World population projections



**Nuclear
Electric**

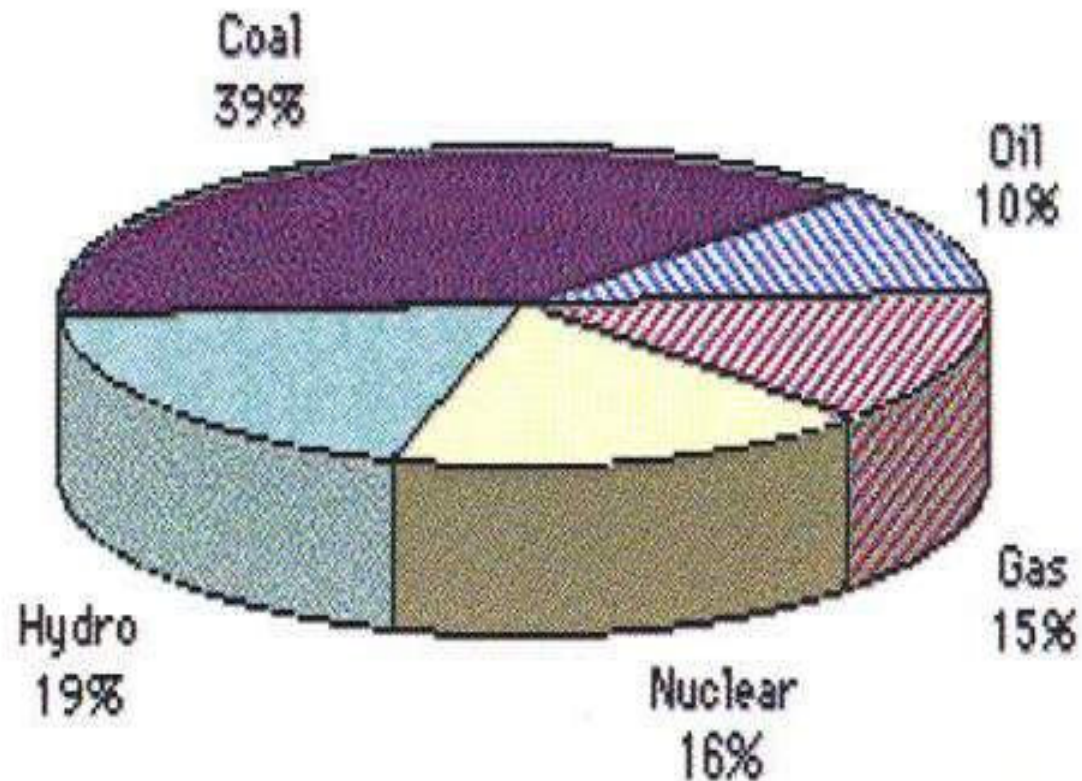


Cities With Population Over 6 Million By 1990



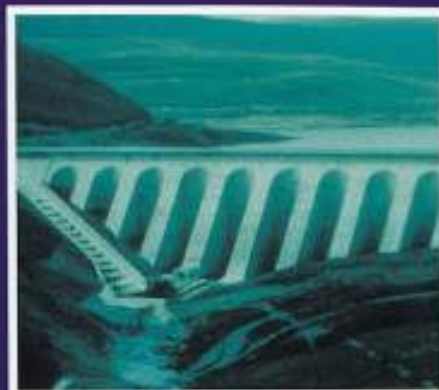


Fuel Sources for Worldwide Electricity Generation





Diversity of supply

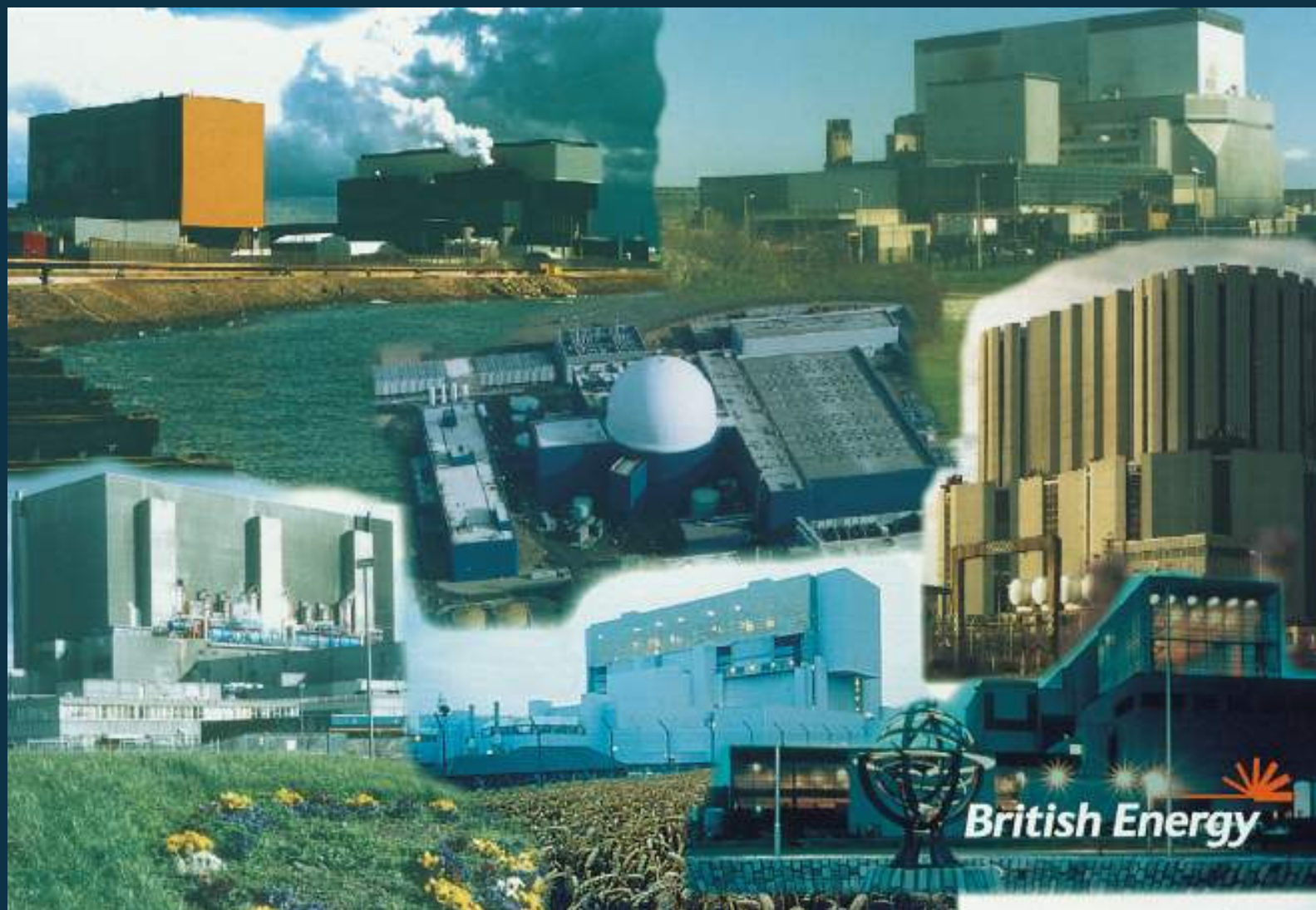


British Energy 



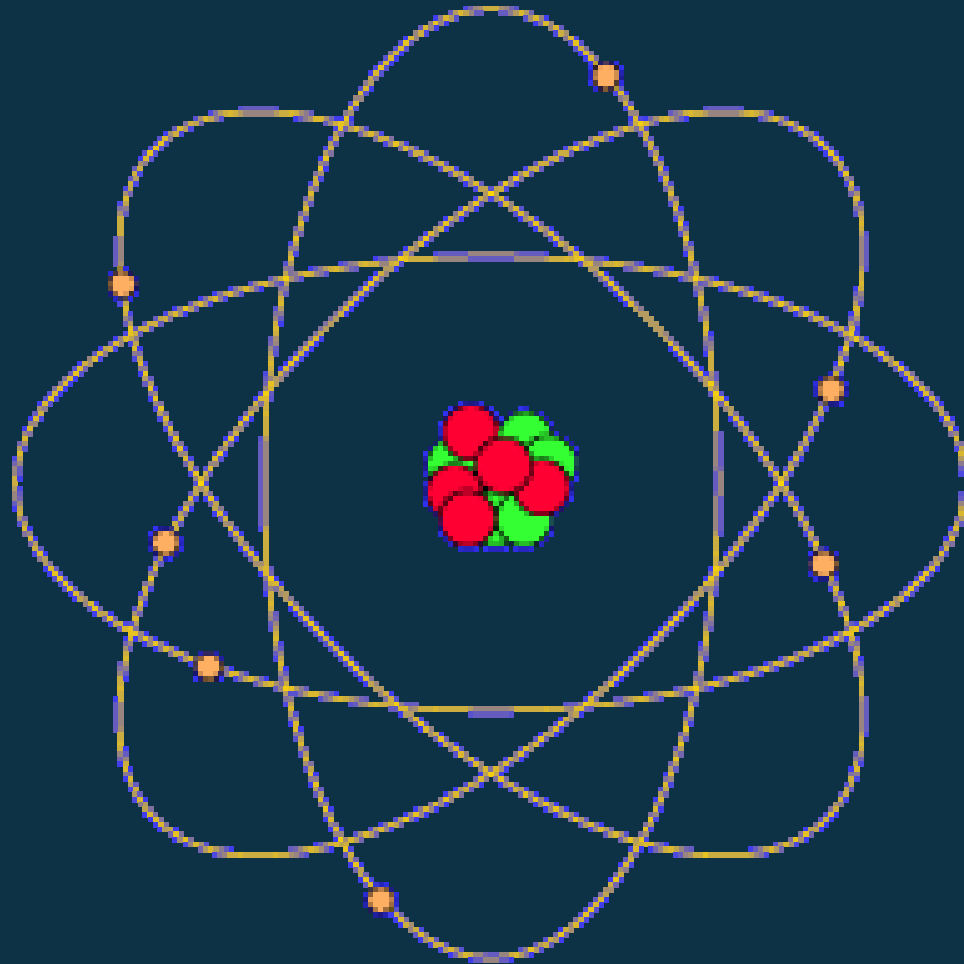
Renewables - Conservation - Nuclear





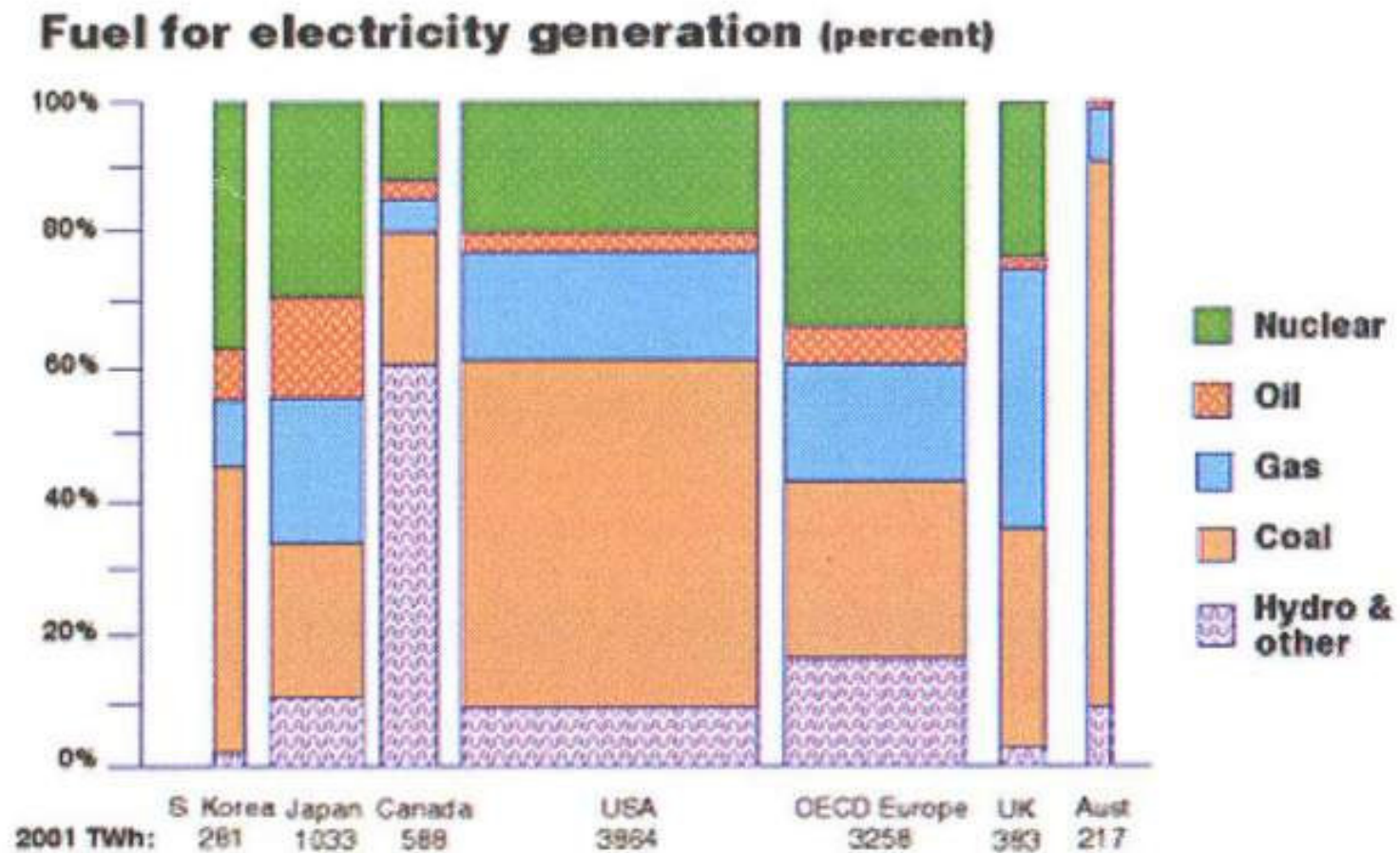


The Present



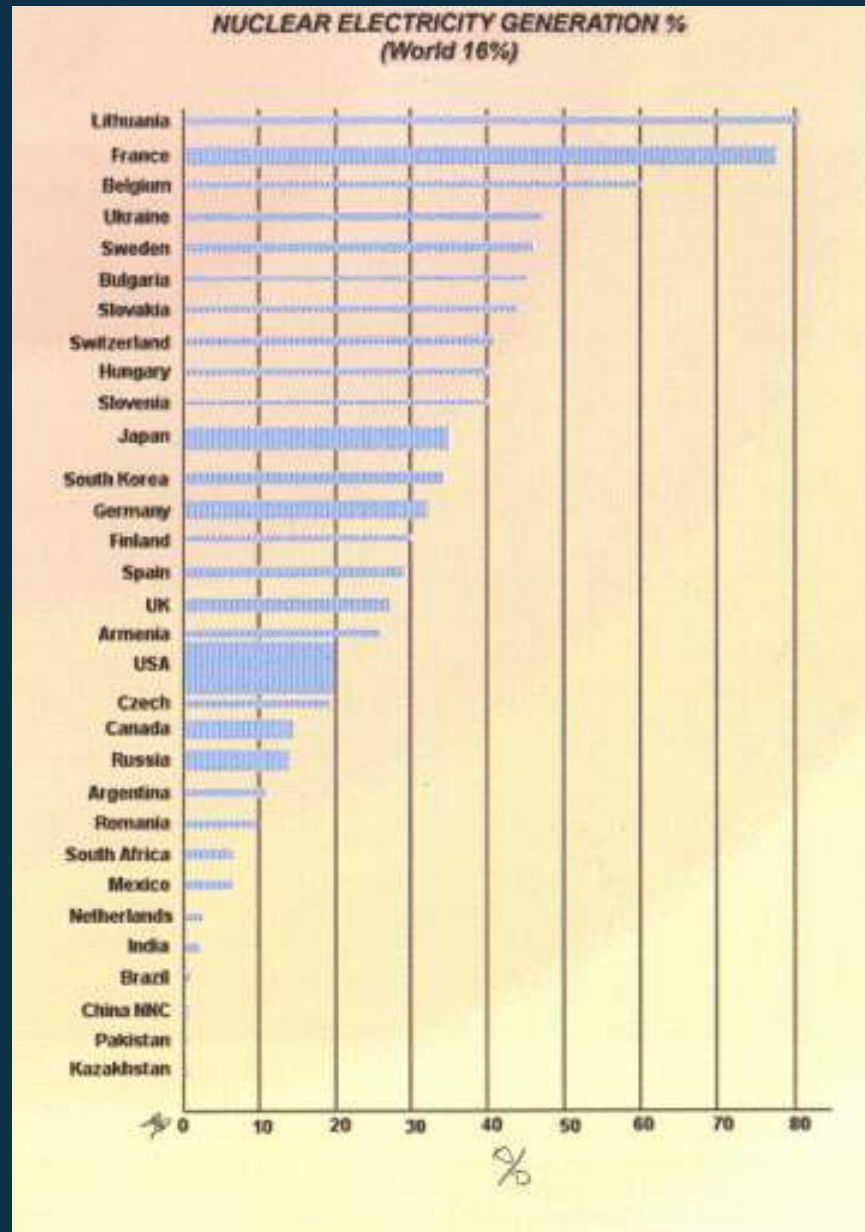


World % of Nuclear Power





Nuclear generation in different countries



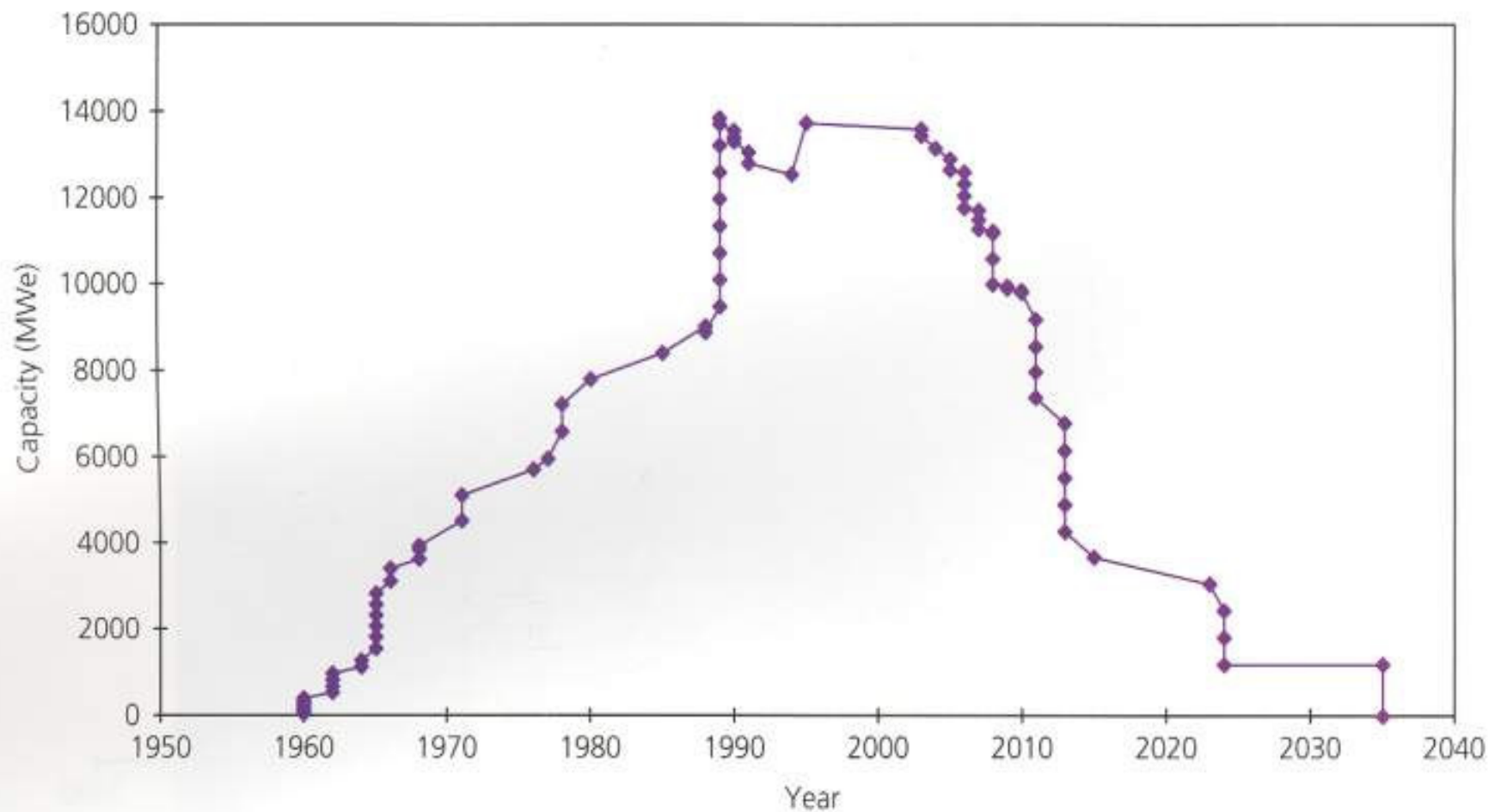


UK Nuclear Fleet

Reactors	Type	New capacity each	Start Operation
Dungeness A 1 & 2	Magnox	225 MWe	1965
Oldbury 1 & 2	Magnox	217 MWe	1968
Sizewell A 1 & 2	Magnox	210 MWe	1966
Wylfa 1 & 2	Magnox	490 MWe	1971-72
Dungeness B 1 & 2	AGR	555 MWe	1985-86
Hartlepool 1 & 2	AGR	605 MWe	1984-85
Heysham 1 & 2	AGR	575 MWe	1985-86
Heysham 3 & 4	AGR	625 MWe	1988-89
Hinkley Point B 1 & 2	AGR	610 MWe	1976-78
Hunterston B 1 & 2	AGR	595 MWe	1976-77
Torness 1 & 2	AGR	625 MWe	1988-89
Sizewell B	PWR	1188 MWe	1995
Total 23		11852 MWe	



UK nuclear generating capacity





Problems with Nuclear

- Economics
- Disposal of Waste
- Safety
- Proliferation



Decommissioning in the UK

Decommissioned power reactors in UK

Reactors	Type	MWe each	shut down
Berkeley 1 & 2	Magnox	138	1988-89
Bradwell 1 & 2	Magnox	123	2002
Calder Hall 1-4	Magnox	50	2003
Chapelcross 1-4	Magnox	49	2004
Hinkley Pt 1 & 2	Magnox	235	2000
Hunterston A 1 & 2	Magnox	160	1989-90
Trawsfynydd 1 & 2	Magnox	196	1993
Windscale	AGR	28	1981
Dounreay PFR	FBR	254	1994
Winfrith	SGHWR	92	1990
total: 21			



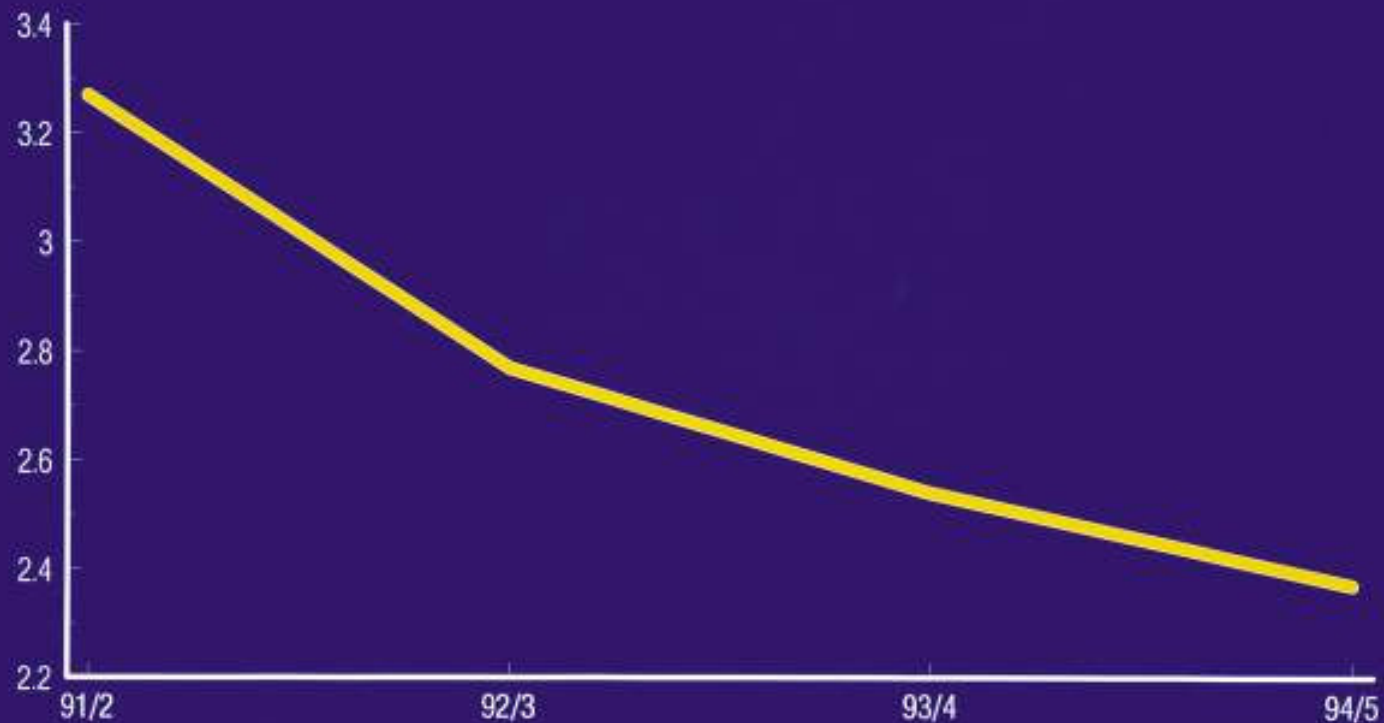
Queen & Calder Hall





Nuclear Electric Unit Costs

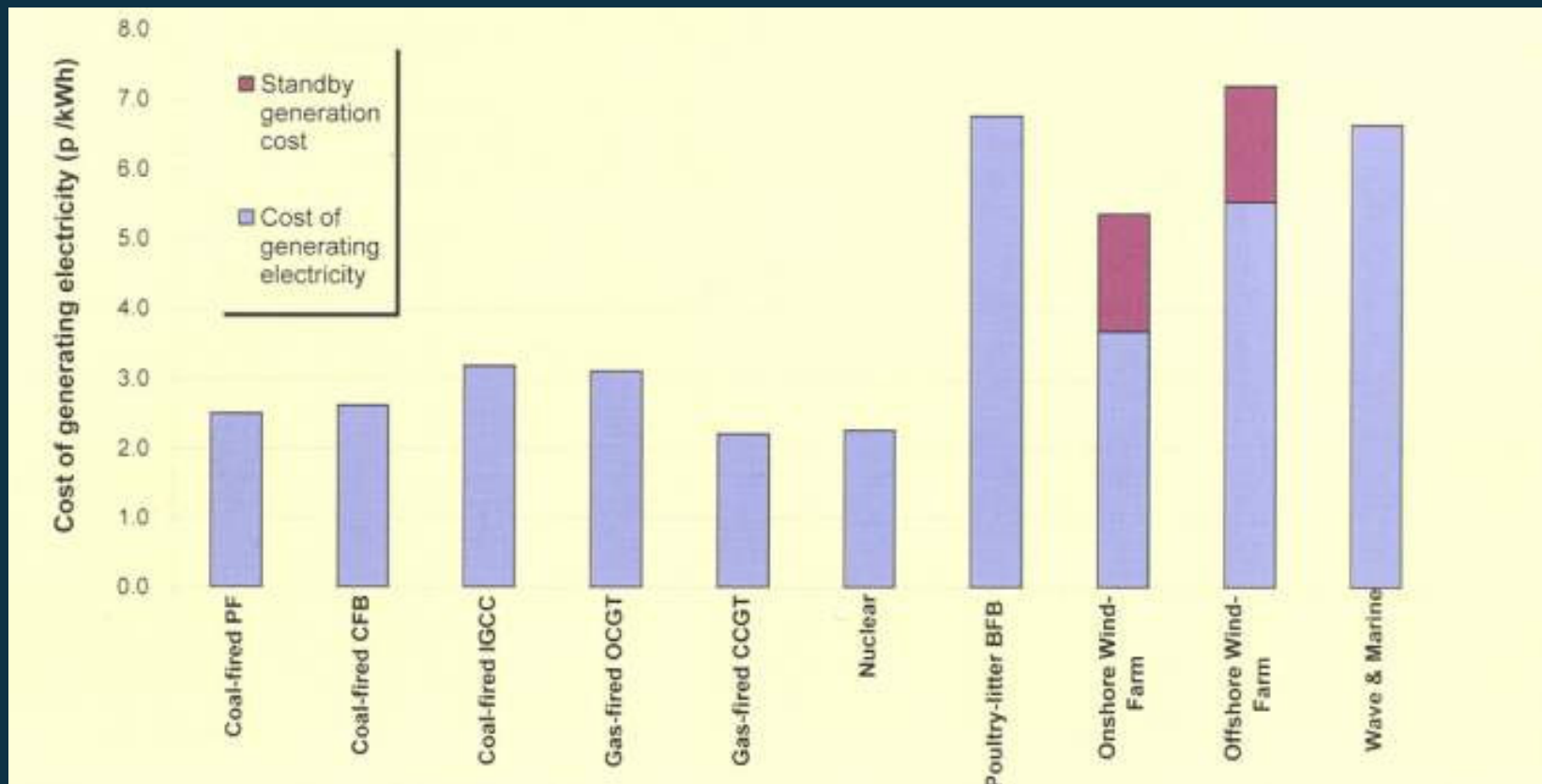
Unit Costs p/kWh



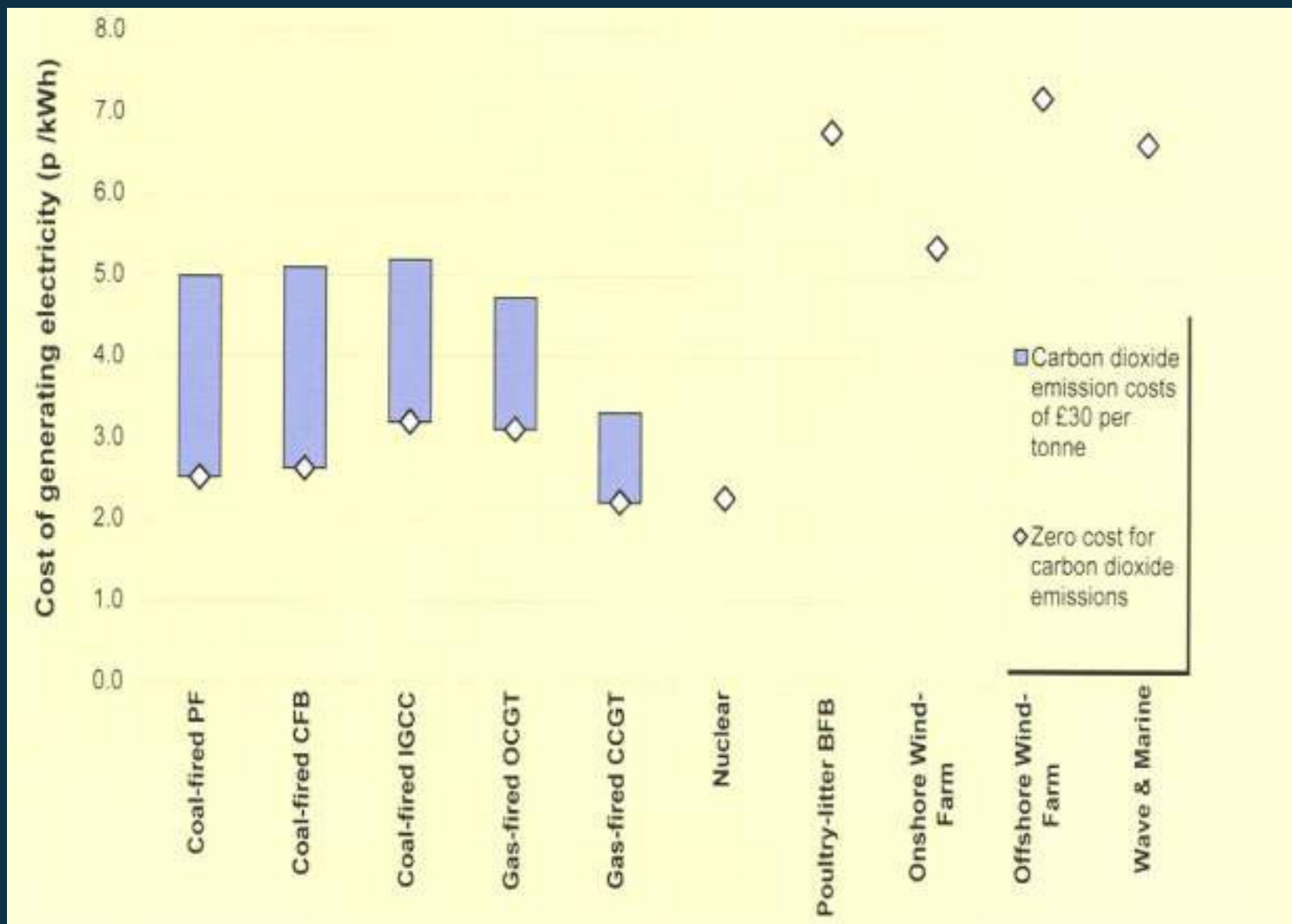
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British Energy

Baseload costs of Nuclear



Baseload costs plus Carbon





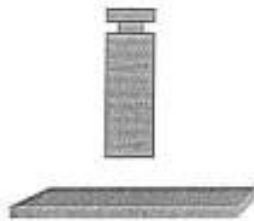
NUCLEAR WASTE

- VERY LOW LEVEL WASTE (VLLW)
- LOW LEVEL WASTE (LLW)
- INTERMEDIATE LEVEL WASTE (ILW)
- HIGH LEVEL WASTE (HLW)



High Level Waste

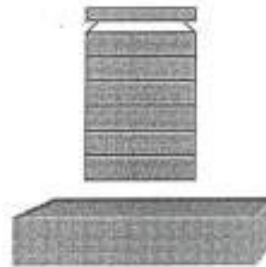
99%
of radioactivity



0.1m³

High Level Waste
(HLW)

1%
of radioactivity



1m³

Intermediate Level
Waste (ILW)

0.001%
of radioactivity



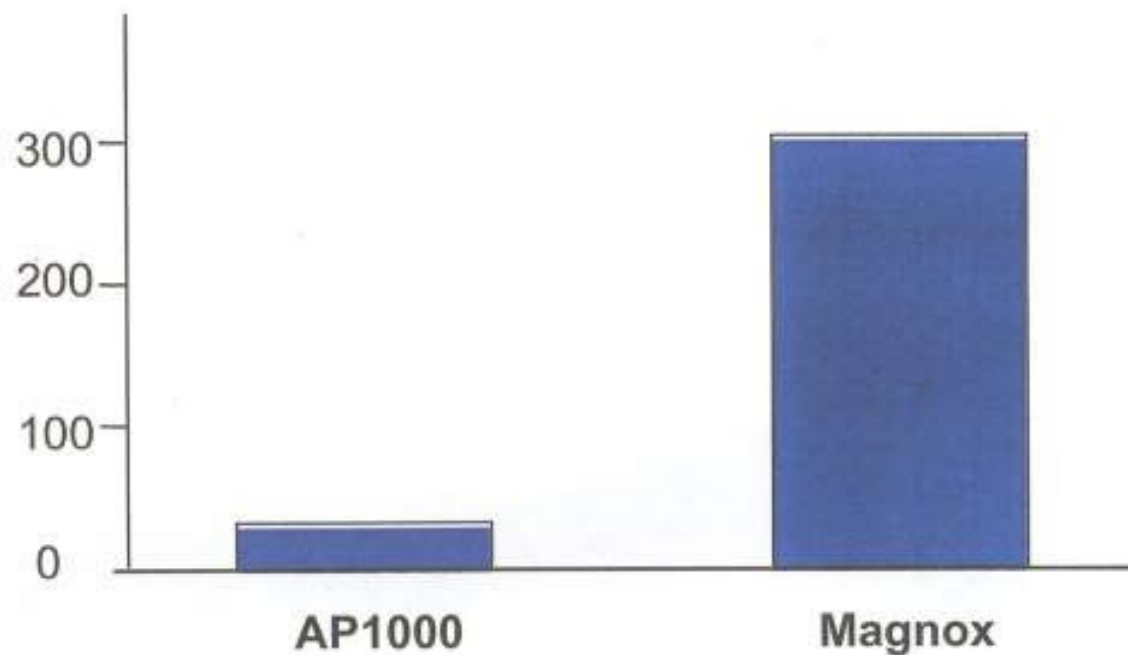
4m³

Low Level Waste
(LLW)

Fuel for an AP1000

AP1000 fuel requirements are very low compared to Magnox reactors

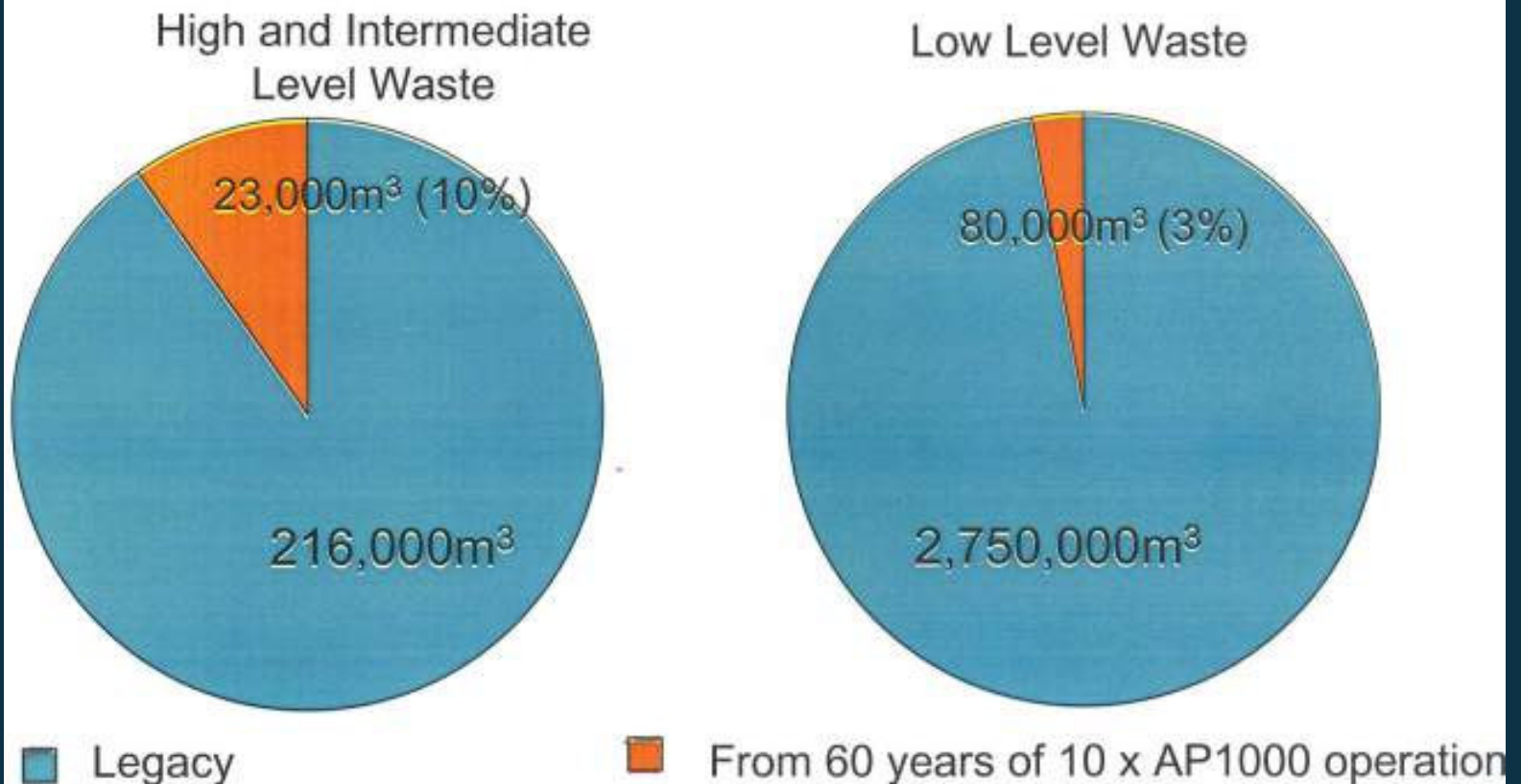
Tonnes of fuel/year to
generate 1GW (electricity)





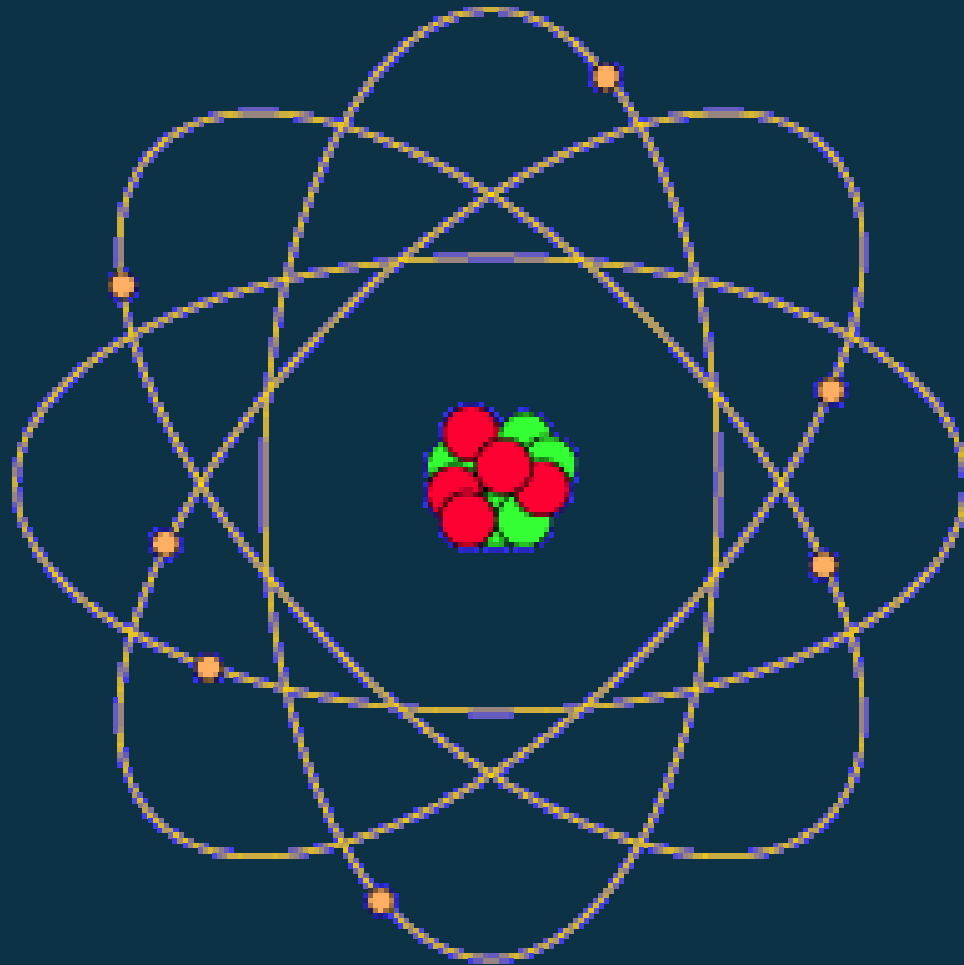
Additional Waste Arising from AP1000

Waste Arisings from a new build programme represent only a small addition (< 10%) to the existing legacy waste inventory





SAFETY

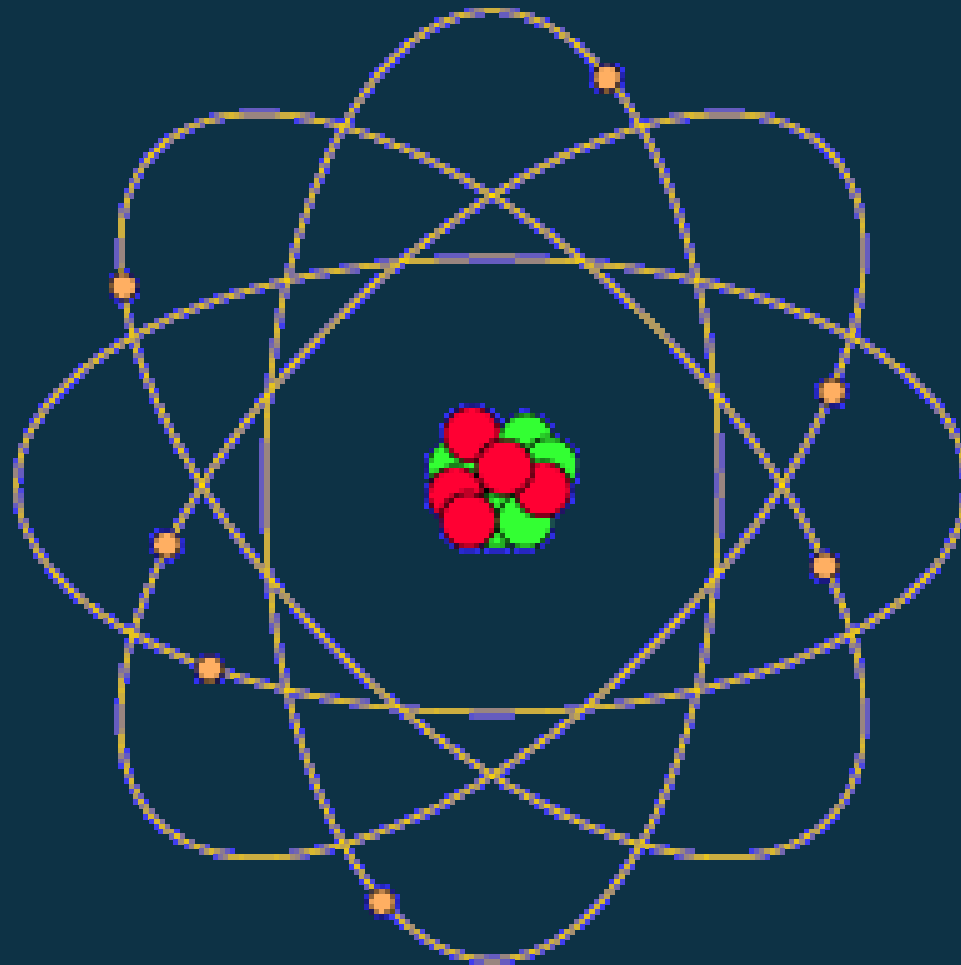


Nuclear Proliferation

- No 'technical fixes'
- Only prevented by international safeguards

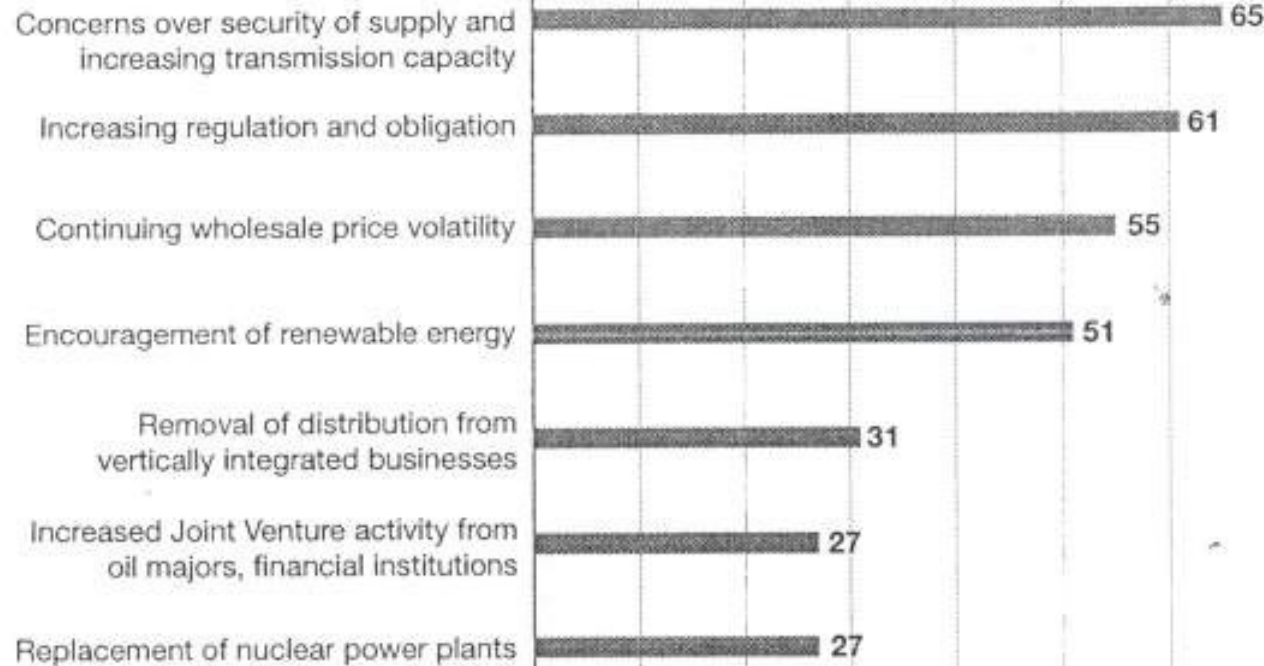


Advantages of Nuclear Power





Global overview of concerns of Energy Utilities

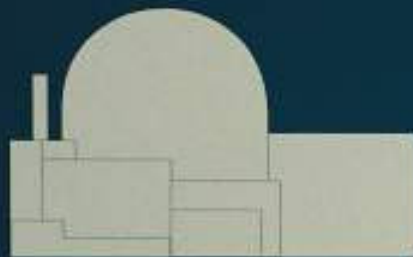




Wind v Nuclear costs

Sizewell C

£3.5 billion



3.0p/unit



5.8p/unit

Wind Farm

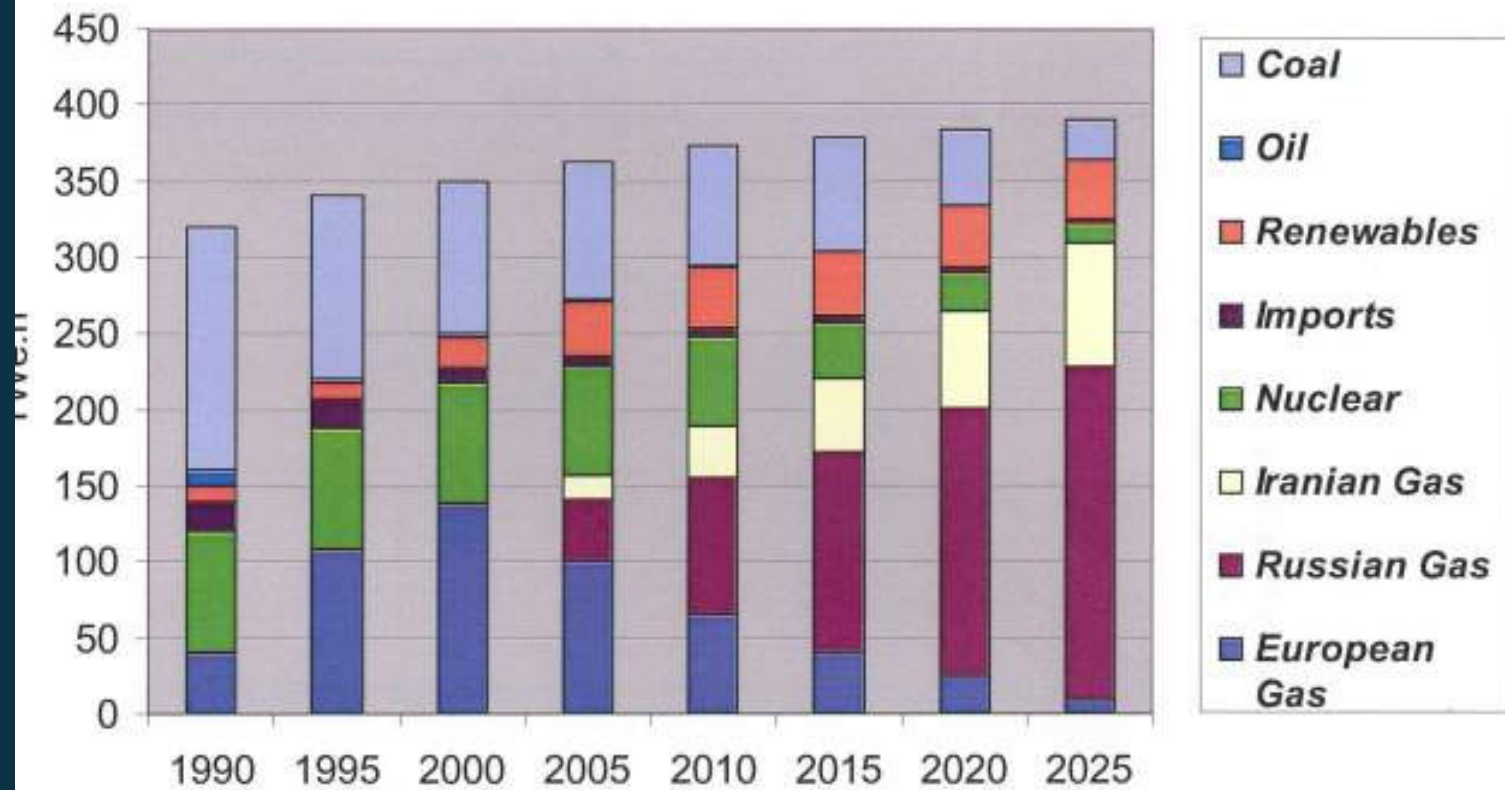
£7.2 billion



Road access -
John O'Groats to Lands End five times

Sources of UK Electricity

Sources of UK Electricity.



Financial Times 11th August 2004

Oil imports exceed exports for the first time in 11 years

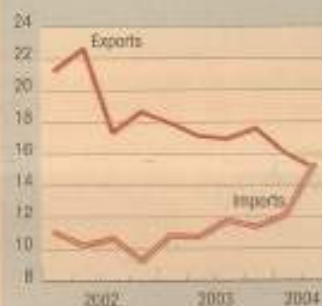
By Kevin Morrison and Steve Johnson

Britain became a net importer of oil in June for the first time in 11 years, official data showed yesterday.

News of the shift came as world crude oil prices touched record highs this week of \$41.70 for benchmark Brent crude and \$45.04 a barrel for West Texas Intermediate. The US government yesterday raised its central price forecast for US oil this quarter by \$4 a barrel to \$41 a barrel and predicted prices close to \$40 a barrel next winter.

The UK's oil imports were at their highest-ever level in the second quarter, according to data from the Office of National Statistics, a government agency. UK oil production peaked in 1999 at 2.8m b/d, and has since been falling as the North Sea's reserves deplete. Wood Mackenzie estimates UK oil output at 2.2m b/d,

UK trade in oil
Crude oil (thous m)



Source: ONS

and some forecasters say production will decline to about 2m b/d next year.

Rhodri Thomas, an energy analyst with Wood Mackenzie, said that, although the June production figures might be lower than normal because of seasonal main-

tenance on oil rigs in the North Sea, the trend was steadily downwards.

"This is no blip, production rates are in decline," he said.

As North Sea output falls, monthly statistics will more frequently show imports exceeding exports. After 2007, the UK is expected to emerge as a net importer for the year.

Revenues from the North Sea have helped strengthen Britain's current account since the country established itself as an oil exporter in 1981. They accounted for more than 20 per cent of total trade goods exports at their peak in the early 1980s, according to research from ING Financial Markets. Oil exports in June accounted for less than 8 per cent of UK goods exports.

Despite importing more than it exported, the UK managed to scrape a net surplus of £22m from oil because North Sea crude is of

a high enough quality to command a premium. But this was the lowest since August 1991, down from £206m in May and a fraction of the record £1.5bn received in May 1985. The drop in oil-export revenues contributed to the widening of the UK's current account deficit for the month to £4.97bn from £4.83bn in May.

Paul Dales, UK economist at Capital Economics, said the figures were "quite worrying".

"We would expect that our oil balance would be soaring at this point. If the balance turns negative then we would expect oil price rises to have a negative effect on UK plc, rather than the beneficial effect they have had in the past," Mr Dales said.

Falling North Sea outputs will lead to an increasing reliance on imports for Britons, who have used about 1.8m b/d of oil since 1991.

James Knightley at ING Financial Markets said: "It's difficult to see production increase in a meaningful way unless they find new fields... The risk is that [the trade balance] will increase unless we see a correction in consumer spending."

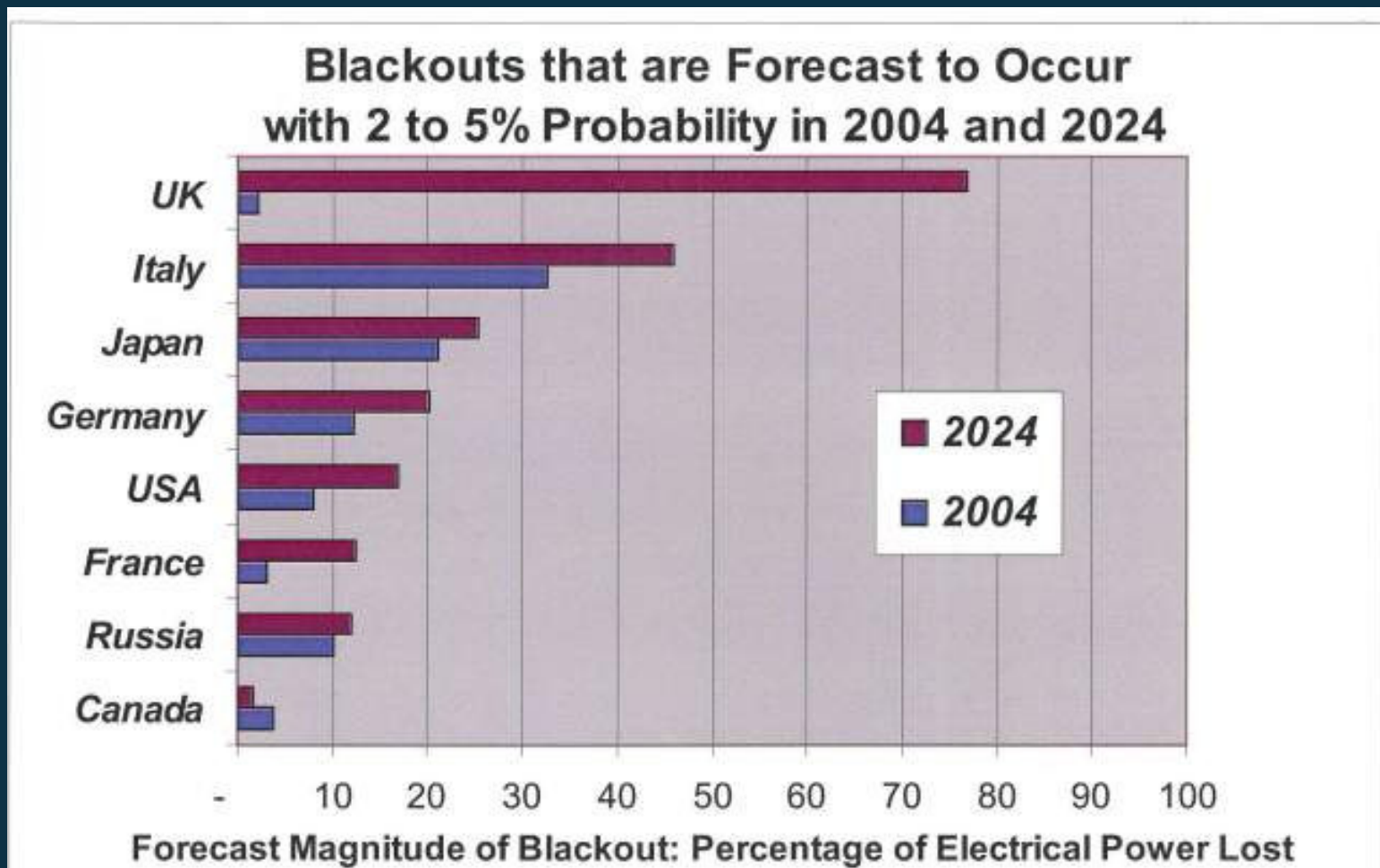
In response to declining output, the government has tried to attract oil companies by cutting rental fees on licences. Britain has also begun work on an import infrastructure such as the construction of liquefied natural gas import terminals, as the UK is expected to become a net gas importer as early as next year.

The UK also intends to increase the renewable share of power generation to 20 per cent by 2020.

Additional reporting by Javier Blas in London

US raises central oil price, Page 8
Commodities, Page 41

Blackouts





The UK political scene

No 10 Downing Street





The US political scene



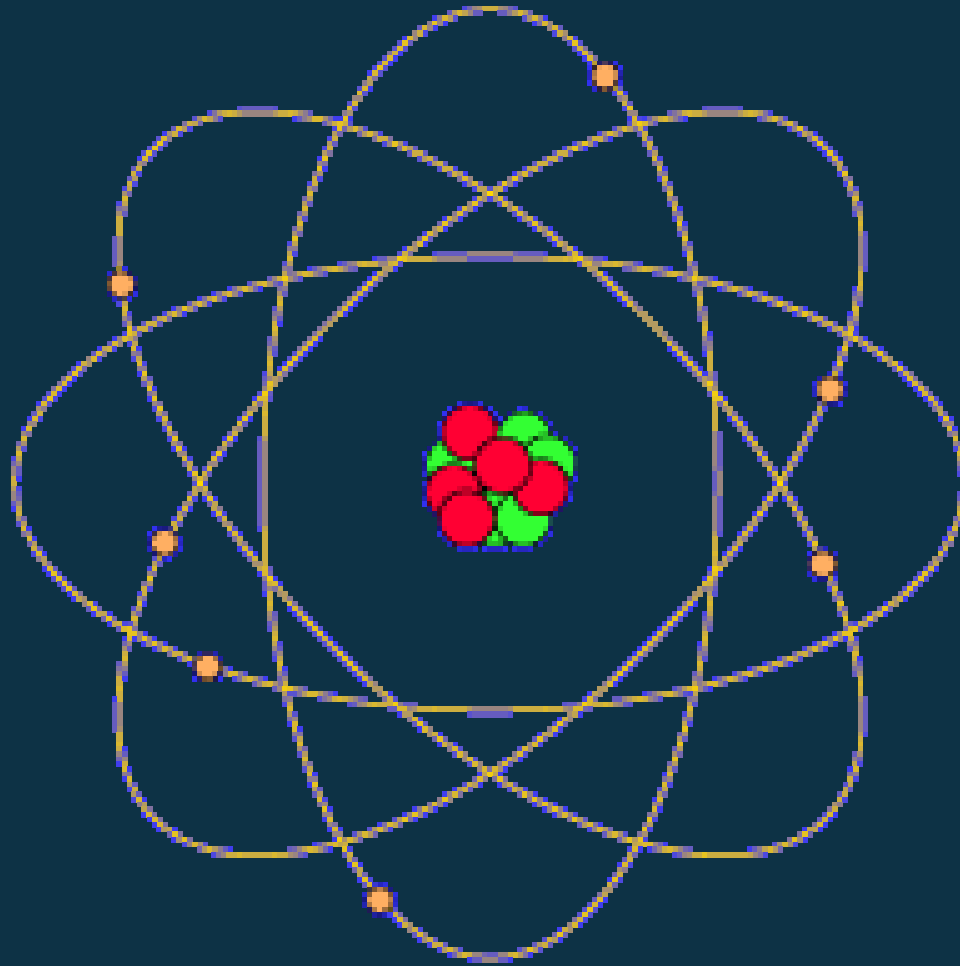


The European Union political scene



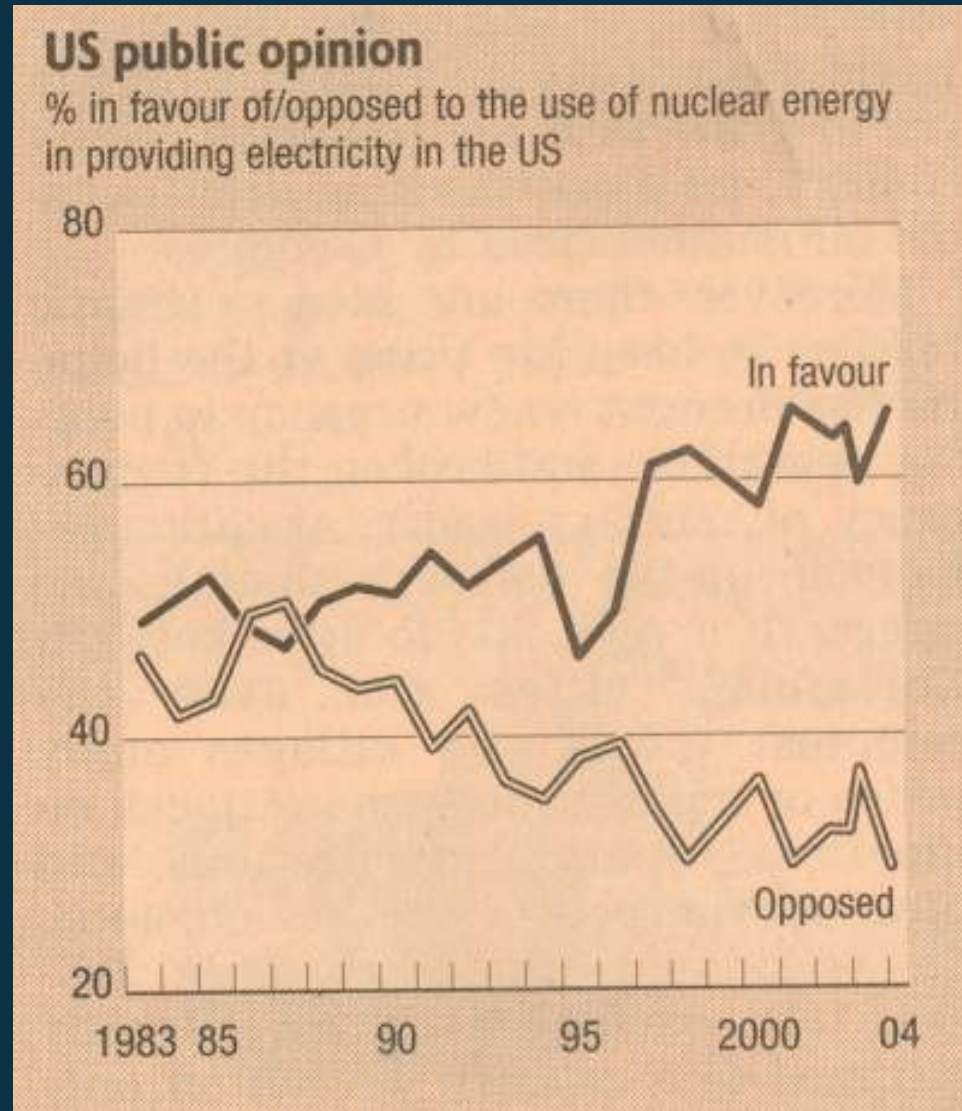


What does the UK need to do?





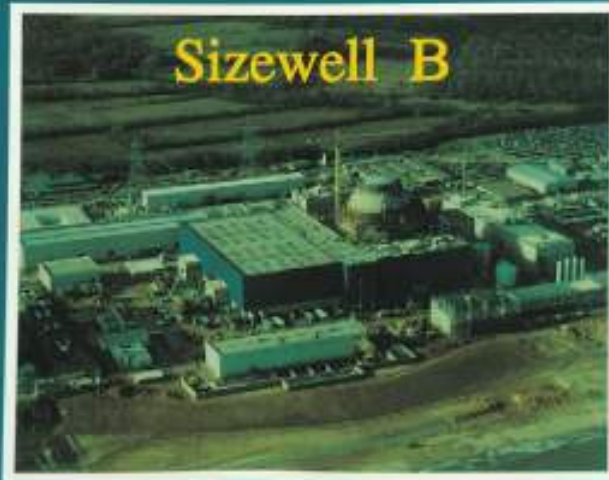
US opinion



Financial Times 10th August 2004

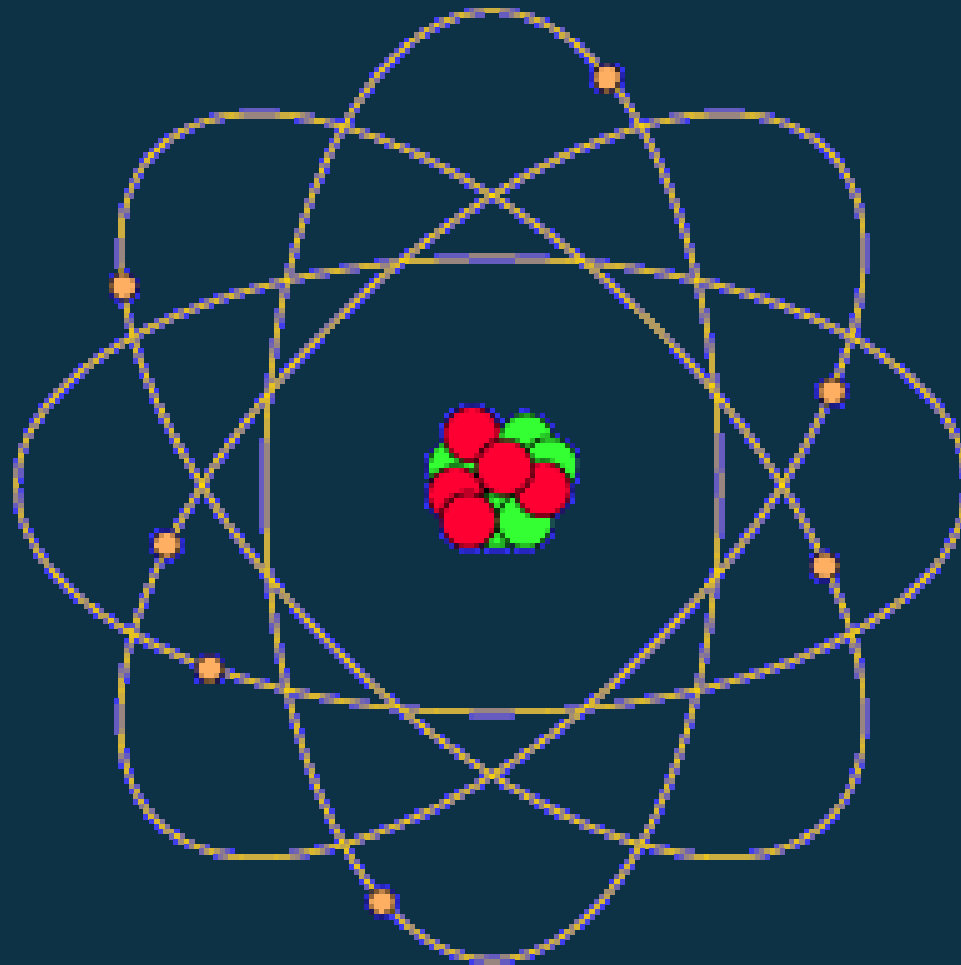


Sizewell B, C & D





Conclusions





Recommended Government Action

- Inspectorate to start licensing choice of reactors for construction on existing sites.
- Set reasonable timetable for public enquiries which avoids indefinite delays
- As emissions of greenhouse gasses negligible, exempt from climate change levy
- Designate a site for long-term repository for nuclear waste



