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BRITAIN'S ENERGY CRISIS

A Discussion Paper on UK Energy Policy

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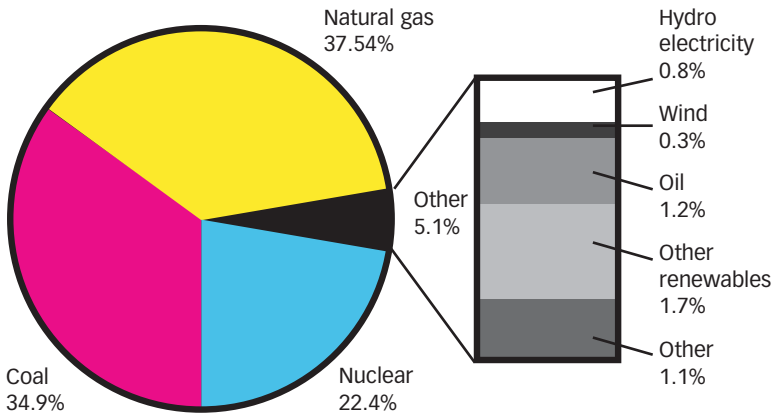
When first gas, and then oil, was discovered in UK waters - in 1965 and 1969 respectively – it ushered in an era of cheap and clean energy for industry and homes all over Britain.

But now the bonanza has run out. Since the end of 2003 we have had to import gas and have been a net importer of oil since 2004. Of course, this is not unexpected: initially Britain's oil and gas was projected to last around 25 years but new technology and innovative production methods by the oil companies extended this by another decade or so. A decade which should have given the UK government ample time to put in place an assured energy strategy for the next 25 years – but instead, we are rapidly heading towards an energy crisis.

Current UK energy sources

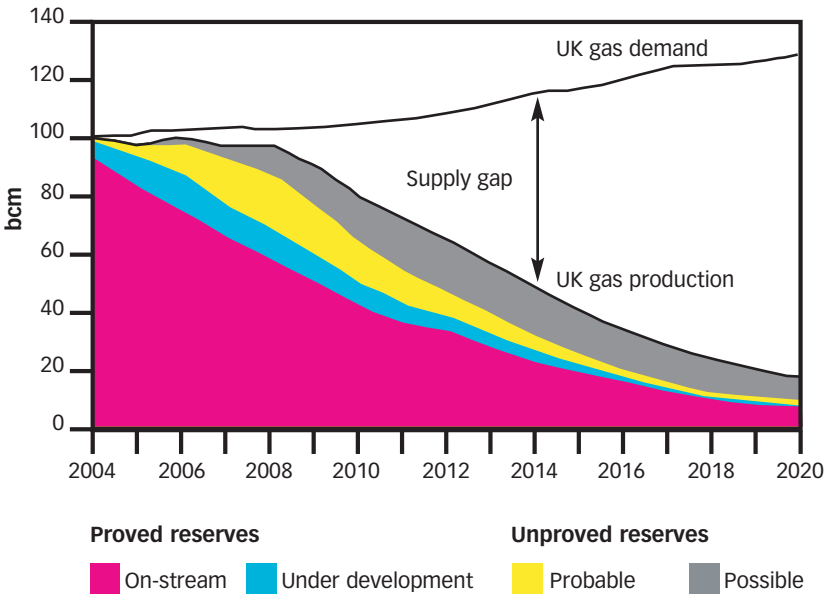
Let's take a look at how we currently meet our energy needs and generate electricity:

Diagram 1 - *Source: DTI digest of Energy Statistics (DUKES 2004)*



Natural Gas
The dominance of natural gas is not unexpected, a direct result of its historic cheap, local and plentiful supply, clean burning and a privatised energy market – and North Sea gas has served us well. But now let's look at a projection of UK annual gas extraction and demand for the next 15 years

Diagram 2 – From surplus to shortage



Source: Modified from WoodMackenzie 2004, 'From surplus to shortage'.

Frightening, isn't it? The capacity to import anything like this volume of gas simply doesn't exist at the moment. Even if the infrastructure did exist or can be built in time, what would the gas cost? We have been paying little more than extraction costs for indigenous supplies of gas. Importing gas will carry a considerable premium including costs for new pipelines, new tankers and terminals, profits for foreign governments, profits for foreign companies and a premium due to global competition.

As part of its fixation with the European Union, Britain has liberalised its energy market, whereas our European 'partners' have refused to liberalise theirs, placing Britain at a grave disadvantage. Other EU member states are apparently reluctant to sell gas to the UK, preferring, not unreasonably in their eyes, to meet the needs of their own national consumers first.

Another problem is the lack of gas storage capacity in the UK. Because our infrastructure did not develop as a result of import dependency we do not have 'strategic' gas storage, merely top-up facilities to supplement the normal amount of gas delivered to customers at peak-use periods. What little storage the UK does have amounts to **13 days supply** – but remember this is not an additional 13 days emergency supply: it is used every winter during high-usage periods. If this winter is as cold as the forecasters anticipate, it won't be enough.

Oil
Oil, although we have had domestic supplies from the North Sea, provides only 1.2% of our power-station capacity. This is because oil-fired stations are regarded as 'dirty' because of the quantities of CO2, sulphur dioxide (sox) and nitrous oxide (nox) emissions they produce. Most UK power generators switched to gas-fired facilities during the so-called 'dash for gas' period of the early nineties, so almost all UK oil is refined into petroleum products or exported to be blended with heavier Middle East crude oils.

Nuclear
But let's take another look at Diagram 1 – and we see that a reassuringly large proportion of our energy comes from nuclear sources. So that's good news, isn't it? Can we just increase the amount of energy we obtain from our nuclear power stations and cover any shortfall that way?

Well, no, we can't. All the UK's nuclear power stations are coming to the end of their lives and will be defunct within a few years. Sizewell B was the last to be commissioned in 1996 - after taking 15 years to get planning permission, build and commission. Two further proposed nuclear stations were cancelled in 1995. Seven nuclear facilities will close by 2010 (loss of 31% capacity); all but three will be closed by 2014 (loss of 70% of capacity); and only Sizewell B will still be operating after 2023 (loss of 90% of capacity).

So once again, successive UK governments have let us down. Their short-sighted refusal to marshal the facts, address the safety and security issues and the problems of radioactive waste disposal and make the case for clean, cheap nuclear energy, means that we now have no nuclear capacity available to pick up the shortfall from gas.

France, on the other hand, now produces 76% of its electricity from nuclear sources, thus assuring security of supply combined with the lowest energy costs in Europe.

Nuclear fusion - as opposed to nuclear fission, which is how we currently produce nuclear energy – is accepted as the holy grail for the nuclear industry. And it is France again which is pioneering research into nuclear fusion with the ITER project at Cadarache on behalf of a six-entity consortium (USA, Russia, Japan, South Korea, China and the EU).

In terms of the physics and huge amounts of energy involved, the ITER project is akin to building a star on the Earth. To produce controlled fusion reactions it is necessary to heat a gas to temperatures exceeding 100 million degrees Celsius, many times hotter than the centre of the sun. One kilo of fusion fuel would produce the same amount of energy as 10,000,000 kilos of fossil fuel and fusion, unlike fission, does not lead to large stores of long-lived highly radio-active waste.

Scientists believe commercial nuclear fusion is achievable, but it is a long way down the road: estimates vary between 30 and 50 years to produce viable commercial energy from fusion. So meanwhile the option is existing nuclear fission technology and the government has to grasp the nettle, make the safety case and ensure that new nuclear power stations are fast-tracked through the planning and construction process and producing energy for Britain within a very few years.

Coal
According to Diagram 1, coal seems to provide almost 35% of our electricity needs, so maybe we can mine more coal? After all, it is often called the forgotten fuel. In 2004 we used more than 60m tonnes *(DTI digest of Energy statistics DUKES 2005, section 2.7)* so there must still be plenty about. Well, there certainly is still plenty of coal which could have been mined, but the state of the industry since the miners strike in 1984 and successive governments' attitudes means very little mining is being done here. Of the 60m tonnes used in the UK in 2004, almost 37m were imported and the figure will be higher each coming year as more UK pits close.

When the miners' strike started in March 1984 there were 170 collieries in Britain – now there are about 10 and although a few pits are ostensibly on 'care and maintenance' which theoretically means they could be re-opened, far more have had concrete poured down their shafts and will never again see the light of day.

Mrs Thatcher may well have had sound political reasons for her fight to the death with the miners, but the result has been another indigenous source of energy lost to the country and dependency on imports from places such as Indonesia and Colombia.

The Labour government from 1997 might have been able to reverse the trend but showed no inclination to do so, probably because, by this time, Tony Blair was fixated on the chimera of Kyoto, climate change, being a world leader in sustainable energy and his environmental 'legacy'. Coal, as a 'dirty' fuel, could have no place in this fantasy.

Other energy sources

What's left?
A meagre 5.1% of Britain's electricity generation comes from 'other' sources, mainly the so-called 'renewables' such as wave, bio-fuels and wind power.

Wind turbines are useless – even the Renewable Energy Foundation admits that experience in Germany indicates that between **80 and 100 per cent of their capacity will need to be replicated** – by conventional power stations – for windless days. So not only is wind power a very expensive form of energy (more than twice as expensive as nuclear energy - a fact currently disguised by subsidies from central government which will amount to £1 billion by 2010) they only work when the wind blows, about 31 per cent of the time!

At all other times conventional power stations have to pick up the shortfall. For example the coldest day of 2005, December 28th, when temperatures were below zero across much of the UK, was a clear, bright and windless day - and not a single wind turbine in the UK was turning. With every power station pumping to capacity, a catastrophic failure of the national electricity grid was only narrowly averted, thanks, ironically, to boosting supplies from the old 'dirty' Drax coal-powered station.

Wind farms also kill birds. The RSPB has objected to more than 30 wind farm projects and US wildlife organisations have recently launched a law-suit against a San Francisco wind farm known to kill 5,500 birds per year.

Quite plainly, despite Blair's determination to blight the English countryside with ugly, expensive, inefficient, noisy, murderous and essentially useless wind turbines, these energy sources – which are not viable as stand-alone facilities anyway – are not going to come anywhere near meeting the needs of a 21st century, industrialised nation.

Bio-fuels are even more expensive. The world's first poultry-litter power plant, in East Anglia, struggles to produce electricity even at three times the cost of nuclear energy.

Wave power is also expensive and the technology is in its infancy. Wave power potential depends upon harnessing the long wave-length, long period, deep water ocean waves, arriving in the northern UK waters from the Atlantic.

The UK government began funding research into wave energy in 1974 under its Wave Energy Programme. The programme concentrated on large-scale offshore systems, as it was thought that they held the greatest potential for electricity generation for the future. Following reviews in 1983 and 1985 the Department of Trade and Industry concluded that ".. the economic prospects for large- scale offshore wave power were poor compared with other electricity generating renewable energy technologies". This programme was terminated after more than **£17 million** had been spent.

Hydro-electric can work efficiently where the topography is dominated by a lot of high mountains but even Norway, which relied on hydro-electric power for decades, has recently had second thoughts, and is switching to natural gas, as evidence grows that the dams have the effect of destroying aquatic habitats, altering river courses and affecting fish populations.

On top of the ecological damage, in some parts of the world projects have silted up from the erosion caused by deforestation, rendering the dams inefficient. The reduced water flow downstream also disturbs riverbeds, and deltas experience a greater influx of salt water, affecting coastal ecosystems essential to fisheries.

Tidal power is a variation of hydro-electric power which generates electricity by utilising the moving water caused by the tides. A huge dam – or barrage – is built across a river estuary and the tidal flows used to fill and empty large reservoirs to drive turbines.

However, very few places have the right tidal conditions: where there is a large enough difference between high and low tides but also fairly shallow water to allow as short as possible a dam to be constructed. Around the world there are only about 20 potential sites and the only working tidal power station in Europe is at Rance in France, constructed in 1966. France decided against building any more and concentrated on its nuclear power-generation capacity.

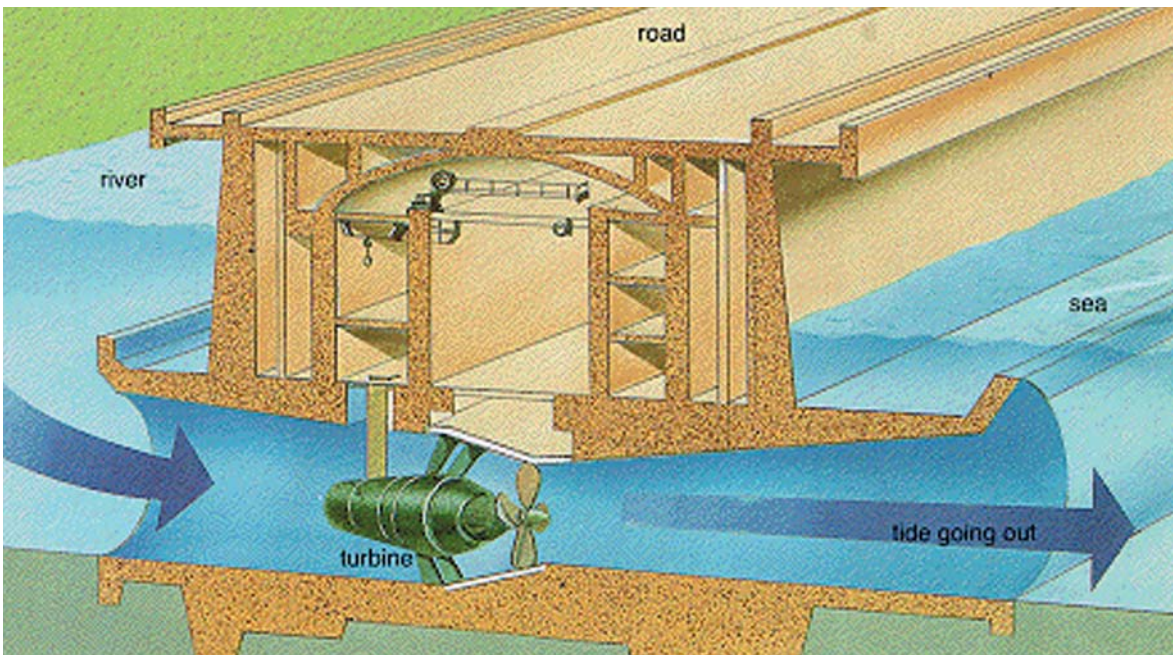
The most practical drawback for tidal power is that conventional turbines only turn when the tide is flowing out, although there are some new reversible turbines that can also operate when the tide is coming in. However, this still means that electricity is produced for only about ten hours per day which may well not be at peak demand times for electricity and it cannot be stored. But on the other hand, unlike wind or solar power at least the tides are reliable and will continue to flow in and out at regular intervals.

Another problem which stops the increased use of tidal energy is that although operating and maintenance costs of tidal power plants are low because the fuel, sea-water, is free, barrages and tidal generating stations are extremely expensive to build and maintain. Therefore the overall cost of electricity generated is still very high - too high for the market to bear, even in the centralised electricity market of France. Within a deregulated, highly competitive electricity supply market such as the UK, coupled with the need for private sector investment, tidal energy is unlikely to be commercially developed.

Growing environmental concerns also militate against tidal power. The environment is changed for many miles, both upstream and downstream, adversely affecting fish, other marine life and wading and sea birds.

An alternative to tidal barrages, currently being explored, is underwater turbines, a sort of submerged wind farm. Currently there are no commercial schemes anywhere in the world but several concepts are being researched and two experimental demonstration turbines are being tested in the UK at Lynmouth in Devon and Loch Linnhe.

Diagram of typical tidal barrage



Geothermal energy sounds enticing. We live on a planet with a molten core – could we tap this for energy? Well, drilling into the core is neither technically possible nor in any way a sensible course of action. Fractures in the earth's mantle result in volcanic eruptions, earthquakes and other unpleasant manifestations.

However, what can be done, if you live in the right place - primarily volcanic regions or island chains – is to drill into hot springs and reservoirs. Deep circulation of groundwater along fracture zones will bring heat to shallower levels, collecting the heat-flow from a broad area and concentrating it into shallow reservoirs or discharging it as hot springs. By drilling into such reservoirs the hot water and/or steam is piped to the surface where it can be used for direct heat applications and then returned underground to be reheated. Iceland, New Zealand and the Philippines all produce significant amounts of their energy requirements from geo-thermal sources at an economic rate and with no emissions or waste decommissioning issues.

But in the UK our geology offers very few geothermal opportunities. Southampton has a relatively small but successful geo-thermal project which provides 18 per cent of its district heating from a local hot-brine well more than a mile deep. The temperature of the water is 76C and rises naturally in the well to within 100 metres of the surface: it is then pumped to the heat station and passed through a heat exchanger. There is also a small greenhouse project at Penryn, using 22C water from a 275 metre-deep well for the cultivation of tomatoes.

There are certainly other alternative fuel sources being researched and of course this research should be encouraged, but none of these alternative fuels are going to be commercially viable, economically achievable, thermally efficient enough or, most importantly, ready in time, to replace the energy sources we are losing in the UK.

We are rapidly heading towards a dangerous energy crisis. If nothing is done **now**, within a few years – or less if we suffer more hard winters – power cuts will be a daily fact of life. Industry will be disrupted, people will be shivering – and old people will be dying - in their freezing and darkened homes. And we will all be paying greatly increased charges to buy less energy.

Electricity generation - cost comparison of sources

The chart below compares various forms of electricity generation:
Diagram 3

Energy Source	Cost (pence per KWh)	Reliability	Safety	Security of supply	Long term viability	Emissions	Decommission-ing issues	Back-up supply (power station)
Gas	2.2 (UK sourced)	****	***	*	**	****	**	no
Nuclear	2.3	****	***	****	****	****	*	no
Coal	2.6 - 3.2	***	***	*	**	*	**	no
Wind	5.4 - 7.2	*	***	*	?	****	****	yes
Wave power	6.5	*	***	*	?	****	****	yes
Poultry-litter	6.8	***	***	***	?	****	*****	no

Cost data taken from 2004 Royal Academy of Engineering Report 'Costs of Generating Electricity'

What must be done?

Successive UK governments have taken the North Sea bonanza, squandered the taxes raised on their pet projects, wasted the revenue to bribe the electorate, indulged in grandiose schemes like the Dome and given no thought to the future.

Not only that, but because they have senselessly squandered our own resources and made no provision for the future, we are now dependent upon governments that are not necessarily friendly to western nations. And let us not forget that oil and gas is usually found in very unstable parts of the world, some of which are becoming ever more volatile and unreliable.

The oil-rich states of the Middle East demonstrated their strength in the 1970s, when they flexed their muscles in an attempt to bring the West to its knees. Do we really want to be dependent on their goodwill?

UKIP demands a **'Britain First'** energy policy from the UK government: a policy which will guarantee security of supply; long term viability and efficiency; reliability and affordability; and which puts the needs of the British people above the short-term vanities, prejudices and fixations of politicians and party politics.

In the short-term there is little option but to rely more and more on imported gas and coal, even though this may be expensive, and to try to ensure that these supplies come from stable countries like Norway. Currently the only UK gas import route is via the Interconnector pipeline which runs from Belgium to Norfolk and can only supply the UK with gas from continental Europe. However, there are also import possibilities via the Frigg field which straddles the median line between Norway and the UK and in October 2006 a new pipeline from Norway, reaching landfall at Easington in Yorkshire, comes onstream. This, together with increased capacity from the interconnector by the end of 2006, will help ease the short-term gas supply situation, at least over the winter of 2006-2007.

It might also be possible to re-open disused coal mines in the UK which still hold large reserves of coal and produce commercially viable coal to help plug the energy gap, even though this would be a 'dirty' fuel. In parallel, research and development of the so-called 'clean coal' technology should be actively pursued.

Research into renewables should certainly be pursued but these sources of energy are way down the road before they can sustain an industrialised 21st century society.

In the medium and long-term the chart plainly shows the way forward – it has to be nuclear. It fulfils all the important criteria: cost, security of supply, long-term viability, stand-alone energy source, and low emissions. But the decision to build new traditional nuclear power stations must be made **now** and the restrictive planning processes streamlined so that they can be on-stream as soon as possible. **To build 10 new nuclear power stations would cost less than the UK contributes to the EU budget in two years.**

When nuclear fusion is a reality it will have the potential to provide mankind's energy requirements into the foreseeable future. Until then, energy from nuclear fission, which has served us well, must be utilised, as quickly as possible.

The major anxieties about nuclear energy relate to the security and safety of the nuclear facilities against natural disasters, accidents and terrorist attacks and the disposal of radioactive waste material. Every effort must be made, and no expense spared, to identify and address these concerns. Initial investment in current nuclear technology to mitigate these issues and ensure safe and efficient energy from nuclear fission must be backed up by long-term research and investment and a commitment to develop long-term energy from nuclear fusion.

Since the beginning of the Industrial Revolution Britain has been able to predominantly rely on its own indigenous energy supplies. Now, thanks to the negligence of successive British governments, we will be reliant on expensive energy from foreign, and not necessarily friendly, countries. We have a stark choice – do nothing and risk returning to a pre-Industrial Revolution standard of living or act now to ensure affordable, adequate, safe and secure energy supplies.

Whatever it takes, the UK government must take immediate action to safeguard the energy needs of the British people and make up for the wasted years.

Westinghouse AP1000 nuclear reactor