

## The low-carbon energy debate

**Nick Reeves, Alasdair Beal and Stuart Parkinson outline contrasting positions on the issue of low-carbon energy in the UK. In the first article (below), Reeves questions whether ministers can be trusted on the environment if they say that nuclear power and coal are a major part of the answer to Britain's energy needs. In the second (p.15), Beal questions whether it will be straightforward to avoid building new coal-fired power stations. In the third article (p.16), Parkinson discusses the implications of some recent UK energy modelling studies.**

### Responsible energy solutions can power Britain – when its leaders switch on

Every product we make, every building we construct, and every road we travel definitively and permanently alters the environment. The human economy wastes and discards, while the natural economy is cyclical and replenishes. The human economy has turned the world upside down and is a root cause of climate change, which is the greatest threat to humankind.

We are failing to reduce global greenhouse gas emissions. This means that we are now staring at something very sinister, as the DEFRA Chief Scientist, Professor Bob Watson, has warned<sup>1</sup>: a 4°C rise in global warming. In reality this will mean an end to living and the beginning of survival or, arguably, the start of extinction. The drive for cleaner and sustainable sources of energy has never been more important or more urgent. Cue political leadership.

Prime Minister, Gordon Brown, has just created a new Department for Energy and Climate Change (DECC). This looks like a tactical move to persuade the public that his discredited energy policies are green and synonymous with action on climate change, and risks leaving DEFRA (Department for Environment, Food and Rural Affairs) diminished. The test will be the resulting action.

It is heartening that the government has accepted the advice of the Committee on Climate Change and strengthened the targets in the new Climate Change Act<sup>2</sup> – greenhouse gas emissions must now be reduced by more than 80% from 1990 levels by 2050. However, DECC's new minister, Ed Miliband, continues to reaffirm the government's backing for new nuclear power and energy from new coal plants. Consequently we have every right to ask: can this government really be trusted on the environment or with action on climate change?

Ministers are swallowing the line from disingenuous energy companies that one solution is to use carbon capture and storage (CCS) technology, which will make energy from coal green and clean. This is baffling: even the House of Commons Environmental Audit Committee argues that CCS is unproven and very costly<sup>3</sup>.

We are used to the idea that the government is wedded to nuclear, despite the advice of its own Sustainable Development Commission whose independent research warned against the nuclear option<sup>4</sup>. I'm reminded of the French, who launched their nuclear programme back in the 1950s on the back of the slogan "We may not have any oil, but we have ideas". Had they also had foresight, they may have been tempted to rethink their ideas. Enriched uranium, necessary for nuclear-generated electricity, is a finite resource and therefore unsustainable. Furthermore we can meet our carbon emissions targets without resorting to nuclear power.

Renewables can power Britain, given the political will. Between 80% and 100% of our electricity could be produced from renewable sources<sup>5</sup>. Wind, wave, tidal, solar, hydro and geothermal could between them deliver more than twice as much electricity as the proposed new nuclear reactors. Together with technologies such as combined heat and power, decentralised energy, energy efficiency and sustainable transport strategies we could meet or even exceed emissions targets. Investment in energy conservation alone instead of nuclear would result in seven times the reduction in emissions<sup>6</sup>. These are proven technologies on which (along with action on consumer consumption) we should focus our efforts. Around 40% per cent of Europe's wind blows across the British Isles, yet we obtain a pitiful 1.5% of our electricity from wind; compare this with Denmark, which ratcheted up a credible 19% from wind last year<sup>7</sup>.

Feedstock and finance aside, the real problems with nuclear are reactor safety, waste disposal and the proliferation of nuclear weapons (which can follow on from nuclear power generation capacity).

The most serious of these is nuclear waste. Britain is sitting on 3,000 tons of high-level nuclear waste<sup>8</sup> with no viable plan for getting rid of it, making the nuclear option as irresponsible as coal. We can have genuine energy security only when we produce electricity safely from within our own borders.

The bottom line is this: nuclear power delivers too little too late and is dangerous, extremely expensive and unnecessary. Clean coal remains a romantic dream. Responsible options will unlikely be favoured until we also recognise the need to shift from being a greedy, consumer-led economy fixated on gross domestic product, to one based on nature, compassion and replenishment.

It takes a long time for a new government department to bed in and make an impact. DEFRA was created five years ago and the sweat of integration has been long and slow. Ed Miliband's new department has eighteen months at most to deliver concrete strategies that will truly tackle climate change.

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5. For example, see: Centre for Alternative Technology (2007). Zero Carbon Britain – an alternative energy strategy. CAT publications, Machynlleth. <http://www.zerocarbonbritain.org/>
6. All Party Parliamentary Group on Climate Change – personal communication.
7. As note 6.
8. As note 6.

## Should we 'call the coal thing off'?

The current proposal for a new coal-fired power station at Kingsnorth in Kent has generated a lot of controversy. It is argued that to reduce carbon dioxide (CO<sub>2</sub>) emissions, and so tackle climate change, new plants such as that at Kingsnorth should not be built. This case has been laid out, for example, in a recent briefing by anti-coal campaigners entitled *Let's call the coal thing off*<sup>1</sup>.

On the face of it, the argument is straightforward: burning coal emits more CO<sub>2</sub> emissions per unit of energy output than any other source – twice as much as natural gas and at least ten times as much as renewables, once lifecycle emissions have been taken into account<sup>2</sup>. However, things are not so simple. For a start, the proposed new Kingsnorth power station will generate 20% less CO<sub>2</sub> than the coal-fired power station it replaces so, if all else is equal, it will actually significantly reduce CO<sub>2</sub> emissions. Similarly, closing the UK's most efficient coal-fired power station, Drax B, (as called for by many at the 2006 Climate Camp) could have led to an increase in overall CO<sub>2</sub> emissions.

The problem with turning complex issues of electricity supply and the environment into simple 'yes/no' questions and campaigns against individual power stations is that it can cause confusion and play into the hands of the environmental movement's opponents. Thus stopping Kingsnorth would certainly be good news for the natural gas and nuclear power lobbies – but the consequences for the environment and climate change would be less certain. It might even end up as an 'own goal', leading to an unsustainable 'dash for gas', an even more unsustainable new nuclear power programme, and possibly (at least in the short term) increased CO<sub>2</sub> emissions through less efficient coal use. It is also important to balance the issue of climate change with other concerns, such as the potential for conflicts over natural gas and oil supplies, or the radioactive waste and weapons proliferation issues related to nuclear power.

If we stop construction of new coal-fired power stations, what will be used instead to generate the electricity? In the short term, the answer is likely to be 'older, less efficient power stations' – but what about the longer term? The anti-coal campaigners' briefing says that "Given the new impetus to build renewables at a fast rate, the green light for nuclear and the large amount of CCGT [combined cycle gas turbines] in the pipeline, there is no clear case for building new coal plants on the basis of need"<sup>3</sup>.

Many will disagree with the view that we should regard the green light for new nuclear power stations as 'given' – that debate is certainly not over. However, elsewhere the briefing points out that for the UK to achieve its EU target of 15% of energy from renewables by 2020, 45% of its electricity will need to come from renewables. The final paragraph of the briefing then acknowledges that, if this is to be achieved, "an additional mid-term strategic imperative is to reconfigure conventional capacity" so that it can "cycle readily to maximise the use of renewable technologies"<sup>4</sup>. This means that in a system where 45% of electricity is supplied by renewable sources, conventional power stations will no longer be able to run steadily all day long producing constant 'base load' power. Their role will be to fill the continually changing gap between variable demand for electricity on one side, and the fluctuating output from power sources such as wind turbines on the other. This is a problem for nuclear power stations, which need to be run at steady output and can take days to fire up or shut down. (Perhaps this is why the nuclear lobby is so happy to support anti-wind farm campaigns?)

Thus in the UK electricity supply system of 2020, if it meets its targets for renewable energy, there will be a very limited role for nuclear power. If we also take the advice of the campaign briefing and phase out our coal-fired power stations, then (apart from a limited amount of hydroelectricity) the main source of power left to meet electricity demand variations and to prevent power cuts when renewable output is low will be natural gas. It is worth bearing in mind that for most UK households, when there is no electricity, the only alternative source of energy for heating and cooking is ... natural gas.

Natural gas is a limited resource. Modern condensing boilers can use it at 95% efficiency for heating and it has many other uses, including as road vehicle fuel. Should we be burning this valuable premium fuel for electricity when even the latest CCGT power stations are only 60% efficient? Is it wise to move to a situation where we would be more heavily reliant on imported natural gas not only for heating and cooking but also for our electricity supplies?

We certainly should not be building new coal-fired power stations designed only for base load generation. However, unless we are happy to rely heavily on gas, it is hard to escape the conclusion that there will still be a role for efficient coal-fired

plants which are designed to cope with variable loads and also co-firing with wood chips or other sustainably-sourced biomass<sup>5</sup>.

In reality, 'supply side' arguments, such as whether or not to build a new coal-fired power station at Kingsnorth, miss the point. If we wish to maximise use of renewable energy sources for electricity, then the choice of fuels to provide the remainder is limited – and in this scenario we cannot simply 'call the coal thing off'. What we should be campaigning for – in addition to renewable energy – is practical measures to reduce electricity demand. Demand reduction is the most effective way of reducing CO<sub>2</sub> emissions from electricity generation – and it is also the key to a sustainable energy policy.

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## Notes and references

1. Anon (2008). *Let's call the coal thing off*. Kingsnorth briefing, 26 March. (Copy available from article author.)
2. Figure 4.19 of: IPCC (2007). *Climate Change 2007: Mitigation of climate change. Fourth Assessment Report (Working Group III)*. Intergovernmental Panel on Climate Change, Geneva. <http://www.ipcc.ch/>
3. p.5 of: Anon (2008) – see note 1.
4. p.10 of: Anon (2008) – see note 1.
5. Recent experience has shown that many coal-fired plants can accept up to 15% of their fuel (by energy content) from a wide range of solid biomass. p.277 of: IPCC (2007) – see note 2.

## Low-carbon, non-nuclear electricity scenarios for the UK

Over the last few months, proposals have begun to be put forward for new nuclear power stations and a new coal-fired power station in the UK. These are argued to be consistent with strategies to tackle climate change while maintaining energy security. Indeed, in its energy white paper (EWP) of 2007, the government explicitly argued that a new generation of nuclear power stations was needed<sup>1</sup>. But several detailed studies published in the last few years have highlighted alternative paths. In this article, I briefly outline three of the most comprehensive of those studies.

One of the key concerns stated in the EWP is that a large number of power stations are planned to close in the near future, and hence potentially there could be a shortfall in electricity supply. In 2007, 76 gigawatts (GW) of electricity capacity were connected to the national grid<sup>2</sup>. By 2020, the government estimates that 30% of this capacity (22.5GW) will be closed<sup>3</sup>. This lost capacity includes older coal and oil plants – closed in order to comply with new EU emissions regulations – and ageing nuclear power stations that will reach the end of their planned operating life. So how do the alternative scenarios tackle this potential shortfall? And what do they suggest for further into the future?

### Pöyry study<sup>4</sup>

This study was published by Pöyry Energy Consulting, one of Europe's leading energy consultancies. It assessed six scenarios for the electricity sector up to 2030, the scenarios making different assumptions about energy demand and renewable energy policies. The key constraint was that the UK should meet its proposed EU target of supplying 15% of its total energy from renewable energy sources by 2020. The study used the EURENO model, which had been previously used to provide analysis for the government in drawing up its own energy strategy. The model explicitly takes account of the variability of renewable energy sources, such as wind and solar, to assess the ability of (for example) the national grid to meet peaks in demand.

The report concluded that the UK is capable of hitting its renewable energy target – requiring 35%–45% of electricity to come from renewable sources – and successfully implement its National Energy Efficiency Action Plan to reduce total energy demand. Under these conditions, the analysis indicates that *no* major new power stations (nuclear, coal or gas) would be needed to ensure that Britain can meet its electricity requirements up to at least 2020. Moreover, the report finds that this strategy would reduce the UK's CO<sub>2</sub> emissions by up to 37% by this time.

The study estimated that the total installed renewable energy capacity in the electricity sector in 2020 would be between 32GW and 52GW, of which around two-thirds would be wind farms (offshore and onshore). In just one of the six scenarios was there a slight dip below the desired 20% margin of spare power capacity (for coping with winter peak demand), and this was only short-lived. The authors argued that this could best be dealt with using demand-side management or by installing small 'top-up' peaking plants.

In the period after 2020 when more of the UK's existing coal and nuclear plants are due to close, the report observes that a number of further options could be deployed including more combined heat and power plants, further roll-out of renewables, and possibly carbon capture and storage.

### Tyndall Centre study<sup>5</sup>

This study was published by the Tyndall Centre for Climate Change Research, one of the world's most influential climate research institutes. It models the development of the whole UK energy sector up to 2050. The key constraint was that the UK should meet its share of a global target to keep the atmospheric CO<sub>2</sub> concentration below 450ppm (parts per million). This, the authors note, implies a cut in emissions of 90% by 2050.

The results indicate that the emissions reduction target can be met with major near-term efforts to curb energy demand and large-scale R&D and investment in new technologies. Its emissions reduction targets are more demanding than those in the Pöyry study, and hence it argues that there will be a large role for carbon capture and storage technologies, so long as adequate major investment is made to make this technology widely available.

In terms of the electricity sector, the key changes that are projected up to 2030 are:

- a major expansion of renewable energy, especially offshore and onshore wind;
- a major expansion of carbon capture and storage, especially with coal-fired power stations; and
- a significant expansion of electricity demand, as transport energy comes increasingly from electricity rather than oil (due to, e.g., plug-in electric cars).

### Zero Carbon Britain<sup>6</sup>

This study was published by the Centre for Alternative Technology in Wales, a leading education and research centre on green lifestyles and technologies. It proposes a detailed scenario for the UK whereby direct carbon emissions across the economy are reduced to zero over a 20 year period. Hence it is more ambitious than either of the preceding studies.

The scenario proposed in this report is based on measures that lead to a 50% reduction in total energy demand over the period, coupled with a major expansion of renewable energy. The huge reduction in energy demand is achieved through a combination of economics instruments – the main one being 'tradable energy quotas' – and technological improvements to support lifestyle change, such as better insulation, more efficient public transport, plug-in electric cars and 'smart' meters. The expansion of renewable energy is rather more rapid than in the studies above, with about 50% of electricity supplied by wind, 35% supplied by marine (tidal and wave) sources, and a few percent each for biomass, solar and hydro.

### Concluding comments

These studies show that the goals of tackling climate change and improving energy security can be achieved without recourse to new nuclear power or large, new, unabated coal plants such as that currently proposed at Kingsnorth in Kent. The key condition is that major investments are made quickly in energy efficiency, renewable energy technologies and carbon capture and storage, supported by other policies to curb energy demand.

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