Oxford Energy Comment
June 2006

The UK Energy Review and Decentralised Generation

Malcolm Keay

The UK government is expected to publish its Energy Review later this summer and has been dropping heavy hints that the Review will propose a new generation of nuclear reactors, to fill the prospective "energy gap" caused by the retirement of Britain's existing nuclear plant over the next decade or so. Meanwhile, a range of outside commentators (including such varied figures as David Cameron, Ken Livingstone, the Liberal Party and Greenpeace) have been launching pre-emptive attacks on this expected recommendation, arguing instead in favour of decentralised generation.

Missing the Point?

The debate is an odd one, for a number of reasons:

- First, because the UK has a liberalised energy market. If there is a prospective gap, it should be up to private investors, as in other markets, to undertake what investment is needed. Government concerns about such factors as energy security and the environment should be reflected in appropriate policies and incentives. It is not clear why the Government should try to make all the investment decisions itself.
- Second, because there is no real reason to see nuclear and decentralised power as mutually exclusive alternatives. Different sorts of power generation can co-exist within a system – indeed, the examples of decentralised power most quoted by the commentators are from systems such as those of the

Netherlands, Denmark, Finland and Sweden, all of which have centralised as well as decentralised power plants, and three of which have nuclear plants.

- Third, because it bypasses one of the biggest issues facing power generation in the UK – the development and integration of renewable sources. That is one clear theme of Government policy and it is supported by an ambitious (and expensive) Renewables Obligation, stretching out for the next ten years. The implications of this growth of renewables should therefore be a key starting point for any consideration of future power needs – but renewables do not fit into the centralised/decentralised split in any meaningful way. Renewables tend to be relatively small-scale, but distant from the point of consumption. (This depends on which particular renewable source is involved, of course, but is true of the main renewable sources expected to make the major contribution to meeting the Renewables Obligation). Fitting these remote sources into a system based on distributed (local) power raises some serious issues. If these are not addressed, there is an inherent tension between the dual push for renewables and decentralised power.
- Fourth, because the debate seems to be based on two major over-simplifications – that decentralised power, district heating and combined heat and power (CHP) are all much the same thing; and that decentralised power is inherently more efficient and better for the environment than centralised power. Neither assumption is valid – some decentralised power systems are CHP, some are not; some are good in environmental terms, some are not (and exactly the same applies to centralised power systems).

What is decentralised energy?

Starting first with the question of definition – the commentators rarely say what they mean exactly by "decentralised energy". The electricity industry tends to talk instead about "distributed generation" – i.e. small scale generation directly connected to the distribution system, but this does not seem to be what the promoters of decentralised power usually have in mind. Because of the blurring of the concept with that of CHP, many of the examples they quote are of situations where the electricity generation

may be relatively small scale, but the heating system is relatively large and centralised. Whether this is really decentralised energy is debatable.

Greenpeace, in particular, confuses the issue thoroughly. In an advertisement in the press, it starts off by saying that "in a decentralised system, the electricity is generated close to where it is needed, so that the heat, which would otherwise be wasted, **can** be used in surrounding homes, offices and factories." In a later paragraph, this "**can** be used" becomes a straightforward "electricity and heat **are** generated at the same time".

The underlying assumption is that decentralised electricity generation is so intrinsically CHP friendly that it normally produces heat as well. But this is not by any means always the case in practice and it ignores the different dynamics of electricity and heat. In a distributed electricity system, as defined above, the electricity is indeed generated close to where it is needed. However, for a CHP scheme the driving factor in location is the heat load, not the electricity demand (because heat is more difficult to transport than electricity, systems are not usually designed to export or import a lot of heat – they are therefore normally based around large steady heat loads, which may or may not be close to the point of electricity consumption.)

In practice, because of the need for a major heat load, CHP stations are often relatively large installations outside urban centres (i.e. in major industrial plants or parks). UK data show that of the 5.6GW of CHP in the UK, 4.6 GW (82%) is in the largest category (greater than 10MW). Most of these large plants are in places like oil refineries and petrochemical works, and little of the UK's CHP plant is used for urban district heating.

In other words, the UK's CHP capacity does not fit the image given by the commentators, who normally focus on district heating examples from overseas. But developing district heating systems of this sort in the UK, where nearly all urban homes already have individual gas central heating, raises enormous practical problems. Simply making an announcement in favour of decentralised power, or

improving access for distributed generation, would do nothing to overcome these problems. Very significant additional policy interventions would be needed – and it is very doubtful whether such policies would be publicly acceptable, cost-effective or indeed have any significant effect on emissions.

Emissions reductions

The debate is further confused by the fact that it generally avoids any examination of the evidence on emissions reduction. There are many understandable objections to nuclear power. Nonetheless, its ability to reduce greenhouse gas emissions is not in doubt, so those proposing alternatives have a duty to consider the emissions implications, if they are serious about addressing climate change. Unfortunately – so far at any rate – most commentators have not risen to the challenge.

Indeed, the discussion rarely gets beyond the level of debating points. A common claim is that CHP plants are "up to" 95% efficient, as Greenpeace asserts. In fact, UK Energy Statistics show that average efficiency is around 70%; 95% is only achievable on the very best sites and for obvious reasons they are developed first – i.e. efficiencies tend to go down as penetration of the technology increases. So the 95% figure is not representative either of the current situation or of any future programme (especially if that involved household heating, which is intrinsically seasonal, making it difficult to achieve the good balance of heat and power demand necessary for high levels of efficiency). Data produced on the basis that all CHP stations will achieve the maximum possible efficiency are wholly unrealistic – indeed, the UK Government has had some difficulty in meeting its threshold for "good-quality CHP", even though the bar is set relatively low, at 75%.

Typically too, the commentators further confuse the issue by comparing the efficiency of CHP with that of conventional power stations (which they usually rate below 40%). But the point about CHP is that it produces heat as well as power (about twice as much on average in the UK), so to make a valid comparison it is necessary to look at the overall efficiency of meeting the power **plus** heat load (the efficiency of CHP schemes in pure electricity terms is quite low - in the low 20%s according to UK

energy statistics – and, since they are normally built to serve a heat load, it is quite misleading to treat them as simply using waste heat). Heat generators are often over 90% efficient (the UK minimum standard for domestic boilers is 86%), while new combined cycle gas turbines are up to 60% efficient, so a comparison between separate generation of electricity and heat and CHP does not necessarily favour CHP, except in the minority of cases when it does achieve 90% plus efficiency. (The point is explored further in an earlier OIES comment – *CO_2 emissions reduction: time for a reality check*.) In other words, CHP does not necessarily lead to significant emissions savings.

The evidence is no clearer when it comes to distributed power in general (i.e. leaving aside the CHP issue). While such plant can indeed improve overall efficiency by reducing electricity transmission losses, this does not necessarily balance out other factors. Distributed plant is not necessarily thermally efficient – the major recent application of decentralised generation was of relatively inefficient open cycle gas turbines installed in the US after the California crisis. If distributed fossil plant replaces centralised nuclear plant (as is being proposed) this would normally lead to an increase in emissions.

So there is no strong reason a priori to expect decentralised generation to reduce emissions. This is obscured by the tendency for the commentators to look at particular individual cases or at projections which, at the minimum, suffer from considerable "appraisal optimism". An alternative is to look at actual experience – i.e. the evidence on emissions levels and emissions reductions in practice. Is there any correlation between decentralised generation and low emissions; and is there any evidence that it is better than nuclear at lowering emissions?

The commentators do not examine these facts, perhaps because they do not support their case. Three of the countries usually listed as most committed to decentralised power (Netherlands, Denmark and Finland) have a worse emissions story than the UK – higher emissions per head and a poorer track record on emissions reduction. The other (Sweden) has a good record on emissions – but this is due to its reliance on

nuclear and hydro power; in fact it has only relatively small amounts of decentralised power (and this adds to its emissions total, unlike its nuclear and hydro plant).

By contrast, countries with heavy reliance on nuclear and hydro like Sweden, France and Switzerland have emissions per head some 30-40% lower than the European or UK average – these are serious reductions even in terms of the UK's long term emissions targets. While the evidence does not show that nuclear is the only route to lower emissions, the claim that decentralised power is of itself a route to significant emissions reduction (and superior to nuclear) is unsubstantiated.

In short, the whole debate is spurious: it is not clear that the choice of new generation is for Government to make; there is no reason to believe there is a simple choice between nuclear power and decentralised generation; decentralised power is not necessarily better in environmental terms than centralised power; decentralised power is not the same as CHP, nor CHP as district heating; and framing the debate in terms of nuclear vs. decentralised power leaves out the key issue of integrating renewables. It is difficult to avoid the impression that many of those involved are simply using the issue of decentralised power as a smokescreen to avoid having to consider the emissions consequences of their anti-nuclear stances.

The interaction of energy policy and climate change is a serious, difficult and long term issue. It deserves more considered discussion than it has been getting so far – and it remains to be seen whether the Government's Energy Review will give it that serious consideration or simply fall into the opposite camp from that of the commentators discussed above, of knee-jerk support for nuclear power.