INTERVIEW

From poetry to energy research

David Smith talks to John Constable, policy and research director for the Renewable Energy Foundation (REF), a charity providing comment and analysis on the energy sector.

John Constable in the early morning light somewhere in Suffolk with a large pike.

DS: I understand that you read English at university and that you did a PhD on the British modernist writer and painter Wyndham Lewis. How on earth did you end up in the energy business?

JC: I have a bad case of science-envy, so the transition wasn't a wrench, and in fact I'd been moving for a while on the edges of psychology and linguistics. Working with the leading Japanese physicist Hideaki Aoyama at Kyoto University, I isolated a mathematical distinction between verse and prose in English. It was a long way from the appreciation of poetry.

We looked at the distribution of word boundaries and syllables in text. If the text is composed in verse, say with a line that is more often than not 10 syllables in length, then the writer is introducing a degree of order or periodicity into the text, and this is, interestingly, not present in prose. We demonstrated this by converting texts into strings of values representing the number of syllables in each word, and then calculating the frequency of all adjacent sequences of whole words totalling n syllables, which is termed Q_n in our analysis. For a prose text the chart of these Q_n values will be flat, while for a verse text there will be peaks at the line length and all subsequent multiples.

A really interesting thing about this method is that you can detect and demonstrate lineation even in texts that aren't printed as verse. R D Blackmore's novel *Lorna Doone* and the books of Jim Crace are well known for their curious rhythmical texture. We were able to show that these books are mathematically lineated.

I also suggested that these restricted forms are common and culturally stable because, as they introduce order into one axis of language (usually surface features, such as word length), they degrade order in another, usually a semantically-relevant axis, syntax for example or diction. Using a model of language processing from cognitive linguistics I argued that this degradation increases the chances of a textual shimmer which causes the mind to go into inferential overdrive and conjure up a mirage of profundity. I can't say it was a popular idea, but I still think it's worth devising some experiments to try and test it. One day I might get around to it, but for the time being my energy interests have taken over.

Having heard you speak, how did you gain such an obviously strong grasp of the science involved?

There hasn't been a time when I wasn't interested in the sciences, and I've maintained my reading, more or less, some of it technical. Knocking around with non-humanities colleagues in the universities helped me keep my hand in, so the necessary conversion to the energy business was a matter of hard graft rather than psychological

reprogramming.

I've also had some very good teachers. REF has a large technical advisory group, and under their supervision I've undergone a sort of intensive degree course. Even so, a day never passes when I don't have to plug, as best I can, a shameful gap in my understanding.

But being half-in, half-out of two worlds helps, because what I'm trying to do at present is to carry information between engineers, on the one hand, and policy makers, who by and large are verbal people (often lawyers) with a slightly superstitious view of the relationship between language and the world. At present these two constituencies don't communicate well. Public policy rises to its feet like a Michelangelo, and says 'Let there be (cheap, clean) light!', but the engineers groan, hold their aching heads in their hands, and quietly explain, and not for the first time, that system frequency is dangerously low already, and that simultaneously maximizing several variables is difficult. Public policy, of course, doesn't see why its open-hearted eloquence is treated in this way, and repeats itself, only louder and more slowly, like a cartoon Englishman speaking to a foreigner. The engineers, for their part, just can't understand why their warnings aren't understood. It's an impasse, and we really need to resolve it. If every MP grasped the difference between energy (MWh) and power (MW) a strange calm would fall over the House of Commons. This wouldn't fix our problems, but it would be good start.

The energy debate seems to be hotting up (so to speak), and more and more people are asking whether the UK can make a difference to climate change, and if so how. Do you think that the right issues are being discussed?

Yes. All the right notes are being struck, but not necessarily in the right order, and the order is crucial. Get it wrong and UK policy will be a futile gesture. Get it right, and we might make a contribution to encouraging low-carbon energy provision in the developing world. There's too much careless talk about doing our bit, with the assumption that 'every little helps'. That isn't really true. Greenhouse gas emissions are at the front of everyone's minds, but you can't begin to address this matter until you see the UK's potential contribution in perspective.

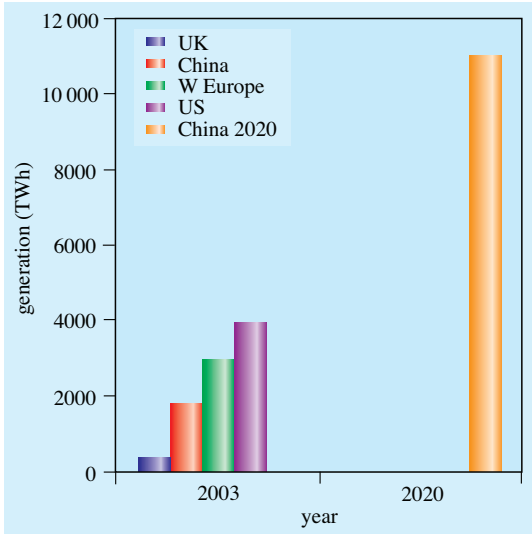

Figure 1. *Electricity generation in the UK, China, western Europe and the US in 2003, compared with predicted Chinese demand in 2020. Sources: DTI, IEA and Zhang Guobao, vice-minister of the National Development and Reform Commission, quoted in* China Daily *(19 October 2004).*

We contribute about 2% of global emissions at present, a proportion that is falling as the economies of China and India, for example, grow. At present China is about 4–5 times the size of the UK electrically, generating about 1800 TWh, as compared to the UK's output of 390 TWh. One Chinese government source estimates that by 2020 they will need 11 000 TWh from a portfolio of 2400 GW, predominantly from coal-fired stations (see figure 1).

The UK currently has about 78 GW of plant. Even the conservative estimates, such as that of the International Energy Agency (IEA), suggest that China will need 7600 TWh in 2030, from a portfolio of 1500 GW, with nearly 80% of that coming from coal because it's cheap and abundant.

Against this daunting background it's clear that the UK can only hope to make a qualitative rather than a quantitative contribution. We need to offer a compelling economic example, and hope that this helps China to burn its coal in as clean a way as possible. As it happens, the UK is also going to be dependent on coal for a long time to come, so we have a real opportunity to showcase carbon capture

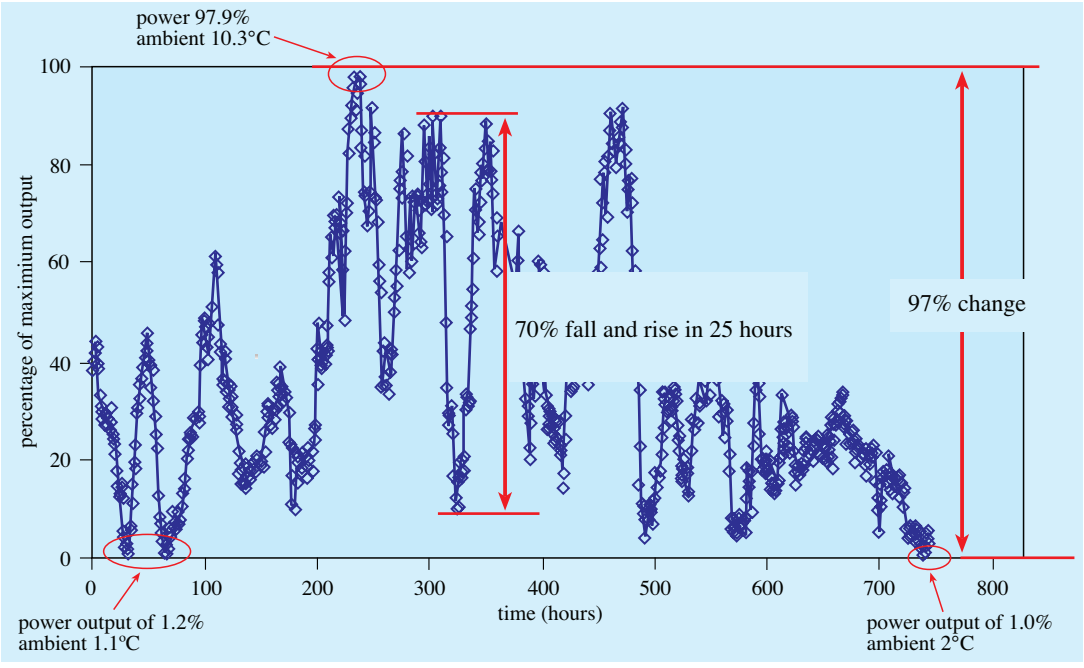

Figure 2. *A model of the power variation of 25 GW of wind distributed over the UK, derived from Met Office hourly wind-speed data for January 2006. Ambient temperatures at Nottingham are indicated, and show a correlation between low wind and low temperature.*

and sequestration, perhaps for enhanced oil recovery in the North Sea.

What we really have to avoid is setting a bad example, and achieving small emissions savings at a very high cost. Our 'little bit', far from helping, will actually be counterproductive if it costs a fortune and damages us economically. Unfortunately that's what we're currently doing. Ofgem, the energy regulator, recently pointed out that the Renewables Obligation, a £32 bn subsidy mechanism, achieves emissions savings at the cost of over £400 per tonne of carbon. That's unbelievably expensive, and entails a terrible opportunity cost.

It seems that you are as interested in the security and reliability of energy supply as in carbon dioxide; is that right?

Again, it's a question of presenting an economically compelling example. Self-harm will not impress the developing world. Our voice won't carry unless we're perceived as competent and healthy, but at present we look rather sloppy.

EDF Energy estimates that by 2015 the UK will have a shortfall of generating capacity approaching 32 GW. That's about 40% of the current portfolio, and over 50% of peak winter load. This worrying gap is opening up, partly because of the closure of nuclear plants and partly because of the EU large combustion plants directive, which places strict regulations on coal plant emissions of sulfur dioxide and nitrogen oxides (NOx). These require the fitting of flue gas desulfurization and probably selective catalytic reduction, to deal with NOx. But both technologies are expensive, and many coal generators will simply close rather than add such equipment to obsolete plants. The likely candidates, then, to meet this shortfall are combined cycle gas turbines, which have low capital requirements and rapid construction times.

It's important for us all to realize that renewable energy sources won't contribute much to dealing with the capacity crunch (and wind energy hardly anything at all). I know this is disappointing, but it's just a fact. Part of the problem is that the Renewables Obligation is currently insensitive to the ability of technologies to deliver firm capacity. Investors have therefore logically selected the least capital-intensive ticket to the subsidy stream, and, after

a flurry of interest in landfill gas, which is firm, wind power is expected to account for about 75% of the 2010 and 2015 targets for renewable energy. This would need a very large nominal wind capacity (about 25 GW), but it would deliver hardly any of this as firm power.

Surprisingly, no-one had attempted to use Met Office wind speed records to model how this much wind would behave, or to see if geographical distribution would actually produce smoother output. REF commissioned an independent consultancy, Oswald Consultancy Ltd, to do this work for us, and we are still in the process of developing it. But the work so far published is very striking. Figure 2 shows the modelled power fluctuations for 25 GW of wind distributed over the UK.

These are large fluctuations, and the rates of power-change are significant from the point of view of grid-balancing. Conventional plants could compensate for these swings, but the cost and the impact on plant availability are likely to be significant, and it may drive us towards an unhealthy dominance of gas generation, perhaps lower-efficiency open-cycle gas generation.

We also have to recognize that swings of this magnitude will almost limit the market access of other low carbon generators, such as firm renewables (biomass, tidal), and clean conventional generators, such as fossil fuel with carbon capture and sequestration, and nuclear. That may not be sensible. We've been urging the DTI to review this entire matter, and take a more rigorous system level perspective.

What ought the rest of the world be doing?

I'm afraid we're not in a position to lecture the rest of the world, and pretty often we'd be better off listening to what they have to offer. I mean, cultivating our own garden is going to be hard enough without wasting time leaning over the fence to tell the Chinese when to sow rice. The best we can hope for is that our example, some part of our practical action, will be worth copying.

How should we teachers be guiding our students in this time of conflicting opinions?

You're thinking of the rough and tumble about climate change, or the conventional versus renewables skirmishes. In the 1950s and 1960s teachers of English used to justify their existence by saying that they fostered critical thinking, the ability to read carefully and discriminate between arguments on reasoned grounds. This was the wisdom of my elders and teachers, and I used to think it a rather modest goal. Now it seems like an Everest of an ambition, but very desirable nonetheless.

In the 1990s the melée of critical theory in US universities reduced many staff to 'teaching the conflicts', avoiding any sort of resolution. That sort of abdication helps nobody. It certainly won't be of the slightest use in the current maelstrom engulfing energy and climate change. Students need to see you marshalling the evidence, avoiding the false dichotomies, applying reason and coming to a conclusion which is transparent and non-dogmatic but firm enough to be a guide to action.

If there is one idea that you would like us to pass on to young people, what would it be?

Ah, my message to mankind, my famous last words. Perhaps what I really hope is that teachers can somehow lead their pupils to realize for themselves that scientific methodology isn't mentally or imaginatively constraining, and that science, in spite of having no ultimate foundations, really is the north-west passage between cynicism and credulity. It's a great career, economically and intellectually. As a society, and globally, we need more engineers and scientists, and we desperately need more politicians and more business people with a background in those subjects.

I asked you for a photograph to illustrate this interview and the only one you could find was of you holding a fish, a pike (*Esox lucius*). Is this interest scientific?

Partly. Pike have an astonishing acceleration (8–12 Gs) from 0 up to about 6 m s^{-1}, and they're interesting creatures in evolutionary terms, because their basic design has been stable for an extremely long period of time, and they have a significant degree of binocular vision. But I'm not an icthyologist. Very occasional fishing is largely an excuse to be near rivers in the early hours of the day; I hardly ever catch anything. It's just a way of clearing the mind.

- For further information see www.ref.org.uk.