

## **Getting Energy Right**

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I don't like 'energy conservation'. I don't like 'energy efficiency' either. I've disliked them for more than thirty years. Come to that, I don't even like 'energy' – at least not the way it's usually used. However, before you all throw me out bodily, let me make myself clear. What I object to is the expression 'energy conservation'. I'm a physicist. Energy conservation is already the law, a law that can't be broken. I mean the first law of thermodynamics. Energy can never be created nor destroyed. In any physical event, energy is ALWAYS conserved. Why, then, have we spent more than three decades advocating 'energy conservation' and lamenting that it isn't happening fast enough? We don't of course, mean 'energy conservation'. We mean 'fuel conservation'. The distinction matters. Fuel is not energy. Energy is not fuel. If we smear them together as we so often do, we lose sight of differences that are crucially important.

This is just one of many ways we still get energy wrong. We use sloppy terminology that confuses and muddies the language of energy policy. That matters, not just to pedants like me: because it blurs and obscures the real options and opportunities we have. This morning I'll try to explain the ways we have energy wrong, and what we might do to get it right.

Of course the first thing we have to do is to find people who WANT to get energy right. That's why I'm so pleased to be invited to speak to you. You and your colleagues are exactly the people we need – people with a professional interest in getting energy right, and the skills and knowledge to make it happen. But let's not delude ourselves. A lot of people – also skilled and knowledgeable – have absolutely no interest in getting energy right. They are already doing very nicely by getting energy wrong. They, their companies and their organizations have become powerful and influential – disproportionately so - precisely for this reason. They are more than content to let society go on getting energy wrong; indeed they throw up major obstacles to keep society from changing its approach. The obstructions and impediments they create are entirely understandable. If we start getting energy right, many people and companies will find their power and influence waning. But we must not allow them to shape policy for their own narrow benefit. Society demands and deserves better.

How, then, do we get energy wrong? To begin with, we describe the issue wrong. We persist in using language and concepts that drastically misrepresent what we are actually doing – so much so that we ourselves don't even understand what we want to do, or what choices we have about how best to do it. We even talk about 'consuming' energy. That expression makes my teeth ache. We don't – we CAN'T – 'consume' energy. We 'consume' fuel. But we USE energy. This all-too-common, wilful mistake typifies the central problem that underpins all the others. What we call 'energy policy' is nothing of the kind. It is 'fuel and electricity policy'. It is almost completely preoccupied with the supply of fuels and electricity – commercial energy carriers bought and sold as commodities in batch transactions, in which what matters is the unit price. This is an entirely valid

activity, as far as it goes. But it ignores and takes for granted the entire reason for wanting fuel or electricity.

Modern fuels and electricity are useful only when combined with the necessary technology, the physical assets that actually deliver the services we want – comfort, illumination, cooked food, refrigeration, information and so on. If you already have the buildings, lamps, the motors, the chillers, the electronics and other technologies, of course you want to be sure you can also get the requisite fuels and electricity to run them. But what you want is not just 'energy', otherwise unspecified. You cannot run your computer on natural gas, or your car on coal. Each particular end-use technology requires a particular form of fuel or electricity to run it – high-octane unleaded petrol, say, or 50-hertz 240-volt alternating current.

To smear all these different energy carriers together and call them all 'energy' suggests that they are all interchangeable. They are not – not without yet more technology, and sometimes not even then. Technology takes not only money for investment but also time, whether it is technology to produce an energy carrier or technology to use it. That time factor is important, because it usually implies a trade-off. If you want to ensure, say, comfort, in five years' time, you can use the intervening time in different ways. In many contexts you can either add more supply technology to deliver more energy carriers, or alternatively you can upgrade the end-use technology to make extra supply unnecessary. The same holds true for many aspects of energy use, although not – to be sure – for all.

By 'technology' I mean all the physical artefacts that go to make up energy systems. The most important physical artefacts of all, the most important energy technologies of all, are buildings, for shelter and comfort and as platforms for so many other energy technologies. That, by the way, is why I don't like 'energy efficiency'. You can measure 'fuel efficiency' – the percentage of useful energy you get out of a device, compared to the amount of fuel energy you put in. But you can't measure the 'efficiency' of a building. A building intervenes in natural energy flows, and makes the temperature inside more stable and comfortable than the temperature outside. But you don't – indeed realistically you can't – measure the input energy, from sunlight, warm bodies, electronics and so on, or the 'useful' output energy either; so 'efficiency' is meaningless applied to buildings. I talk about 'energy performance', and avoid spurious quantification.

Real 'energy policy' must deal explicitly with buildings as well as all the other technologies – not just the technologies that produce and deliver energy carriers, but also the technologies that deliver the energy services we actually want. Real 'energy policy' is not just about commodity fuels and electricity. It is about infrastructure. Moreover, it is not just about so-called 'energy supply' infrastructure, such as refineries and power stations. It is about what we should explicitly and emphatically call the 'energy service' infrastructure.

We see that most clearly when we consider electricity. Some of you may have seen the text of a presentation I gave at York University in Toronto in September, which develops this analysis (see 'The Electric Challenge: Getting The Story Right' at <http://www.chathamhouse.org.uk/index.php?id=174>), under 'Publications'). At the beginning of the 1990s, when the UK government liberalized electricity, it imported the language and concepts of the hydrocarbon industry. It made electricity into a quasi-commodity, bought and sold like barrels of oil, in batch transactions in a competitive 'electricity market'. The objective of introducing competition was to make the price of a unit of electricity, a kilowatt-hour, as low as possible. It still

is – as if this were what users wanted. It is not. What users want is a low electricity BILL – not the same thing at all. What users also want is reliable services – keeping the lights on. We now know, as we might have anticipated, that a low unit price and reliable electricity may not be compatible.

No matter what free-market ideologues may say, electricity is not and never can be a commodity like oil or gas. If you are selling a commodity, you can store it and withhold it from the market until you get the price you want. You cannot store electricity. Electricity as we use it is a process, taking place simultaneously throughout a complete system of physical assets – generation, network and loads. A fuel such as oil or gas comes from a hole in the ground at a particular place. To use it anywhere else you have to carry it there. Electricity, however, you can generate anywhere, in quantities from minute to awesome. You can have electricity without fuel, but not without infrastructure. Electricity exists only in infrastructure. We must shake off the misguided belief that electricity policy can be treated as commodity policy, and electricity business as commodity business. Electricity policy should be first and foremost infrastructure policy – that is, policy to guide and shape the evolution of the physical assets that use electricity to deliver the services we want.

We already have an array of policy levers available to guide, shape and upgrade our energy service infrastructure. We should begin by recognizing explicitly that they are energy policy levers – more important than any policy levers that focus purely on fuel or electricity or their price per unit. We keep hearing that only 'higher unit prices' will make us improve our use of energy. That is simply nonsense, as you and your colleagues know better than most. Minimum performance standards, planning requirements and government procurement are all potent policy levers to improve infrastructure. Perhaps most potent of all is asset taxation – the tax treatment of buildings and other energy technologies. But tax policy worldwide still stubbornly persists in a fundamental flaw. If you invest in an asset to sell its measured output – say a refinery or a power station – it is considered a business asset, and taxed accordingly. If, however, you invest in an asset to deliver an energy service – say a well-insulated, comfortable home – it is NOT a business asset. Its output, of 'comfort' is not measured or sold. In general, such investments are treated much less generously for tax purposes than business investments whose outputs are to be sold. That one single assumption skews all investments in energy infrastructure, in favour of investments to supply saleable energy carriers and away from investments to deliver better energy services. Of course we do sometimes get grants, tax breaks, rapid write-offs, or other financial and fiscal benefits for improved end-use technologies. Unfortunately, however, such measures tend to be ad hoc, short-term, inconsistent and incoherent. They have never been subsumed into coherent policy for energy infrastructure. They should be, as a matter of urgency, starting immediately.

To get energy right, we have to start by changing the way we think about it. You and your colleagues ought to be in the front line of this essential change, explaining its profound and exciting implications to the politicians, financiers and journalists that still fail to understand it. If we are serious about tackling 'fuel poverty', energy security and climate change, if we are serious about keeping the lights on, we have to start by getting energy right.