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Energy, Environment and Resource Governance Working Paper

Managing Energy: Rethinking the Fundamentals

Managing Energy Wrong

Working Paper One

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Four decades ago no one managed energy. No one sold energy, or bought it. No one had heard of energy companies. No one made energy policy. Yet energy is now the world's largest business. Most of the world's largest companies are energy companies. If you google 'energy policy' you get more than 30 million pages. Hundreds of millions of people are now actively involved in managing what they call energy. Many of their achievements are impressive; some are spectacular.

Why, then, are we making such a mess of managing energy? Despite all the dramatic technological and economic advances we have seen, some two billion people, one-third of humanity, are still without electric light. Those of us who have it worry about 'energy security', that we may soon have trouble keeping the lights on. Meanwhile the best available scientific evidence suggests more and more urgently that we are now upsetting climatic systems, with consequences that could be catastrophic worldwide. Something is seriously wrong with the way we manage energy. Can we not do better? And if so, how? To answer these questions we need first to understand much more clearly, and in much more detail, what we are doing now - how we now manage energy, who does what and why.

Before the early 1970s the energy business did not exist. Oil, natural gas, coal and electricity, major economic activities, were sometimes interrelated but separate and distinct. The oil business sought and found petroleum, transported it, processed it, and sold petrol, diesel, jet fuel, fuel oil, lubricants and other products to users. Managing the oil business was above all about deciding which oilfields to develop, how and when. If you found natural gas, it was more often a hazard than a resource. The easiest way to manage natural gas was to burn it at the wellhead, to get rid of it. Although it too was a hydrocarbon fuel it required very different transport and processing, mostly for other categories of uses and users. Where natural gas did find buyers, in parts of North America and Europe, the natural gas business mainly entailed constructing and managing networks of pipelines between gasfields and users.

By the early 1970s, in many parts of the world, the coal business was changing fast. Coal was more difficult to transport and to use than petroleum. Where petroleum products were available, coal fireplaces, boilers and furnaces were disappearing. Where coal had been used to produce 'town gas', it was being supplanted by natural gas. Instead, coal was being used to generate electricity, in ever- larger power stations, often located close to coal mines. Underground coal mining, a dirty and dangerous activity, was increasingly being supplanted by surface or 'strip' mining with massive

machines. Managing coal business was interconnected more and more closely with managing electricity.

At the time, however, electricity was not a business in the usual sense of the word. All over the world electricity systems were 'utilities', monopolies supplying their captive users with electricity at prices fixed either by government or by an official regulator. Managing electricity therefore differed significantly from managing any of the fuel businesses. The fuel businesses all involved risks of various kinds. Managing meant identifying and assessing risks and deciding accordingly, especially about investment. Bad planning, bad projects, bad investment and other ill-managed activities could entail major losses. Getting a decision wrong could damage or even destroy a fuel business. In monopoly electricity, however, captive users bore the risks. For electricity monopolies, when management made mistakes, captive users paid.

Until the early 1970s all these multifarious activities had their own separate identities, to go with the very different risks, competences, decisions and management they required. The oil business was global, the coal business almost entirely national or regional. Unlike oil or coal, the natural gas business involved a fixed network with monopoly attributes. It was thus similar in some respects to electricity, but in other respects very different. Managing any of these various activities, however, did share one key objective: investing in technologies that could produce and deliver either a particular fuel or electricity to users. The key challenge was to make the right investment. If you did, you could generate enough revenue, by selling the fuel or the electricity, to make an adequate return on the investment. The fuel businesses were just like other businesses, and electricity was closely akin to other utilities such as water and sewerage.

Those actually managing the relevant activities knew what they were doing, and acted accordingly. In the early 1970s, however, some academic analysts and media commentators began to employ a convenient shorthand, in which the vaguely common attributes of different fuels were lumped together with electricity and called 'energy'. The Ford Foundation Energy Policy Project, 1971-74, was the first significant manifestation of this usage. But it received a dramatic boost in the autumn of 1973. The 'oil shock', when the Organization of Petroleum Exporting Countries quadrupled the world price of petroleum, coincided with problems of natural gas supply in the northeastern US, labour unrest in the UK coal industry and similar problems elsewhere. Shortages of petrol and fuel oil, power cuts, price rises and system breakdowns caused

severe economic disruption in many parts of the world. Politicians and the media proclaimed an 'energy crisis'.

One of the first responses to the energy crisis was for governments, politicians and commentators to demand a 'substitute for oil'. An immediate beneficiary of this sudden enthusiasm was nuclear power, notably in France and Japan. Few politicians seemed to realize the obvious inconsistency of this proposal. The most important and distinctive role of petroleum and its products was and still is in fuelling transport, particularly motor vehicles. Nuclear power produces baseload electricity. It was and still is essentially irrelevant for motor vehicles. Even for less specialized applications such as heating, the substitution entails not just replacing fuel oil with electricity but replacing the entire system of technology through which it flows, especially the end-use technology. You cannot run an oil heater on electricity, or an electric heater on oil.

The search for a 'substitute for oil' in the mid-1970s nevertheless set the pattern for future discussions of what was thenceforth called energy and energy policy. Using the word 'energy' as shorthand for all fuels plus electricity allowed non-specialists, particularly politicians, to presume that they were all more or less the same commodity and interchangeable, that one could substitute for another, with no reference to the timescales or technologies involved.

In the intervening decades, government statistics, energy forecasting and scenarios, and other analytic and planning tools of energy policy have focused on measured commodity quantities and flows of fuels and electricity, described as aggregates and averages. This approach takes technology and physical assets for granted - not only the technology to produce and deliver the fuel or electricity, but also the technology to use it, to deliver the service the user actually wants. It tells us about commodities, but nothing about the multifarious physical infrastructures through which they flow, or the investment the infrastructures entail. The aggregates and averages of commodity quantities smear together many different applications and services, with vastly different attributes, ranging from vital and acutely sensitive to incidental and undemanding. If all you want to know is how much oil, coal or natural gas is sold, such information will tell you. For purposes of managing energy, however, we collect the wrong data, and we analyze it wrong.

Despite the usage of the last four decades energy is not one business but many. The different businesses involve different problems and options,

different contexts, different costs, different risks, different decisions and different timescales. Neither the problems nor their potential solutions are readily interchangeable one with another. We do ourselves no favours by blurring them together under the convenient but misleading rubric 'energy', seeking a single, one-size-fits-all answer. They would not be problems if the answers were easy; but they are more amenable to solution if we keep separate problems separate. Managing energy therefore requires not one skill-set but many, related but different.

One key difference is the distinction between commodity transactions and investment. Those actually making decisions in the energy business usually understand the distinction very well. Those making energy policy, however, politicians and sometimes even regulators, now seem preoccupied with commodity transactions in a so-called 'energy market'. They appear to assume that energy investment, too, is determined by this commodity energy market. Most current attempts to address the looming issues of climate and energy security strive to rectify perceived 'market failures' with what are essentially short-term commodity measures, inherently volatile and unpredictable.

The energy security that worries politicians concerns supplies of imported oil and natural gas, not the secure delivery of energy services, such as keeping the lights on. Some of the measures most vigorously promoted try to improve fuel security by enhancing commodity supplies. But measures such as switching from gas to coal for electricity generation, developing tar sand deposits, and promoting coal-to-liquids conversion for transport fuels will grievously aggravate climate problems. Meanwhile the entire 'carbon market', and the emissions trading by which it functions, adds an additional commodity to the policy mix, but does not address directly the need to improve the performance of energy technologies and infrastructure. Calls for 'energy conservation' and 'energy efficiency' continue. But conservation and efficiency tell us only how well technology and infrastructure use commodity fuels and electricity - not how well they deliver services.

We need a much more fundamental change of approach. We need to reassess the nature of the problems we face, and the options available for managing them. But we do not have to start from scratch. We can call upon an impressive body of analysis and innovative thinking that dates back almost to the advent of 'energy' as a policy concept. In January 1979, for instance, a team led by Gerald Leach at the International Institute for Environment and Development (IIED) in London published a landmark report entitled *A Low Energy Strategy for the United Kingdom*. Three decades later it makes

unnerving reading. If its policy proposals had been adopted and implemented, the UK would have led the world in showing how to avoid fuel supply problems and minimize climate disruption.

Instead, the Leach team report was rejected out of hand by the UK's energy establishment. Yet it was by no means radical, much less heroic. As its opening page explains, 'This book presents a different view of the future. It does so for the United Kingdom, but its approach and findings should hold broadly for other industrial countries. It demonstrates, systematically and in detail, how the United Kingdom could have 50 years of prosperous material growth and yet use less primary energy than it does today ... We show that Britain - and by implication other countries - can move into a prosperous low-energy future with no more than moderate change. All that is necessary is to apply with a commitment little more vigorous than is being shown today by government, industry and other agencies some of the technical advances in energy use which have been made, and are still being made, in response to the oil price increases of 1973-74.'

The key feature of the approach the Leach team adopted was to move on from commodity aggregates and averages, to separate out the many distinct strands of energy use in UK society and analyze them one by one. To do this they had to identify and characterize not only the individual fuels and the electricity used, but also - and explicitly - the end-use technologies involved, starting with buildings. They analyzed the energy services desired and delivered, the technologies and infrastructure and their performance, separated out into precise details, and only then the fuel or electricity required for any particular service. They called this a 'bottom-up' analysis, by contrast with the 'top-down' analysis of fuel and electricity aggregates and averages then otherwise typical of 'energy forecasting'.

A key message of the Leach team report, emerging from page after page of meticulous dissection, was that managing energy means managing technology, physical assets and infrastructure, not just commodities; indeed that commodity fuels and electricity should enter the picture only after the appropriate management of the energy service infrastructure; and that investment decisions are not and should not be determined only by prices of fuels and electricity, actual or anticipated.

Three decades later we are at last beginning to see some recognition of this crucial realization. The implications for managing - what to manage, who to manage it and how - are profound and immediate. One corollary is clear: most people have neither the skills nor the time nor the interest to manage

the energy they use. The well-known hassle factor has long been a major obstacle to improving the management of energy throughout society, whether it involves loft insulation or switching fuel supplier. If we are to change the way we manage energy as a society, and indeed as a species, our most promising option may be to start with those who already manage energy for the rest of us. What do these major players do now? What skills and competences do they deploy, for what forms of business? How do they accrue revenues? How might these arrangements evolve? How can we enlist the know-how of today's energy business, technical and economic, social and political, to improve the way our global society manages energy?

The potential is there. Global energy is already changing rapidly. Electricity, which almost everywhere used to be a local or regional monopoly with captive customers, is now in many parts of the world an international competitive business, with risks to match. Its structure, function and nature could evolve yet further; see *Keeping The Lights On: Towards Sustainable Electricity*, by the present author (Chatham House / Earthscan 2007). International oil companies that once held sway around the world are gradually being stripped of their primacy, and their oil reserves, in favour of the national oil companies of petroleum-exporting countries. To counter this threat the international companies are having to seek new options. Natural gas, now an international fuel business in its own right, is also emerging as an instrument of foreign policy in the hands of Russia's Gazprom, with other national gas companies hoping to follow Gazprom's example. Buyers and users of imported natural gas are becoming uneasy. Coal has lately become the most controversial fuel of all, cheap and available almost everywhere but the most disruptive to climate unless and until accompanied by the novel, unproven and costly technology of carbon capture and storage.

Wherever you look, traditional energy players that were once content to concentrate on producing and selling commodity fuels and electricity, within economic and political frameworks well understood and more or less stable, now face a variety of new and major uncertainties about their future. They might well be receptive, therefore, to opportunities for new forms of activity and new sources of revenue that take advantage of their corporate skills and competence, their technical and economic know-how and their organizational and managerial capabilities. In particular they are long since experienced and versatile at designing, investing in, engineering and managing many kinds of energy infrastructure. In recent years, indeed, oil companies and electricity companies have reported substantial success in upgrading the energy performance of their own physical assets and infrastructure, including not only

process plant and other industrial facilities but also office buildings and other non-industrial facilities.

How, then, might this expertise and management capability be brought to bear on upgrading the rest of society's energy technologies, its energy service infrastructure? We have known for decades about the potential technical and economic improvements available in buildings, lighting, heating and ventilation, motors, chillers, and electronics. But far too little has actually happened. Over the years, energy companies themselves have attempted to establish so-called energy service subsidiaries, to offer customers opportunities to improve the energy performance of their premises, facilities and end-use technologies. To date, however, such energy service companies have remained at best incidental activities, with limited budgets and staffing, living from one modest contract to another and never attaining credibility as an essential and profitable form of energy business.

One reason for this ineffectiveness is that upgrading infrastructure requires investment. It is not merely a commodity question, such as seeking a better deal for cheaper electricity or natural gas. Yet the emphasis in today's 'energy market' is all about such short-term transactions - not about the investment that would reduce the amount of electricity or gas required to deliver desired services. Meanwhile the business plans of major energy players are predicated on selling as much fuel or electricity as possible. That is how they earn their revenues and make their profits.

How might we break out of this impasse? One immediate possibility arises. Governments all over the world, national, regional and local, use energy in their own facilities, especially buildings. In the UK, for example, the national government is directly or indirectly responsible for tens of thousands of buildings across the country. Within the past two years reports from the UK Sustainable Development Commission and the National Audit Office have declared not only that the energy performance of the UK government's buildings is unsatisfactory but that since the year 2000 it has deteriorated. The conclusion should be obvious. Governments such as that of the UK should stop telling the rest of us what to do, and show us instead. Governments should launch programmes to upgrade their own facilities, their own energy service infrastructure, to much higher standards - better insulation, doors and windows, better lighting, better controls, better appliances and electronics, probably even complete local systems using on-site generation of electricity, heat and cooling.

Such government programmes could create the conditions for the new form of energy business we need. They would make managing energy explicitly a matter of investment in infrastructure, especially energy service infrastructure, as it must be. Government upgrade programmes, with their scale, variety and continuity, would be a launching pad, to persuade major energy players to create effective and profitable energy service companies to bid for and carry out the work. They would create skilled jobs everywhere. They would also offer the private sector a vivid example of the benefits of such investment. Bulk orders for upgrades would bring down the unit cost of innovative materials and technologies. And of course, properly managed, government upgrade programmes would save all us taxpayers money. Imagine what such an approach could accomplish all over the world, enhancing climate and energy security while bringing economic advantages to countries, companies and citizens alike.

These ideas are neither new nor radical. Many articulate advocates in many countries have advanced them before, almost since the advent of energy policy nearly four decades ago. Perhaps, at last, their time has come.

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