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Playing With Fire:
Will Your Business Model Go Up In Flames?

Keynote address by Walt Patterson

When you say ´energy risk´, what do you mean? What do you think of as ´energy risk´? Looking through the programme of your conference, I see that the focus is on what you call ¨energy trading¨ - that is, buying and selling coal, petroleum and petroleum products, natural gas and electricity, all treated as commodities, in mainly short-term transactions. The risk you plan to manage includes the risk of changing demand and variable supply, the role of evolving technology, the effect on prices, and the impact of various forms of regulation on the commodity business you transact.

Yesterday afternoon, however, in one parallel session, you did briefly consider ´long-term risks and disruptive trends´. I hope you took them seriously. The long term is closer than you think, and the coming disruption will be comprehensive.

When I spoke to this conference two years ago, I warned you about fire risk. I have to tell you that in the intervening two years that risk has increased substantially. It arises from an obvious fact that still tends to be overlooked in policy discussions and debates around the world.

Why can´t you breathe in Beijing or Delhi? Why is the air here in London toxic, like the air in cities everywhere? The answer, of course, is fire - fire in vehicle engines, in power stations, in industry and buildings. We hear so much about what are alleged to be the problems of fossil fuels. But the problem is not the fossil fuels. The problem is what we do with them. We set fire to them. We burn them. Fire is what poisons the air in our cities. Fire also releases the greenhouse gas carbon dioxide, that is upsetting the climate of the entire planet, a threat so grave we try not to think about it.

We have always known that fire is dangerous. As I pointed out here two years ago, fire insurance is one of the oldest forms of risk management. Nevertheless, throughout the whole of human evolution we have relied on fire for essential activities. Indeed our Neanderthal precursors, and indeed the recently-discovered early humans in Morocco, were already using fire. Through many millennia we used fire to make light, to keep warm, to cook food, to bake pottery and smelt metals. At length, three centuries ago, Thomas Newcomen and James Watt devised the steam engine. With it we could use fire to exert force and move things - an extraordinary breakthrough, whose profound implications we still struggle with.

Fire therefore created our modern world, for good or ill. But fire also gave us one further boon. Using fire enabled us to produce the materials with which to generate and control electricity. Instead of fire we can now use electricity to produce light, keep warm or cool, cook food, manipulate materials, exert force and move things. We also use electricity to process information, rapidly becoming the most important human activity of all. Throughout most of human evolution, fire was essential, enabling us to do what we wanted to do. Now, however, for most of what we want to do, we no longer need fire. Instead of fire, with all the problems it creates, we can use electricity.

Fire is a chemical process. It produces heat at a temperture so high it´s dangerous. It turns resources rapidly into waste, and the waste is frequently pernicious, locally and globally. Electricity is a physical process. You can use it at any temperature, down practically to absolute zero. It does not use up resources, and produces no waste. We could therefore switch most of our human activities from fire to electricity, clean up city air and minimize disturbance to the climate - if not for one obvious problem. We still make most of our electricity using fire.

We don´t have to. When we first learned to control electricity we made it with batteries - no fire. Then Faraday showed us we could generate electricity by moving a wire in a magnetic field. At first we used water wheels and windmills to move the wire - again, no fire. Then Thomas Edison and others began using steam engines, usually burning coal, to move the wire. Throughout the ensuing century we came to rely mainly on electricity based on fire.

That, of course, had profound implications for planning, investment, business and regulation. When in 1989 the Thatcher government decided to liberalize electricity and make it competitive, they attempted to create an ´electricity market´ by analogy with the market for natural gas, based on buying and selling electricity by the unit, a commodity market in kilowatt-hours. But the analogy is spurious. Natural gas is a physical material. It can be stored, held back from the market until you the seller get the price you want. Electricity is not a physical material. It is a process, happening instantaneously and simultaneously throughout an entire interconnected system - generators, network and loads. Electricity cannot be stored - not, at least, as electricity. That introduces a quite different category of risk to the electricity market, as became apparent almost immediately in the 1990s, as companies folded like ninepins.

The travails of the electricity market for a quarter-century, as one design after another has unravelled, should suggest that something is wrong with the basic concept. The rise of renewable generation demonstrates the fundamental fallacy of treating electricity as a commodity. When you base electricity on fire, you do at least have a commodity involved - the fuel. The cost of a kilowatt hour does depend at least in part on the cost of the fuel required to generate it. For wind power or solar power, however, almost the entire cost of generation is the initial investment in the requisite hardware, however it may be financed. Wind power and solar power entail no commodity cost whatever. You do not use up the wind or the sunlight, nor do you pay for them.

Six weeks ago, on 19 May, the Financial Times ran a double-page spread under the headline ´The Big Green Bang´. It said ´After years of hype and false starts, the shift to clean power has begun to accelerate at a pace that has taken the most experienced experts by surprise. Even leaders in the oil and gas sector have been forced to confront an existential question: will the 21st century be the last one for fossil fuels?´ The FT piece detailed many examples of this striking trend. The steep and continuing drop in the cost of wind and solar generation means that these fire-free options are now often actually cheaper than traditional, conventional fire-based generation, with no subsidy involved - even without taking into account the hefty subsidies to fossil fuels and the unpaid local and global costs of fire-based generation.

The future for this conventional generation looks ever bleaker. Many companies see the writing on the wall, closing coal-fired plants that can no longer compete. Even gas-fired plants are often finding operations difficult, as abundant wind and solar electricity drive wholesale prices negative, a bizarre commentary on the flaws of the so-called ´electricity market´. My judgement is that conventional generation, in huge remote inflexible so-called ´baseload´ power stations, looks as doomed as the dinosaurs.

The configuration and operation of electricity systems is changing so fast that ´baseload´ itself is no longer a useful concept. Conventional electricity was a homogeneous, ´one size fits all´ process, lending itself to the commodity approach exemplified by the ´electricity market´. However, as innovative electricity becomes more and more decentralized, it is rapidly diversifying into many different processes. An Indian-American engineer friend of mine called Mahesh Bhave has just published an engrossing book entitled *The Microgrid Revolution.* Its subtitle is *New Business Strategies for Next-Generation Electricity*. Although now working on electricity, Bhave comes from the telecoms industry. He argues that after the headlong transformation that has engulfed telecoms, electricity is now undergoing a similar - similarly spectacular, similarly swift and similarly disruptive - transformation; and I agree.

Electricity entrepreneurs can now offer complete service packages, including efficiency upgrades, on-site generation with gas and renewables, battery storage, and versatile information, communication and control technology. They can target specific applications, such as street-lighting, water-pumping, electric-vehicle charging or security. The advent of affordable battery storage, at every scale from household to substation, allows a dramatic loosening of previously essential large-scale networks. As electric vehicles enter the mix, we can anticipate what Bhave calls ICTTE - information and communication technology with transport and energy, a complete interacting system.

Homes and other buildings with photovoltaic generation and battery storage can have separate direct-current circuits to run all their LED lamps, computers, phone chargers and consumer electronics. In the US many office buildings are installing DC wiring for these applications, and I expect the same to happen in Europe and elsewhere. Universities, hospitals, airports, shopping malls, the list of potential microgrids, possibly using both AC and DC in parallel, grows steadily longer. The traditional regulated monopoly franchise electricity system is obsolete, giving way to what may become a loosely-interconnected federation of microgrids, large and small.

Against this background, to ask about the future ´energy mix´ in our economy and society seems to me pretty futile. ´Energy mix' used to mean the proportions of coal, oil, natural gas and other fuels bought and sold. But that concept may soon fade from the picture. If, for instance, you are a homeowner in New South Wales, with a solar array on your roof and a battery bank beside the house, perhaps also with an electric car in the garage, your house no longer even connected to the grid, who is going to measure the electricity you use, or how you use it? All you care is that the lights stay on, the appliances work and the car starts. You may have a contract with a company that maintains your system. But no one is buying or selling kilowatt-hours.

For what it´s worth, I think the proportion of coal in the fuel mix will continue to decrease, even in places such as China and India. They now realize that the air toxicity that fire creates - not just air pollution, but air toxicity - is a major scandal and a serious public health and indeed public order problem. Natural gas will be around longer. It's cleaner and more versatile than coal, and lends itself to higher-efficiency applications such as on-site cogeneration and trigeneration. But it still feeds fire, with all that that implies. The major market for petroleum is now transport fuel, especially road vehicles. Every major car manufacturer is now focusing on electric vehicles, as the FT article described. Coupled with the drive to make urban air less poisonous, the switch to electric vehicles has serious implications for the oil market worldwide.

We have already seen the disruptive effect these developments are having on what some people continue to call ´utilities´. Applied to electricity, that appellation has been inaccurate for two decades, and grows steadily less defensible. Companies such as RWE and E.On have had to take

drastic action, as their share prices have plummeted. Electricite de France has been technically bankrupt for many months. I expect more dramatic upheavals in the near future, as the international so-called ´energy companies´ try frantically to revise their business models in the effort to remain relevant and competitive.

The speed of transformation is affecting not just the way we use and produce fuels and electricity, but also the way we buy and sell them. For instance, a new consortium called the Energy Web Foundation, including some of the best-known companies you deal with, is - as its website proclaims - ´focused on accelerating blockchain technology across the energy sector´. The potential blockchain offers, for bypassing intermediaries in transactions, might by itself make many energy traders superfluous to requirements.

All in all, I have to tell you that the gravest risk you face is that your current business activities could soon be as irrelevant as whale oil after the advent of electric light. We no longer have to rely on fire, or on feeding it. Fortunately, however, electricity business is getting rapidly more exhilarating. As you weigh the risks, fire-free clean electricity, in all its exciting manifestations, looks a pretty good bet. If I were you I´d go for it.

Walt Patterson is associate fellow in the Energy, Environment and Resources Department, Chatham House, London. His latest book, Electricity Vs Fire: The Fight For Our Future*, is a free download at Walt Patterson On Energy, <www.waltpatterson.org/evf.htm>.*