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## **Electric Future**

### **Presentation by Walt Patterson**

We've already started transforming electricity. But we have a long way to go. The resources are there. We can enhance generation, performance and infrastructure all together. Indeed that's the way we need to approach the transformation, as a complete package. We should be aiming at a complete new concept of electricity in society, a transformation of the whole system. That's the first and most difficult transformation: we have to change the way we think about electricity. Then we have to change the rules accordingly.

We've come to think of electricity as a commodity. We've come to believe that what matters is an 'electricity market', commodity trading in kilowatt-hours, short-term batch transactions in which the unit price is key. But electricity is not a commodity. Electricity is a process, a process in technology. What matters is the technology. What matters most, moreover, is not the electricity generating technology, nor the delivery network. What matters most is the user-technology and user-infrastructure: the buildings and what's in them, the fittings and appliances, lamps, motors, electronics and so on - the technology that actually provides the electricity services we want, the comfort, illumination, motive power, mobility, information and entertainment.

We keep hearing about problems of energy security and climate. These problems are not about 'energy'; they are quite specifically about fuel. When politicians worry about what they call 'energy security', they are really worrying about supplies and prices of hydrocarbon fuels, particularly oil and natural gas. The main climate problem is the effect of using fossil fuels. If we want to reduce our vulnerability to disruption of fuel supplies and climate, we have to reduce our use of fuels. When we talk about a low-carbon future we really mean a low-fuel future.

We hear a lot about competition, as a way to get the best energy services. What we need to understand is that the key competition is not between different suppliers of fuel or electricity. The key competition is between fuel and technology. The better the user-technology, the less fuel we need to get the service we want. We need to shift the balance away from fuel, toward technology. We can do this in two ways.

First we need to upgrade the performance of our user-technology and user-infrastructure, especially buildings. We know how; we've known how for decades. We need to get serious about it. Reducing energy waste should be our top priority. Then we need to realize that we use two kinds of electricity. One kind we generate from fuel, such as coal, natural gas or uranium. The other kind we generate by using technology and infrastructure to convert natural ambient energy - sunlight, wind, waterfalls - into useful electricity. Most people call this 'renewable'. I call it infrastructure electricity. Infrastructure electricity does not use fuel.

Performance upgrades and infrastructure electricity go hand in hand. Both require mainly upfront investment, with minimal subsequent running costs. Both are completely different from what today's politicians call the 'energy market'. What we need is not short-term batch transactions but a market in long-term contracts, forming long-term business relationships and creating the jobs that

produce the physical assets, the high-performance user-technology and the infrastructure electricity to run it.

Traditional electricity is based on a technical model now more than a century old, overdue for transformation, starting with generation. Before climate became an issue I spent much time and effort advocating advanced coal technology, with little success. Coal producers were utterly uninterested. Now I have to conclude that we had better phase out coal worldwide as fast as possible, or we'll have no hope of preventing climate catastrophe. At one stage I thought carbon capture and storage might alleviate the problem. Now I'm deeply skeptical, because it depends on staying with traditional electricity rather than transforming electricity itself.

People ask 'do we need nuclear power?'. To me that's like asking 'do we need a broken leg?' If you're really serious about climate - and you'd better be - why pick the slowest, the most expensive, the narrowest, the most inflexible and the riskiest of all the options to put your political weight behind? By 'riskiest', I used to mean in purely financial terms. That's why private finance will not fund new nuclear power plants without open-ended guarantees from taxpayers. Now, however, Fukushima has reminded us that nuclear risks are not just financial. Nuclear power is a dangerous distraction - traditional electricity at its worst.

Natural gas, on the other hand, is a valuable partner for innovative infrastructure electricity. Natural gas generation can come in small, rapid increments, right down to onsite generation, cogeneration and trigeneration. It helps to foster the essential change in electricity networks. Traditional centralized electricity needs radial one-way networks. They carry large electric currents long distances from huge remotely-sited power plants to much smaller user-applications. Innovative electricity will be much more decentralized. It will have meshed two-way networks linking many more much smaller generators with applications of broadly similar sizes. All parts of the system will be heavily instrumented, communicating with each other continuously in real time.

People wonder what sustainable electricity might look like. It won't happen by 2030; but I think sustainable electricity will eventually be invisible - not just invisible as it already is, but invisible to any so-called 'market'. Suppose, for instance, you have an office building with a photovoltaic skin, and low-voltage direct-current cabling to drive its high performance LED lamps, its computers, its motor-drives and all the other direct-current appliances we already use. If your own building is powering your appliances you won't need to meter the DC, any more than you meter the DC flowing through your Blackberry. Infrastructure keeps the lights on.

Let's change the way we think about electricity, and change the future for the better.

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