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Down with Conservation! Forget Efficiency! and other provocations

By Walt Patterson

Good morning everybody - -

So here we are in Las Vegas, to talk about sensible use of electricity. Yes ... Do you feel a doubt creeping in? Coming to Las Vegas to talk about using electricity sensibly is like going to an opium den to quit smoking.

When it comes to electricity, Las Vegas is a throwback, to the earliest days of electricity and electric light, to the 1880s and 1890s, to the Paris Exposition and the Chicago World's Fair - electric light as an extravagant spectacle to dazzle the populace. That's fine, if that's what turns you on. But in today's world that's not what electricity is about - not even in Las Vegas, not in Nevada, not in the US, not in the whole world.

In today's world, electricity is about keeping us comfortable, whatever the weather, whatever the temperature outdoors. It's about holding back the darkness when the sun is gone. It's about delivering more motive power than we can get from muscles. It's about organizing information and communicating it, for work and for leisure - and Las Vegas certainly knows about leisure

In this twenty-first century, nevertheless, electricity is about providing the services that make modern civilization possible - whether or not you think that includes Las Vegas. You and your colleagues here at this conference understand this better than most people. Why, then, are we all still stuck with electricity arrangements that date back to the nineteenth century? Think about it. The traditional electricity system that we all take for granted, not just in Las Vegas, not just in the US but worldwide, is based on the 1890s, when electric light was just a spectacular extravaganza.

This traditional electricity is a technical model now more than a century old. It arose because of the economies of scale associated with water power and steam power, the only two options people then had to drive electricity generators. Traditional electricity is still based on these large central-station generators. We call them power plants.

Most power plants operate either intermittently or at only partial load most of the time. The power plants that use fuel waste two-thirds of the fuel energy before it even leaves the plant. The system has to have long lines of network. Line losses cost another significant fraction of the energy flowing. The system is inherently vulnerable to disruption, by mishap or malice, over a wide area and almost instantaneously. We see the resulting blackouts all too often, even in the US and Canada, not to mention Europe and elsewhere. Yesterday it was Florida, Alabama and Georgia. Tomorrow it could be anywhere.

Traditional electricity assumes that every load is essentially equivalent - that all loads require the same high quality of electricity. The system produces and delivers the high-quality electricity required by sensitive loads. But we then use most of this high-quality electricity for undemanding

services such as heating and cooling. The generators are almost all at least a hundred times, and more often ten or a hundred thousand times, larger than most of the loads on the system. Most of the loads, such as lamps, motors and computers, are inherently intermittent or variable; but the system's large fuel-based generators are inherently inflexible. The mismatch is already so complete you'd think we planned it that way. But it gets worse.

All the key technologies of traditional electricity - large dams, coal-fired and nuclear power plants, and overhead transmission lines - face mounting problems, both financial and environmental. Everywhere you look, world electricity is in turmoil, and the turmoil is spreading, even in rich countries like the US and the United Kingdom. Keeping the lights on gets harder and harder. Two billion people - one-third of humanity - have no electricity at all. The International Energy Agency has estimated that by 2030 the investment needed for electricity will be ten trillion dollars - more than one thousand billion dollars every three years. Yet many parts of the world are trying to change the way they manage electricity. They are changing to competitive commodity markets, in which you buy and sell electricity by the unit, as though it were barley, coffee or pork bellies. This change has cost many of those in the electricity business their jobs, their shirts or their companies - tens of billions of dollars' worth of losses already. Future electricity investment, to say nothing of ten trillion dollars, could now be so risky it might not happen.

Can't we do better than this? Of course we can. We have a sumptuous shopping list of new electricity technologies, that would have made Thomas Edison's mouth water. You can find a lot of them in the exhibition hall at this conference, and in the pages of EC&M magazine every month. But the people who make electricity policy, the governments and the regulators, keep getting it wrong. The fundamental mistake goes right back to Edison in the 1880s. When Edison set up his first power stations, in London and Manhattan, he was selling electric light - what his customers actually wanted. He charged them according to how many lamps they used. To keep the costs tolerable he had to get the best possible performance out of every part of the system - not just the steam engine and generator but also the cables, switches and lamps.

Then, in the mid-1880s, it all went wrong. They invented the electricity meter. Suddenly, instead of selling electric light, Edison and his competitors were selling electricity, by the measured unit. Suddenly, if you were selling electricity, having your customers use poor-quality lamps was good for your business. To get adequate electric light they had to use, and pay for, more of your electricity. What a perverse incentive! It has distorted our electricity arrangements ever since.

Another major change happened nearly two decades ago. It started in the United Kingdom, where I live. At the time, the Prime Minister was a woman named Margaret Thatcher. In the late 1980s she and her government abruptly decided to break up and sell off the UK's government-owned electricity system. They wanted the proceeds of the sale to pay for tax cuts before the next election. But they argued that liberalizing electricity and introducing competition between generators would bring down prices, and benefit electricity users. UK electricity evangelists carried the gospel of liberalized electricity to the four corners of the earth, with some success. It even made some inroads here in the US.

I have no problem with taking electricity away from government, breaking up monopolies and making the business competitive. But the way they did it meant that every time they solved one problem they created two new ones - lost jobs, lost fortunes, bankruptcies, blackouts, even in the richest parts of the richest countries. For instance, not one of the companies created when the UK sold its electricity system in 1990 still exists. Seeing the results for nearly two decades, we can see that the whole undertaking is fundamentally misguided. World electricity urgently needs a drastic overhaul.

Start with the electricity meter. Ever since it came along, we have treated electricity as though it were a fuel, a commodity, like pork bellies. We sell and buy electricity by the measured unit, the kilowatt-hour. We talk as if the price per kilowatt-hour is what matters to users. It's not. Most electricity users have no idea what price they're paying per kilowatt-hour. What matters to them is the bill - the total bill. You don't make the bill low by making electricity cheap. You make the bill low by *making electricity expensive*. That makes users install better technology. Users do not want a low price per kilowatt-hour of electricity. Users want a low cost of services - and not just a low cost. They want *better* services - not only cheaper, but also more reliable and cleaner. Better technology delivers better services.

That's because electricity itself is NOT a fuel, nor a commodity. Electricity is a PROCESS, happening throughout an entire interconnected circuit, simultaneously and instantaneously. You can't store it, or withhold it from the market until you get the price you want. The whole idea of an 'electricity market' is deeply suspect, at the very least. What matters is the whole system, and how it performs, not just how much electric current is flowing through it. You need to optimize the whole system - not just the generation, but also the networks and especially the end-use technologies. Why do we, and our politicians and policymakers, ignore this?

To begin with, we talk about it wrong. Politicians talk a lot about what they call 'energy policy'. But they don't know what they're talking about. They think they're talking about energy, but they're only talking about fuels and electricity. Fuels and electricity by themselves are useless. They're useful only when they run energy technologies. The energy technologies are what really matter. Energy technologies give us comfort, illumination, motive power, refrigeration, information, communication - the services we actually want. The better these technologies, the less fuel and electricity they need. That's how to make your electricity bill lower. You have to invest in, upgrade and use better technologies. It's that simple - a no-brainer. Why, then, does it not happen?

We've known for decades how to make better buildings, lamps, motors, chillers, electronics and other energy technologies. But we haven't bothered. The language we use is all about fuels and electricity, not about technologies. We have the wrong regulations, the wrong standards, the wrong finances, the wrong business relationships and the wrong incentives. Energy policy should not be about fuels and electricity that we treat as commodities. Energy policy should be about the technologies that give us energy services. The time has come for real energy policy.

Let's start by forgetting about 'energy conservation' and 'energy efficiency'. Politicians and chief executives tell us again and again how important they are. But almost nothing happens. 'Energy conservation' and 'energy efficiency' are just distractions from what we should really be thinking about. When we talk about 'energy conservation' and 'energy efficiency' we're still talking about fuels and electricity. 'Energy conservation' and 'energy efficiency' only tell us how well a technology uses fuel or electricity. They don't tell us how well the technology delivers the service we actually want. We're letting energy technologies themselves become an afterthought, a way to use fuel or electricity.

We don't buy technology in order to use fuel or electricity. We buy technology to get the service it delivers. What matters is not fuel conservation, or efficiency. What matters is performance - energy performance, if you like. We want to get the best out of all the resources we use. That should start with the technology, not with the fuel or electricity to run it. The better the technology, the better the performance. What we call energy conservation, or energy efficiency, simply misses the point. Let's make energy technology itself, especially energy service technology, the top priority for policy. Let's plan explicitly to improve our energy service technologies. That's what we should mean by real energy policy.

We can begin right here on your own turf, with electricity, electricity technologies and the services they deliver - that is, with what you design, manufacture, install, operate and maintain. That's what matters most, and that's what we can do most easily, most rapidly and most effectively. It also, of course, should be good business for you and your colleagues, not just here in the US but around the world.

Let's think for a moment specifically about electricity. Electricity is different. A fuel such as oil or coal comes from a hole in the ground. If you want to use it somewhere else you have to carry it there. Electricity you can generate anywhere, in any quantity from minute to vast. In particular, if you want to, you can generate electricity close to where you want to use it, and in the quantities you want to use. We already do this some of the time - think of a flashlight or an iPod. But we can now also do this on a larger scale, for a whole building or group of buildings, a neighbourhood or a village. The shopping list of innovative small-scale, clean generating technologies is already long, and expanding rapidly. If we want to, we can now design and implement local systems using local electricity, to deliver comfort, illumination, motive power, refrigeration, information and entertainment. Such local systems can be at once cheaper, cleaner and more reliable than traditional electricity.

One of the earliest and most famous examples of this innovative local approach is not far from where I live in the UK, a town called Woking, south of London. It used to be best known as the town where the Martians landed in *The War of the Worlds*, by H G Wells. More recently, however, it has become world-famous for energy innovation, especially electricity. If you google 'woking energy' - that's W O K I N G - you get more than 300 000 entries. Woking's borough engineer, a hard-nosed realist called Allan Jones, backed by the Woking town council, set the process in motion in 1990, as soon as Margaret Thatcher had liberalized UK electricity. What Woking did worked out much better than Mrs Thatcher's plans.

Woking installed their own local electricity generation, including several combined heat and power cogeneration plants, small wind turbines, fuel cells and photovoltaic arrays, all connected by their own local network operating independently of the UK grid, with elaborately instrumented and with real-time control technologies. At the same time, to make the best use of their own local generation, they steadily upgraded local buildings, with better insulation, doors and windows, high-performance lighting indoors and out, motor controls and many other technical innovations. They integrated the local generation with the local loads and optimized the whole system. Perhaps the most remarkable part of the Woking achievement is that each phase of the programme saved money. Each phase financed a further phase and yet more improvement. The Woking programme was so successful that the Mayor of London recruited Allan Jones to set up a similar programme of local generation, upgraded buildings and high-performance electrical technologies for London. That programme is already under way in London.

In July last year my institute, known as Chatham House, in London near Piccadilly Circus, held a launch party for my new book. The book is called *Keeping The Lights On*; its subtitle is *Towards Sustainable Electricity*; and it's about how we can change electricity for the better. We were lucky enough to have Allan Jones, the Woking and London pioneer, speak at the party, about 'Sustainable Megacities'. For weeks afterwards people came up to me to say that the launch party with Jones was the best Chatham House meeting they'd ever attended. It was exhilarating and visionary, yet practical and down to earth, with vivid specific examples of what has already been accomplished and what is now happening.

That's the reality of innovative local small-scale electricity. It's not science fiction. It's real, and it works. But it does not sit comfortably with traditional centralized, remotely-generated electricity. Defenders of traditional electricity do not like these innovative options. They are unimpressed by small-scale generation. As far as they're concerned, real men build gigawatts. Small-scale generation costs too much. It does not fit into either the configuration or the operating regime of existing electrical networks.

Are these objections valid? What about the cost of generation? The so-called 'cost of electricity', comparing different technologies, is usually plucked out of the air and stated baldly to fractions of a cent: 'Coal electricity costs 5.5 cents a unit; wind electricity costs 7.3 cents a unit; solar electricity costs 13.7 cents a unit', or numbers like that. These alleged costs leave out almost everything that matters. They say nothing about who does the accounting and how; nothing about how the finances work; nothing about taxes and who pays them; nothing about subsidies, whatever they may be; nothing about risks and who bears them; nothing about how generation affects the rest of the system; nothing about how it affects the network ... and so on and so on. These details are essential, not incidental. They influence profoundly both the costs and who pays them.

The 'cost of electricity' you hear quoted by politicians and lobbyists is essentially a 'hooray' number or a 'boo' number. Lobbyists use these purported 'costs' to promote one generating technology or put down another. Today, in particular, they routinely claim that traditional large-scale remote fossil-fired generation is 'cheaper' than smaller-scale renewable or cogeneration closer to users. The comparison is phony. For policy purposes these alleged 'costs' are meaningless. They should have no influence whatever on policy. Policy determines costs - not the other way round. That's worth repeating, with emphasis: ***policy determines costs***. That indeed should be the aim of electricity policy, sensibly and coherently developed. Sensible electricity policy will make the most reliable, cleanest options the cheapest.

Networks are a prime example of this policy challenge. Traditional electricity networks are radial, one-way networks. They carry large amounts of electricity long distances, from huge remote power plants to users many miles away. Innovative small-scale generation close to users needs networks that are laid out differently and operate differently. Innovative electricity needs meshed, two-way networks that communicate directly with both generators and loads - that adjust both loads and generation in real time to maximize system stability and minimize costs. We can set up such networks right now - we have the technology. But we're stuck with traditional networks, so-called 'legacy' networks. They're fault-prone, out of date and obsolete. Updating the networks while keeping the lights on is going to be a major challenge. But the first step is to change the way we think about networks - and to make sure our regulators also update their thinking.

Innovative electricity is a vast improvement over the outdated, obsolete legacy electricity we're still stuck with. But how do we get there from here, while keeping the lights on? Start with the way governments themselves use energy. All over the world governments themselves, not only national governments but regional and local governments, have vast estates of facilities that are their own responsibility - everything from schools to prisons. In the UK, I know, the quality and energy performance of these facilities - the buildings themselves, and the lighting, heating, motors, chillers and other technologies inside them - is mostly substandard, and often appalling. Even official studies say so. McKinsey and the investors group Ceres have just published a report that indicates that the same is true here in the US.

The opportunity is obvious. Governments can launch programmes to upgrade ***their own facilities*** to much higher standards - better insulation, doors and windows, better lighting, better appliances and electronics, probably even complete local systems including on-site generation of electricity, heat and cooling. Such government programmes would be valuable pump-priming for the energy service

companies that would bid for and carry out the work - energy service companies that would also be your clients and employers. Government investment programmes would bring down the unit cost of innovative technologies. They would create skilled jobs all over the place. They would be a vivid example to the private sector. And of course, properly managed, such programmes would save all us taxpayers money. If American municipalities, cities and states were to launch such programmes, imagine what such an approach could accomplish here in the US - even in Las Vegas.

What does all this mean for you, your work, your business? When you leave Las Vegas, what next? No single one of you can make much difference, any more than I myself can, alone. But if these ideas make sense to you, you can think about them and talk about them. You might even want to find out more about them. If you google my name, Walt Patterson, you'll find our website [Walt Patterson On Energy](#), full of free downloads. Pass it around! You can make sure your colleagues and clients know about innovative electricity and its exciting potential. Talk to the exhibitors here at this conference. Talk to the trade organizations that represent you to politicians in your cities and states. Innovative electricity has to focus on investment. We have to upgrade the technologies that deliver our energy services. That has to be good business for you, your colleagues and your suppliers.

The way we use energy is getting us into trouble, here in the US and around the world. But we know we can do better, far, far better, starting with electricity. Enlightened electricity people can show the rest of the world the way. If we can do it in Las Vegas, we can do it anywhere. Let's get to work.