Make Every Home a Generator

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INTRODUCTION

→ We are facing a power generation crisis. It is a local crisis and a global crisis. It applies where I am writing in Ontario, Canada, just as it applies in the UK, India, China and Brazil. Most of the remedies that are being put forward in these places are based on traditional methods of producing electricity - nuclear plants in Ontario and the UK, coal-fired power stations in India and China, and so on. But these are costly, especially if you factor in their environmental impact, as we should do. What is needed to resolve this crisis is complete rethink on how we go about producing power - a new paradigm where we are no longer simply consumers of electricity. We need to turn our homes into renewable energy generators.

To understand how this might work, it is useful to use an analogy. In the early days of computing, there were mainframes. There were comparatively few of these giant machines, and they were mostly found in special air-conditioned rooms in large organizations. Users were networked to these machines via their terminals (although the mainframes themselves were not networked) and when the machine went down they couldn't work, which happened quite often.

Today, we live in a completely different world. Many people have access to one or more computers, and one or more ways of getting onto the Internet, which is a vast array of interconnected computers. The Internet is never down. Even in a crisis like 9/11, when the local telephone networks were severed, workers could still communicate using their Blackberry handheld email devices accessing the Internet via wireless.

So now computing and communication is more reliable and much less risky. It is decentralized and distributed with multiple access points. And it is scalable - if more users come along, they simply hook their machines onto the network and they become part of the system. Furthermore, if they choose, individuals and organizations can contribute to the resources on the Internet, either by adding content or services, such as Websites or Internet stores, or by allowing their computer when it is idle to be used by a project such as the search for extraterrestrial intelligence (SETI@home).

Now compare this with electricity generation. Today, we live in the equivalent of the mainframe era. There are relatively few giant plants that produce power. And although we are hooked into them via a network called the grid, the plants are single points of failure - if one goes down, hundreds of thousands of people can be without electricity. The residents of Montreal, for example, know only too well the consequences of a Quebec ice storm on their power supplies. This centralized model of producing energy is risky and unreliable. Nor does it scale very well. If

usage increases, you need to build more giant plants at tremendous cost and long lead times.

The mainframe model of power generation is a problem because it assumes every user is a passive consumer of electricity. But what if we turn this on its head and see what an Internet model of electricity generation might look like.

HOME GENERATORS

→ Let's assume that, as in the Internet era where everyone has their own computer, or multiple computers, and can be a contributor as well as a user of computing resources, every home is a generator as well as a consumer of energy.

How can a home be a generator? There are three main ways – it could use geothermal exchange (using the fact that the earth just below the surface is at a constant temperature whereas the above ground temperature varies) to generate heat and hot water; it could heat water using solar panels; and it could produce electricity from solar panels or from wind turbines. In addition, the homeowner could commit to buying any additional electricity that is required from renewable sources.

While we are away at work or school, our houses could be net producers of electricity and, if the network was set up to allow it, could feed this power into the grid - with the homeowner getting paid for it. Our excess energy can be distributed to where it is needed elsewhere in the grid. And if all of our houses were contributing to the grid when we were at work, etc., it would even out the overall power generation requirement, and the peaks and troughs of consumption, lessening the likelihood of blackouts, which mostly occur in daylight hours. Also, by making every home a producer of electricity tied to the grid it would lessen the need for the long-distance distribution of electricity, which is itself a big consumer of energy because of the inefficiencies involved.

Now we are no longer so reliant on giant centralized power plants. We all have the equivalent of a personal computer for our energy needs and can contribute to the overall network's resources when we are not using it - a sort of 'power@home'. This is much safer and more reliable. If an ice storm were to hit Quebec, the residents of Montreal would no longer be completely at its mercy. Or if or a terrorist attack were to takes out a power station, the decentralized distributed system would takes up the slack.

And it's safer in terms of the environment and climate change too. If every home were a generator, we would take a massive load off the grid. In most parts of the world, homes and offices are one of the top three users of energy, along with

industry and transport (although the actual amount differs from place to place - Canadians use far more energy in their houses than Europeans, for example). But wherever they may be, if every home was a generator it would have a dramatic impact on carbon emissions. Home generation - geothermal, solar, wind - is clean. If houses became net generators rather than just consumers of electricity it could reduce power requirements by up to a third in places like Canada. This would mean a massive reduction in carbon emissions, and a huge step towards meeting Kyoto and other climate change targets.

And if we committed to buying any electricity we did require from renewable sources wherever possible that would also help reduce the dependency on old-fashioned centralized unreliable polluting power plants.

Furthermore, this model is scalable. If a city builds 100,000 more homes and they have geothermal and solar facilities, it creates 100,000 more generators and not just 100,000 more consumers.

This also means that environmentalists ought to rethink their mantra of 'get off the grid'. In an Internet world that makes as much sense as saying 'get off the Web'. The grid isn't the problem - it is the fact that the way it operates now forces us to only consume and not contribute. An ecologically designed home that exploited its natural energy sources could contribute more to local and global sustainability by being on the grid and offering its surplus energy than cutting itself off. And the homeowner will have energy independence with the security of being connected to a reliable grid.

LET'S DO IT

→ So what would it cost to make every home and generator, and why aren't we doing it now? While we haven't costed it properly yet, it is safe to say that for an area like Ontario it would cost much less than the $40-60 billion that is being proposed to build new nuclear plants to avoid the looming electricity crisis. Already without any economic incentives, geothermal exchange is a cost-effective way of producing heat and hot water domestically. Solar powered hot water has a short payback time - around two years in many cases. Solar electricity has a longer payback time and would need something to grease the wheels if it were to be widely adopted. But if the environmental impact of the traditional means of power generation was were properly priced, then even solar electricity would starts to look economical. And the price would fall further once the economies of scale kicked in as manufacturing ramped up with widespread adoption.

Right now, regulated pricing, which aims to protect the consumer, in fact shields the power generators from the environmental price of their activities, and discourages households from creating their own generating facilities. And no one factors in the cost of generating plant outages into the price of electricity. When Montreal shuts down because an ice storm has hit a Quebec power plant there is a massive cost to business and society.

Other barriers to every home becoming a generator are mostly technical and political, and could easily be overcome. At the moment, if I turn my home in into a generator I can't sell my surplus electricity back to the grid. But this is changing. The installation of so-called smart meters in Ontario, which track when and how energy is consumed, should be able to track - and reward - generation as well as consumption. This model is being adopted by forward-thinking utilities that realize that distributed generation is a smart way of meeting increased demand.

CONCLUSION

→ By turning every home into a generator we adopt the Internet model and create a connected, cleaner, safer, cheaper, more reliable and more sustainable way of producing the energy we need. And we don't need a 'big bang' approach. It would still have a massive impact if we moved toward this goal slowly over, say, 10 years, as our personal finances permit. It would also help tremendously if we could get our governments to provide incentives to move in this direction. By signing up to this initiative, we will send a strong message to our governments that we are serious about alternative models for generation.

ABOUT ZEROFOOTPRINT

→ Zerofootprint is a socially responsible enterprise whose mission is to apply technology, design and risk management to the massive reduction of our environmental footprint. We operate both in the for-profit and charitable domains through two entities, Zerofootprint Software and Zerofootprint Foundation using shared technology.