

Part II (I)

To understand why smart grids are necessary, you need to understand a bit more about how we currently consume electricity. Today, we use electricity when we want to and as electricity is difficult to store, the flexibility to meet this changing demand is provided by a small number of large generators that change their output to match our needs. For most of us, the lights stay on most of the time and the system works pretty well. So why the need for change? Well, there are a number of reasons, most rooted in climate change and the need to move to more sustainable sources of energy.

Reducing Carbon Emissions

Most electricity today is produced from carbon-rich energy sources such as coal and gas. But, to tackle global warming, there's a general acceptance that we need to move to lower carbon energy sources. This presents a challenge since low carbon generation such as nuclear and renewables tends to be inherently less flexible than, say, a gas-fired plant that can increase or decrease output at relatively short notice. In the case of renewables, the challenge is even greater since they're often not only inflexible but also unpredictable. (Who knows when the wind's going to blow or the sun's going to shine?)

Living with sustainable generation

Moving to low-carbon energy sources will require a fundamental shift in the way we use and store power. The unpredictability and inflexible nature of power generated from sustainable sources means that we've either got to get better at storing electricity or at using it when it's available – in truth, we're going to have to get better at both. Energy storage technology still has some way to go. So, in the short term, we need to be able to shape energy demand to match available generation. For demand to align to low-carbon generation, consumers need to:

- ✓ Be aware of when power's available.
- ✓ Be able to schedule their consumption accordingly.

In short, consumers need to become a lot more engaged with the electricity industry than they have been to date.

Managing growth in electricity consumption

At the same time as facing a fundamental change to the way we consume electricity, we're also set to start using a lot more of it. The World Energy Council envisages that by 2050 energy will come from at least eight different sources: coal, oil, gas, nuclear, hydro, biomass, wind and solar. Electricity is set to play an important role in integrating this diverse supply portfolio, and the International Energy Agency predict electricity's share of the total energy market to grow from 24 per cent in 1970 to 40 per cent in 2020. The largest growth in electricity usage is likely to occur in residential heating/cooling and in transportation, two heavy users of carbon-rich energy sources. Whilst lowcarbon alternatives such as bio-methane, hydrogen, fuel cells and bio-diesel are all possibilities, these have some way to go before becoming commercially viable and in the meantime, electricity is likely to be the most practical alternative. We need to substitute our gas central heating for electric heat pumps and our 'gas guzzlers' for electric vehicles (often referred to as 'EVs'). To reduce carbon, we need to electrify transportation and residential heating/cooling which means we need to generate even more electricity than we do today (from low carbon sources, naturally). That, in turn, means more electricity to distribute and more pressure on our distribution grids. If new electricity demand is to be met, it must be flexible enough to adapt to the increasingly inflexible and unpredictable sources of sustainable generation.