

Diesel Generators and Renewable Energy may not seem like natural partners in crime, but this form of generation may play a really important part in our low carbon future. Research into how we integrate renewable energy into the electricity network or 'Smart Grid' is integral to the success of our low carbon transition.

But let's take a few steps back... 'The Smart Grid', what does it even mean? That's a question I get asked a lot when I start to talk about my research. It's not a particularly well defined concept even within the academic research surrounding it, but in short, it is what the electricity network of the future will look like when we have more renewable energy sources contributing to our electricity demands.

As well as clever control systems, flexible power supplies and a greater contribution from storage solutions like batteries, the way we use electricity is going to change. Before you all cling to your phone chargers and laptop docking stations for dear life, this doesn't necessarily mean that each of us at home will even notice a difference. Our electricity system is currently demand led. That means that the 'grid' must make sure there is enough electricity in the wires every time we turn on the lights or the TV. However, as more renewable electricity is generated, we need to move to a more flexible demand, to make sure that we use the low carbon energy when it is available and minimise demand when there is less available supply.

There are lots of different ways to 'flex demand' and some of them are fairly familiar. Demand Side Management (DSM) is a term used to describe all of the ways of managing variable supply by changing the pattern of demand. Time-of-use tariffs are one example and though it may not be a familiar term, examples such as Economy 7 should ring a few bells. Charging users different rates for 'peak' and 'off peak' services is not a new concept at all. Commuters are all too familiar with paying for peak train tickets and many of us will have peak and off peak phone tariffs. While not many of us have yet seen these tariffs for our electricity consumption in our homes, this is certainly something which could change in the future. It is also something which is already seen in the non-domestic building stock on a regular basis. For many large consumers of electricity this is not an option – mandatory time of use tariffs charge more at peak times no matter what.

So DSM boils down to reducing the demand when the supply is low – for example switching off air conditioning units when the wind drops. But is that simple in practice? Well, as many researchers will tell you, it really isn't! Reducing demand on cue involves accurate predictions of supply and demand – you can't just 'turn off the lights'. So how else can we manage the levels of supply and demand?

My research looks specifically at the thousands of diesel generators sitting up and down the country, and indeed the world, behind the scenes of shopping centres, hospitals and factories. They were installed in case of power cuts, but in today's world of a secure electricity system, they are often only run for maintenance and very rare emergencies. There's a lot of factors to consider as to whether we can use these generators more effectively. The technical issues of complying with the code set out to anyone who exports power to the electricity network, the financial aspects of fuel and maintenance and the logistics of changing a system in a large company to name a few. But simply moving the pre-

existing maintenance schedules to higher demand periods in the day and year can help with network management and make the companies who own the generators money!

Managing intermittent supply with flexible demand is vital in order to meet international targets for renewable energy generation and carbon emissions reduction. This means research in this area is a really key topic in the low carbon agenda and the battle against climate change. This makes it an exciting area to be involved in. This research isn't about saying 'no' and telling consumers what they can and can't do. The idea of a smart grid is all about enabling more intelligent use of electricity. Parts of this may be shiny new technologies or exciting new control strategies. But let's not forget to rehaul what we already have, to make sure we are using it in the best way possible to help achieve common engineering goals.