Future Electricity Markets

Pinson, Pierre

Published in:
Projects Magazine

Publication date:
2015

Document Version
Publisher's PDF, also known as Version of record

Link back to DTU Orbit

Citation (APA):

General rights
Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.
Renewable energy generation is on the rise in a big way. 2014 saw record levels of deployment of both solar and wind technology, with countries motivated by mitigation of climate change and security of supply. The transition from today’s oil-and-coal-dominated world into the envisaged green future will not necessarily be easy, however. As the energy production landscape changes, the operation and design of energy markets will need to evolve just as quickly in order to accommodate the dynamic and uncertain nature of renewable energy sources.

The 5s project aims to provide both a scientific and technical core for future models of pricing and exchanging electricity. Based in Denmark, which has set itself the ambitious objective of achieving 50 per cent renewable energy by 2020, it aims to provide Danish power systems with the proper market mechanisms to cope with such a change. These mechanisms will be based in an advanced optimisation framework, from the base methodological developments to the practicalities of their implementation (for instance requiring a parallel computing environment).

Preparing for a renewable future
“The first thing that needs to be assessed is what impact the introduction of these new types of energy producing technologies will have on the existing markets,” says Professor Pierre Pinson of the Technical University of Denmark and coordinator of the 5s project. “There will inevitably be some negative sides to the impact. For instance, increased levels of solar and wind will have a tendency to drive prices down, which will make investing in appropriate technology for the future less attractive for investors. So it is important that once we understand this impact, we then look to see if we can come up with new ideas in terms of market design to improve things.”

Pinson and his team have collated a huge number of datasets to create a simplified version of the entire European transmission network. Data from meteorological institutes has allowed them to model forecasts and measurements for renewable energy production over a period of several years. By combining this with economic and technical information about the energy-producing units from across Europe, they have created a simulation that allows them to look at various outcomes, such as changes in revenue and changes in power flow. It also allows them to test the effects of coupling the markets in different ways.

Assembling the datasets has made up a large part of the work so far. Developments in the electricity market have led to greater transparency, and greater transparency has led to more accessible data, but the sheer volume of this data has been tricky to deal with at times. “There
and ideas into the energy market, but the very nature of the market means that this will likely be a fairly slow process. “One thing you have to remember is that at the European level, the integrated electricity market has to go through a lot of compromise to achieve consensus among all members, which makes bringing disruptive ideas in fairly difficult,” he explains. “This is made even more difficult when you consider that the electricity market is actually not entirely linked to the actual operation of the system. Finally, the present lack of understanding about the effects of bringing renewables into the system makes it harder to agree upon a solution. Academics are giving conflicting opinions about the best course of action, which makes the likelihood of decision makers acting upon their ideas less likely.”

**Changing behaviour, changing market**

As the evidence piles up about the negative effects of excessive consumerism on the planet, there is a growing trend towards actively making lifestyle changes to try and counteract the damage being caused. Renewable energy sources are now being rapidly introduced, but the next real paradigm shift could occur in terms of demand rather than supply. ‘Prosumers’ – those who produce electricity themselves via solar panels etc. but also consume – have been talked about a lot, but changes in how and when energy is consumed could prove to be even more disruptive. If the behaviour of consumers of energy alters significantly, the market will be forced to alter itself to accommodate them.

Encouraging people to change their behaviour is not easy, however. Pinson and his colleagues have been working on another project that is helping consumers become more proactive by using automated technology that reacts to the changing price of energy or controls a building’s heating. “The problem you find is that even if you fully automate something for someone, they still want to play with it and adjust it!” says Pinson. “People do not like to think that their comfort is being affected, so it is a challenge to try and maintain changes in behaviour.”

---

**Future electricity markets**

The design of Europe’s energy market currently uses simplified zones that don’t truly represent the transmission network used for sharing electricity. Using these simplified zones comes at a cost, however. In countries such as the US, the transmission network is represented as accurately as possible, with prices set at every node of the network. It is possible that by using a system such as this in the future, Europe could cut losses in social welfare. Pinson and his team have been attempting to quantify the potential loss in social welfare that arises from using the current system, and have been simulating whether other systems could be more effective as more renewables are introduced.

Pinson is keen to help facilitate the introduction of disruptive technologies is so much information out there that it is sometimes difficult to know how to manipulate it in a way that can give you new insights,” he says. For the data that is not available, there are a number of statistical methods that can be used to fill in the gaps.