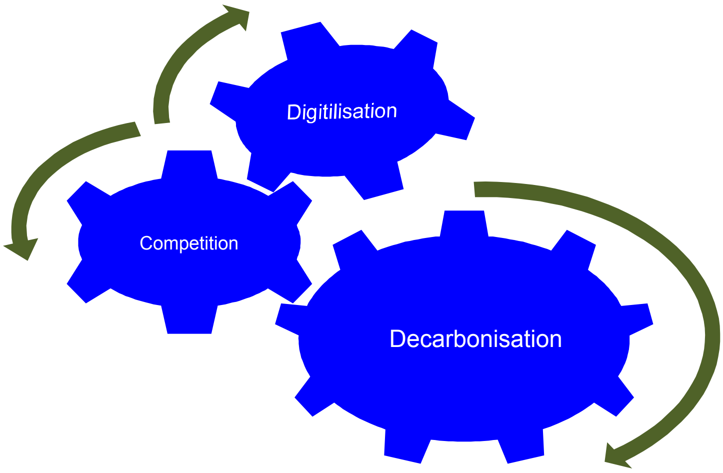
# ZERO CARBON BRITAIN and active energy market participants

By Peter Kästel




**Drivers of change in energy markets**

Energy markets are currently in a transition phase, which is driven by three major factors: decarbonisation, digitalisation and competition. Zero Carbon Britain (ZCB) will be influenced by all three trends. This discussion paper will be highlighting some relating issues, give some practical examples, show how they interact with each other and how retail consumers are expected take a much more active role in energy markets.

The decarbonisation of the UK energy market is underpinned by the Climate Change Act 2008, which sets a net UK carbon reduction target of at least 80% by 2050 against 1990 values (United Kingdom, 2009). Renewable energy (RE) plays an important role in reaching that target and even more in ZCB. The UK is equipped with significant natural, technological and financial resources to make use of RE. RE generation has also become more popular and economically competitive over recent years. This is evident in an increasing market share of 11.3% of the electricity generation in 2012 (DECC, 2013a). However UK RE is mainly dominated by medium to big size developments of institutional investors and utilities, e.g. off-shore wind parks. But with the introduction of Feed-in-Tariffs (FiT) in 2010 also retail sized installations have created meaningful generation capacities, e.g. UK photovoltaic (PV) installation reached 1.7GW capacity in October 2013 (DECC, 2013b) whilst a large power plant has a capacity of around 1GW for comparison. Arguably that is only the tip of the iceberg since RE lends itself to decentralized small-scale production units. This can change energy market dynamics relatively quickly, e.g. in Germany where the RE share of electricity increased almost four folded to around 25% since 2000 (Germany Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (BMU), 2013) mainly driven by small to medium sized installations. In this context, the emergence of so-called "prosumers" – entities and households that are both **pro**ducer and con**sumer** of energy can play an important role. Prosumers can be much more active market participant and a wide spread adoption will influence energy markets in many ways:

- Self-produced green energy will reduce demand for conventional energy
- It can partially lock in energy price, hence protect prosumers from energy price inflation
- It can democratise the energy generation market and increase competition
- Retail investments can supplement institutional investments, hence can help to replace aging power plants
- Electricity networks and access regulation would need to be adapted over time

A practical UK example can be found in Ashton Hayes where an entire community aims to become carbon neutral and where self-produced PV energy plays an important role (SP Energy Networks, 2013).

The UK smart meter roll-out is scheduled to be completed by 2020 (DECC, 2013c) and will open the energy market to the digital age. It will make it possible for every single household to communicate real time with the electricity grid and other market participants. It will allow an increased access to and transparency of energy related data, e.g. consumption patterns and analysis, real time billing, energy budgeting and other services. However, controversially discussed related issues are privacy and data protection, which needs to be taken serious.

In the context of digitalisation also automated electricity demand side management (DSM) can be utilised, which is basically the possibility to shift energy consumption in a household to different times. Two main aspects may be thought of, technical and economical ones.

Technically an electricity grid must always be balanced, i.e. supply and demand of electricity must always be the same to ensure network stability. Such balancing is often only needed for very short periods and needs fast and flexible ways to deal with it. Traditionally that has been achieved by switching on/off gas and hydro power plants to balance unexpected demand variations. However, with DSM also electricity demand can be reduced/increased in order to fulfil the same function. In order to avoid any service interruptions only non-time critical functions would be affected and ones, which would not be noticeable to consumers, e.g. fridges, charging of electric vehicles or heat pumps.

Also economically DSM can be applied by shifting demand depending on price signals. A basic form of that are Economy 7 tariffs, where night-time electricity is cheaper than daytime electricity, hence incentivises consumers to shift demand. These were often used in combination with electric storage heating systems. Such principles can be extended to smarter tariffs, which are linked to different times of the day, seasons or weather conditions. Smart meters allow consumer to be much more active choosing economically advantageous tariffs and shift consumption accordingly. However, research indicates that such models have their highest potential in households with high electricity usage and a high proportion of shiftable electricity loads, e.g. air conditioning, space and water heating and electronic vehicles (Gottwalt et al., 2011; Prüggler, 2013). The German government has also initiated an extensive field research program called 'E-Energy' with six separated model regions. Also see www.e-energy.de. The focus was on the use of information and communication technology, economical solutions, energy security and environmental compatibility in the context of the German 'Energiewende' (German Federal Ministry of Economics and Technology (BMWi), 2013).

The UK electricity market is fairly concentrated and dominated by the Big Six utility companies[1] (Nationwide Utilities, 2013) and the UK regulator Ofgem has the promotion of competition in its focus (Ofgem, 2013a). In the recent past increasing energy prices have led to doubts that competition is sufficient and effective. Political strategies to improve the situation have been to increase tariff transparency and encouragement to switch energy providers (DECC, 2013d). Subsequently a number of collective switching schemes have been initiated and sponsored by the government (DECC, 2013e) and have been organised by local councils and third party organisations, e.g. www.opt-4.org and www.biglondonenergyswitch.org.uk.

In Germany the high penetration of RE have led to significant reduction in electricity wholesale prices and reduced price volatility (Tveten et al., 2013) although not to reduced retail prices for standard electricity consumers. However, an increasing number of consumers are using small-scale RE installations to reduce their bills and decouple themselves from energy inflation. This has also increased pressure on established utilities and their business models and which is currently driving change in the German energy market.

The paper demonstrates that decarbonisation, digitalisation and competition are dominant topics in our energy markets and are changing market dynamics considerably. It is not always clear what the optimal solution is, since that is dependent on the priorities of involved parties, time horizon considered and assumptions taken. However, change is inevitable and consumers will/can be much active and empowered market participants if they choose to.

**About the author:**

Peter Kästel is a recent Centre for Alternative Technology student and consultant in energy markets, infrastructure and smart grids. He did an MSc Architecture: Advanced Environmental and Energy Studies and wrote his thesis on: 'Economics of pooling small local electricity prosumers'. The discussion paper was based on the research work for the thesis. Prior to his MSc he obtained a business economics degree as Diplom Betriebswirt (FH) at the FH Kiel/Germany and worked almost twenty years in finance and consulting.

[1] EDF, Eon, npower, British Gas/Centrica, Scottish Power and Southern & Scottish Energy

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