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Integrated Energy Services for the industrial sector: an innovative model for sustainable electricity supply

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ABSTRACT

Liberalization policies, the challenges of integrating distributed generation resources, and the recent flattening of electricity demand due to the economic crisis and technological change have led to lower returns for European electricity suppliers. Innovative and sustainable business models are needed to serve electricity customers while reflecting the operational needs of the system and maintaining supplier financial viability. This paper describes a novel model of Integrated Energy Services that encompasses distributed generation (DG) and demand response (DR) resources for industrial customers. We further reflect on some of the market opportunities and regulatory drivers for the development of similar schemes across Europe.

1. Introduction: the rise of innovative and sustainable business models for electricity supply

The traditional business model for electricity supply, based on low-cost volume-based provision of energy generated by large centralised plants with limited customer engagement and standardized contracts, co-evolved with the broader energy system; market operators greatly benefited from economies of scale and this dynamic contributed to the marginalization of alternative business models (Hannon et al., 2013).

Nonetheless, operational conditions across Europe over the last ten years have evolved rapidly and conventional strategies in electricity markets have proven to be out-dated (Electricity Innovation Lab, 2013). The implementation of the three pillars of the European Energy Policy (competitiveness, security of supply, and sustainability) (European Commission, 2007) and technological improvements in Information and Communication Technologies (ICT) are shaping the transition to a less centralised power system (Jenkins and Pérez-Arriaga, 2014). In spite of persistent market concentration at the national level, the European Union is the world's largest region undergoing liberalization. In addition, the wide diffusion of renewable energy sources, accounting for 27% of the EU's electricity production in 2013 (Eurelectric, 2015), has led to excessive generation capacity: the additional generation from renewable sources from 2000 to 2012 amounted to 350 TWh, with a total increase in demand of 267 TWh (Henriot and Glachant, 2015).

Domestic and industrial customers are increasingly aware of energy costs and the environmental impact of electricity usage; some are becoming *prosumers* (generating electricity on-site) due to the expansion of small generation facilities (Pérez-Arriaga et al., 2013). The combination of these factors, together with the flattening electricity demand due to the economic crisis (−0.2%, −0.1%, and −0.2% year-on-year variations in 2011, 2012, 2013 respectively) (ACER/CEER, 2014), has resulted in lower and more volatile returns for electricity utilities (Fig. 1).

According to a report by Eurelectric (2013), the value of earnings before interests and taxes (EBIT), a measure of firm profitability, declined by 10% between 2011 and 2012 for conventional generation companies. On a market capitalization basis, the EU's five largest power generators, which collectively represent 60% of European generation (EDF, GDF Suez, Enel, E.On and RWE), lost more than 100 billion euros (37% of their value) between 2008 and 2013 (CTI, 2015).

Researchers have already tried to define the main element of business models for electricity supply in the new context, also considering the typical contracts of Energy Service Companies

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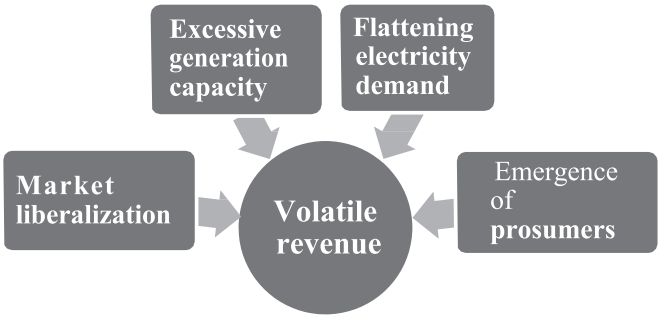

Fig. 1. The need for innovative and sustainable business models for electricity supply.

(ESCO) (Schoettl and Lehmann-Ortega, 2011; IEA RETD, 2012; Richter, 2012, 2013; Electricity Innovation Lab, 2013). The transition is calling for customized supply solutions, with bundled offers of energy and services, and suppliers are becoming fee-based service providers. In Italy, Enel Energia is currently proposing a scheme, to which we refer as Integrated Energy Services (IES), which has the potential to serve electricity customers while reflecting the operational needs of the system and maintaining supplier profitability (Lorenzoni, 2014).

This study has two aims: the first is to describe the characteristics of innovative and sustainable business models, with a particular focus on IES; the second is to reflect on the main patterns that can promote the development of IES. The remainder of the paper is organized as follows. Section 2 describes in general business models for electricity supply under the transition to a less centralised energy system, focusing on industrial consumers and on the most important features of IES. Section 3 suggests market roles and policies that regulators could modify in order to advance the development of IES. Section 4 describes the current market and regulatory frameworks for innovative business models as implemented in the cases of Italy, the UK, and Spain. Section 5 draws some key conclusions.

2. Innovative and sustainable business models and Integrated Energy Services

The electricity sector in Europe and elsewhere was designed according to a supply-oriented system, aimed at providing affordable and secure electricity for any level of consumer demand. Traditional vertically-integrated utilities are usually large entities and somewhat inflexible given the nature of their assets and the well-established practices in the sector, but they are well aware of the ongoing transition and in the new context they will still play a relevant role as the interface between customers and the electricity system (Kuzemko, 2015).

Recently, some of the most important European operators announced significant changes in their business structure. E.ON[1] will focus on renewable energy sources, distribution networks and customer solutions and established a new company for its conventional generation and trading businesses. RWE[2] declared that it would position itself as a "project enabler, operator and system integrator of renewables". The Spanish operator Iberdrola[3] has begun to offer energy supply contracts to its customers as well as the installation of photovoltaic equipment.

Generally speaking, a business model describes the rationale for how an organization creates, delivers and captures value, and guides the realization of a firm's strategy (Osterwalder and Pigneur, 2010). The analysis of business models for electricity supply is central to the transition toward a more sustainable and decentralised energy sector because such plans encapsulate how suppliers, customers, and operators will interact. This section focuses on business opportunities for electricity supply for industrial consumers and provides a description of the main characteristics of Integrated Energy Services.

2.1. Business opportunities for electricity supply in industrial segment

The possibility to integrate locally available Distributed Generation (DG) with Demand Management (DR) is still unexploited in most electricity markets (Lorenzoni, 2015). However, the high penetration of DG is challenging the operation of the electricity system (Trebolle, 2013): the intermittency of variable resources (such as wind and photovoltaic power plants) is already creating local issues of power quality, including problems of voltage variations and bottlenecks, when local injections of variable resources are higher than local simultaneous extractions.

Both the supply and the demand sides are relevant to meet growing flexibility requirements (Directive 2012/27/EU; Eurelectric, 2013; IEA, 2014). Flexibility services relate to the ability to adapt to and anticipate uncertain and changing power system conditions in a timely, secure, and cost-efficient manner while maintaining system stability (Van den Oosterkamp et al., 2014; ECOFYS, 2014). DR is defined as the "changes in electric usage by end-use customers from their normal consumption patterns in response to changes in the price of electricity over time, or to incentivize payments designed to induce lower electricity use or when system reliability is jeopardized" (U.S. Department of Energy, 2006). DR allows the Transmission System Operator (TSO) and the Distribution System Operator (DSO) to have an additional instrument to manage short-term conditions in their respective grids, mitigate price volatility, and reduce the need for future investments (Strbac, 2008; Torriti et al., 2010; Grünewald and Torriti, 2013). DR can be provided in an ancillary services market (a venue where market operators procure the resources needed for managing, operating, monitoring and controlling the power system to maintain system security) or through bilateral contracts (Behrangad, 2015). Electricity retailers can create added value by clipping load or shifting from peak to off-peak periods (Fuerriegel and Neumann, 2014); electricity customers can realize financial benefits in terms of lower bills (Koliou et al., 2013). These opportunities have not been fully exploited because regulated retail prices are still in place and consumers lack real-time price information; existing flexibility services have been developed in a context characterized by higher management costs and an emphasis on generation-side resources (Warren, 2014).

Currently, DR relies on the industrial sector, as most European utilities offer direct load control and interruptibility programs, with fixed compensations (Torriti et al., 2010). The business case for the provider of these services is generally positive because a significant amount of load can be accessed through one industrial connection point. Energy-intensive industries are business entities where energy products and electricity amount to at least 3% of production value, including the iron and steel, paper, and chemical manufacturers per Directive 2003/96/EC. These industries are likely to

[1] http://www.eon.com/content/eon-com/en/media/news/press-releases/2014/11/30/new-corporate-strategy-eon-to-focus-on-renewables-distribution-networks-and-customer-solutions-and-to-spin-off-the-majority-of-a-new-publicly-listed-company-specializing-in-power-generation-global-energy-trading-and-exploration-and-production.html/.

[2] http://energypost.eu/exclusive-rwe-sheds-old-business-model-embraces-energy-transition/.

[3] https://www.iberdrola.es/clientes/hogar/eficiencia/energia-solar/smart-solar-iberdrola.

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