Chapter 10
Enabling Small-Scale Actors to Operate on Markets of Energy and Ancillary Services

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ABSTRACT

Widespread renewable energy alters infrastructures and business by changing a way to balance between the demand and the offer. In customer-centered model, flexible economic behavior of small-scaled energy actors mitigates variability and uncertainty in flows of power and energy. Flexible cooperative behavior of many intraday market participants has a potential to reduce uncertainty in renewable energy flows. However, owners of small-scale renewable energy plants play limited market role. This chapter presents changed socio-economic and technology contexts and attracts attention to new challenges. New ICT enabler activates role of small-scale renewable energy actors by complementing their physical energy by structured information about the capacity and flexibility. In new market scenario, unpredictability of renewable energy is reduced by adding knowledge and exploiting better flexible behavior. Main conclusion is about using the information about flexibility to activate small-scale actors on real-time markets while improving ecological sustainability.

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INTRODUCTION

In any business scenario, the *producer* of a good plays certain well-defined role during all the steps of product lifecycle. In most of known business scenarios, there is a visible time gap between the instant of time when the product is created and offered to commerce, and the time instant when the product is sold (consumed). As a result, the producer's role appears segmented in time. At the beginning of the lifecycle, the producer warrants the availability of the amount over certain time, the quality of a product, and the homogeneity of the quality. During the remaining stages of the product lifecycle, the producer warrants the availability of the product and parts of it for the replacements and reparations. Moreover, during the product distribution and commercialization stage, the producer warrants the non-deterioration of quality during certain duration of time. Usually consumers purchasing a good, they desire to know the name of producer and the brand because of reputation aspects.

In electric energy business example that uses storage-less power distribution systems, no gap appears between the time instants when an energy product is being produced and when it is being consumed. In effect, the electricity being produced (measured in kWh) is immediately consumed or lost. Because the electricity product is standardised, all kilowatt-hours appears identical. For this reason, the brands can remain unknown. Because energy consumer deals with the power distribution companies, the role of energy producers acting on energy markets has certain peculiarity. In the current energy business scenario (Sioshansi, 2013), large-scale energy companies bid directly on the energy markets, while the owners of small-scale power plants cannot operate in the same way. In other words, Small-Scale Actors (SSA) play passive market role, so there is a need to include them in energy markets by offering them new empowering tools.

The market of energy products and services is comprised of distinct day-ahead and real-time *processes* organized in such a way to meet reliability needs and serve loads. Main energy product on the Day-Ahead Market (DAM) is represented by an *amount of electricity* (expressed in kWh but priced in monetary units after the conversion rate \$/kWh) that is delivered daily to the consumer in the form of a *flow of capacity*. In the *demand-led* model, the forward market establishes the generation (laggard) required to meet *forecast demand* (leader). Flow aspects can be described by the *rate* (expressed in units/s) that can be constant or time-varying and by the timescale (expressed in units of time) associated with the use of the reserved capacity (expressed in units). In this scenario, consumer has a complete freedom to transform said capacity into a work by expending energy at *any rate* $\partial E / \partial t$ (expressed in kWh/s) being agreed between the parts at any time. The maximum contractual threshold can be defined sharply (for example X kW max) or softly (for example up to X kW at any time, but more than X kW for less than Y seconds once at a time).