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# Certification prerequisites for activities related to the trading of demand response resources

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ABSTRACT

Certification according to international standards brings many benefits to the society, including technical, economic and environmental aspects. In this context, this paper highlights the benefits of certification of Demand Response, including the additional credibility which provides to the trading of flexibility and higher confidence between different players. The consequence is a dynamic environment which facilitates the market acceptance of Demand Response services and products, providing significant benefits to providers and users of such services. A methodology for the systematic certification of different activities related to the transaction of Demand Response resources has been developed and it is presented here. In particular, three types of certificate have been specified, considering the certification of the entity providing the resource (Demand Response Provider), the contractual framework between the provider and the requester (Demand Response Product) and the physical platform to enable and guarantee such transaction (Demand Response Energy Service Trader).

The results of this paper may help regulators and standardization bodies in the design and specification of a future norm to allow the certification of the above-mentioned activities, or a further development of existing regulation for certification of energy efficiency systems (like ISO (International Standard Organization) 50001), where certification of Demand Response activities could be complementary.



## 1. Introduction

DR (Demand Response) represents an adequate option for reserve capacity in the context of increasing wind power generation and usage, which is characterized by its variability and unpredictability [1]. The promotion of electricity from renewables is a key European Union priority for several reasons, including the security and diversification of energy supply, environmental protection and social and economic cohesion. In other countries, like the United States state governments and federal initiatives such as the production tax credit and others have promoted the growth of renewables [2]. Also in Australia, some research has demonstrated that wind power producers can employ DR to maximize its profit [3]. However, the expansion of renewable energy sources requires new means of load management and greater quantities of various ancillary services [4]. Whereas conventional energy fuels can be converted whenever needed, renewables cannot. Wind and solar power generation depend on external conditions and their supply is not directly controllable. In this context, DR aims at adjusting the electricity demand to the grid requirements at a given point of time, which make it an important pillar in the context of Smart Grid concepts for achieving the EU's 20/20/20 goals, contributing to increase the efficiency of the power system [5].

Different provisions dealing with demand side participation have been included in various EU policy documents, specifically the Electricity Directive (2009/72/EC) and the Energy Efficiency Directive (2012/27/EU). On the other hand, a large potential of DR resources have been identified in Europe [6]. However, as stated by Refs. [7], the market designs and policies in place in

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most of the European countries do not promote today the participation of demand in electricity markets. On the contrary, DR and related activities such as aggregation remain illegal in many of them and in the majority of system services and wholesale markets [8].

DR has proven to be a useful mechanism that produces significant benefits for both the customer and the power system [9–13]. Thus, customers may enrol in some DR program, designed and implemented by energy suppliers and network operators. These programs may provide a profitable option for customers that modify their usual pattern of consumption as response to an external event. On the other hand, system operators or utilities can use DR to curtail or shift loads instead of just building more infrastructures for generation or energy storage, which provides significant cost savings in close to real time, often at lower cost than generation resources [14]. However, DR does not happen naturally and it needs mechanisms to be stimulated [15].

The certification of the different activities involved in the transaction of DR resources would add credibility to the trading of flexibility, increasing the dynamism of the market and the confidence between the different players, facilitating the market acceptance of DR services and products. Nowadays, certification based on international standards has become a strategic tool to ensure that business operations are as efficient as possible, increasing the productivity and helping companies to access new markets [16].

Some efforts have been done in order to create some kind of norm to allow the certification of DR, especially in the US. Previous research has identified the need to develop standards to integrate and enable buildings to participate in Smart grids [17]. According to this interest, the LBNL (Laurence Berkeley National Laboratory) designed the OpenADR (Open Automated Demand Response) [18], which represents the only standard existing in the World related to DR, even if it is only applied to communication purposes for commercial buildings [19]. Nevertheless, an international norm to allow the certification of the different activities related to the trading of DR resources is still missing.

Energy efficiency systems can be certified according to the standard ISO (International Standard Organization) 50001 [20] and, based on this fact, several European countries offer financial instruments to promote the adoption of more efficient technologies and particularly, the utilization of renewable energy resources [21]. Nevertheless, due to the lack of a norm or standard for this purpose, DR cannot be certified by now even when energy management has been identified by ISO as one of the top five areas that require the development and promotion of international standards [22]. Therefore, this paper proposes a methodology for the systematic certification of different activities related to the transaction of Demand Response resources. This methodology has been designed in the framework of the European LIFE + Project “Demand Response in Industrial Production”.

The paper is organized as follows: Section 2 provides some basic concepts about Demand Response, the way how Demand Response actions can be classified and the reasons why it is necessary nowadays for the proper operation of power grids. Section 3 describes the roles and considered scenarios which frame the resulted methodology for certification of DR activities, detailed in Section 4. The further implementation of the proposed methodology and its limitations are discussed in Section 5 where the next steps for its application are highlighted. Finally, conclusions of this research are presented in Section 6.

## 2. Demand response overview and its benefits

### 2.1. What is demand response?

The concept of DR is understood as the ability of consumers to modify the power demand from their expected consumption either as a response to a requirement from the grid operator, LSE (load-serving entity)[1] or other demand response provider when a reliability problem occurs in the system, or as a reaction to variations in the price of electricity. While DR actions can take place at any time, not only during the peak period [23], their implementation could be key during peak periods of electricity use, and they are usually less costly than building more power plants [24].

Depending on how Demand Response actions are performed, the different actions can be divided into three blocks, as shown in Fig. 1 [9]:

- Demand shifting by moving some energy packages from some periods (usually on-peak to shoulder or valley periods) when electricity is cheaper or the operation of the grid is less critical. This is the most frequent type of demand response action, which takes place in the industry. The net balance in the energy consumption may be zero, but the economic benefit achieved by the customer is positive, as the price of electricity is different during those periods.
- Demand reductions (or increases), which are not compensated by rises (or reductions) during the rest of the time. A typical example is lighting, which if reduced, it is not later reconnected to recover the consumption. These actions imply a loss of service, which may be translated into loss production and extra cost.
- Autonomous self-generation, producing the electricity that customers use onsite, which translates to a net reduction of the demanded power from the grid with no load modifications required from the consumer.

The planning, implementation and monitoring of activities designed to encourage consumers to modify patterns of electricity usage is known as DSM (Demand Side Management) [25]. DSM and load management strategies have been commonly used in the operation of electricity systems for more than 30 years in such countries like the United States [26]. However, DR resources have been underutilized in other regions like Europe, where the absence of initiatives on demand response, which now arise, could have been motivated by the inexistence of a single European energy market [7].

Today, DR is becoming more automatic and easier to implement for customers since electricity prices and similar information can now be automatically delivered and because communication technology is more accessible [27]. System operators can therefore allow customers to participate in different DR alternatives. Since the year 2000, in both the USA [28] [29], and Europe [30] [31], different research has been carried out in order to develop new DSM programs which involve commercial and residential customers (and not just large industrial ones like it was common in the past) in the operation of the electricity systems.

### 2.2. Benefits of demand response

DR is an important pillar in the context of Smart Grid concepts and it can contribute significantly to achieving the 20/20/20 goals.

[1] LSE (Load-serving entity) collectively refers to utilities and competitive retail suppliers [14].