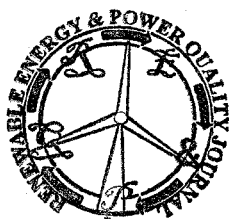


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Spanish microgrids: current problems and future solutions

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Abstract. Some years ago microgrids (μ -grids) became the most promising solution to the problems of the current electric system. There are many studies that demonstrate the advantages of using μ -grids, among which the following can be highlighted: microgrids can improve power quality inside and outside them; supply reliability of the internal loads is higher [1][2]; and the generalization of μ -grids could extend the usage of distributed generation (DG) systems.

Despite being very extended in the scientific and engineering world, the μ -grid concept is not usual in the ordinary world. Proof of this is that current electric legislation does not include their usage. Prior to its spread, μ -grids must have an appropriate legal and economic environment. Through this text, the authors would like to show the legal limitations that the μ -grids usage will find in Spain and the solutions that are applied in other countries and states.

The final objective of this paper is to present a legal and economic framework that would promote the development of μ -grids in Spain.

Key words

Microgrids, Spanish Legislation, Economic framework, Feed-in Tariff, Net-metering.

1. Introduction

A microgrid is formed by a group of loads and micro-generators operating as a single system that provides electrical and thermal energy [3]. Another definition states that a μ -grid is a network of low voltage (LV) consumers and producers able to export energy in some circumstances and also to work in an isolated way in emergency situations [4]. Attending only to the electrical part, we can define a μ -grid as an electric system composed of generation and storage systems that feed a group of electric loads, which can work properly both isolated and grid-connected.

As it has been said, a μ -grid has three groups of principal components: electric generators, storage systems and

electric loads. There are no technical problems that prevent the joint operation of these devices but there is, in general, a lack of legislation to regulate their performance [5]. Even in some countries, like Spain, the joint use of DG systems (photovoltaics), storage equipment and electric loads is very limited and problematic.

An in-depth analysis of the Spanish electric and renewable energy legislation shows some aspects that limit and even prevent the use of μ -grids. This document studies the most problematic articles of the Spanish regulation and looks for the solutions adopted in other countries.

Once the legislation allows the usage of μ -grids, the next step would be the creation of an economic framework that provides a good profitability to these electric systems. This paper will analyse the economic regulation of other countries and a new economic framework will be proposed for Spain. This new economic framework will be analyzed and compared with the current Special Regime.

2. Current configurations

One of the main advantages of the usage of μ -grids is that they use widely DG systems and renewable energies (RE). This has a disadvantage; DG and RE are more expensive than the classic systems used for generating electricity. For this reason, in Spain and in some other countries electricity generation from RE is legally and economically supported by the Government, within a legislation called "Regimen Especial de Generación de Energía Eléctrica" (Special Regime for Electricity Generation). The inclusion of μ -grids in this regime is essential for their development.

As it has been said, μ -grids and their architecture are not recognized by the Spanish regulation, so their development is very restricted. In the next paragraphs