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Reference model for distribution application for microgrids

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European foreword

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Introduction

The current and future distribution networks have to face the fact that there is no more a unidirectional power flow in their lines. The increasing of the installed power within Distributed Energy Resources raises potential problems in the grid (overvoltage, congestion, imbalance…). It is also noteworthy that the deployment of more and more Electric Vehicles (EVs) on European roads will mean an increase in electricity demand as never seen before.

Moreover, the increasing share of Renewable Energy Sources in the European Power Systems implies the need for more accurate forecasting tools to better calculate the energy that these sources will deliver. The intermittence and uncertainty of the weather phenomena which mobilize these energy sources mean an increase of the uncertainties for network operation purposes.

In order to avoid these potential problems, some strategies are being developed during the last years. These strategies are mainly focused not only on reducing the operating problems of the Demand Energy Response (DER) and Renewable Energy Sources (RES) but even in taking advantage of these kinds of sources and use them to improve safety and secure operation of the distribution networks. One of the strategies with the highest potential is the performing of Demand Response (DR) campaigns. Thanks to the modulation of the energy consumption of small and medium users, it is possible to produce beneficial services to the distribution grid. Furthermore, the increase of storage solutions such as domestic or industrial batteries and the batteries of the EVs, due to Vehicle to Grid (V2G) activities, can be used to improve the quality of the Medium Voltage MV and Low Voltage LV grids.

These activities must go hand in hand with the development of new technologies such as smart meters, power electronics, big data analytics, or the establishment of new algorithms that helps to ensure the reliability of the grid.

WiseGRID project directly tackled these facts with the development through a methodology a tool addressed to small Distribution System Operators (DSOs) and Microgrid Operators. This development led to propose a reference model and a methodology that could be used to develop similar solutions in different small and medium smart grids. These solutions would help them to better control and monitor their MV and LV networks without forgetting the decarbonization goals of the European Commission and also taking advantage of the technological and conceptual improvements above mentioned.

The first approach for developing a Distribution Management System (DMS) is to define the modules that would compose it. The experience and results of WiseGRID project recommend clustering the modules into different categories:

a) Real-Time monitoring

This section deals with the modules which collect data from different meter sources (such as Unbundled Smart Meters, AMIs or SCADAs. Inside this section monitors all these data sources and provide the necessary KPI calculations in order to correctly assess the performance of the tool.

b) Off-Line processes

In this cluster are included the tools which do not need permanently Real-Time data to work. These are the modules dealing with the topology and geographical information of the monitored grid, a power quality assessment of the distribution lines and an assistant for planning future grid improvements.

c) Problem detection and reaction

These modules are focused on the control of the distribution grid. These modules will detect the possible problems of the network (incidents) and will establish the best strategies that will solve those incidents.

d) User Interface

The WG Cockpit User Interface will be the interaction point with the DSO operator. Therefore, it must show all relevant information compiled by all other modules present in the architecture of the application.

1 Scope

This document aims to describe and explain a methodology used for the design of requirements, use cases, scenarios and key performance indicators for planning a Distribution Management System (DMS) of small Distribution System Operators (DSOs) and Microgrid Operators. It is focused on the needs that the DMS must address to provide valuable functionalities.

This document explains the background needed to collate and understand the methodology. The annexes contain the practical example of the application of this methodology to define the WiseGRID tool.

This document will not define either requirement related to safety aspects or consist on a management system.

2 Normative references

IEC 62559-2:2015, *Use case methodology – Part 2: Definition of the templates for use cases, actor list and requirements list*

3 Terms and definitions

Actor name	Description	Actor type
Aggregator	Accumulates flexibility from Prosumers and Consumers and sells it to the Supplier, the DSO or the TSO.	Organization
AMI	*Advanced Metering Infrastructure*. A set of systems that monitor, collect and analyse electricity consumption, and have two-way communication capabilities.	System
Balance Responsible Party	A party that has a contract proving financial security and identifying balance responsibility with the Market Operator entitling the party to operate in the market. [The meaning of the word “balance” in this context signifies that the quantity contracted to provide or to consume must be equal to the real quantity provided or consumed.]	Organization
Battery Operator	Entity responsible for operating a set of Storage Units connected to the electricity grid.	Organization
Data Provider	Independent entity responsible for undertaking and coordinating the information exchange and translation of the data of various sources into a common data model.	Organization