This work was partly funded by national funds through the FCT – Fundação para a Ciência e a Tecnologia, I.P.,
under the grant PTDC/EEI-EEE/31711/2017

Project OptiGRID

Methodology of Dynamic Capacity Analysis of Lines and Optimized Management of Electrical Networks

Final Workshop

20th September 2022

Disclaimer: The statements and opinions expressed in this presentation do not bind the organizations participating in the study: LNEG, R&D NESTER.

Motivation

- The **additional capacity resulting from the use of (Dynamic Line Rating) DLR can reduce congestion** problems in **overhead transmission lines located near regions with high renewable potential**.

- T**he correlation between the additional capacity of the lines and the increase in wind production** in conditions of high wind speeds suggests **the implementation of DLR in existing electricity grids for increasing levels of renewable energy integration.**

- An additional **DLR application relates to the ability of exchanges between networks (import/export)** that are limited by restrictions on international lines. In Portugal, the restrictions associated with MIBEL's operation may activate of the market separation mechanism between Portugal and Spain.

Objectives

- **To develop a methodology and an operational tool for the analysis of the dynamic capacity of airlines in electric power grids** in order to facilitate an optimized and economical integration of renewable energies.

- OptiGRID project (and the developed tool) aim **to demonstrate the benefits of using DLR techniques** with regard to:

    1) **increase levels of renewable energy** integration (and avoid curtailment) into the Portuguese power system while minimizing grid's reinforcement;

    2) reduce in the periods of market separation (between Portugal and Spain) in the Iberian Electricity Market (MIBEL) and consequent impact on the prices of this electricity market, thus contributing to more efficient electricity trading.

Structure and main activities

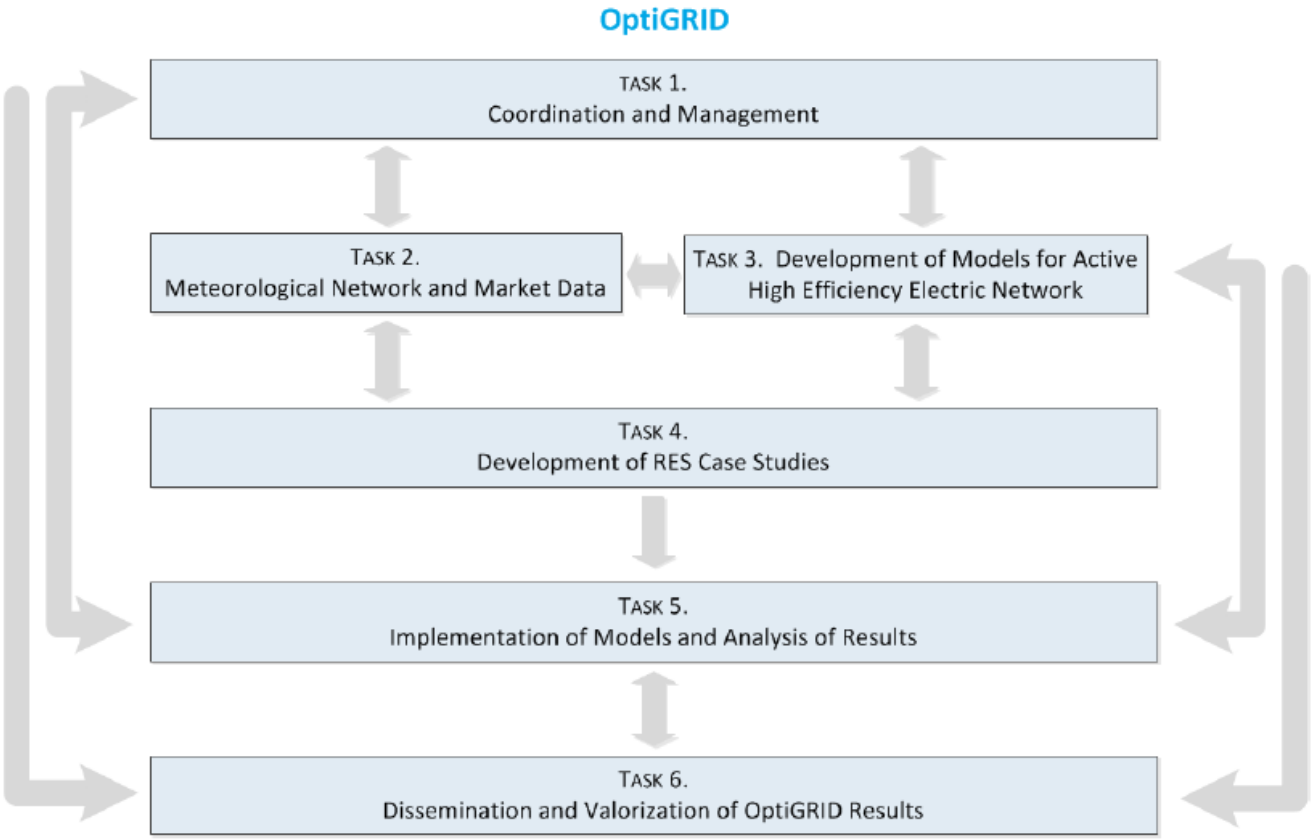


Figure 1 - Workflow of the project's methodology.

Activity 2: Meteorological, network and market data

2.1 - Meteorological forecast data - Coupling NWP and CFD Modeling (LNEG);

2.2 - Definition and validation of transmission network data in the regions of the case studies (NESTER&LNEG)

2.3 - Definition and validation of MIBEL data (NESTER)

2.4 - Merging the datasets (NESTER&LNEG)

This task deals with the necessary data to conduct OptiGRID research activities.

It provides hourly forecast meteorological data with a time horizon comprising the day-ahead market; Portuguese transmission network data; and to MIBEL operation.

The data fed the DLR and OPF modules, developed within the project, for application to each case study. market data related

Activity: 3 - Development of models for active, high efficiency electric network operation

3.1. - Development of mathematical models (LNEG)

3.2. - Development of DLR models (LNEG)

3.3. - Development of GIS interface (LNEG)

This task deals with:

i) the development of mathematical models for networks with high levels of vRES to study of constraints at RNT operation, from both the high penetration level of renewable energy and MIBEL energy market operation thus allowing to quantify the benefits resulting from including the DLR analysis.

ii) building a DLR analysis software, incorporating the developed models under a structured operational methodology, to allow automated DLR analysis in large-scale power networks with high levels of distributed vRES. A GIS interface will be developed, as a user-friendly interaction platform

Activity 4: Development of vRES Case Studies

4.1 - Case study A - Region predominantly with wind distributed generation (LNEG)

4.2 - Case study B - Region predominantly with photovoltaic distributed generation (LNEG)

4.3 - Case study C - Market splitting in MIBEL (R&DNester, LNEG)

Three case-studies are studied: i) a region with large distributed wind capacity; ii) a region with large PV production; and iii) market splitting occurrence in MIBEL due to congestion in interconnections. A few overhead power lines in the RNT are exploited near their thermal limits, thus operational gains granted by using DLR are explored in the regions under study.

Data from activity 2 are used as the main input of this task.

Activity 5: Implementation of models. Analysis of results

5.1 Analysis of improvements in renewable energy integration case studies (LNEG)

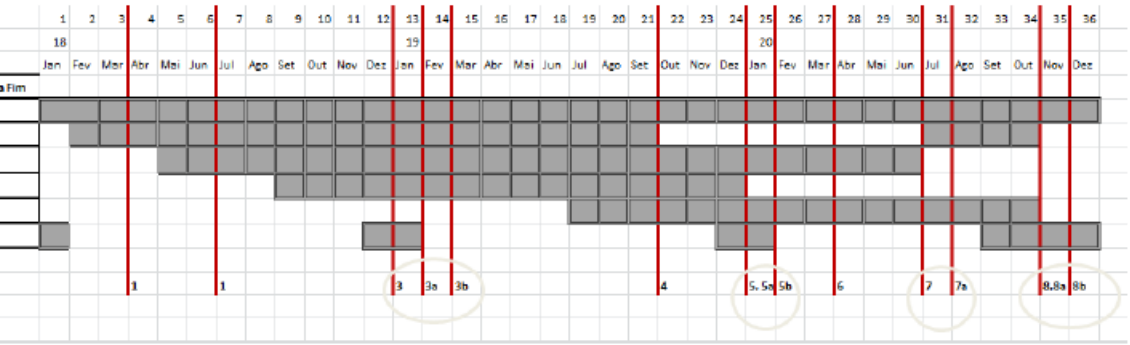
5.2 Analysis of improvements in MIBEL operation case studies (R&DNester)

This task uses the models and tools developed in the scope of OPTIGrid and apply them to the three different case studies of Task 4
Outcomes from this task aim to highlight the benefits of using DRL techniques to achieve higher levels of wind and photovoltaic generation in the Portuguese system while keeping grid reinforcement to a minimum. It aims to assess the impact of the tools in the operation of MIBEL, namely by reducing the number of hours with market splitting activation between Portugal and Spain.

Timetable

Project OptiGRID - Cronogram/Gantt scheme

Nº	Tasks	Data Inicio	Data Fim
Task 1.	Coordination and management	M1	M36
Task 2	Meteorological, network and market data	M2	M24
Task 3	Models for active high efficiency electric network operation	M5	M30
Task 4	Development of RES case studies	M18	M34
Task 5	Implementation of models. Analysis of results	M24	M36
Task 6	Dissemination and exploitation of OPTIGrid results	M1	M36



Start: 1st October 2018

Duration – 3 years (+1 year, extension)

Methodology and Approach

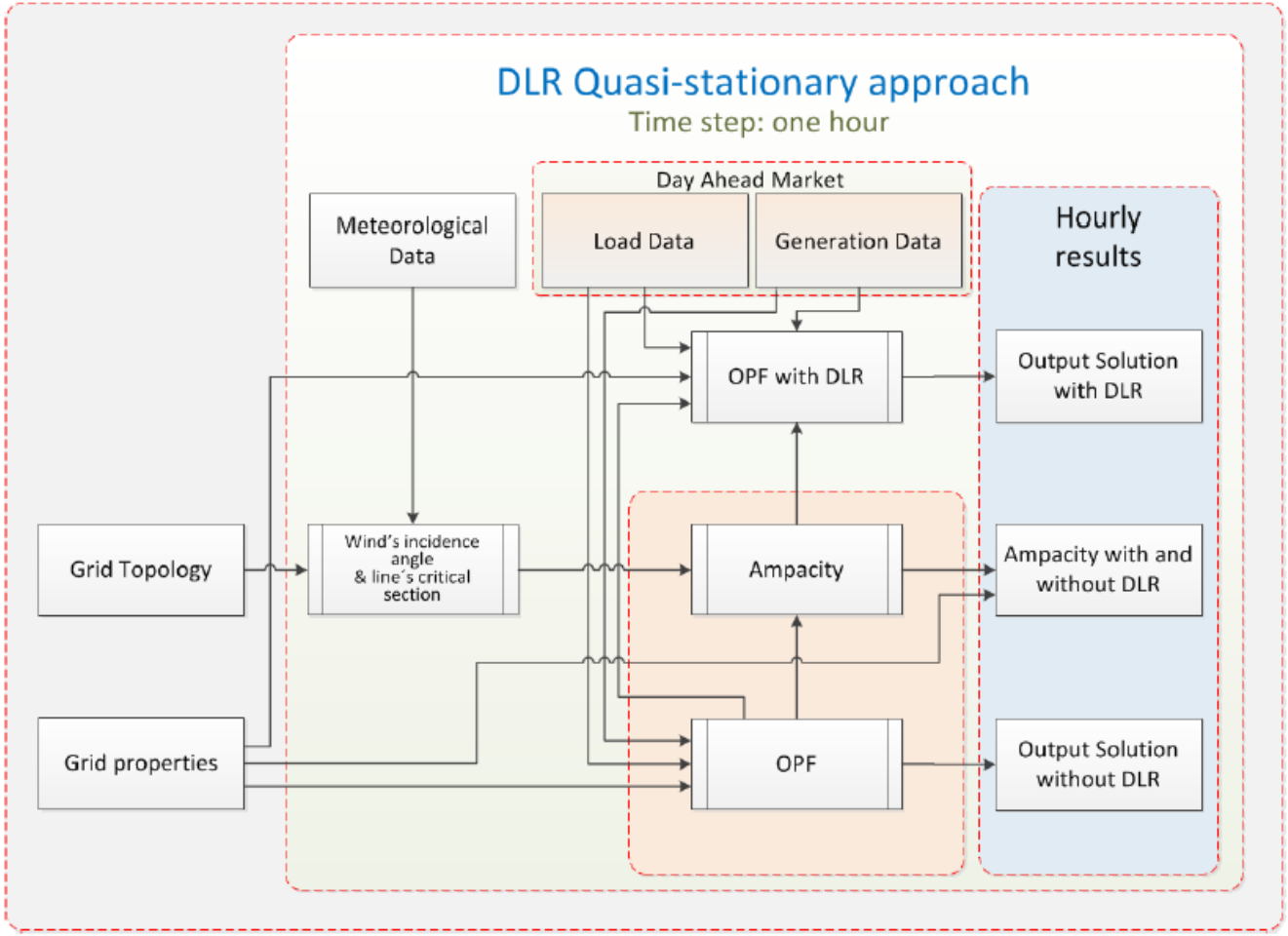


Figure 2 – Schematic representation of a quasi-stationary approach for DLR analysis of potentially congested networks.

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Further information available at: https://optigrid.lneg.pt

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