



Integrated cyber-physical solutions for intelligent distribution grids with high penetration of renewables

|                   |                            |
|-------------------|----------------------------|
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## Deliverable 1.4 Data Management Plan

|                     |                                     |
|---------------------|-------------------------------------|
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## Version history

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|---------|--------|-------------|--------------------------------------------------------|
| 0.1     | 180315 | Tuan Le     | Creation                                               |
| 0.2     | 180402 | David Steen | First version                                          |
| 1.0     | 180430 | Anh Tuan Le | Final version                                          |
| 1.1     | 190513 | David Steen | Updated chapter 3 on data sharing and interoperability |
|         |        |             |                                                        |

## Deliverable abstract

The Data Management Plan will outline what data that will be collected, processed and used. It describes also how the data will be made accessible for verification and re-use, and how it will be curated and preserved after the project. *It should be noted that this DMP is a living document and will be updated/developed regularly during the course of the project.*

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## Project overview

UNITED-GRID aims to secure and optimise operation of the future intelligent distribution networks with unprecedented complexity caused by new distributed market actors along with emerging technologies such as renewable generation, energy storage, and demand resources. The project will provide integrated cyber-physical solutions, while efficiently exploiting the opportunities provided by the new actors and technologies. *The core deliverable is the UNITED-GRID tool-box that could be “plugged in” to the existing Distribution Management System (DMS) via a cross-platform for advanced energy management, grid-level control and protection.* This cross-platform allows interoperability from inverter-based DERs up to the distribution grid at the low and medium voltage levels, thus going beyond the state-of-the-art to optimise operation of the grid with real-time control solutions in a high level of automation and cyber-physical security.

The project has genuine ambitions to create impacts and to enhance the position of European member states in the development of smart grids. The core elements in this quest are:

- **Proof-of-concept and demonstration:** Developed UNITED-GRID tool-box and business models will be validated in real-life demonstration sites in Netherlands, France and Sweden which cover a majority of European market conditions. At the sites, UNITED-GRID will demonstrate the capabilities of intelligent distribution grids hosting more than 80% renewables by incorporating the advanced optimisation, control and protection tool-box, which are supported by real-time measurement systems. Such technologies with TRL in a range of 3-4 will be matured via the demonstrations up to TRL level 5-6 to address comprehensively compatibility and interoperability issues.
- **Pathways:** Upon request by directly involved stakeholders such as distribution system operators (DSOs), energy suppliers, UNITED-GRID will develop pathways that will step-by-step guide in the transition from the passive distribution grids of today to the active and intelligent distribution grids of tomorrow. The pathways incorporate technical as well as non-technical considerations such as cost-benefit, investments, business models, end-user privacy and acceptance.
- **Use and deployment:** UNITED-GRID will nourish and firmly support the utilisation and exploitation of technologies, tools, and services in distribution grids by integrating the inherent innovation chain of the partners and their networks with EU such as KIC InnoEnergy and SSERR.

## Consortium



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# 1 Data collection process

## 1.1 Purpose of the data collection/generation and relations to objectives of the project

The main objective of UNITED-GRID is to provide integrated cyber-physical solutions, while efficiently exploiting the opportunities provided by the new actors and technologies. The core deliverable is the UNITED-GRID tool-box that could be “plugged in” to the existing Distribution Management System (DMS) via a cross-platform for energy management, grid-level control and protection.

In order to meet this objective, the project will first need to collect the data in the demo-sites of the project to support with simulations of the systems and testing of solutions and algorithms developed within different work-packages. The relations between data collected and the work-packages are shown in Figure 1.

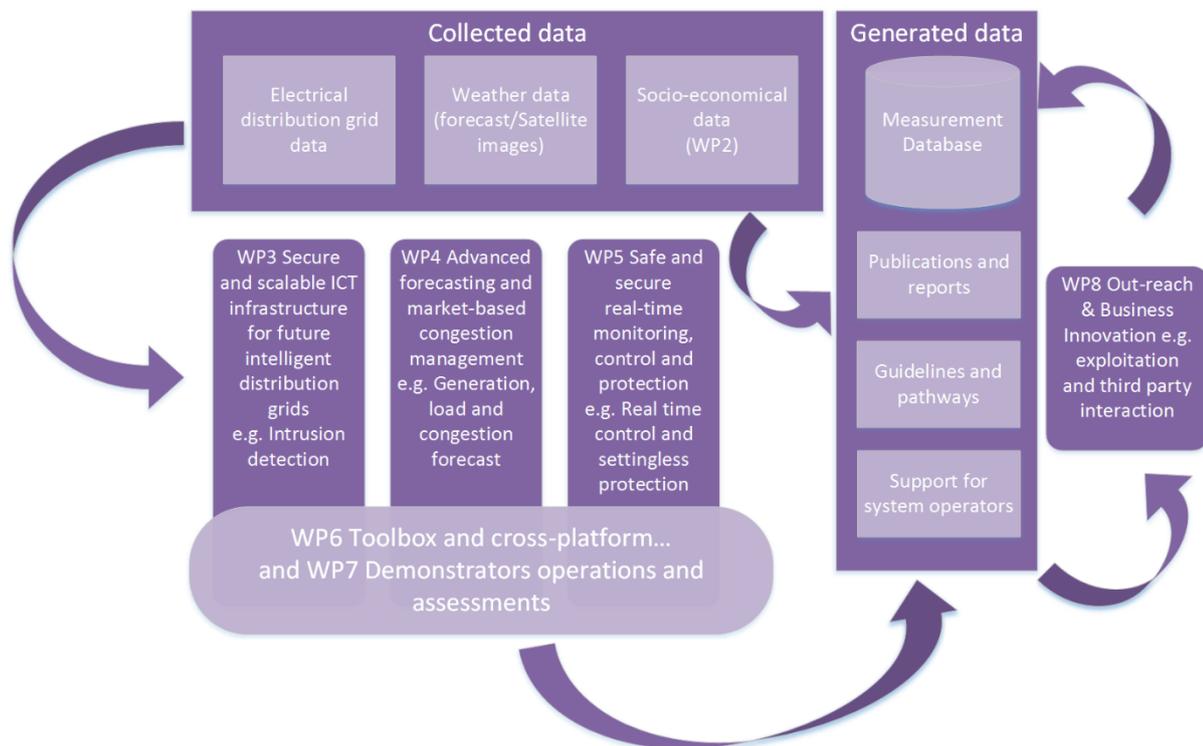


Figure 1: Relations between data collected/generation to the project's WPs.

The data that are collected include:

- *Historical electrical customer demand data:* The demand data will be used in WP4 for development and validation of load forecasting models as well as network congestion forecast model.
- *Electrical distribution grid data:* These data be used in all technical work-packages (WPs 3-7)
- *Real-time measurement data:* The real-time measurement data will be used in WP5 to support development and validation of real-time control models as well as the setting-less protection algorithms.
- *Weather data:* This will be used for development and validation of very short-term solar production forecast models.
- *Socio-economic data:* These will include information on e.g., the current practice on the planning and operation of the distribution system operators (DSOs), regulatory and policy situation in partners' countries, and economic/business models for DSOs, etc.

The data which will be generated from UNITED-GRID will include, e.g.:

- Measurement data from hourly smart meters and other types of real-time measurements at the demo-sites in France, The Netherlands and Sweden.
- Specifications for advanced functionalities of distribution management systems.
- Publications: The publications contain the main results from the project in both technical and non-technical media.
- Guidelines: These will be step-by-step guides in the transition from the passive distribution grids of today to the active and intelligent distribution grids of tomorrow. The guidelines incorporate technical as well as non-technical considerations such as cost-benefit, investments, business models, end-user privacy and acceptance.

It is noted that all data collection and processing will be carried according to EU and national legislation. Each WP leader is aware that they are responsible to follow national legislation. Chalmers as coordinator is responsible to follow up on this with each partner. Data will be protected in established validated systems suitable for sensitive data.

## 1.2 Types and formats of data

Depending on types of data, partners will gather information and agree on the formats of the data to be exchanged. The data that the project will generate/collect is shown in Table 1.

Table 1: Date collected or generated by UNITED-GRID

| No. | Type of data                      | Collected or Generated | Data formats     |
|-----|-----------------------------------|------------------------|------------------|
| 1   | Customer demand/metering data     | Collected              | csv, xls         |
| 2   | Electrical distribution grid data | Collected              | raw (PSS/E), xls |
| 3   | Socio-economic data               | Collected              | xls, txt, doc    |
| 4   | Output data in different WPs      | Generated              | csv, xls         |
| 5   | Results, publications             | Generated              | pdf, exe         |

## 1.3 Re-use any existing data

Data that are already available from previous projects by project partners will be used. An example is the electrical distribution grid data of Chalmers demo-site used in other on-going projects at Chalmers can be re-used.

## 1.4 Origin of the data

The following types of data which will be used in UNITED-GRID and their sources are as follows:

- The customer demand data will be used in load forecasting applications in WP4. The data comes from individual customers, the data will be anonymized so that no connection can be made with that individual.
- The electrical distribution grid data will be provided by the DSOs partners within the consortium.
- Socio-economic data will be gathered via surveys to the DSOs within the project and other relevant stakeholders.

## 1.5 Data utility

Stakeholders will benefit from the data which are collected and generated from UNITED-GRID. Table 2 presents the data utilities of the main data in the project.

Table 2: Data utility by stake-holders in UNITED-GRID

| No. | Type of data                                                                                                                   | Stake-holders                   | Data utility                                                                                                                                                                                                                                                                                                  |
|-----|--------------------------------------------------------------------------------------------------------------------------------|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1   | Customer demand data                                                                                                           | All partners                    | All partners will benefit from having access to the data. The academic partners will use the data to validate the forecast models which will be developed. The DSOs partners will have a better understanding of their grid conditions if more data on real-time from the customers' side is to be collected. |
| 2   | Electrical distribution grid data                                                                                              | Academic partners               | This data will be used for the simulation purpose. The academic partners will use the data to simulate the electrical grids in different countries and test different solutions before demonstrating the solutions at the demo-sites.                                                                         |
| 3   | Socio-economic data                                                                                                            | All partners                    | All partners will benefit from the data. The data will be used to support with scenarios development as well as with business models and exploitation plan of the developed solutions.                                                                                                                        |
| 4   | Output data in different WPs (e.g., technical solutions, business models, guidelines, technical reports and papers, and etc.). | DSOs, SMEs, Policy makers, etc. | The results from the project will benefit the DSOs, SMEs partners, as well as policy makers in different partner countries, and other EU member states.                                                                                                                                                       |

## 1.6 Responsible for data management

The project management office (PMO) will be responsible for overall data management process within UNITED-GRID. Partners will of course contribute to the data collection as well as generation of data from the project results.

## 2 Data Organization Description

Folders and data files will be named according to the following:

- Level-1: A parent folder of each type of database: This will contain a number starting with 01 to order the information in a list, and a name describing its contents. "01. Electrical Distribution Grid Database".
- Level-2: Under this folder, there will be sub-folders containing database related to the parent folder for different data sets from different distribution grids.
- Level-3: Under each sub-folder, there will be a file containing actual data with date-tag according to the format: "yyyy-mm-dd". As soon as the data is updated, the file will be saved as a new file with new date-tag. The old file will still be kept but will be moved to a folder named "Old" which will be created under Level-2.

There will be a description of data that has been collected and generated from UNITED-GRID in Excel format. This file will be placed under the general folder of the project's database.

### **3 Data sharing, open access and data interoperability**

#### **3.1 Sharing within consortium**

All partners in the consortium will have access to UNITED-GRID data based in Box. The partners are allowed to add and make changes in the database.

#### **3.2 Open access**

Publications should be published as open access. Also, partners will be encouraged to make data as “open access” whenever possible. Regarding the resources for long term preservation (costs and potential value, who decides and how, what data will be kept and for how long), at the moment, the consortium has not discussed about the resources for long term preservation of data. It will be discussed in the later stage of the project.

#### **3.3 Data Interoperability**

The data produced in the project will be made interoperable to the extent possible (as agreed by partners) to allow data exchange and re-use between partners within UNITED-GRID. Non-confidential data could be made available to the public upon request with agreement by partners who own the data.

### **4 Data security**

It was decided at the first UNITED-GRID consortium meeting that all data will be securely stored in Box file storage system ([www.box.com](http://www.box.com)) which is the service bought and recommended to use by the IT Support at Chalmers University of Technology for both storing and sharing purposes. The data will also be backed up locally on the file server at Chalmers University of Technology which in turn is backed up every day. Regarding the sensitive data issue, in cases where data come from individual customers, the data will be anonymized so that no connection can be made with that individual.

### **5 Ethical aspects**

There is no issue with ethical aspects in UNITED-GRID. In the project, humans are not subjects to any experiments or research. Any images with human beings will be anonymized and randomized so that no personal sensitive data will be collected or processed. All data collection and processing will be carried according to EU and national legislation.