

UNITED GRID

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

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Deliverable abstract

This report presents the situation analysis strategy that will be used throughout the project. It presents the situation analysis team members and the working approach and interaction with the project management office. Furthermore, a brief analysis of the current situation is provided.

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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



Table of Contents

Version history 2

Deliverable abstract 2

Project overview 3

Consortium 3

Table of Contents 4

1. Introduction 5

2. The situation analysis team 5

3. Working approach and strategies to interact with coordination team 6

4. Current status..... 6



1. Introduction

The energy sector is facing drastically changes due to a number of reasons, including; aging infrastructure, reduced investment cost of renewable energy technologies, distributed generation, active customers, regulation, business development, etc. To operate and coordinate a project in an ever-changing world it is important to stay informed of external events and trends that could affect the Energy sector.

Within UNITED-GRID project management framework, a Situation Analysis Team (SAT) has been formed. The team consists of senior members that are well connected on Global/European level. The main tasks of SAT are to:

- Advise the project management to take action based on external events effecting the Energy sector (Politics, regulation, business development, etc.). This would give the possibility for the Project Coordinator to align R&D&I activities in a fast changing environment, rendering in results that are more relevant to the Global/European-community.
- Support with relevant networks to enhance impacts of project results.
- Support in the development and chairing of the dynamic Reference Groups of the project.

The main objective of this deliverable is to describe the structure and the operation of the SAT, underlining their major responsibilities and their cooperation with the coordination team toward the successful implementation of the project. Harmonic cooperation will lead to the development of solutions that will assist DSOs to handle emerging phenomena in future distribution level smart grids. Furthermore, in Section 4, a brief summary of the current status of smart grid applications and concerns is presented, so that the impact of UNITED-GRID solutions in future distribution networks is described. The current situation and requirements needed to adapt more advanced solutions in the distribution system will be further investigated within work package 2 of the project.

2. The situation analysis team

In UNITED-GRID the Situation Analysis Team (shown in Table 1) consist of four senior experts with great insight in the European/global energy sector.

Table 1 Members of the Situation Analysis Team

	<i>Karin Widegren, Vice-Chair of International Smart Grid Action Network, ISGAN.</i> ISGAN is a multilateral government-to-government collaboration to advance the development and deployment of smarter electric grid technologies, practices, and systems. Reports ministers of the Clean Energy Ministerial, in addition to satisfying all IEA Implementing Agreement. Karin supports with regulation, standards, network
	<i>Diego Pavia, CEO KIC InnoEnergy and a serial entrepreneur.</i> Diego leads the most relevant innovation and exploitation paths for project findings globally. He supports in with innovation paths, funding opportunities and investments and network.
	<i>Professor Tomas Kåberger, Renewable energy advisor to governments, suppliant in Fores think tank, Director of Energy, Chalmers.</i> Thomas supports with networks, policy, standard, regulation and pathways
	<i>Dr. Anna Wolf, special advisor in energy systems and smart grid, Power Circle.</i> Anna main contribution are trends, holistic view of smart grids and society, the evolvement of energy systems

3. Working approach and strategies to interact with coordination team

The input from the situation analysis team is highly valuable for the coordination team of the project in order to keep the project aligned with any changes in the society that could affect the potential to utilize the project results. The situation analysis team will be communicating with the coordination team both directly via physical meetings and via phone or web meetings. The project coordination team will have continuous discussions with the members of the SAT and present their findings at the consortium meetings and discuss with the project partners if any adjustments are deemed necessary.

Important subjects to discuss with the situation analysis team includes:

- Trends in technology development e.g. price, availability, improvements etc.
 - Is any technology evolving faster than other, e.g. solar PV, batteries, thermal storage
- Changes in policies e.g. new subsidy programs, at national, EU or international level, etc.
 - Any new policies being discussed or implemented? E.g. regarding distributed generation, storage, possibility for customer participation etc.
 - Any technologies that are being promoted more or less?
- New or innovative business models, market structures etc.
 - Any new business models for distribution system operators or electricity retailer being discussed or implemented? E.g. customer participation, local energy markets etc.
 - Any changes in the structure of the electricity market within EU?
- Changes in regulation
 - Is there any changes proposed in the regulatory framework for the electricity sector on a national/European level?
- Political trends
 - Any changes in the political climate? E.g. how do the European politicians respond to USA new directions?
 - Changes in interest for sustainability?
- Changes in social acceptance?
 - Any changes in the customers interest or acceptance for e.g. local energy communities, microgrids, customer participation in the electricity market or customer owned production?
- Upcoming projects (national/EU/international level) that are important to follow?

4. Current status

At the kick-off meeting in November, Karin Widegren represented the SAT. Other members that were not able to participate in the meeting have been supplied with material from the meeting and been introduced to the project to be able to provide the best support for UNITED-GRID. At the meeting the SAT brought up aspects that could be of importance for the project development, e.g. the winter package and EUs effort to harmonize the energy sector.

From the submission of the proposal until today the energy sector has evolved rapidly. The following points have been highlighted by the member of the SAT:

- The reduction in cost for both renewable production and energy storage as a key driver but also that development in ICT solutions enable new approaches for controlling and trading electricity. Current regulation could hinder some of the possible solutions such as peer to peer transaction. For some countries the regulation promotes DSOs to invest in more cables rather than other smart grid solutions which could result in higher cost for the customers and could hinder the development of more advanced solutions, such as the ones that are being developed in UNITED-GRID.
- The role of DSOs in future active distribution grids is of primary concern. Current regulation about DSO role dictates that DSOs should act as neutral market facilitators that should not interfere with market functioning by restricting consumption or production, for example regarding demand response [1]. Moreover, DSOs should guarantee system stability, power quality, technical efficiency and cost effectiveness [2].

- Congestion and voltage issues are getting higher significance in distribution level due to the increasing penetration of Distributed Generators (DGs) such as solar panels and wind turbines, and new and unpredictable types of loads (such as heat pumps and electric vehicles) that cause bidirectional power flow. Exploitation of end-users' flexibility is increasingly important in future networks, especially in distribution level, as it provides an efficient and economical alternative to DSOs for proper management of their network, so that possible congestion and voltage instability problems are mitigated [3]. According to current regulation, DSOs are not allowed to own storage and/or production units and, as a result, to exploit their potential flexibility. In some countries, DSOs can procure flexibility services through bilateral agreements with large customers or via market-based instruments to manage their networks efficiently and securely, while deferring investments in grid expansion (e.g. building new cables and transformers). From regulators' perspective DSOs should act as neutral market facilitators that enable flexibility services to develop. However, DSOs should not distort the potentially competitive market in flexibility services [4]. The respective regulatory framework should be non-discriminatory and not hinder or unduly disincentivize DSOs from facilitating the development of flexibility [5]. From DSOs perspective, DSOs should act as neutral market facilitators and coordinators of all network customers due to the deep knowledge of their networks [6]. DSOs require legislation changes, amongst other, regarding prevention of double use of flexibility resources when used for congestion management [6]. They also recommend that each system operator (DSOs and TSOs) should make decisions in its own system, as they hold the remit and the responsibility for operating their own networks securely and reliably [6]. Moreover, suitable TSO-DSO coordination schemes should be established so that efficient and secure use of flexibility is guaranteed [5]-[8].
- From a policy perspective: The focus has changed from more investment based subsidies to support the local production via e.g. tax reduction. The dilemma of applying environmental taxation of since it could lead to decommissioning of power plants and financial problems for energy companies. The policies is also tending to support use of flexibility and energy storages and they emphasize the need to carefully design the mechanisms in order to avoid unexpected and undesired behavior of the actors. The policies may have a great implication on the customer acceptance.
- The winter package: The promotion of local energy communities are to some extent in conflict with the goal of unbundling the energy sector. They see a trend in providing electricity as a package in combination with other services.
- Regarding the political situation: The political situation in Eastern Europe with less interest in renewables is posing a risk of blocking the EU of adapting more progressive policies and regulation that could promote renewable generation. In several countries the politics are shifting focus from mainly promoting investment in renewable to also consider the integration of the renewable energy sources. On a global level the team highlight the efforts made on creating a global transmission system. If this will be successful it will speed up investments in both wind and solar.

From a UNITED-GRID perspective, the SAT argues that the solutions that will be developed within the project will be valuable for the market although they see a need for changes in regulations to fully adapt the potential of the solutions. The work within WP2 is seen as an important contribution in order to highlight the difficulties with implementing the solutions in different market context.

Distribution level smart grid is an involving procedure all over the world. In Europe, lots of significant steps have been made toward efficient and resilient implementation of smart grid. However, there are more things that need to be done so that future distribution networks are more intelligent. From technical perspective, academia and industry should develop efficient tools of high sophistication that will allow smart grid application to expand. UNITED-GRID aims to this direction as academic and industrial partners develop useful software, middleware and hardware tools to facilitate "smarter" management of distribution networks by DSOs. From regulatory and policy perspective legislative changes are necessary, so that the integration and maximum exploitation of these tools is facilitated.

5. References

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