AI-assisted decision support for operational planning in distribution systems

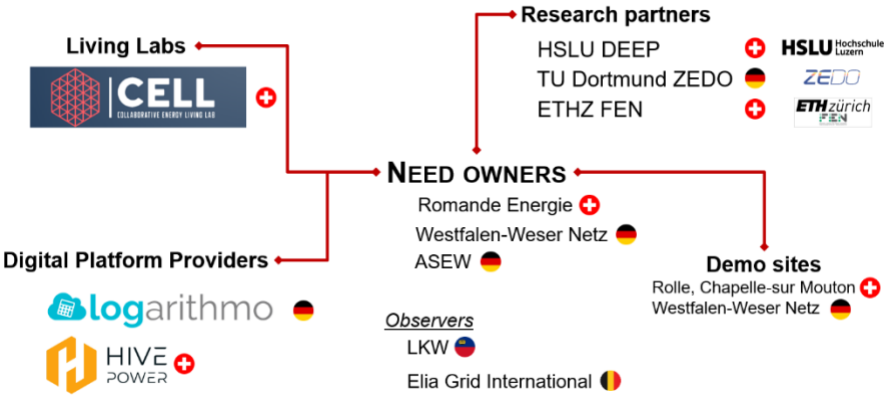
Newsletter #1 – Introduction

We are pleased to share the first in a series of newsletters on our new ERA-Net project, AISOP. We will distribute these newsletters every 6 months - they will contain selected highlights from the project. In addition to general updates, we will include discussion on a selected set of topics relevant to the project. Future newsletters will discuss operational planning in distribution networks, grid state forecasting, risk identification, anomaly detection in active distribution grids, dynamic tariffs, and digital twins applied to distribution systems.

In our first newsletter, we introduce the project and the team, and we share with you our vision for operational planning for distribution systems. Enjoy reading!

For more information, and to subscribe to future updates, visit www.aisopproject.com.

Who we are: an international consortium from Switzerland and Germany



What we do: data-driven decision support system

AISOP will create an **AI-assisted decision support system for the electric distribution system operators** (DSOs) to drive decarbonisation that is underpinned by **advanced digital technology**. The decision-support system securely and privately acquires, processes, interprets, and exploits data for the benefit of DSO operational planning. AISOP expands data-driven techniques for improved operational planning in distribution/local grids with high shares of DERs by integrating AI/ML-based solutions, enhanced situational awareness and market incentives. We combine *(i)* data access and ingestion, *(ii)* distribution grid situational awareness, *(iii)* decision-support for distribution grid management, *(iv)* dynamic tariffs, and *(v)* digital platform integration with exploitation through test and training environments.

Topic #1: Operational planning for active distribution grids

In AISOP, we create a new "**operational planning**" framework for distribution system operators, inspired by similar approaches that are already in place for transmission system operation.

Today, operational planning is used in transmission systems to manage network constraints such as line congestions and voltage violations. The system operator prepares a forecast of the situation in the grid, as much as a year in advance, and then refines it as they approach real time. The information they obtain from the operational planning process helps them to manage the grid.

AISOP project has received funding in the framework of the joint programming initiative **ERA-Net Smart Energy Systems**' focus initiative Digital Transformation for the Energy Transition, with support from the European Union's Horizon 2020 research and innovation program under grant agreement No 883973.

Today, no such system exists at the distribution level. However, as the levels of embedded generation increase, and as they are combined with widespread electrification of loads such as electric vehicles, we see significant benefits for the DSO in applying similar approaches.

The DSO will need to manage an active distribution grid consisting of an increasing amount of local generation that does not necessarily correlate with demand. Making investment decisions for such a dynamic system in a timely manner is also increasingly challenging. It is a fact that adjusting the setpoints of the generators and demand is not as easy in the distribution system as it is in transmission system operation. In addition, the DSO cannot replace the underground cables or the transformers frequently – the system must be actively managed to accommodate changes in loads or generation connected to the network.

Therefore, there DSO will benefit from an “operational planning” framework that can help operate the grid, identify the needs for flexibility, and identify candidates for flexibility provision to defer investment decisions, reducing risk with automated processes.

Operational planning comprises various **tasks** that lead to **outcomes** – these create **value** for the DSO:

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Smart Energy Systems ERA-Net

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AISOP	Operational planning for active distribution systems
Outcomes	Curative or proactive congestion management Day-ahead (or x-hour-ahead) preparation for probable events – based on forecasts: weather, solar generation Feeder reconfiguration: emulating (n-1) redundancy Voltage management (distributed or decentralised) Online security assessment
Value	Investment deferral Fault location isolation and system restoration Identification and forecasting new loads (i.e., HP, EV charging) and solar generation Coordinating, designing (or helping to design) market or tariff mechanisms Providing services (e.g., Redispatch 2.0 in Germany: DSO contributing to redispatch) Coordination of utilization of resources in distribution Component monitoring and predictive maintenance Sustaining scarcity / autarky
Tasks	Assimilating data from smart meters and grid sensors Managing information security Assessment of available flexibility and load flexibility controls: ripple control, load shifting Assessment of network configuration changes (switches, tap changer-equipped substation) DSO-DSO-TSO interactions
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In AISOP, the framework will be performed on intra-day and day-ahead timescales and will be realised in part through a digital process twin architecture. Future work will include defining the requirements and characteristics of the digital process twin, developing an AI-based framework for grid situational awareness,

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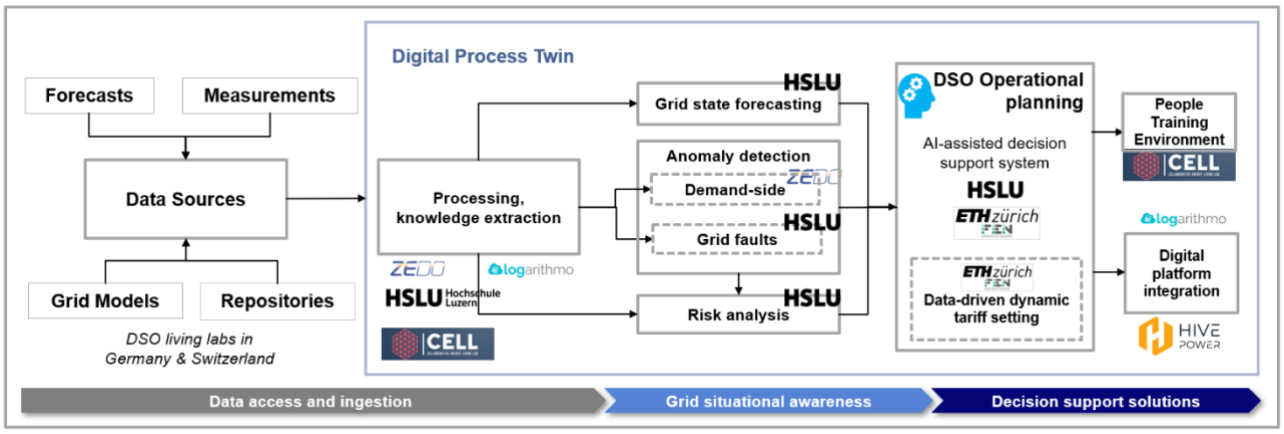
conducting risk-based analysis, formulating dynamic tariffs, and conducting model-based trials in Switzerland and Germany. The workflow is shown in the diagram below:



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