

# European Research Infrastructure supporting Smart Grid and Smart Energy Systems Research, Technology Development, Validation and Roll Out – Second Edition

*Work Package WP3*

## NA2 - Dissemination, Communication, and Collaboration

*Deliverable D3.3*

### D-NA2.2b Progress Report of Project Networking and Collaboration Activities

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16/10/2022	v1.2	I. Abdulhadi (UoS), I. Gilbert (OCT)	Review of final draft version
18/10/2022	v1.3	M. Sosnina (DERlab)	Reviewers' comments implemented
06/02/2023	v1.3	E. Mrakotsky (AIT)	Language and grammar check
30/03/2023	v1.4	T. Strasser (AIT)	Final version

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## List of Abbreviations

<b>AC</b>	Alternating Current
<b>COVID-19</b>	Coronavirus Disease 2019
<b>DC</b>	Direct Current
<b>DER</b>	Distributed Energy Resources
<b>DG</b>	Distributed Generation
<b>DSO</b>	Distribution System Operator
<b>EC</b>	European Commission
<b>GA</b>	Grant Agreement
<b>GIS</b>	Geographic Information System
<b>HIL</b>	Hardware-in-the-Loop
<b>HTD</b>	Holistic Test Description
<b>ICT</b>	Information and Communications Technology
<b>IoT</b>	Internet of Things
<b>MooC</b>	Massive Open Online Course
<b>MVDC</b>	Medium Voltage Direct Current
<b>NCP</b>	National Contact Point
<b>PV</b>	Photovoltaic
<b>PoC</b>	Person of Contact
<b>RDI</b>	Research, Development and Innovation
<b>RI</b>	Research Infrastructure
<b>ROS</b>	Robot Operating System
<b>RES</b>	Renewable Energy Sources
<b>RTS</b>	Real-Time Simulation
<b>TA</b>	Trans-national Access
<b>TF</b>	Task Force
<b>TRL</b>	Technology Readiness Level
<b>VA</b>	Virtual Access
<b>WP</b>	Work Package

## Executive Summary

ERIGrid 2.0 aims to offer a broad spectrum of advanced services and tools for researchers who are active in smart grids, smart energy systems, and the integration of renewables. In particular, the provision of its Research Infrastructures (RIs) and contributing to the integration of Europe's RIs are the focus points of the project. The consortium recognizes that establishing new connections and continuing existing collaborations with other relevant projects and initiatives in the smart energy domain are essential for reaching these objectives. Thus, they can be considered as direct contributors to the success of ERIGrid 2.0.

Collaboration activities established in the first project stage and continued throughout the given time frame are presented in the current report. Furthermore, several new collaborations are documented. The focus areas of these collaboration activities encompass the full range of research topics within the scope of ERIGrid 2.0. These activities are also varied geographically, targeting projects, networks, and initiatives on national, European, and intercontinental levels.

With project activities previously being significantly impacted by Coronavirus Disease 2019 (COVID-19) related regulations, the consortium anticipates more physical, on-site activities and knowledge transfer events in the upcoming stages.

# 1 Introduction

## 1.1 Purpose and Scope of the Document

This document reports an update of the number of broad collaboration activities that were carried out by ERIGrid 2.0 from 1 April 2021 until 30 September 2022. The collaborations that hold potential for joint activities in the near future are also taken into account. The purpose of this overview is to help the ERIGrid 2.0 consortium assess whether its collaboration with other initiatives is on track and whether its research agenda is reflected in its networking activities. The addressed projects and networks are thematically linked to ERIGrid 2.0, and there is at least one person who participates in both parties and can act as a Person of Contact (PoC) for collaboration between the parties.

Joint activities between ERIGrid 2.0 and its collaborators are essential to the success of this project. As reflected in the Grant Agreement (GA) (*ERIGrid 2.0 Grant Agreement*, 2019), collaborators will provide feedback to ERIGrid 2.0 activities, stimulating further improvements of the integrated RI. ERIGrid 2.0 in turn will support their activities by sharing methods and experiences on laboratory-based testing and validation of smart grid concepts, as well as offering free access to its state-of-the-art laboratories.

Bearing the effect of COVID-19 regulations, most of the collaboration activities and knowledge exchange for the given time frame have taken place in the form of email communication, joint web meetings, and webinars. More joint physical events are expected to take place in the remaining lifetime of the project.

## 1.2 Structure of the Document

This document is organised as follows: Section 1 provides general details about the background of collaboration activities and outlines the report's purpose and scope. Section 2 gives an overview of projects on the European, national, and international levels that ERIGrid 2.0 is collaborating with. Further, in Section 3, an overview of collaborative efforts with networks is presented. The deliverable is concluded in Section 4.

## 2 Collaborations with Projects

Earlier in the project, ERIGrid 2.0 identified several relevant European and national projects for cooperation and knowledge exchange. Furthermore, these collaborations should be able to provide valuable feedback about project results and contribute to their exploitation.

The nature and contents of the collaborations in the currently reported time frame are described in the following sections.

### 2.1 European Projects

Table 1 outlines the European projects which are collaborating with ERIGrid 2.0. In the following sections, more details are provided about the cooperation with those projects.

*Table 1: Overview of European projects with links to ERIGrid 2.0.*

Name	Funding	ERIGrid 2.0 Partners Involved	ERIGrid 2.0 PoC	Project PoC
RICH Europe	Horizon Europe	yes	Thomas Strasser (AIT)	Andrea Pantarelli (ARPE)
int:net	Horizon Europe	yes	Thomas Strasser (AIT)	Antonello Monti, Alberto Dognini (Fraunhofer)
StoRIES	Horizon 2020	yes	Thomas Strasser (AIT)	Stefano Passerini (KIT)
PANTERA	Horizon 2020	yes	Diana Strauss-Mincu (DERlab)	Diana Strauss-Mincu (DERlab), Venizelos Efthymiou (FOSS)
eNeuron	Horizon 2020	yes	Leonard Ramos (DERlab)	Leonard Ramos (DERlab)
GIFT	Horizon 2020	yes	Evangelos Rikos (CRES)	Evangelos Rikos (CRES)
HYPERRIDE	Horizon 2020	yes	Thomas Strasser (AIT)	Thomas Strasser (AIT)
SINERGY	Horizon 2020	yes	Thomas Strasser (AIT)	Thomas Strasser (AIT)
RE-EMPOWERED	Horizon 2020	yes	Panos Kotsampopoulos (ICCS-NTUA)	Panos Kotsampopoulos (ICCS-NTUA)
JPP Smart Energy Systems	ERA-Net/Horizon 2020	yes	Thomas Strasser (AIT)	Michael Hübner (bmk), Ludwig Karg (B.A.U.M.)
ELECTRA	Integrated Projects – Smart Growth/RIF	yes	George Makrides (FOSS)	George Makrides (FOSS)
BERLIN	ENI CBC MED	yes	Venizelos Efthymiou (FOSS)	Venizelos Efthymiou (FOSS)
EDDIE	Erasmus +	yes	Panos Kotsampopoulos (ICCS-NTUA)	Alexandros Chronis (ICCS-NTUA)
CCRSg	Erasmus +	yes	Panos Kotsampopoulos (ICCS-NTUA)	Panos Kotsampopoulos (ICCS-NTUA)



### 2.1.1 RICH Europe

**Full Name:** Research Infrastructures Consortium of NCPs in Horizon Europe (RICH Europe)

**Funding Framework:** Horizon Europe

**Coordinator:** Andrea Pantarelli (APRE)

**PoC on Behalf of ERIGrid 2.0:** Thomas Strasser (AIT)

**PoC on Behalf of RICH Europe:** Andrea Pantarelli (ARPE)

**Project Duration:** 1 June 2022 - 31 May 2029

**Description:** The aim of *RICH Europe*<sup>1</sup> is to improve and support the professionalisation and harmonisation of RI National Contact Points (NCPs) services across Europe and to contribute to the consolidation of the European research infrastructure ecosystem.

**Collaboration Activities:** Having similar target audiences, ERIGrid 2.0 and RICH Europe are collaborating on knowledge exchange and networking related to RIs and the corresponding access provision.

### 2.1.2 int:net

**Full Name:** Interoperability Network for the Energy Transition (int:net)

**Funding Framework:** Horizon Europe

**Coordinator:** Antonello Monti (Fraunhofer)

**PoC on Behalf of ERIGrid 2.0:** Thomas Strasser (AIT)

**PoC on Behalf of int:net:** Antonello Monti, Alberto Dognini (Fraunhofer)

**Project Duration:** 1 May 2022 - 30 April 2025

**Description:** *int:net*<sup>2</sup> bring together all stakeholders relevant to the European energy sector to jointly work on developing, testing, and deploying interoperable energy solutions and services. It will also push for improved cooperation between energy services to ensure synchronisation between providers.

**Collaboration Activities:** Having similar target audiences, ERIGrid 2.0 and int:net are collaborating on knowledge exchange and networking related to validation and testing facilities.

### 2.1.3 StoRIES

**Full Name:** Storage Research Infrastructure Eco-System (StoRIES)

**Funding Framework:** Horizon 2020

**Coordinator:** Stefano Passerini (KIT)

**PoC on Behalf of ERIGrid 2.0:** Thomas Strasser (AIT)

**PoC on Behalf of StoRIES:** Yannick Wimmer (AIT)

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<sup>1</sup><https://rich-europe.eu/>

<sup>2</sup><https://intnet-project.eu/>

**Project Duration:** 1 November 2021 - 31 October 2025

**Description:** *StoRIES*<sup>3</sup> promotes a European ecosystem of industry and research organisations to develop innovative concepts and competitive and less costly energy storage technologies. The consortium consists of members of the European Energy Research Alliance and the European Association for Storage of Energy. By providing access to first-rate RIs and services, the project will speed up the advancement of knowledge and technology in the field of energy storage. One of its technological goals is to optimise hybrid energy systems.

**Collaboration Activities:** Having similar target audiences, ERIGrid 2.0 and StoRIES are collaborating on knowledge exchange and networking related to RIs and the corresponding access provision.

#### 2.1.4 PANTERA

**Full Name:** Pan European Technology Energy Research Approach (PANTERA)

**Funding Framework:** Horizon 2020

**Coordinator:** Venizelos Efthymiou (FOSS)

**PoC on Behalf of ERIGrid 2.0:** Diana Strauss-Mincu (DERlab)

**PoC on Behalf of PANTERA:** Diana Strauss-Mincu (DERlab), Venizelos Efthymiou (FOSS)

**Project Duration:** 1 September 2019 - 31 December 2022

**Description:** *PANTERA*<sup>4</sup> set up a European forum composed of Research & Innovation stakeholders active in the fields of smart grids, storage and local energy systems, including policy-makers, standardisation bodies and experts in both research and academia representing the EU energy system. The project created the corresponding multi-functional collaborative platform EIRIE, which serves as a reference operational point to unify European activity, incentivise further investments in smart grids and support access to exploitable results.

**Collaboration Activities:** Having similar target audiences, ERIGrid 2.0 and PANTERA collaborated for knowledge exchange and networking. Furthermore, PANTERA's EIRIE platform presented lab access and virtual services of ERIGrid 2.0.

#### 2.1.5 eNeuron

**Full Name:** greEN Energy hUbs for local integRated energy cOmmunities optimization (eNeuron)

**Funding Framework:** Horizon 2020

**Coordinator:** Marialaura Di Somma (ENEA)

**PoC on Behalf of ERIGrid 2.0:** Leonard Ramos (DERlab)

**PoC on Behalf of eNeuron:** Leonard Ramos (DERlab)

**Project Duration:** 1 November 2020 - 31 October 2024

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<sup>3</sup><https://www.storiesproject.eu/>

<sup>4</sup><https://pantera-platform.eu/>

**Description:** *eNeuron*<sup>5</sup> will set out a practical and evidence-based framework for optimising the design and operation of local energy communities acting as energy hubs. It will draw on pioneering software and hardware solutions and develop new use cases so that local energy communities can rise to the challenge of widespread roll-out.

**Collaboration Activities:** With the topic of multi-energy being in the scope of research both for *eNeuron* and *ERIGrid 2.0*, there is potential for collaboration on use cases and testing requirements and methodologies.

### 2.1.6 GIFT

**Full Name:** Geographical Islands FlexibiliTy (GIFT)

**Funding Framework:** Horizon 2020

**Coordinator:** Zoran Marinsek and Saso Brus (INEA)

**PoC on Behalf of ERIGrid 2.0:** Evangelos Rikos (CRES)

**Poc on Behalf of GIFT:** Evangelos Rikos (CRES)

**Project Duration:** 1 January 2019 - 31 December 2022

**Description:** *GIFT*<sup>6</sup> is an innovative project that aims to decarbonise the energy mix of European islands through the development of multiple innovative solutions, such as a virtual power system, energy management systems for harbours, factories, homes, better prediction of supply and demand and visualisation of those data through a Geographic Information System (GIS) platform, and innovative storage systems allowing synergy between electrical, heating and transportation networks. *GIFT* will increase the penetration rate of renewable energy sources into the islands' grid, reducing their needs for diesel generation and thus decreasing directly related greenhouse gas emissions.

**Collaboration Activities:** The activities of *GIFT* are highly relevant for the scenarios and focus analysis of *ERIGrid 2.0*. The areas of interest for *GIFT* are flexibility, prosumers, local energy communities, distribution grid management, electric vehicles, and storage technologies. In this respect, the *GIFT* activities cover several of the *ERIGrid 2.0* scenarios. In addition, the Holistic Test Description (HTD) of *ERIGrid 2.0* is planned to be used in the replicability and scalability analysis of *GIFT* for the description of the selected tests. Therefore, *ERIGrid 2.0* will benefit from important feedback from the use of the methodology by *GIFT*. The PoC between the two projects is also in charge of using the HTD in *GIFT*, which ensures a more interactive implementation of and feedback on the HTD methodology.

### 2.1.7 HYPERRIDE

**Full Name:** HYbrid Provision of Energy based on Reliability and Resiliency via Integration of DC Equipment (HYPERRIDE)

**Funding Framework:** Horizon 2020

**Coordinator:** Gerhard Jambrich (AIT)

**PoC on Behalf of ERIGrid 2.0:** Thomas Strasser (AIT)

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<sup>5</sup><https://eneuron.eu>

<sup>6</sup><https://www.gift-h2020.eu/>

**Poc on Behalf of HYPERRIDE:** Thomas Strasser (AIT)

**Project Duration:** 1 October 2020 - 30 September 2024

**Description:** *HYPERRIDE*<sup>7</sup> will contribute to the field implementation of Direct Current (DC) and hybrid Alternating Current (AC)/DC grids by identifying and providing solutions to overcome barriers for a successful roll-out of new infrastructure concepts throughout Europe. Under the coordination of Gerhard Jambrich (AIT), 10 consortium partners from 6 European countries develop grid planning and operation guidelines and adapt available sizing tools for DC. The Technology Readiness Level (TRL) of enabling technologies will be raised focused on Medium Voltage Direct Current (MVDC) breakers, sensors and DC measurement units to provide field-ready devices for grid automation and protection. During the project's lifetime, automation algorithms will be created, validated and transferred to demo sites. This involves concepts and solutions for cyber-security and fault mitigation to avoid cascading effects. Pilot sites are planned in Aachen (Germany), Lausanne (Switzerland), and Terni (Italy) to showcase the above mentioned technologies. Finally, the solutions are evaluated, focusing especially on the benefits of the integration potential of renewables. Furthermore, business models will be created for products, services and applications.

**Collaboration Activities:** Concerning the HYPERRIDE efforts and ambition of developing grid automation and protection concepts (cyber-security concepts) there are numerous interfaces and common research topics. The two projects may also find common ground when it comes to educational activities (together with EPFL University) and the validation of results.

## 2.1.8 SINERGY

**Full Name:** Capacity building in Smart and Innovative eENERGY management (SINERGY)

**Funding Framework:** Horizon 2020

**Coordinator:** Nikola Tomašević (IMP)

**PoC on Behalf of ERIGrid 2.0:** Thomas Strasser (AIT)

**Poc on Behalf of SINERGY:** Thomas Strasser (AIT)

**Project Duration:** 1 January 2021 - 31 December 2023

**Description:** *SINERGY*<sup>8</sup> The primary objective of the project is to strengthen the research capacity and to further unlock the innovation potential of the Institute Mihajlo Pupin (IMP), transforming it into a regional Centre of Excellence in smart energy management. Once established, as a novel regional excellence centre, IMP will promote the added value of smart energy management technologies, coordinate research efforts and unite scarce research resources in this field in the Southeast European region, but also encourage communication with leading external EU parties, aiming at full integration into the European Research Area (ERA). In this way, IMP will be capable of further disseminating the project outcomes (strategies, policies, training courses, webinars, etc.) and supporting companies and institutions (both research and industrial) in the region to strengthen their EU competitiveness. To reach SINERGY's ambitious objectives, a strategic partnership and transfer of multidisciplinary "know-how" from leading EU research institutions, and beyond, will play the main role in gaining and exchanging the re-

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<sup>7</sup><https://hyperride.eu/>

<sup>8</sup><https://project-sinergy.org/>

lated competences needed for the development of high impact innovative energy management solutions suitable for efficient and reliable energy networks of the future.

**Collaboration Activities:** There are several overlaps between the projects, especially in the areas of validating smart energy systems as well as corresponding educational activities.

### 2.1.9 RE-EMPOWERED

**Full Name:** Renewable Energy EMPOWERing European and InDian communities (RE-EMPOWERED)

**Funding Framework:** Horizon 2020

**Coordinator:** Nikos Hatziaargyriou (ICCS-NTUA)

**PoC on Behalf of ERIGrid 2.0:** Panos Kotsampopoulos (ICCS-NTUA)

**PoC on Behalf of RE-EMPOWERED:** Panos Kotsampopoulos (ICCS-NTUA)

**Project Duration:** 1 July 2021 - 31 December 2024

**Description:** *RE-EMPOWERED*<sup>9</sup> aims to develop a set of solutions (ecoToolset) for efficient, decarbonised and RES-intensive multi-energy islanded/isolated communities and microgrids. The tools will facilitate energy planning, energy management and optimal operation of the local energy systems, demand side management and demand response capabilities, communication of the various tools, implementation of control algorithms through smart converters, monitoring of the quality of the surrounding environment, etc. Special focus will be given to exploiting synergies among energy vectors, increasing demand flexibility through customer engagement using digitization that will foster an active energy community via sustainable business plans and investments. The solutions of the toolset will be tailored to the specific needs of four pilot cases in the EU and India but will aim at a wide target group for replication and exploitation in both the developed and developing world.

**Collaboration Activities:** In the frame of RE-EMPOWERED, the Holistic Test Description (HTD) template developed and expanded in ERIGrid 2.0 was used to set and describe the test scenarios for the stability studies that will take place for the demo sites.

### 2.1.10 JPP Smart Energy Systems

**Full Name:** ERA-Net Digitalisation of Energy Systems and Networks (JPP Smart Energy Systems)

**Funding Framework:** ERA-Net/Horizon 2020

**Coordinator:** Michael Hübner (bmk)

**PoC on Behalf of ERIGrid 2.0:** Thomas Strasser (AIT)

**PoC on Behalf of JPP Smart Energy Systems:** Michael Hübner (bmk), Ludwig Karg (B.A.U.M.)

**Project Duration:** 1 December 2020 - 30 November 2025

**Description:** *JPP Smart Energy Systems*<sup>10</sup> provides a sustainable, reliable, and efficient management structure for multilateral joint programming. The Steering Board and Management

<sup>9</sup><https://reempowered-h2020.com/>

<sup>10</sup><https://www.eranet-smartenergysystems.eu/>

Board provide the framework for joint planning, decision-making, and collaborative implementation of joint calls and joint activities. The Coordination supports the partners in strategy, decision-making and governance, cooperation of programs and partners, communication and dissemination, organisation of joint calls, and contractual and financial management. Beyond that, the JPP Smart Energy Systems has well coordinated with the European SET-Plan Action 4 initiatives.

**Collaboration Activities:** ERIGrid 2.0 and the JPP Smart Energy Systems have formally set up formal cooperation where ERIGrid 2.0 is an associated partner and also a partner in the living labs and testbeds network. The goal of both projects/initiatives is to exchange and share knowledge related to the validation of smart energy systems as well as to provide related testing facilities and approaches.

### 2.1.11 ELECTRA

**Full Name:** Modernising the distribution grid for enabling high penetration of photovoltaic electricity through advanced data analytic operational observability and management (ELECTRA)

**Funding Framework:** Integrated Projects – Smart Growth/RIF

**Coordinator:** George Makrides (FOSS)

**PoC on Behalf of ERIGrid 2.0:** George Makrides (FOSS)

**Poc on Behalf of GIFT:** George Makrides (FOSS)

**Project Duration:** 1 June 2020 – 30 June 2023

**Description:** *ELECTRA* aims to fuse extensive interdisciplinary research in the field of grid integration of Renewable Energy Sources (RES) and to target the major challenges and barriers to boost the integration of RES, by covering the whole research and innovation spectrum of enabling dynamic, automated and cost-effective management of smart distribution grids.

Essentially, the main aim of *ELECTRA* is to pave the way for increased penetration of Distributed Generation (DG) systems (predominantly solar Photovoltaic (PV) systems), to be integrated and optimally managed at the distribution grid level. Since the strong growth and uptake of the photovoltaic sector (future dominant renewable technology at the distribution system) is also associated with the potential of the grid to accommodate the variability of DG, a key factor that will boost the further increase and uptake of the technology is to enable the efficient and reliable operation of future distribution systems with high DG shares. This can only be achieved by modernising the distribution grid for real-time predictive observability and automated control with the use of advanced data analytics that leverage machine learning principles. An important aspect of this project is also the development of an adaptive multi-service distribution management architecture (end-solution) that will provide and deliver the required bi-directional electricity flow control and flexibility in distribution grids with high RES shares.

**Collaboration Activities:** *ELECTRA* and ERIGrid 2.0 have many thematic overlaps that can be used for collaboration. Both projects are engaged with advanced controls of PV and storage systems, centralised control for smart grids and full Distributed Energy Resources (DER) digitalisation for real-time controls.



### 2.1.12 BERLIN

**Full Name:** Cost-effective rehabilitation of public buildings into smart and resilient nano-grids using storage (BERLIN)

**Funding Framework:** ENI CBC MED

**Coordinator:** George E. Georghiou (FOSS)

**PoC on Behalf of ERIGrid 2.0:** Venizelos Efthymiou (FOSS)

**Poc on Behalf of GIFT:** Venizelos Efthymiou (FOSS)

**Project Duration:** 1 September 2019 - 30 September 2022

**Description:** *BERLIN*<sup>11</sup> aims to implement cross-border pilot measures to support innovative & cost-effective energy rehabilitations in public buildings based on the nanogrid concept, the building block for smart microgrids. The motivation is multi-fold: a) to address high energy consumption in the building sector that is primarily fossil-fuel based, b) to support areas of weak grids, common in the MENA region and rural areas, as high energy consumption in buildings can compromise electric service reliability, c) to achieve higher grid penetration of RES whilst ensuring grid stability and power quality. To this end BERLIN will focus on increasing PV grid penetration, combined with storage and demand side management, along with the enhancement of energy efficiency in buildings. Cost-effectively utilising these 3 technologies, the goal is to reach high levels of self-resilience in public buildings and to make them green(er), smart, innovative and sustainable.

**Collaboration Activities:** The activities of BERLIN are relevant for the focus analysis of ERI-Grid 2.0. In the scope of research both for BERLIN and ERIGrid 2.0, there is a potential for collaboration on some use cases and testing requirements and methodologies.

### 2.1.13 EDDIE

**Full Name:** EDucation for Digitalisation of Energy (EDDIE)

**Funding Framework:** Erasmus +

**Coordinator:** Fernando de Cuadra García and Miguel Ángel Sánchez Fornié (Comillas Universidad Pontificia)

**PoC on Behalf of ERIGrid 2.0:** Panos Kotsampopoulos (ICCS-NTUA)

**PoC on Behalf of EDDIE:** Alexandros Chronis (ICCS-NTUA)

**Project Duration:** 1 January 2020 - 31 December 2023

**Description:** *EDDIE*<sup>12</sup> aims to develop a Blueprint Strategy for the Digitalisation of the Energy value chain (BSDE). It will be based on the sustainable cooperation between key industry stakeholders, education and training providers, social partners and public authorities. The BSDE is an industry-driven strategy that will meet and anticipate the skills demands for the sustainable growth and digitalisation of the European Energy sector. This new strategic approach will reinforce the competitiveness of the European Energy Sector efficiently and innovatively by creating a highly skilled workforce.

<sup>11</sup><http://www.enicbcmmed.eu/projects/berlin/>

<sup>12</sup><https://www.eddie-erasmus.eu/about-eddie/>

**Collaboration Activities:** There are several overlaps between the projects, especially in the area of coping with the skills' demands for the energy sector and energy transition, as well as the appropriate educational activities and methods that will facilitate the training of the targeted audience. Knowledge exchange activities are planned to take place between EDDIE and ERIGrid 2.0.

### 2.1.14 CCSRSG

**Full Name:** Cybersecurity Curricula Recommendations for Smart Grids (CCSRSG)

**Funding Framework:** Erasmus +

**Coordinator:** Tero Vartiainen (University of Vaasa)

**PoC on Behalf of ERIGrid 2.0:** Panos Kotsampopoulos (ICCS-NTUA)

**PoC on Behalf of CCSRSG:** Panos Kotsampopoulos (ICCS-NTUA)

**Project Duration:** 1 October 2020 - 31 March 2023

**Description:** CCSRSG<sup>13</sup> aims to recommend curricula for higher education programs in smart grids on how to integrate cyber-security learning outcomes as well as for organizations dealing with the training of their professionals in cyber-security issues in smart grids.

**Collaboration Activities:** Knowledge exchange activities are planned between CCSRSG and ERIGrid 2.0 on topics related to efficient educational methods to facilitate the digitalization and the energy transition of power systems.

## 2.2 National Projects

Table 2 provides an overview of projects on national levels that cooperate with ERIGrid 2.0.

*Table 2: Overview of national projects with links to ERIGrid 2.0.*

Name	Funding	ERIGrid 2.0 Partners Involved	ERIGrid 2.0 PoC	Project PoC
PowerTeams	FFG (Austria)	yes	Thomas Strasser (AIT)	Thomas Strasser (AIT)
PoSyCo	FFG (Austria)	yes	Thomas Strasser (AIT)	Thomas Strasser (AIT)
Project 2.2	RdS (Italy)	yes	Luigi Pellegrino (RSE), Riccardo Lazzari (RSE)	Chiara Gandolfi (RSE), Riccardo Lazzari (RSE)
Project 2.3	RdS (Italy)	yes	Enea Bionda (RSE)	Carlo Tornelli (RSE)

In the following sections, more details about the cooperation with those projects are provided.

### 2.2.1 PowerTeams

**Full Name:** Collaborative engineering of smart grid applications (PowerTeams)

<sup>13</sup><https://blogs.uwasa.fi/ccrsg/>



**Funding Framework:** Austrian National Energy Research Programme (7th Call 2021)

**Coordinator:** Christof Brandauer (SRFG)

**PoC on Behalf of ERIGrid 2.0:** Thomas Strasser (AIT)

**PoC on Behalf of PowerTeams:** Thomas Strasser (AIT)

**Project Duration:** 1 April 2022 - 30 September 2024

**Description:** *PowerTeams*<sup>14</sup> addresses the concept of a model-based, service-oriented, and cooperative development and validation platform for smart grid applications to cope with future requirements. The goal is to develop an architecture of an interoperable, distributed, and service-oriented ecosystem that offers modular services to collaborative development teams for automation-supported engineering over the entire application lifecycle. This platform enables the management of engineering data, which is necessary for continuous, transparent and interoperable digitization of the energy system. The concept will be validated using a proof-of-concept implementation and selected use cases.

**Collaboration Activities:** ERIGrid 2.0 results related to validation and testing (especially virtual services) provide essential contents that can be integrated into PowerTeams platform. Furthermore, experiences and improvement suggestions are feed back from PowerTeams to ERIGrid 2.0

### 2.2.2 PoSyCo

**Full Name:** Power System Cognification (PoSyCo)

**Funding Framework:** Austrian National Energy Research Programme (4th Call 2017)

**Coordinator:** Helfried Brunner (AIT)

**PoC on Behalf of ERIGrid 2.0:** Thomas Strasser (AIT)

**PoC on Behalf of PoSyCo:** Thomas Strasser (AIT)

**Project Duration:** 1 January 2019 - 31 December 2021

**Description:** The cognification of the power system enabling more intelligence within system operation is the approach of PoSyCo. The Power System Cognification flagship project extends the state-of-the-art protection system with intelligent add-ons. The envisioned 'SOFTprotection system' will provide intelligent overload prevention functionality and will allow the power system operators to actively integrate information on faults in their operation and planning processes. As the term 'add-on' suggests the system will not replace existing protection systems but rather extend them, leaving the protection system with a fallback variant. To achieve such a system, PoSyCo investigates the technical solution of an innovative Information and Communications Technology (ICT) system for automated operation, the roll-out process, how to deal with malfunctions as well as how to integrate the resulting system into established working processes. This includes the human-to-machine interaction to ensure that Distribution System Operator (DSO) employees are supported by trustful and necessary information at the right time in an intuitive way. To realise the envisioned system, state-of-the-art technology innovations provided from the field industrial Internet of Things (IoT) will enable a cost-efficient and extendable architecture. The expected results of PoSyCo are a blueprint for the implementation of advanced smart grid functionalities in general and the SOFTprotection approach, and its

<sup>14</sup><https://www.salzburgresearch.at/en/projekt/powerteams/>

validation in laboratory proof of concept. With this, PoSyCo will increase the level of protection of the future power system to allow the penetration of renewable and volatile energy sources as well as volatile demand loads like e-mobility.

**Collaboration Activities:** There are several thematic overlaps between the projects, especially in the areas of validation of results and in developing advanced concepts of network safety and security.

### 2.2.3 Project 2.2

**Full Name:** Project 2.2 “Architecture and management models of the system and the electricity grids and the regulation that favour the integration of renewable and non-programmable generation, self-production, storage, energy communities and aggregators and that take into account electrical penetration”

**Funding Framework:** Italian funds for electrical power system “Piano triennale di realizzazione 2019-2021 della ricerca di sistema elettrico nazionale”

**Coordinator:** Chiara Gandolfi (RSE)

**PoC on Behalf of ERIGrid 2.0:** Luigi Pellegrino (RSE), Riccardo Lazzari (RSE)

**PoC on Behalf of Project 2.2:** Chiara Gandolfi (RSE), Riccardo Lazzari (RSE)

**Project Duration:** 1 January 2019 - 31 December 2021

**Description:** *Project 2.2* aims to develop methodologies, studies, software tools, prototypes and demonstrators to optimise electrical transmission and distribution grids by considering new architecture and system management and regulation models to favour the renewable and non-dispatchable generation integration, the self-production, the storage and the aggregators taking into account the electric penetration. The project addresses the planned issues by ensuring a system approach, supporting institutions and technical standardisation at national and international levels to accelerate the development, testing and availability of the technologies needed for the energy transition. In particular, the project is divided into four research areas: new grid models, architectures and control logic, the flexibility of the electrical system, aggregation of distributed resources and generation and load forecasting.

**Collaboration Activities:** The project involves the participation of research and innovation at national and international levels (EERA, ISGAN, Mission Innovation, CEM) where ERIGrid 2.0 results can be exploited.

### 2.2.4 Project 2.3

**Full Name:** Project 2.3 “Application to the electrical system of information technologies, internet of things, peer to peer”

**Funding Framework:** Italian funds for electrical power system “Piano triennale di realizzazione 2019-2021 della ricerca di sistema elettrico nazionale”

**Coordinator:** Carlo Tornelli (RSE)

**PoC on Behalf of ERIGrid 2.0:** Enea Bionda (RSE)

**PoC on Behalf of Project 2.3:** Carlo Tornelli (RSE)

**Project Duration:** 1 January 2019 - 31 December 2021

**Description:** *Project 2.3* develops methods, tools, demonstrators and experiments aimed to evaluate the possible application of the most advanced information and communication technologies for the benefit of the electrical power system. These technologies make it possible to face the growing complexity of system management and control, due to the significant presence of non-programmable RES, by exploiting the flexibility of all available energy resources and also with the involvement of new subjects, including end users. The research aims to promote the interoperability and security of the communication and computing systems used in the processes of the electrical power system to achieve a high degree of integration between the management, control and protection systems of the networks. Tools for verifying the resilience of the cyber-physical system are included, which allow the impact assessment of cyber-attacks on the power system processes and, ultimately, on the quality of service to users.

**Collaboration Activities:** The project provides tools, such as RSE's Distributed Energy Resources Test Facility shadows and JaNDER, which are used by ERIGrid 2.0.

## 2.3 International Projects

Besides European and national initiatives, also cooperation on the international level is established as outlined in Table 3.

*Table 3: Overview of international projects with links to ERIGrid 2.0.*

Name	Funding	ERIGrid 2.0 Partners Involved	ERIGrid 2.0 PoC	Project PoC
USPRISM	US National Science Foundation	yes	Mazher Syed (UoS)	TMazher Syed (UoS)

### 2.3.1 USPRISM

**Full Name:** U.S. Scotland Program for Research on Integration of Renewable Energy Resources and SMart Grid (USPRISM)

**Funding Framework:** The program is supported by the US National Science Foundation through International Research Experience for Students Program under grant OISE-2017301.

**Coordinator:** Ali Mehrizi-Sani (Virginia Tech)

**PoC on Behalf of ERIGrid 2.0:** Mazher Syed (UoS)

**PoC on Behalf of IRES USPRISM:** Mazher Syed (UoS)

**Project Duration:** 1 August 2016 - 31 July 2022

**Description:** *IRES USPRISM* was a collaborative project under the International Research Experiences for Students (IRES) program between Virginia Tech University and the University of Strathclyde. The project provided six US students (annually) with the opportunity to participate in the diverse smart grid research atmosphere at the University of Strathclyde, undertaking projects to address challenges in renewable energy integration. The objectives of the USPRISM project were to: (i) advance the appreciation of the challenge of increasing penetration of renewable energy resources, (ii) increasing career interest in power systems and the

smart grid, and (iii) improving the quality and quantity of the power engineering workforce in the United States. These objectives directly translate into benefits with a more capable and larger student intake that can address the workforce shortage problem; helping the transition to a modern power grid with higher efficiency, reliability, and resiliency.

**Collaboration Activities:** In July 2022, a joint knowledge-exchange workshop between the USPRISM and ERIGrid 2.0 projects was held at TU Delft. The workshop was led by UoS, and supported by ICCS-NTUA and TU Delft. Four undergraduate and post-graduate researchers from different universities in the U.S. had the opportunity to visit TU Delft to present the outputs of their research undertaken at UoS. This was followed by a presentation from ICCS-NTUA and UoS on the experimental methodologies under development within ERIGrid 2.0, giving the students an appreciation of power system testing for potential adoption in their research in the future. The workshop concluded with a visit to the laboratory facilities at TU Delft and a demonstration of cybersecurity for power systems.

### 3 Collaborations with Initiatives

The cooperation and information exchange on a broader scale is also an important point for disseminating and exploiting potential project results and to gather feedback about them. Therefore, ERIGrid 2.0 has already identified several such initiatives which are worth collaborating with. Table 4 outlines those networks, platforms, and initiatives where ERIGrid 2.0 has already set up connections or is planning to do so in the near future.

Table 4: Overview of networks, platforms, and initiatives with links to ERIGrid 2.0.

Name	Type	ERIGrid 2.0 Partners Involved	ERIGrid 2.0 PoC	Network PoC
European Initiatives				
EERA JP Smart Grids	Network (European)	yes	Evangelos Rikos (CRES), Kari Mäki (VTT), and others	Luciano Martini (RSE), Evangelos Rikos (CRES), and others
BRIDGE Energy Communities Task Force	Network (European)	yes	Panos Kotsampopoulos (ICCS-NTUA)	Leen Peeters (ThInk-E), Ludwig Karg (Baum Group)
ETIP SNET	Technology & Innovation Platform (European)	yes	Nikos Hatzargyriou (ICCS-NTUA), Kari Mäki (VTT), Venizelos Efthymiou (FOSS), Antonello Monti (RWTH)	Venizelos Efthymiou (FOSS), Diana Strauss-Mincu (DERlab), Antonello Monti (RWTH)
National Initiatives				
Smart Otaniemi	Network (national)	yes	Kari Mäki (VTT)	Kari Mäki (VTT)
ENET-RTLlab	Network (European)	yes	Antonio de Paola (JRC)	Andrea Mazza (Politecnico di Torino)
International Initiatives				
IEA ISGAN/SIRFN	Network (international)	yes	Mihai Calin (AIT), Kari Mäki (VTT)	Ron Brandl (DERlab)
Mission Innovation IC#1 Smart Grids	Network (international)	yes	Enea Bionda (RSE), Kari Mäki (VTT)	Mattia Cabiati (RSE)
DERlab	Network (international)	yes	Leonard Ramos (DERlab), Maria Sosnina (DERlab), Thomas Strasser (AIT)	Diana Strauss-Mincu (DERlab), Roland Bründlinger (AIT), Graeme Burt (UST)
IEEE PES Teaching Task Force	Task Force (international)	yes	Panos Kotsampopoulos (ICCS-NTUA), Nikos Hatzargyriou (ICCS-NTUA), and others	Panos Kotsampopoulos (ICCS-NTUA), Nikos Hatzargyriou (ICCS-NTUA)
IEEE WG P2004	Working Group (international)	yes	Georg Lauss (AIT), Panos Kotsampopoulos (ICCS-NTUA), Antonello Monti (RWTH), Thomas Strasser (AIT), and others	Michael Steurer (FSU), Georg Lauss (AIT)
IEEE PES EICC Task Force	Task Force (international)	yes	Mazher Syed (UoS), Graeme Burt (UoS)	Mazher Syed (UoS), Graeme Burt (UoS)

In the following sections, more details about the cooperation with those initiatives are provided.

## 3.1 European Initiatives

### 3.1.1 EERA JP Smart Grids

**Full Name:** European Energy Research Alliance Joint Programme Smart Grids

**Type:** European Network

**Coordinator:** Luciano Martini (RSE, Italy)

**PoC on Behalf of ERIGrid 2.0:** Evangelos Rikos (CRES), Kari Mäki (VTT), and others

**PoC on behalf of EERA JP SG:** Luciano Martini (RSE), Evangelos Rikos (CRES), and others

**Description:** *EERA JP SG*<sup>15</sup> by means of an extended cross-disciplinary cooperation involving many Research and Development participants with different and complementary expertise and facilities, aims at addressing, in a medium to long term research perspective, one of the most critical areas directly relating to the effective acceleration of smart grid deployment: smart grids technology, its application and integration.

**Collaboration Activities:** Through the link with the EERA JP SG specific collaboration opportunities are offered to ERIGrid 2.0:

- Possibility for joint workshops/events
- Regular information transfer from the ERIGrid 2.0 consortium on the EERA/EU-related activities, publications, etc.
- Promotion of Trans-national Access (TA) and Virtual Access (VA) opportunities through the EERA JP SG activities which engage a substantial number of European and international stakeholders.
- As with its predecessor project, there will be an opportunity for external users related to EERA to access the ERIGrid 2.0 facilities, physically or remotely, and benefit from the harmonised testing procedures on the topics that ERIGrid 2.0 covers.
- EERA JP SG will get insights from ERIGrid 2.0 testing methodology developments and the results of investigations about RI needs.

### 3.1.2 ETIP SNET

**Full Name:** European Technology and Innovation Platform Smart Networks for Energy Transition

**Type:** European Network

**Coordinator:** Secretariat: Zabala Innovation Consulting (Spain)

**PoC on Behalf of ERIGrid 2.0:** Nikos Hatzigargyriou (ICCS-NTUA), Kari Mäki (VTT), Venizelos Efthymiou (FOSS), Antonello Monti (RWTH)

<sup>15</sup><https://www.eera-set.eu/component/projects/projects.html?id=53>

**PoC on behalf of ETIP SNET:** Venizelos Efthymiou (FOSS), Diana Strauss-Mincu (DERlab), Antonello Monti (RWTH)

**Description:** *ETIP SNET*<sup>16</sup> role is to guide Research, Development and Innovation (RDI) to support Europe's energy transition. More specifically, its mission is to set-out a vision for RDI for Smart Networks for Energy Transition and engage stakeholders in this vision, prepare and update the Strategic Research and Innovation Roadmap, report on the implementation of RDI activities at European, national/regional and industrial levels.

It provides input to the SET Plan action 4 which addresses the technical challenges raised by the transformation of the energy system, identify innovation barriers, notably related to regulation and financing, develop enhanced knowledge-sharing mechanisms that help bring RDI results to deployment and prepare consolidated stakeholder views on Research and Innovation to European Energy Policy initiatives.

The work is organised through six working groups:

- WG1 Reliable, economic and efficient smart grid system,
- WG2 Storage technologies and sector interfaces,
- WG3 Flexible generation,
- WG4 Digitisation of the electricity system and customer participation,
- WG5 Innovation implementation in the business environment, and
- WG6 National stakeholders coordination group.

**Collaboration Activities:** Through the involvement of ERIGrid 2.0 partners DERlab and FOSS in ETIP SNET WG5, there is a continuous process of information sharing about lab access opportunities in ERIGrid 2.0. There is also potential for further collaboration in dissemination activities.

### 3.1.3 BRIDGE Energy Communities Task Force

**Full Name:** BRIDGE Task Force on Energy Communities

**Type:** European Network

**Coordinator:** Leen Peeters (Th!nk-E), Ludwig Karg (Baum Group)

**Support Leader:** Panos Kotsampopoulos (ICCS-NTUA)

**PoC on Behalf of ERIGrid 2.0:** Panos Kotsampopoulos (ICCS-NTUA)

**PoC on behalf of BRIDGE Task Force:** Leen Peeters (Th!nk-E), Ludwig Karg (Baum Group)

**Description:** *BRIDGE Task Force on Energy Communities*<sup>17</sup> was established following BRIDGE General Assembly of 2019 to look into existing and upcoming frameworks in various EU countries and how the development could be further facilitated.

The Task Force (TF) has been in charge of preparing reports and formulating recommendations for the European Commission (EC) on the replicability, upscaling, and the need for support, as well as on informing about further research and demonstration needs.

<sup>16</sup><https://www.etip-snet.eu/>

<sup>17</sup>[https://www.h2020-bridge.eu/wp-content/uploads/2020/01/D3.12.d\\_BRIDGE\\_Energy-Communities-in-the-EU-3.pdf](https://www.h2020-bridge.eu/wp-content/uploads/2020/01/D3.12.d_BRIDGE_Energy-Communities-in-the-EU-3.pdf)



**Collaboration Activities:** The TF aims to provide an overview of the existing legal developments regarding energy communities in the EU and provide recommendations, highlighting existing experience of energy communities between countries and specifying the principles of autonomy, effective control, locality, etc. Thus, because in the frame of ERIGrid 2.0 the focus is placed also on energy communities and active engagement of the prosumers, a channel of communication with the TF can be established for mutual knowledge exchange.

## 3.2 National Initiatives

### 3.2.1 Smart Otaniemi

**Full Name:** Smart Otaniemi Innovation Ecosystem

**Type:** National Network

**Coordinator:** Ismo Heimonen (VTT, Finland)

**PoC on Behalf of ERIGrid 2.0:** Kari Mäki (VTT)

**PoC on behalf of Smart Otaniemi:** Kari Mäki (VTT)

**Description:** *Smart Otaniemi*<sup>18</sup> is an innovation ecosystem connecting experts, organisations, technologies and pilot projects bringing together building blocks of a smart future. The aim is to renew the way research and development is done and push the boundaries of new energy technology with Finnish hi-tech excellence. The focus areas are:

- Local flexibility,
- Building level intelligence,
- Smart mobility, and
- Platforms, connectivity and enabling technologies.

**Collaboration Activities:** There is a potential to collaborate through the involvement of ERIGrid 2.0 partner VTT in Smart Otaniemi on knowledge sharing and piloting via the TA programme of ERIGrid 2.0.

### 3.2.2 ENET-RTLlab

**Full Name:** EnSiEL National Energy Transition Real-Time Lab

**Type:** National network of laboratories

**Coordinator:** Ettore Bompard (Politecnico di Torino, Italy)

**PoC on Behalf of ERIGrid 2.0:** Antonio De Paola (JRC)

**PoC on behalf of Smart Otaniemi:** Andrea Mazza (Politecnico di Torino)

**Description:** The *EnSiEL National Energy Transition Real-Time Lab* (ENET-RTLlab) is a network of interconnected Italian laboratories for the realization of geographically-distributed real-time simulations. The ENET-RTLlab is coordinated by the Energia e Sistemi Elettrici (Ensiel) consortium, which brings together different Italian universities operating in the areas of digital

<sup>18</sup><https://smartotaniemi.fi/>



simulations and power systems. ENET-RTLab aims at fostering collaboration and the pooling of expertise and resources between different research institutions, with the final objective of developing and testing new technologies for the energy transition. In particular, the utilisation of geographically-distributed real-time simulations will allow to share the hardware and software resources of multiple research institutions, with more efficient utilisation of the available computational power and opening up the possibility by other research partners to access and utilise costly and powerful equipment.

**Collaboration Activities:** The JRC Smart Grid Interoperability Lab (SGILab) in Ispra took part in the first practical demonstration of the ENET-RTLab on 11 April 2022, conducting a geographically-distributed real-time simulation with other four laboratories (Politecnico di Torino, Politecnico di Bari, Università di Genova and Università di Napoli) aimed to assess the capability of renewable energy sources to support the operation of future low-inertia power systems. The collaboration with ENET-RTLab is continuing with the involvement of other ERIGrid 2.0 partners (RWTH Aachen) and envisages new joint research and dissemination activities. One of them is the joint RTDS demonstration held during the JRC seminar on real-time simulations scheduled for November 2022.

### 3.3 International Initiatives

#### 3.3.1 IEA ISGAN/SIRFN

**Full Name:** IEA ISGAN (International Smart Grid Action Network) Annex 5 SIRFN (Smart Grid International Research Facility Network)

**Type:** International network

**Coordinator:** Russel Conkling (DOE, USA)

**PoC on behalf of ERIGrid 2.0:** Mihai Calin (AIT), Kari Mäki (VTT), Mazher Syed (UoS)

**PoC on behalf of SIRFN:** Ron Brandl (DERlab)

**Description:** *SIRFN*<sup>19</sup> gives participating countries the ability to evaluate pre-competitive technologies and systems approaches in a wide range of smart grid implementation use cases and geographies using common testing procedures. Research test-bed facilities will be selected based on their complementary capabilities to conduct specialised, controlled laboratory evaluations of integrated smart grid technologies including cyber-security, plug-in hybrid integration, load management, automated metering infrastructure, protection, network sensing, energy management, renewable energy integration and similar applications.

In this way, research within each individual member country will derive the value of the unique capabilities and environments of the other partner nations. Data from these tests will be made available to all SIRFN participants to accelerate the development of smart grid technologies and systems, and enabling policies.

**Collaboration Activities:** There is high potential for SIRFN and ERIGrid 2.0 to collaborate in RI improvement, knowledge exchange and through the lab access programme of ERIGrid 2.0.

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<sup>19</sup><http://www.sirfn.net>

### 3.3.2 Mission Innovation IC#1 Smart Grids

**Full Name:** Mission Innovation Challenge IC#1: Smart Grids

**Type:** International network

**Coordinator:** Luciano Martini (RSE, Italy), Yibo Wang (CAS, China), JBV Reddy (DST, India)

**PoC on behalf of ERIGrid 2.0:** Enea Bionda (RSE), Kari Mäki (VTT)

**PoC on behalf of Mission Innovation:** Mattia Cabiati (RSE)

**Description:** *Mission Innovation Challenge IC#1 on Smart Grids*<sup>20</sup> aims to accelerate the development and demonstration of smart grid technologies in a variety of grid applications, including demonstrating the robust, efficient, and reliable operation of regional grids and distribution grids as well as microgrids in diverse geographic conditions, to facilitate the cost-effective uptake of renewable energy. Generally, Mission Innovation (MI) Innovation Challenges (IC) are global calls to action aimed at catalysing global research efforts in areas that could provide significant benefits in reducing greenhouse gas emissions, increasing energy security, and creating new opportunities for clean economic growth.

**Collaboration Activities:** Within the IC1 on Smart Grids Italy proposed and coordinated the development of the Smart Grid Innovation Accelerator (SGIA) platform<sup>21</sup>. SGIA is a cloud-based semantic platform for sharing information regarding the smart grid and, on a more general level, the energy sector. The platform offers an advanced search experience on a database of key documents globally selected and shared by international experts from MI member countries. ERIGrid 2.0 documents and materials are planned to be included in the platform.

### 3.3.3 DERlab

**Full Name:** European Distributed Energy Resources Laboratories e.V.

**Type:** Network (international)

**Coordinator:** Diana Strauss-Mincu

**PoC on behalf of ERIGrid 2.0:** Leonard Ramos (DERlab), Maria Sosnina (DERlab), Thomas Strasser (AIT)

**PoC on behalf of DERlab:** Diana Strauss-Mincu (DERlab), Roland Bründlinger (AIT), Graeme Burt (UST)

**Description:** *DERlab*<sup>22</sup> is an association of leading laboratories and research institutes in the field of DER equipment and systems. The association develops joint requirements and quality criteria for the connection and operation of DER and strongly supports the consistent development of DER technologies. DERlab offers testing and consulting services for DG to support the transition towards more decentralised power systems.

**Collaboration activities:** Involved in the ERIGrid 2.0 consortium are representatives of both the DERlab Office and the DERlab member network, which consists of over 30 research centres in Europe and the US. DERlab provides possibilities for the project to reach out to these

<sup>20</sup> <https://www.mi-ic1smartgrids.net/>

<sup>21</sup> <https://www.mi-sgiaplatform.net/>

<sup>22</sup> <http://der-lab.net>

stakeholders. Through DERlab promotion channels, events, and in the *Database of DER and Smart Grid Research Infrastructure*<sup>23</sup>, DERlab ensures consistent project visibility to the member network.

Furthermore, as the Operating Agent of ISGAN Annex 5 SIRFN, DERlab supports the transfer of ERIGrid 2.0 outcomes within the SIRFN context.

### 3.3.4 IEEE PES Teaching Task Force

**Full Name:** IEEE PES Task Force on Innovative Teaching Methods of Modern Power and Energy Systems

**Type:** International Network

**Coordinator:** Panos Kotsampopoulos (ICCS-NTUA, Greece), Nikos Hatziaargyriou (ICCS-NTUA, Greece)

**PoC on Behalf of ERIGrid 2.0:** Panos Kotsampopoulos (ICCS-NTUA), Nikos Hatziaargyriou (ICCS-NTUA), and others

**PoC on behalf of IEEE PES Task Force:** Panos Kotsampopoulos (ICCS-NTUA), Nikos Hatziaargyriou (ICCS-NTUA)

**Description:** *IEEE PES Task Force on innovative teaching methods for modern power and energy systems*<sup>24</sup> successfully kicked off during the virtual IEEE PES General Meeting 2020. The Task Force operates in the framework of the University Education Activities Subcommittee of the IEEE PES Power and Energy Education Committee (PEEC) and will investigate, create, and promote the use of innovative teaching methods and materials in modern power and energy systems. Blended learning, innovative laboratory exercises, and e-learning tools will be in particular focus, complemented with interdisciplinary and efficient teaching methods based on engineering education research. Moreover, the Task Force will serve as a forum for sharing and disseminating educational content, tools, and best practices, while exploring cooperation with other PES committees.

In more detail the Task Force will address:

- New trends in laboratory education for modern power and energy systems: remote/virtual labs, hardware-in-the-loop simulation, and augmented/virtual reality.
- Transforming the power and energy classroom: blended learning and e-learning tools (e.g. interactive notebooks, animations, Massive Open Online Course (MooC), etc.)
- Advanced teaching methods for power and energy systems: problem-based learning, active learning, interdisciplinary approaches, while addressing different skill levels. Moreover, metrics to evaluate the educational outcomes will be addressed.
- Identification of gaps between the current skill/competence needs of the industry and the output of universities.

**Collaboration Activities:** Considering the scope of the network and the focus of ERIGrid 2.0 NA3 Education and Training of Professionals, Researchers and Students, there is a lot of collaboration potential.

<sup>23</sup> <https://infrastructure.der-lab.net/>

<sup>24</sup> <https://smartgrid.ieee.org/newsletters/october-2020/the-ieee-pes-task-force-on-innovative-teaching-methods-for-modern-power-and-energy-systems>

### 3.3.5 IEEE WG P2004

**Full Name:** IEEE WG P2004 - Hardware-in-the-Loop Simulation Based Testing of Electric Power Apparatus and Controls

**Type:** International Network

**Coordinator:** Michael Steurer (FSU, USA), Georg Lauss (AIT)

**PoC on Behalf of ERIGrid 2.0:** Georg Lauss (AIT), Panos Kotsampopoulos (ICCS-NTUA), Antonello Monti (RWTH), Thomas Strasser (AIT), and others

**PoC on behalf of IEEE WG P2004:** Michael Steurer (FSU), Georg Lauss (AIT)

**Description:** *IEEE WG P2004*<sup>25</sup> is a recommended practice that provides established practices for the use of Hardware-in-the-Loop (HIL) simulation-based testing of electric power apparatus and controls. It is intended to be generically applicable in conjunction with any specific testing standard (if applicable).

WG P2004 intends to remain agnostic to the specific real-time simulation and power amplifier technologies but focus on the structures, models, and procedures specific to conducting HIL based testing. P2004 will:

- Establish practices for Robot Operating System (ROS) model development,
- Discuss HIL specific documentation, verification and validation,
- Provide guidance on requirements for power amplifiers, Real-Time Simulation (RTS), and HIL, and interface algorithms for classes of HIL testing needs.

**Collaboration Activities:** ERIGrid 2.0 focuses and promotes advanced laboratory validation methods for smart grid applications, like HIL simulation-based testing. So, various HIL related developments are planned in the project, thus efforts will be made to integrate the most relevant in the IEEE P2004 document.

### 3.3.6 IEEE PES Energy Internet Coordinating Committee (EICC) Task Force

**Full Name:** IEEE PES EICC Task Force on Cloud-Based Control and Co-Simulation of Multi-Party Resources in Energy Internet

**Type:** International Network

**Coordinator:** Xu Yan (Nanyang Technological University, Singapore) and Graeme Burt (UoS, UK)

**PoC on Behalf of ERIGrid 2.0:** Mazher Syed (UoS) and Graeme Burt (UoS)

**PoC on behalf of IEEE PES Task Force:** Mazher Syed (UoS) and Graeme Burt (UoS)

**Description:** *IEEE PES Task Force on Cloud-Based Control and Co-Simulation of Multi-Party Resources in Energy Internet*<sup>26</sup> operates within the framework of Energy Internet Coordinating Committee of the IEEE PES.

<sup>25</sup> <https://standards.ieee.org/project/2004.html#Working>

<sup>26</sup> <https://cmte.ieee.org/pes-eicc/cloud-based-control-and-co-simulation-of-multi-party-resources-in-energy-internet/>

In the “Energy Internet” paradigm, DERs can be controlled by different actors via cloud services to achieve various functions. The control architectures, functions, algorithms and validation tools to enable this vision require further investigation. In particular, attention is deserved in the real-world scalability of such solutions, their rigorous validation, and issues arising from their reliance on communications. This Task Force will facilitate the research and development of cloud-based control frameworks and co-simulation platforms for DERs owned by multiple parties in the Energy Internet.

The goals of the Task Force are summarised below:

- Identify the emerging challenges of multi-party cloud-based control for DERs, i.e., challenges in their validation, current limitations and potential scalability.
- Design control structures and operational algorithms which achieve frequency/voltage regulation, economic dispatch/operation, health management, etc.
- Establish geographically distributed co-simulation platforms with data exchange via Internet and cloud service to support evaluation and validation of control solutions.

**Collaboration Activities:** Within the scope of ERIGrid 2.0 NA3 Education and Training of Professionals, a panel session on “Coordinated control and co-simulation of power systems in Energy Internet” was organised at the PES General Meeting 2022 (Denver, USA), in collaboration with the Task Force. Four presentations from international experts discussed controls, testbeds and validation techniques for power systems within the context of energy internet.

## 4 Conclusions

During the first project year, ERIGrid 2.0 established several collaborations which were continued and strengthened in the current reporting time frame from 1 April 2021 until 30 September 2022. The wide network of collaborators has been expanded with five European projects, one national project, one international project, one national network and one international initiative.

Through these new connections in this reporting period, the project strengthened the collaboration areas of education, technology development, system validation and real-time simulation. With the first developments from technical Work Packages (WPs) becoming available, ERIGrid 2.0 was able to enhance the early established collaborations. Several joint events with ERIGrid 2.0 consortium members and collaborators took place with corresponding knowledge transfer activities, including educational activities. The consortium seeks to build on its previous efforts and expand the collaborator network by establishing new connections and obtaining feedback on project outcomes.

The following topics are representing the research focus of ERIGrid 2.0 and are therefore taken into account for setting up project collaborations.

- Validation and testing needs and possibilities (technology development),
- Advanced power and energy systems technology development and innovation (technology development),
- Multi-domain and cyber-physical based system validation and testing (system validation),
- Integrating pan-European smart energy systems RI (RI Integration),
- Structuring the European smart grid, smart energy systems, and renewables research area (smart energy research),
- RTS, HIL testing, and co-simulation,
- Multi-lab testing, coupling, and automation (multi-lab testing), and
- Assisting the new generation of educated power and energy systems researchers and engineers (education).

The spectrum of collaboration on these topics is presented in Table 5.

*Table 5: Summary of topics of collaborations.*

Name / Topic	Technology Development	System Validation	RI Integration	Smart Energy Research	RTS, HIL, Co-Simulation	Multi-lab	Education
European Projects							
RICH Europe			✓				✓
int:net	✓	✓	✓			✓	
StoRIES			✓	✓		✓	✓
PANTERA				✓			✓

Name / Topic	Technology Development	System Validation	RI Integration	Smart Energy Research	RTS, HIL, Co-Simulation	Multi-lab	Education
European Projects							
eNeuron	✓	✓		✓	✓		✓
GIFT	✓	✓		✓			
HYPERRIDE	✓	✓		✓			
SINERGY		✓					✓
RE-EMPOWERED	✓	✓		✓	✓		
JPP Smart Energy Sysrms		✓					✓
ELECTRA	✓	✓		✓	✓	✓	
BERLIN				✓			
EDDIE							✓
CCRSg							✓
National Projects							
PowerTeams	✓	✓			✓		
PoSyCo		✓		✓			
Project 2.2				✓			
Project 2.3				✓			
International Projects							
USPRISM	✓	✓					✓
European Initiatives							
EERA JP Smart Grids			✓	✓			
BRIDGE Energy Communities Task Force		✓					
ETIP SNET			✓	✓			
National Initiatives							
Smart Otaniemi			✓				
ENET-RTLlab			✓		✓		
International Initiatives							
IEA ISGAN/SIRFN		✓	✓		✓	✓	
Mission Innovation IC#1 Smart Grids							✓
DERlab	✓	✓		✓			✓
IEEE PES Teaching Task Force							✓
IEEE WG P2004					✓		
IEEE PES EICC Task Force		✓			✓		✓

As the topic of multi-lab cooperation appears to be underrepresented, the project shall target this area accordingly in the next reporting period, strengthening collaboration and networking activities in this regard. Through consortium members being active in many relevant initiatives,

ERIGrid 2.0 can ensure the integrated nature of its research and dissemination efforts, as well as the collection of high-quality feedback on its research.



## References

*ERIGrid 2.0 Grant Agreement.* (2019). European Commission.

## Consortium



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