IMPACT

SUPPORTING THE TRANSITION TO RENEWABLE ENERGY

Erigrid Connecting European Smart Grid Infrastructures

AIT AUSTRIAN INSTITUTE OF TECHNOLOGY

This project is funded by the European Union

https://erigrid.eu/

Supporting the transition to renewable energy

***ERIGrid** is a collaboration of industrial and academic researchers working together to develop a European smart-grid energy system to support the transition from fossil fuels to renewable resources by harmonising system-level validation and testing approaches*

The evolution of the EU-funded European Research Infrastructure supporting Smart Grid Systems Technology Development, Validation and Roll Out (ERIGrid) project has been based on the evidence that as activities continue to address global warming with the gradual transition from fossil fuel to renewable energy sources to reduce greenhouse gas emissions, there continues to be limited development of power grid systems. The increasing availability of advanced automation and communication technology – such as the comprehensive digitalisation of today's power systems – which could revolutionise the quality and reliability of power from renewables and sources with limited storage capacity results in a need to advance research collaboration. However, comprehensive validation and testing methods of such cyber-physical smart power systems and a corresponding, integrated research infrastructure are missing up to now.

The trans-national ERIGrid project involves 18 European research institutions from across 11 different countries, who have teamed up together to deliver a four and a half year project focusing on improving validation and testing approaches which is supported by the European Commission through the Horizon 2020 project supporting Research and Innovation (RIA) – Integrating Activity (IA) across Europe.

SYSTEM VALIDATION

ERIGrid Project Coordinator Dr Thomas Strasser, from the Electric Energy Systems Unit at the Austrian Institute of Technology's (AIT) Centre for Energy, in Vienna, says that their work has identified that there is a 'lack of system validation approaches for smart grid systems and a corresponding, integrated smart grid research infrastructure is missing up to now in Europe'. It is this challenge that the collaborative network is hoping to overcome. From Strasser's perspective one of the most important outcomes from the first 18 months of the project is the 'definition of a holistic power system validation and testing approach which will be used by the ERIGrid partners itself but also by external trans-national access user groups to specify validation and testing needs of smart grid solutions in a harmonised way'.

In the initial scoping of the project, the ERIGrid project team identified that the Joint Research Center (JRC) of the European Commission listed 459 smart grid projects in Europe in 2015 with an overall investment of around 3.15 Billion euros and highlighted the need to collate and share the research and knowledge base to support and test practical applications of smart grid technologies. By providing a Pan-European research infrastructure ERIGrid supports the technology development as well as the roll out of smart grid solutions and concepts in Europe. Strasser underlines that 'ERIGrid tackles a holistic, cyber-physical systems based approach by integrating 18 European research centres and institutions with outstanding research infrastructures and jointly develops common testing methods, concepts, and procedures'.

Following discussions within the project group and in technical workshops as well as inputs from various stakeholders, the ERIGrid project team chose to focus on system configurations rather than traditional high-level scenarios and aims to provide a single point of access to integrated smart grid research infrastructure. The key objectives of the project are to integrate major European research centres with outstanding smart grid collaborative research infrastructures and integrate analysis, validation and testing of smart grid configurations. In addition, the project aims to support technological development and roll-out of systems, solutions and concepts across Europe and provide system-level support and education for industrial and academic researchers in smart grid research and technology development.

OPPORTUNITIES FOR APPLICATION

Strasser identifies that the opportunities that the ERIGrid project support also integrate and enhance the necessary research services for analysing, validating and testing smart grid configurations. He highlights that 'system level support and education for industrial and academic researchers is provided to foster future innovation. ERIGrid partners also offer their research infrastructures (outstanding smart grid laboratories) for free to external industrial and academic users in the corresponding trans-national access programme'. In securing funding for the project Strasser notes that 'The ERIGrid project works at three levels; networking of infrastructure and knowledge; joint research activities to validate research and development; and trans-national access supporting research and innovation of external user groups'.

In order to establish a wider knowledge base access to the ERIGrid the ERIGrid partnership offers free access available to users from research, academia and industry through the project website. 'Each application is vetted to establish eligibility particularly in terms of scientific and technical knowledge as well as relevance of objectives and project outcomes,' Strasser notes. The project also aims to increase engagement from young researchers as well as female researchers to support career development and sustainable development in the industry.

CHALLENGES ADDRESSED

The ERIGrid project has already overcome a number of hurdles in developing its collaboration and knowledge exchange mechanism, but wider challenges to the long-term goals of the project involve the practical application and integration of the findings across the energy supply industry. 'Future constraints include those identified in operational development (such as a regulatory framework or interoperability of data), technical limits, prevailing legislation or rules as well as a dependency on the reliability of other components such as the availability of internet and data communication links,' Strasser observes.

To validate research the team has developed a holistic research and testing methodology and is investigating application barriers of the technology. This includes reliability and accessibility as ICT networks develop, as well as cross over interactions from prototype to concept and application. The project is also looking to optimise ICT architecture by ensuring electrical and ICT assets are compatible in future decades without the risk of assets becoming obsolete and increase the need to upgrade expensive infrastructure.

Strasser says that it has been recognised that there are 'significant challenges associated with modelling real-time cyclic dependences on energy and delivery systems as well as virtual and real-time hardware coupling alongside signal-based synchronisation of assets'. The technology must also be able to respond to unplanned events across the smart grid to mitigate risk which highlights the importance of a collaborative project where particularly trans-national supply and demand infrastructure for renewable resources may vary in reliability. This work has identified the need to collaborate in order to model communication, as well as processing automation and control across smart grids to develop a consistency for procedure and management protocols. 'The topical issue of cyber-security is also a concern for the ERIGrid project as traditional supervisory control and data acquisition (SCADA) systems are at risk from connectivity interference and affects both electrical and ICT security which are key to the long-term success of integrating energy from renewable sources into national and international supply grids,' he explains.

AN INTEGRATED FUTURE

The drive for increasing the integration of renewables for sustainable energy supply in Europe is well recorded but until recently there has been a lack of integrated networking of supplies. The project recognises that the future wholesale deployment of renewable energy resources will require the networking of sources at different voltage levels that require new innovations in real-time, co-ordinated control at different scales across Europe. ERIGrid analysis and objectives support the transition of energy supply from fossil fuel dispatchable energy units to more decentralised dynamic responses to users to store or supply energy from renewable sources by advanced testing methods.

The project considers not just short-term energy transition strategies of up to five years but more long-term sustainable supplies up to 20 years in the future. 'Whilst there are many socio-economic barriers to the development of extensive smart grid renewably sourced energy grids in Europe, the ERIGrid project aims to enhance knowledge, research and development and research infrastructure to support wider smart grid energy in the future,' Strasser points out. It is evident from ERIGrid reports and list of collaborators that researchers, energy delivery operators and governments all support the wider networking and practical modelling and testing of future smart grid technology to support energy security in Europe. The ERIGrid project not only facilitates research and development but also by providing access to 19 outstanding laboratory installations through the consortium it allows real-time horizontal and vertical system testing and research across Europe to development trans-national access to smart grid technology.

The development of smart grid technology also supports increased efficiency through advances in communication and grid service modelling that will also respond more quickly to peak supply and demand requirements and reduce levels of redundancy in supply infrastructure. Evidence suggests that through the ERIGrid project that an integrated approach at a technology and infrastructure level will provide the basis for future developments in energy security across Europe using smart grid delivery of energy from renewable sources.

Project Insights

FUNDING

Supported by the H2020 Programme under Contract No. 654113. The content of this article does not reflect the official opinion of the European Union. Responsibility for the information expressed therein lies entirely with the ERIGrid consortium.

PARTICIPANTS

AIT Austrian Institute of Technology GmbH – AIT (Austria) • Commissariat a l'Energie Atomique et aux Energies Alternatives – CEA (France) • Centre for Renewable Energy Sources and Saving Foundation – CRES (Greece) • European Distributed Energy Resources Laboratories e.V. – DERlab (Germany) • DNV GL Netherlands B.V. – DNV GL (Netherlands) • Danmarks Tekniske Universitet – DTU (Denmark) • Institut Polytechnique de Grenoble – GINP (France) • Institute of Communication and Computer Systems – ICCS-NTUA (Greece) • Frauhofer Gesellschaft zur Foerderung der Angewandten Forschung e.v – IWES (Germany) • Ormazabal Corporate Technology, A.I.E. – OCT (Spain) • OFFIS e.V. – OFF (Germany) • Ricerca sul Sistema Energetico - RSE s.p.a – RSE (Italy) • SINTEF ENERGI AS – SIN (Norway) • Fundacion Tecnalia Research & Innovation – TEC (Spain) • Technische Universiteit Delft – TU Delft (Netherlands) • University of Strathclyde – UST (UK) • Teknologian tutkimuskeskus VTT Oy – VTT (Finland) • Hellenic Electricity Distribution Network Operator – HEDNO (Greece)

CONTACT

Thomas Strasser
Project Coordinator

T: +43 664 2351934
E: thomas.strasser@ait.ac.at
W: https://erigrid.eu/

PROJECT COORDINATOR BIO

Dr Thomas Strasser received a PhD from Vienna University of Technology. For several years, he has been a senior scientist in the Center for Energy of the AIT Austrian Institute of Technology. His main responsibilities involve strategic development of smart grid research projects and mentoring and advising junior scientist and PhD candidates.

ERIGrid Connecting European Smart Grid Infrastructures

This project is funded by the European Union

AIT AUSTRIAN INSTITUTE OF TECHNOLOGY

Impact Objectives

- Integrate major European research centres with outstanding smart grid research infrastructures and offering free access to them
- Integrate and enhance the necessary research services for analysing, validating and testing smart grid configurations and solutions

Cyber-physical smart power systems

*Dr Thomas Strasser discusses his work on **ERIGrid**, a European collaboration project supporting the validation and testing of smart grid systems for the roll-out of new approaches and technologies*

How is it hoped the European Research Infrastructure supporting Smart Grid Systems Technology Development, Validation and Roll Out (ERIGrid) project will address some of the big challenges facing Europe's renewable energy industry?

Renewable energy resource integration is a key enabler to decrease greenhouse gas emissions and develop a sustainable electric power system for the future. The intermittent behaviour of renewable energy resources and their limited storage capabilities present new challenges to power system operators in maintaining security of supply, reliability and power quality. However, the increased availability of advanced automation and communication technologies has also provided new intelligent solutions to these challenges. Previous work has presented various new methods to operate highly interconnected power grids with corresponding components in a more effective way. As a consequence of technological developments, the traditional power system can be transformed into a networked, cyber-physical system, a so-called smart grid. Previous and ongoing research activities have mainly focused on validating certain aspects of smart grids, but until now there has been no integrated approach for analysing and evaluating complex configurations and advanced solutions in cyber-physical energy systems, which is what the ERIGrid project aims to do.

Who do you see benefiting from the ERIGrid Project?

It is hoped that the ERIGrid project will add a new integrated level to the European smart grid technology research and development and provide the co-operation that will allow convergence on common standards and technologies with other parts of the world with Europe in the lead. In addition, it is hoped that through collaboration, the trans-national access programme will enable academic and industrial research groups, energy utilities and other players in the domain of smart grids who do not usually have access to outstanding infrastructures, to access world-leading research facilities. This will also strengthen the links between academic and technological research and speed up the innovation to practical application processes.

How successful have you been so far in achieving the development of an integrated European research network to support an understanding of smart grid infrastructure in Europe?

ERIGrid is a continuation of long term collaboration of the consortium members in several European projects and initiatives focusing on system-level validation and testing approaches in the domain of smart grids. It involves 18 academic, research and industrial institutions as well as a network in 11 European countries with a high number of ongoing projects related to intelligent energy systems and smart grids. A large proportion of the ERIGrid project members are also involved in other important European technology and research activities and networks. The core consortium emerged out of the DERlab (European Distributed Energy Resources Laboratories e.V.) and EERA (European Energy Research Alliance) Joint Programme on Smart Grids networks.

Can you share some lessons you have learnt so far?

Best practice has been and will be exchanged and expertise integrated by the synchronisation of background information and promotion of transregional and cross-cooperation with a strong focus on advanced system-level validation approaches and research infrastructures. The industrial partners in ERIGrid see the cooperation with the academic partners as a chance to generate new knowledge that gives them a head start in the development of a technology highly demanded by the European power system and smart grid market. The teamwork among industry partners strengthens the technology absorption patterns as both of those partners successfully work in networks. Academic partners see the chance to continue a successful long-term cooperation in smart grid research. Cooperation with the industry partners gives access to technologies and challenging applications and fosters the realisation of innovations in the smart grids domain – which is a European need.

How do you align this work with other renewable energy projects currently underway across Europe to ensure renewable energy smart grids are best taken advantage of?

ERIGrid has already set up links with other national, European and international Research and Development (R&D) projects, initiatives, networks, and platforms in the field of smart grids. The main collaborative activities so far have been the information exchange on smart grid scenarios, use cases, research infrastructures requirements and needs, and testing and evaluation methodologies.