European Research Infrastructure supporting Smart Grid Systems Technology Development, Validation and Roll Out

TRANSNATIONAL ACCESS PROVISION

RESEARCH INFRASTRUCTURE DESCRIPTION AND TRANSNATIONAL ACCESS CONDITIONS

Laboratoire de Génie Électrique de Grenoble

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Project Duration:	**54 month**

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1   Research Infrastructure

Name of Infrastructure/Installation	**PREDIS Real-Time PHIL simulation platform**
Location	G2Elab, Grenoble, France
Web Site	*www.g2elab.grenoble-inp.fr*

2   Description of the Research Infrastructure

The G2ELab (i.e., GRENOBLE INP) owns two real-time (RT) multiprocessors digital simulators, in the framework of the PREDIS centre. They are a new generation of RT simulators, allowing applications from different physical domains like aerial or surface transports, fluids, mechanical and electrical systems using Matlab-Simulink® environment. Such simulators are able to carry out Hardware-In-the-Loop (HIL) as well as Power-Hardware-In-the-Loop (PHIL) applications. In such simulations, a part of the simulated system is achieved numerically in the heart of the simulator, whereas the other part is integrated in the open (or closed) loop through power amplifiers, in the form of physical components (or emulated numerically by calculators). The different components and the heart of the simulator can be linked by the communication system, which uses different communication protocols (TCP/IP, Ethernet, FireWire, Infiniband, etc.). It allows the remote operation of real-time systems via local networks or Internet. Moreover, a RT smart grid demonstrator is under development in the framework of a national research project. It will include a digital simulation of a distribution grid (MV/LV), some programmable loads and programmable sources to emulate this equipment, smart meters, amplifiers, a SCADA system (Supervisory Control And Data Acquisition) including optimal energy management ADA functions, and a communication network using IEC 61850.
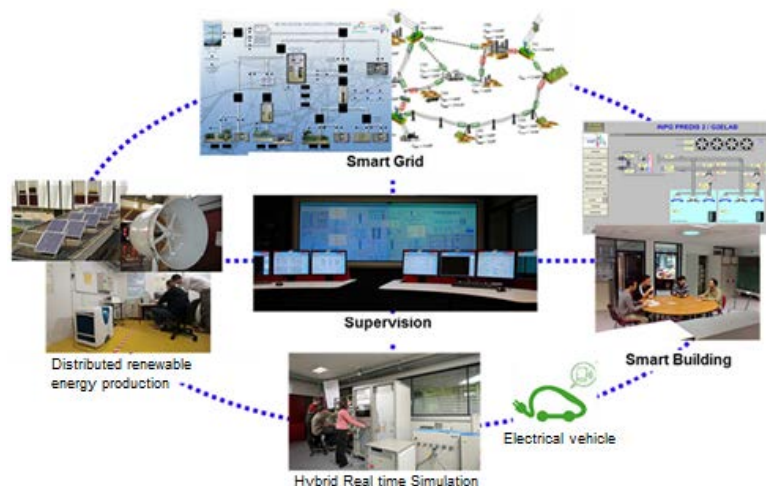
In addition, integrated in the PREDIS center, there are five special platforms to reinforce the capabilities in the specific fields of research:

- **Supervision Platform (SCADA)**: This is the vital organ of the PREDIS center, which allows the development and deployment of central supervision of all other platforms.

Different industrial SCADA are deployed and studied:

- SCADA PCVue: fully developed by the engineers of G2Elab and ENSE3 for supervising the reduced size electrical grid at PREDIS.
- SCADA Lynx: Developed by ATOS ORIGIN
- SCADA Zenon: Developed by COPA-DATA
- SCADA ADACS: specialized for nuclear center.
- SCADA E-Terra: Developed by ALSTOM and used in the project SUPERGRID.

- **Platform of decentralized energy production (PDE)**: This platform regroups multiple means of production, connectable to different reduced grids. It allows the study and control of real energy production, including renewable sources.

- **Platform of reconfigurable electrical grid**: This platform regroups several real instrumented and flexible electrical grids with a reduced size of 30kVA. It allows the study on different structure of future smart grid. The reconfigurable distribution and industrial grids use the production means and loads of PDE platform and is supervised by the SCADA platform.

- **Platform of real time simulation and PHiL**: This platform offers the tools for electrical system design, optimization and control. It allows users to actualize researches on all kind of emulated grids with interaction with real components. This modular platform is suitable for different research thematic, from electrical vehicle to renewable energy resources.

- **Platform of smart building**: The platform is dedicated to the research on smart energy management and auto-consummation. It consists of a demonstrating building with associated measures and instrumentation. The real time management strategy takes into account comfort data, consummation and production and other factors.

3   Services offered by the Research Infrastructure

The PREDIS platform enables to test coupled ICT and electrical infrastructures, through a flexible combination of prototypes, emulation and simulation, including real-time simulation with PHIL facilities. We can list some examples of R&D services:

- HIL applications:
  - (i) test of power systems protection relays, and
  - (ii) Validation of controllers for different kind of equipment (FACTS, wind turbine, hydro turbine, PV, etc.).
- PHIL applications:
  - (i) Smart Grid (RT simulation of distribution network with ICT network IEC 61850, SCADA, ADA functions, DG emulators, DSM emulators with smart meters, etc.),
  - (ii) wind generator emulation,
  - (iii) shunt and series FACTS systems like STATCOM and DVR (Dynamic Voltage Restorer),
  - (iv) residential micro-network with dispersed generation, and
  - (v) Test of industrial converters for photovoltaic generation Systems.

All user projects will be realized according to the procedures developed in NA5

4   Brief description of the organization managing the Research Infrastructure

Ideally located in the heart of the French Alps, Grenoble Institute of Technology is one of Europe's leading technology universities. It offers a range of engineering, masters and doctoral courses both in French and in English, driven by world-class research in 38 laboratories, and 6 technology platforms, developed in partnership with other institutions.

Grenoble Institute of Technology's mission is to empower new generations of engineers to respond to global challenges in the fields of energy, the digital world, micro- and nanotechnologies, the environment, as industries of the future. For 120 years, Grenoble Institute of Technology has been instrumental in developing innovative solutions with industrial partners to support continuous technological advances and economic growth. With its solid combination of teaching, research and business promotion, Grenoble Institute of Technology plays a key role in making Grenoble one of the most attractive scientific and industrial locations worldwide.

International cooperation has always been a priority for Grenoble Institute of Technology, developing programs alongside renowned technology universities in Europe, North and South America and Asia. The Institute is proud to host research and teaching fellows and students from right across the world, and to encourage its students and staff to travel abroad to work in partner universities or do internships in foreign companies.

5   Transnational Access conditions offered by G2Elab/Grenoble-INP

All the offered experimental systems included in the PREDIS centre are in the Green-ER building in Grenoble, France.

Access to PREDIS centre is granted under agreed authorization of both G2Elab and Grenoble-INP.

For **safety reasons**, for **critical applications**, the users are not expected to operate the systems by themselves; even when safety instructions will be provided, tests will be carried out by staff of G2Elab. For **the rest of applications** and after ad-hoc training, the user group will be granted access to the related facilities for the duration of the stay (with the support of G2Elab researchers and laboratory technicians when necessary). The **scheduling of the experiments** will be agreed and booked prior to the stay according to the availability of the involved staff and equipment. Administrative documentation for the access (contract, non-disclosure agreement, etc.) will comply with ERIGrid common indications.

In addition to the general corporate services (Internet connection, canteen, etc.) and the support and advice on accommodation and transportation to G2ELab infrastructure, the access being offered includes supervision and help of G2Elab staff:

- As a complement to the pre-access contacts between the user group and G2Elab, the stay will start with an introductory meeting with a senior researcher for confirming the stay conditions (confidentiality, safety indications), scheduling the activities, explaining the on-site procedures, clarifying the logistics and technical details.
- Preparatory work: a laboratory technician will assist the users for the installation of the devices, electrical connections, use of the specific instrumentation, preparation of a test procedure (if necessary) on the basis of the users requests, and programming of the experimental conditions.
- The preparatory works (before granting access and in the process) are counted towards the units of access. G2Elab researchers will support the realisation and follow-up of the experiments.

- G2Elab researchers will support the results interpretation, data processing and analysis, and test report preparation
- Assurance covering the visiting period may be demanded by the local administrators.

In principle, a typical stay of 1 month is foreseen for a single user group but this period could be extended depending on the concrete user project. The user group can use the infrastructure for the defined time.

The user group will have access to an office, computer and telephone.

Reimbursement of expenses:

User expenses for the Transnational Access are paid by ERIGrid (EU H2020 Programme). This includes travels to PREDIS-G2Elab by plane, accommodation, daily subsistence, and daily transportation during the stay.

For the user projects taking place in PREDIS, ERIGrid will refund the stay expenses when the stay is finished: the user must declare the incurred expenses and present the invoices/receipts to G2Elab in order to get the refund.

Logical expenses must be made by the user: travels will be made in economy class and conventional hotels (not luxury) or equivalent accommodation will be used. As an indication (it is not a daily allowance), a maximum subsistence fee of 160 €/person must be considered per day. Lunch will be provided at local canteen free to the user.

6   Contact details for Research Infrastructure

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