SIRFN Capability Summary
PREDIS, Grenoble-INP, Grenoble, FRANCE

Introduction

PREDIS is the experimental smart grid platform of Grenoble-INP

PREDIS is dedicated three at a time to education, research and technological transfer about smart grids technologies : So PREDIS support both the ENSE3 (Energy, Water and Environmental Sciences Graduate School and from Grenoble-INP) and research laboratories as G2ELAB (Grenoble Electrical engineering Laboratory) and also G-SCOP and GIPSA-Lab.

PREDIS assembles all the different technological tools required for advanced energy management into the smart grids, including each part of the electrical systems: It is able to support a systemic approach of the advanced smart grids solution.

So PREDIS includes

- An experimental Distribution Generation and Storage Platform
- An experimental Distribution Network Platform
- A smart Building, used in real condition
- An energy supervision platform for promoting energy management at a global scale
- A simulation platform

The main objective is to have a representative platform for the development and integration of smart grid technologies.

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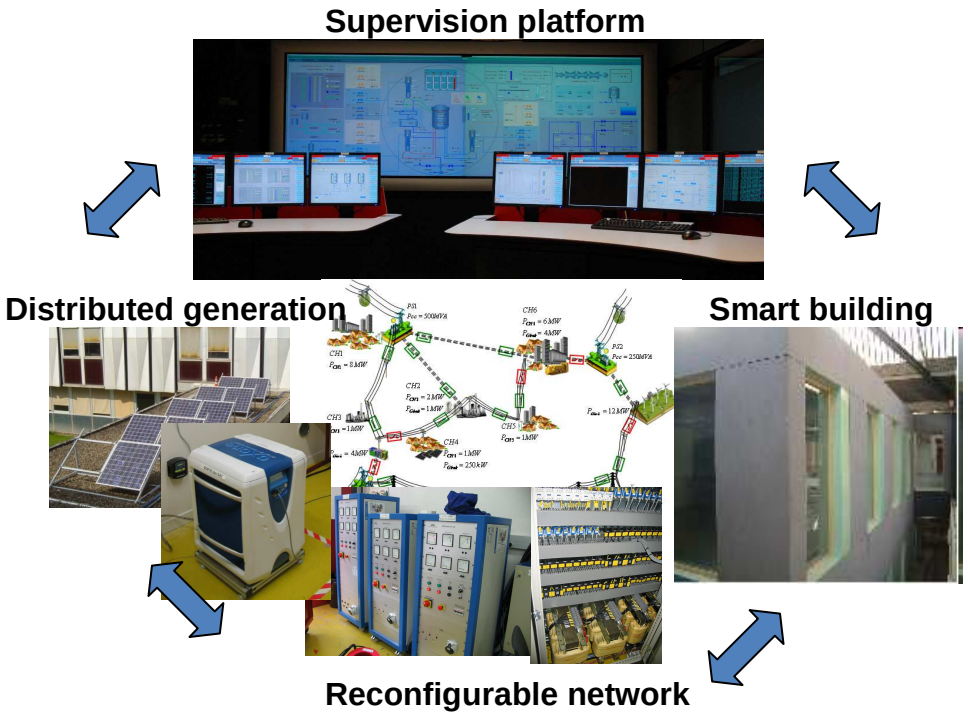

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Renewable Energy and DER Integration

Desired Level of SIRFN Participation: 3

- 1 = Low 2 = Med 3 = High

Description of Activities

PREDIS support

-Modeling of components and systems, modeling of interface between component and grids, hardware in the loop simulation.

-Architecture, dimensioning and control strategies for DER integration to grid: management of the intermittency, control of energy flows and ensuring of the energy quality

- Development and optimization of advances local functions integrated to the global management of the system: DER impact reduction, participation to ancillary services

PREDIS enable to manage complete DER technological portfolio, for optimization of these technologies but also for their combination as complentary DER. Investigated technologies include

- Photovoltaic generation

-Wind generation and micro wind generation

- Cogeneration

- Storage (fuel cell)

- Variable speed micro hydro power

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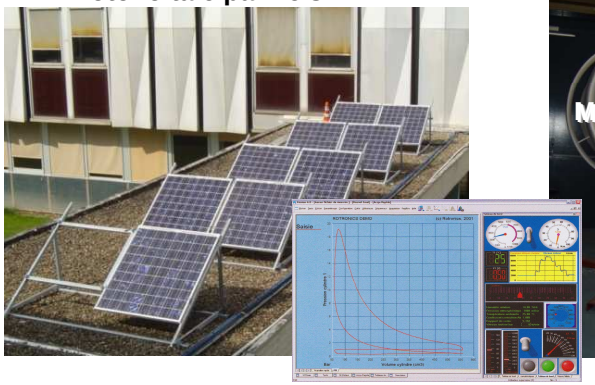
Photovoltaïc pannels



Test bench for micro wind generators

Monitoring systems And power electronics interfaces

Gas cogeneration

Fuel cell

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SIRFN Subtask 2.2

Building Automation

Desired Level of SIRFN Participation: 2

Description of Activities

PREDIS enable

-To collect data about energy use into building in real conditions

- To develop, to test, to evaluate and to optimize energy management strategies dedicated to smart building

- To test different type of sensors, automations and ICT solutions : Lonworks and MODBUS protocol, PLC (Power Line Current), wireless communication as 433 MHz free radio waves or Zig-Bee

- Modeling coupling between energy management strategy and user behaviors

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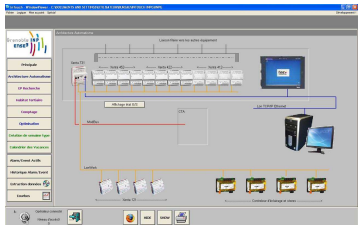
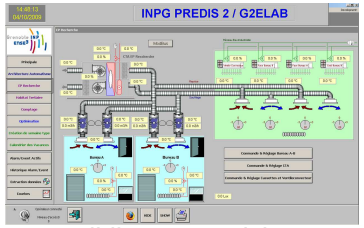
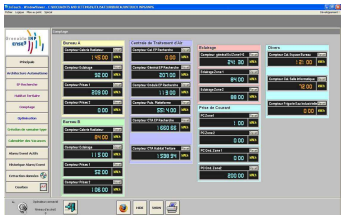
Smart Building



Automative architecture



Building Supervision



Energy metering

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SIRFN Subtask 2.3

PEV Integration

Desired Level of SIRFN Participation: ?

- 1 = Low 2 = Med 3 = High

Description of Activities

Describe activities in this subtask area with an emphasis on nature of research/testing. Include relevant information on current clients/customers and highlight any unusual capabilities, major accomplishments or relationships.

SIRFN Site Focus Area Lead(s):

Name
Title
E-mail:
Phone:

Name
Title
E-mail:
Phone:

Area for photos, diagrams or other graphic material.

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SIRFN Subtask 2.4

Microgrids

SIRFN Subtask 2.5

Distribution Automation

Desired Level of SIRFN Participation: 3

Description of Activities

Modeling of grids (transport, diistribution) and of the systems connected to them

Innovative grid topologies and architectures for DER integration (including distributed generation, flexible load and storage)

Innovative grid operation strategies, able to coordinate the management of the different DER, for more flexible and more efficient grids.

Optimized distributed intelligence: ICT concept and solution

PREDIS include

- Different simulator and hardware in the loop real time simulator (RT-LAB)

-A scale model of a distribution network, which represent an 30 MW distribution network at scale 1/1000, including urban, semi-urban and rural zones.

-Network include substations, lines (with adequate scale factor for impedance), switches, sensors, programmable load and distributed generation

- Network include also automotives, communication network, flair indicators, supervising tools to support implementation of smart grids functionalities and advanced energy management strategies.

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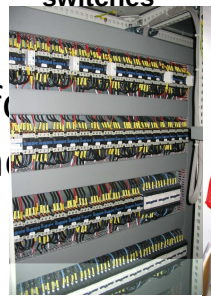
Electrical devices from substations

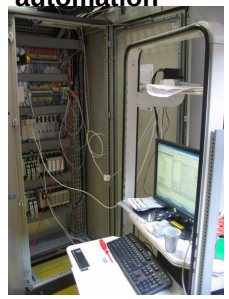
physical scale model of a distribution gric

switches



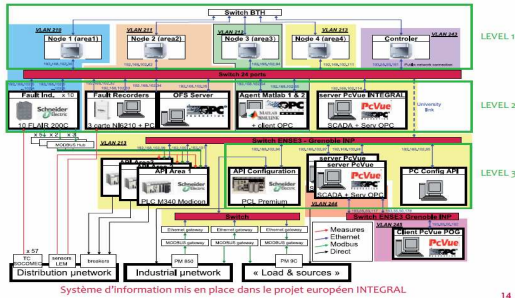
fault indicators

automation



Real time simulator

MAS (Multi agent systems) for distributed intelligence



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SIRFN Subtask 2.6

Security

Desired Level of SIRFN Participation: 3

- 1 = Low 2 = Med 3 = High

Description of Activities

• Defects detection and localization in electrical component and systems
• Optimized location, strategies management and of protections
• Coupled modeling of critical multi infrastructure (coupling between electrical grid and ICT infrastructure)
• Investigation of new failure modes consecutive to interdependencies.
• Topologies and managements strategies for minimize interdependencies and their impacts.
• Adequate strategies to stop failure path into critical multi infrastructure

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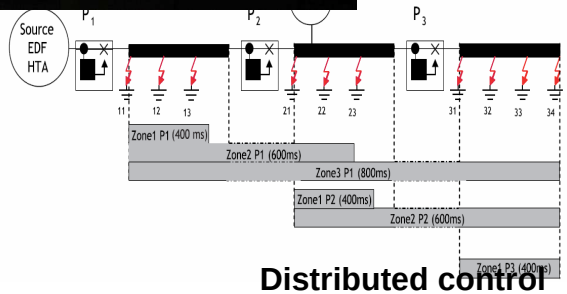
Operating centre



Software tools for investigating critical multi infrastructure

Distributed control architecture & reconfigurable protections

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Summary of Capabilities for Simulation and Testing

AC and DC sources:

- 27 KW of distributed generation (reconfigurable network platform)
- Photovoltaic panels: 3 KW peak (DG platform)
- Gas cogeneration: 7,5 KW electric / 19 KW thermal (DG platform)
- 34 KW of additional synchronous generators (support platform)

Loads:

- 30 KW of fully programmable resistive, inductive and motor loads (reconfigurable network platform)
- 72 KW of adjustable resistive load (support platform)
- 60 KW of motor load (support platform)
- Around 3,5 KW of fully programmable load for heating, ventilation and lighting of Low energy smart building (smart building platform)

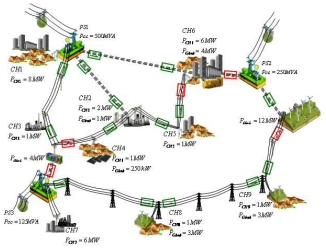
Storage:

- Fuel cell (PEMFC): 2,5 KW (DG platform)
- PC batteries: 1,8 KWh of capacity storage available for smart building management

Test Configurations:

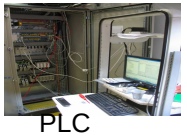
- Demonstration of smart grids solution on physical automotives reconfigurable supervised distribution network : scale model 1/1000 of a 30MW network


Line impedance

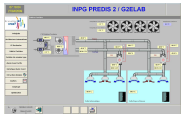



induction motors
synchronous generators


Resistive load

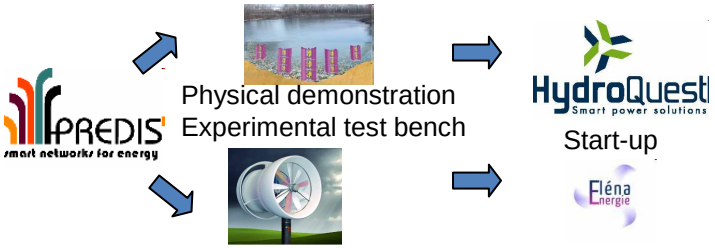

PLC

- Smart energy management in a building, used in real conditions by student and researchers


Sensors, automation supervision


Building real conditions uses

- Demonstration of energy control strategies for distributed generation and storage, up to industrial solutions



Summary of Capabilities for Data Acquisition and Analysis

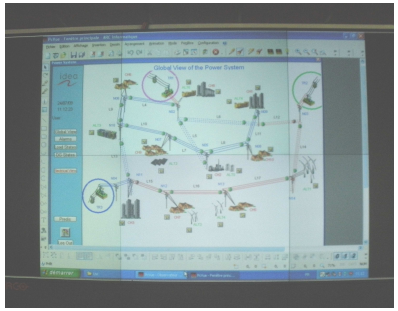
Data Acquisition:

- Data acquisition systems (cogeneration, PV…)
- SCADA (Supervisory and Data Acquisition System) :
  - ADACS for power plant supervising
  - PCVUE for reconfigurable electrical grid supervision and used for the development of DMS (Distribution Management System)
  - E-TERRA for transportation grid supervision, with EMS (Energy Management Systems) including advanced functions for both grid and market operation :
  - BMS (Building Management System) for supervising the smart building systems

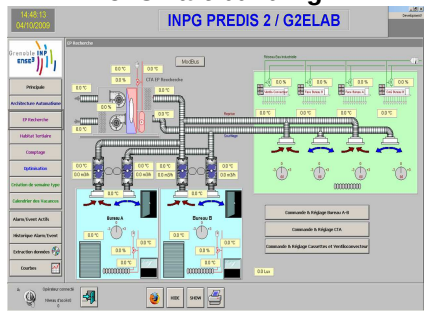
Computer Simulation:

- Hardware in the loop real time RT-LAB simulator including
  - Hardware, external communication, computation power
  - Active cards with FPGA (Full Programmable Gate Area) and graphical interfaces (TestDrive)
  - Power interface
  - Hybrid flexible test bench, with analogic devices including rotating generators, turbines, power electronics and/or industrial devices
- Software dedicated to power systems studies: Eurostag, EMTP, PSAT, MatLab SimPowerSystem

SCADA PCVue
Supervision of reconfigurable distribution network



BMS
Supervision of smart building



Hardware in the loop real time simulation: investigation cases
wind generation, micro hydro power plant, photovoltaïc generation, PHEV integration, analogic devices as protection relay