SIRFN Capability Summary
IRTES-SET, UTBM, France

Introduction

Research Institute on Transportation, Energy and Society (IRTES) of the University of Technology of Belfort-Montbéliard (UTBM) includes several complementary research teams. Our team works on Energy Conversion and Control (CCE team).

The research led by the CCE team evolves in the electrical energy field and covers a continuum of activities such as the production, conversion and storage of energy and its management. The systems engineering approach enables researchers to meet industrial needs and stay close to the latest innovations, thanks to the more fundamental research activities led in parallel.
We develop an experimental and evolutive Smart Grid platform to validate the models and algorithms developed in research or industrial partners, at a low cost.

For more information, contact:

Name
Title
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Website URL: http:/www.energyconversion.fr

Renewable Energy and DER Integration

Desired Level of SIRFN Participation: **1**

- 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:

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Title
E-mail:
Phone:

Area for photos, diagrams or other graphic material.

Building Automation

Desired Level of SIRFN Participation: **1**

- 1 = Low 2 = Med 3 = High

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PEV Integration

Desired Level of SIRFN Participation: **3**

- 1 = Low 2 = Med 3 = High

Description of Activities

Embedded Energy Storage
The team is working on the use of different solutions such as super capacitors and other accumulator technologies. The development of embedded battery management systems (BMS), enabling optimal and secure battery operation, is one of the team's strong points. Works are in progress to have a good estimation of the battery state of health.

Energy Management
Energy efficiency is essential. Research covers control strategies for the optimization of the use of each traction chain element. In the case of rechargeable electric and hybrid vehicles, the interaction with the electricity distribution network is also examined.
Offline and online optimizations are performed for vehicle to grid applications in order to smooth the demand and to minimize the electricity price.

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Microgrids

Desired Level of SIRFN Participation: **3**

- 1 = Low 2 = Med 3 = High

Description of Activities

Intelligent Energy Management
Intermittent energy sources, storage and demand-side management will make managing power flows in the grid even more complex than today. These factors are dealt with through efficient and fully adaptable energy management algorithms taking into account several technical, economic and environmental objectives and constraints.

Control System Architectures
As generation, consumption and storage are becoming more and more local and distributed management systems must adapt:

- Design of decentralized, distributed and networked architectures
- Development of energy management system based on autonomous, flexible and adaptable multi-agent systems.
- Integration of energy storage
- Demand-side management
- Economic and emissions dispatching
- Very short term scheduling
- Long term planning
- Fully automated control and decision support

We also work with colleagues of the institute IRTES on the acceptability of the smart grid.

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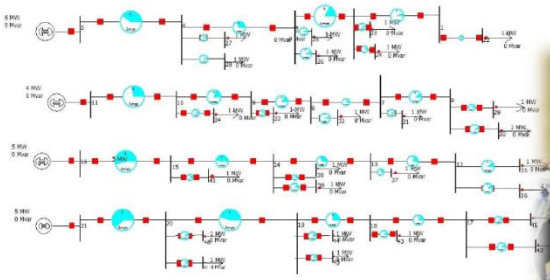

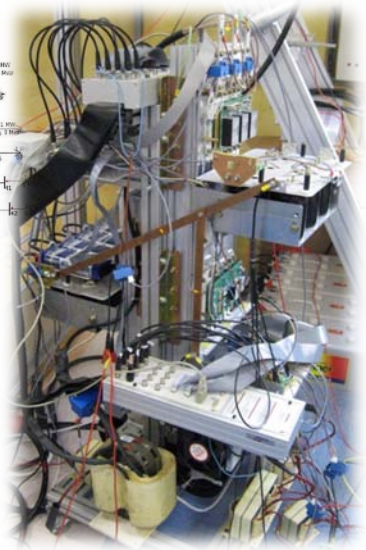

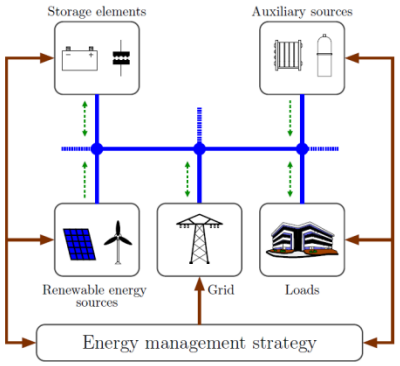

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Distribution Automation

Desired Level of SIRFN Participation: **0**

- 1 = Low 2 = Med 3 = High

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Cybersecurity

Desired Level of SIRFN Participation: **0**

- 1 = Low 2 = Med 3 = High

Description of Activities

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Summary of Capabilities for Simulation and Testing

AC and DC sources:

- 40 kW + 16 kW + 12 kW Programmable DC sources
- 5 kW Fuel cell

Loads:

- 30 kW Programmable DC load

Storage:

- Lead acid batteries
- Lithium Iron batteries (20 kWh, Pmax = 200 kW)
- 30 Ultracapacitors 58F - 15V

Controls:

- dSPACE systems:
  - 5 Microautobox,
  - 1 DS1103
  - 5 DS1104 PPC Controller Boards

Electromagnetic Compatibility:

An electromagnetic reverberation chamber allows the evaluation of the emissions level and the electromagnetic interference immunity for converters, calculators, energy sources.
Tests show the conformity with standards or the necessity to intervene on the design and the architecture and enable bringing adapted solutions to on-site observed problems.

Test Configurations:

- 5 kW modular test bed for electric and hybrid architectures (15 kW max).
- 10 kW DC microgrid, power flow of up to 5 sources can be controlled thanks to dSPACE control. It allows to validate energy management strategies.
- Electric fuel cell emulator based on a real-time 1D multiphysical fuel cell model
- Racing electric vehicle (220 HP)
- SeTCar: lightweight four-wheel electric car (4 kW nominal, 11 kW max) equipped with a 5 kW fuel cell and a lead-acid battery

Summary of Capabilities for Data Acquisition and Analysis

Data Acquisition:

- National instruments systems:
  - CompacDAQ,
  - CompacRIO,
  - PXI RT

Computer Simulation:

- OPAL RT systems: 3 RT-Lab simulators

Test Configurations:

- Characterization bench for accumulators and ultracapacitors
- 24 kW fuel cell test bed for advanced characterization of its performances