

Laboratory Fact Sheet

1 Institution

Name:



Laboratoire Systèmes Solaires
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2 Classification

- independent
- accreditation according to IEC 17025
- long-time DG experience (more than 3 years)
- active in standardisation committees

The newly created INES is the French national research institute for solar energy. It results from the gathering of most of the French actors of research in the field of solar energy. More than 100 researchers from CEA, CNRS and Savoie University are already working in INES.

INES is organised in three branches:

- RDI (Research, Development, Innovation): PV and solar thermal systems, including storage; covers the whole range from the materials over cells, components and systems, up to energy-efficient buildings
- Demonstration: performance assessment of components, systems, models, including those developed by INES RDI,
- Training & Information: training sessions for the main stakeholders and decision-makers (building professionals, architects, consultants), dissemination to improve the public awareness of solar energy.

Today, three laboratories are present at INES RDI:

- Laboratory for Solar Components (LCS) develops PV cells both silicon and organic based,
- Laboratory for Solar Systems (L2S) performs R&D on photovoltaic systems and electrical storage systems, and their components

- Laboratory for Solar Integration (LIS) performs R&D on solar thermal systems and building integration of solar energy.

3 Brief historical background

Already involved in photovoltaic energy for over 20 years, the former GENECE group has been continuously active in technological research and development on renewable energies and energy management. The main objective of research and development activities in the GENECE was to reduce the photovoltaic power system cost. These activities include four aspects: cells, modules, batteries and systems. The activities on batteries began in 1990.

The GENECE team joined INES in 2005. The site where the GENECE group was located is still being used as measurement platform due to its excellent irradiation conditions.

4 Mission statement

The general mission of INES/L2S is to perform R&D in the field of photovoltaic components and systems. It is organised in two groups: “photovoltaic systems” and “storage systems”. The “storage systems” group, the most involved in the DER-Lab project, tests and validates storage technologies, especially the lead-acid and lithium-ion technologies. Particular emphasis is given to the development of innovative management strategies and of prediction tools for costs and values of storage systems, and the coupling of storage systems to the grid.

The R&D axes of INES/L2S are:

- Grid-connected PV systems,
- Electrochemical storage systems,
- Systems for distributed generation and microgrids,
- Stand-alone systems,
- PV modules.

5 Institution in brief

Associations

CEA is a public research organisation.

Accreditations

The CEA part of INES is certified ISO 9001. The INES/L2S laboratory is currently undertaking a procedure towards the COFRAC accreditation to the EN 17025 standard for testing of storage systems.

Number of staff

CEA is an entity with a staff of about 15000 people. Within INES (about 100 people of which 65 from CEA), the INES/L2S laboratory involves 25 researchers among which 16 permanent staff.

Main source of funding

The sources of funding of INES/L2S are: 40% French government, 20% ADEME (French environment and energy management agency) and ANR (National Research Agency), 20% EU, 10% industry. In the context of the implementation of the new INES facilities, additional funding for infrastructure and equipment has been received.

6 Brief summary of competences

Following its participation in the INVESTIRE thematic network where most existing storage technologies were evaluated and based on its wide experience in testing and helping for the standardisation of storage systems, INES/L2S is one of the largest independent testing facilities in Europe for storage components and systems. In the DER-Lab network, INES/L2S is coordinating activities on the storage function within other distributed energy resources. The target is to assess the storage function just as another resource in terms of:

- Energy available in the next defined time period
- Power available during the expected time duration
- Energy available over the whole system life
- Performances measurement, in order to assess the cost as a function of the lifetime and the energy efficiency (extra cost related to the fact that the DER must be loaded)

Matrix of competences

Institution: INES/L2S	
Description of competence	Yes/no / list
Involvement in standardisation groups/committees	Yes – Expert in the technical committees IEC TC 21 and TC 82
Certification expertise	Yes – certified ISO 9001
Area of Scientific expertise	<ul style="list-style-type: none"> - Intermittency and storage - Development of test procedures for storage functions and PV components - Simulation of storage technologies and PV systems - Material characterisation - Ageing procedures - DG integration - Grid connection and inverters
Involvement in consultancy (e.g. for industry and government)	Yes
DG reference project list	<p>EU projects on DER:</p> <ul style="list-style-type: none"> - INVESTIRE - PHOTEX - DISPOWER - EnirDG Net - IRED - ABLE - Benchmarking - SoS-PVi <p>French projects:</p> <ul style="list-style-type: none"> - performance tests of grid connected systems, pumping systems and inverters - performance tests for stand alone systems

Institution: INES/L2S	
Description of competence	Yes/no / list
	and components - development of battery management systems
List of recent publications (say last 3 - 5 years)	<p>2003-2006: 7 papers in the Journal of Power Sources</p> <ul style="list-style-type: none"> • Results and comparison of seven accelerated cycling test procedures for the photovoltaic application • Characterisation of photovoltaic batteries using radio element detection: The influence and consequences of the electrolyte stratification • Irreversible sulphation in photovoltaic batteries • Optimization of charge parameters for lead-acid batteries used in photovoltaic systems • INVESTIRE NETWORK, Investigation on Storage Technologies for Intermittent Renewable Energies in Europe • Temperature behaviour: Comparison for nine storage technologies: Results from the INVESTIRE Network • Lead-acid batteries in stationary applications: Competitors and new markets for large penetration of renewable energies • ABLE project: Development of an advanced lead-acid storage system for autonomous PV installations • Study of the "coup de fouet" of lead-acid cells as a function of their state-of-charge and state-of-health <p>Participation in Conferences</p> <p>2003: Electrochemical society Paris (FR) AABC Nice (FR) 3rd WCPEC Osaka (JP)</p> <p>2004: 9th UECT Ulm (DE) PCIM Nuremberg (DE) PV conference Paris (FR) 9th ELBC Berlin (DE)</p> <p>2005: 24th IPSS Brighton (UK) LABAT'2005 Varna (BG) PV conference Barcelona (ES) Journées d'électrochimie St Malo (FR)</p> <p>2006: 10th ELBC Athens (GR) PV conference Dresden (DE) Storage of renewable energy Gelsenkirchen</p>

Institution: INES/L2S	
Description of competence	Yes/no / list
	(DE) Electrochemical Society Cancun (MX)

7 Laboratory facilities

Facilities	Capabilities
Battery test benches	70 test channels at controlled temperature (-40 to +60°C for some test benches), 12V-20A up to 100V-700A
Test bench for solar home systems	16 channels for SHS testing following IEC 62124 procedure (two climates available)
Chemical laboratory	Battery expertise after testing, mainly for lead-acid batteries, starting activity on lithium-ion batteries
PV systems test bench	Outdoor test facility in two different climates
Simulation tools and models	Matlab, Simulink, Comsol/Femlab, P-Spice
Inverter test bench	Up to 10 kW, including PV-UPS inverters
Pumping systems test bench	2 test channels up to 5 kW
Electronics facilities	Development of electronic devices
Multi-microgrid facility (under construction)	Planned capabilities: 100 kWp PV, 1 MVA transformer

Part of the outdoor test facilities for inverters, PV modules, and solar home systems, is located in Cadarache (south of France), providing two types of possible climatic conditions (Mediterranean or Alpine climate).

8 Standardisation activities

INES/L2S is involved in IEC TC 21, IEC TC 82 and in the joint working group between TC21 and TC 82. INES/L2S is strongly supporting the idea that standardisation has to be performed regarding a function and a service to the end user, not only a component. Therefore many activities were performed in the EU funded project PLISE of which the IEC62124 standard for PV stand alone systems is an outcome. The group has also been strongly involved in the production of the standards IEC61427 concerning batteries for PV installations (development of the test procedure).

9 Testing activities

At the time being, the focus is put on two main activities:

- test of photovoltaic systems and components including panels, inverters
- test and qualification of storage systems