Transdisciplinary analysis of Renewable Energy Development at Ecole Polytechnique TREND-X

Research unit/permanent staff contributing to the projet

LMD: P. Drobinski(*), T. Arsouze, J.C. Dupont, M. Haeffelin, J. Polcher, R. Plougonven, A. Stegner
LadHyX: X. Amandolese, E. de Langre, P. Hémon, S. Michelin
LMS: P. Bérest, A. Dimanov, V. Docquet, N. Triantafyllidis
LPICM: E. Johnson, M. Foldyna, C. Cojocaru, E. Garcia Caurel, P. Roca i Cabarrocas, Y. Bonnassieux, D. Tondelier, B. Geffroy, J. Nassar
LSI: M.C. Clochard, J.E. Wegrowe
PMC: M. Rosso, F. Ozanam
CMAP: F. Bonnans, X. Allamigeon
LIX: C. D'Ambrosio, L. Liberti; M. Fliess
EXCESS: J.P. Ponssard, A. Creti, E. Strobl
I3-CRG: H. Dumez, E. Gigout

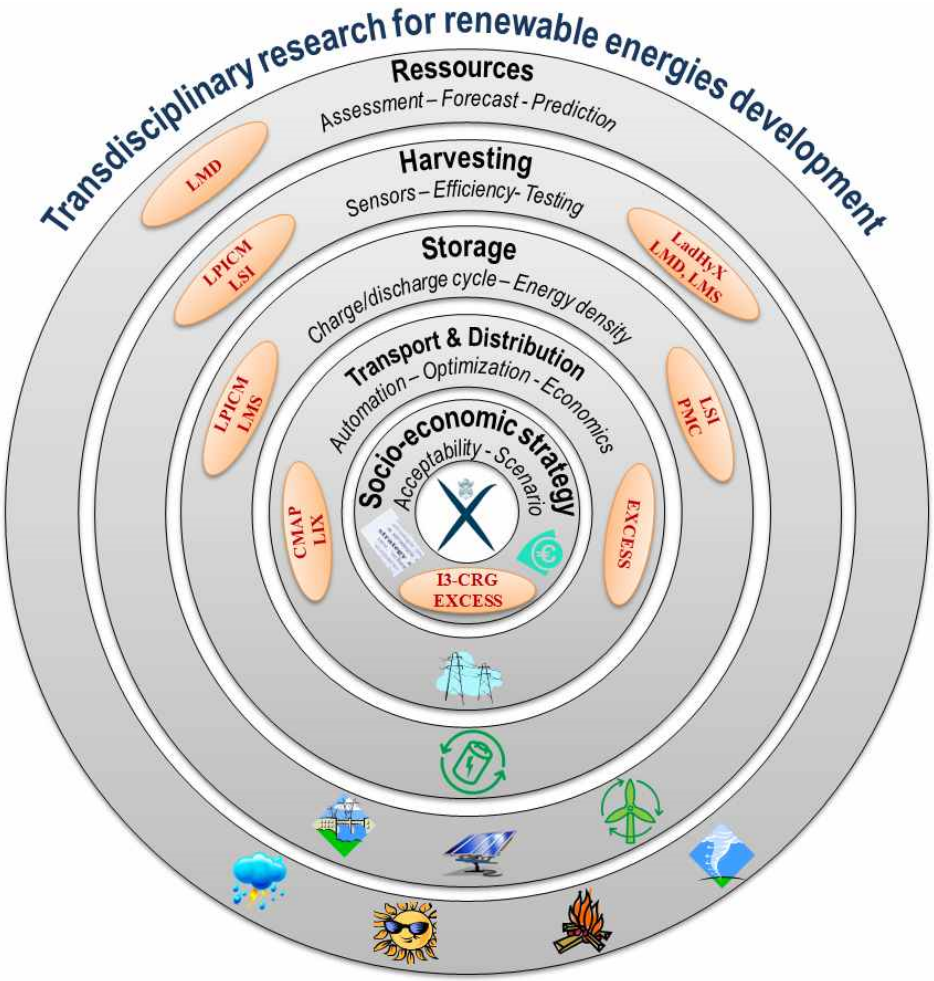
TREND-X project engineer: J. Badosa

(*) The names of the members of the project board are underlined

ÉCOLE POLYTECHNIQUE
UNIVERSITÉ PARIS-SACLAY

Concept

- A hollistic and transdisciplinary approach on renewable energy production in one single institution, Ecole Polytechnique → ***unique framework***
- Large number of research units conducting work related to renewable energies → ***science-based approach***
- Direct support to courses at Ecole Polytechnique (PA, EA, PSC, PRL,…) and to professional training→ ***education -based approach***
- From energy resource assessment and prediction, to storage, production, transport and distribution including socio-economic strategies → ***"end-to-end" analysis***
- Collaborations with a large number of research partners in France (University Paris-Saclay and beyond) and Europe → ***renown expertise and large international visibility***
- Strong collaboration with small to large entreprises → ***strong potential for innovation and transfer***



Project implementation

A renewable energy initiative for Research, Transfer, Education

TREND-X objective

How interdisciplinary expertise may allow better development and optimization of the management of electrical grids?

TREND-X approach

The project has a **strong potential for innovation**. The project will focus on the following objectives:

- integrated modelling for renewable energy resource to transport → **simulating and forecasting the "real" electrical "cycle"** by including geographically localized energy harvesting and storage systems, and electricity network in geophysical models providing the resources → ***unique modeling tool to provide information tailored to stakeholders' needs***

- development of an **experimental micro-grid** based on the SIRTA buidling which would couple wind/solar energy to electricity (already installed), to downstream power conversion, storage devices and smart loads → ***unique experimental tool for (i) the development, test and valorization of energy resource assessment methodology, energy harvesting devices, storage systems and microgrid management and (ii) for integrated model evaluation (see first bullet)***

Such parallel and complementary approaches should help performing innovative research on renewable energies: (integrated modelling: process modelling, sensitivity of the end-to-end chain to the various components of the chain, scenario analysis,...; experimental platform: tests of new sensors, local production and distribution network, technology showcase,...)

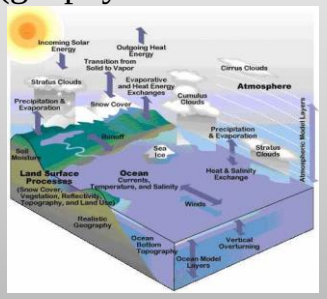
Project implementation

A renewable energy initiative for Research, Transfer, Education

Integrated renewable energy modelling platform

LMD

Renewable energy resources (geophysical modelling)



PMC LPICM

Energy storage (optimization models and transfer functions)

LIX CMAP

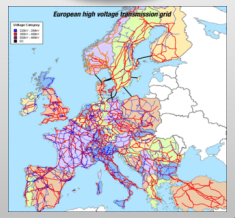
LPICM LIX

Energy harvesting and conversion (transfer functions)

LSI LadHyX

LIX CMAP

Energy transport and distribution (optimization models)



I3 - CRG

Energy strategy scenario

EXCESS

Energy price models

Large-scale network: France, Europe (economic and financial analysis)

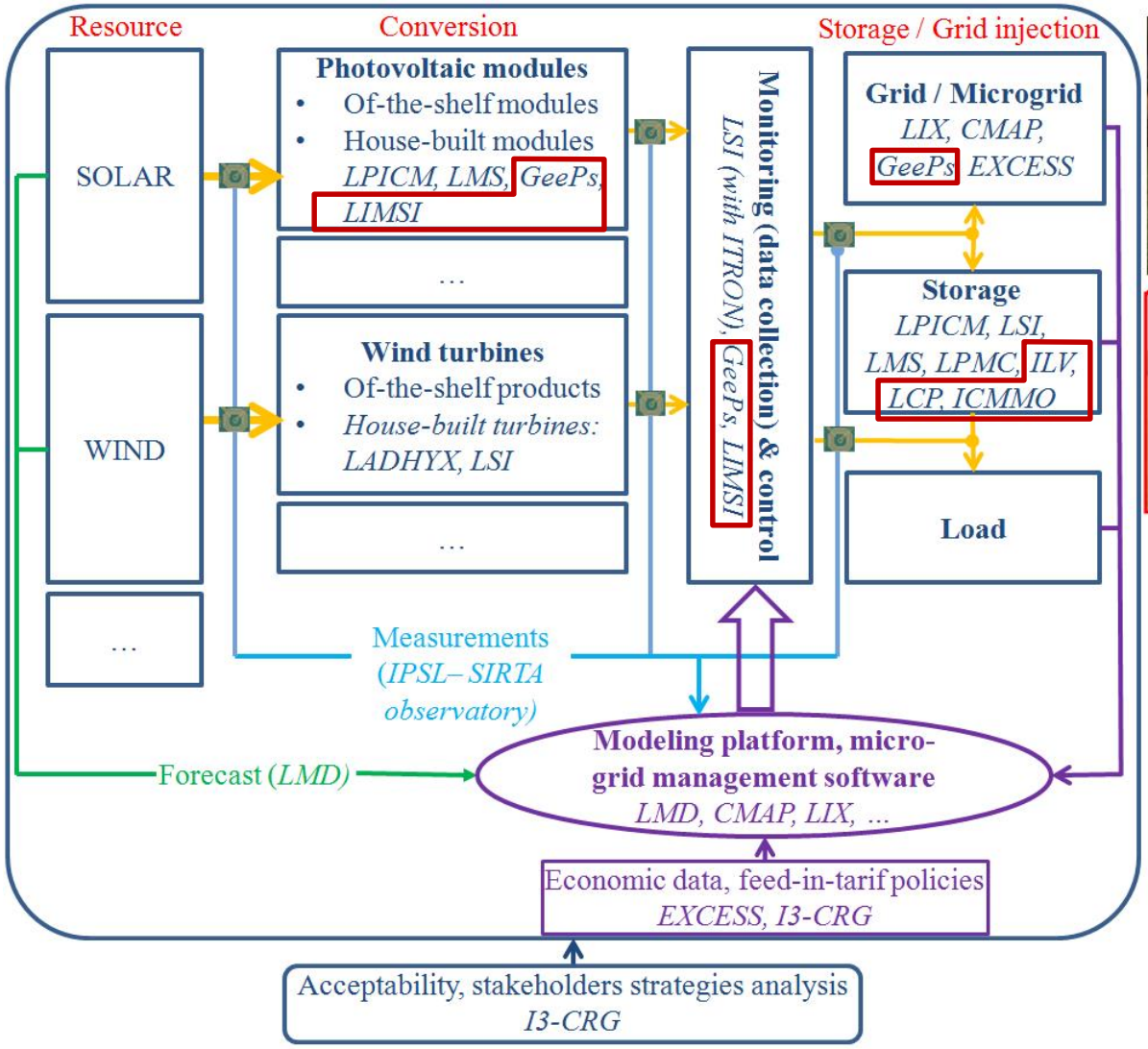
Local network: Chili, Italy, Réunion/French Polynesia, **SIRTA Link with LIVEgrid**

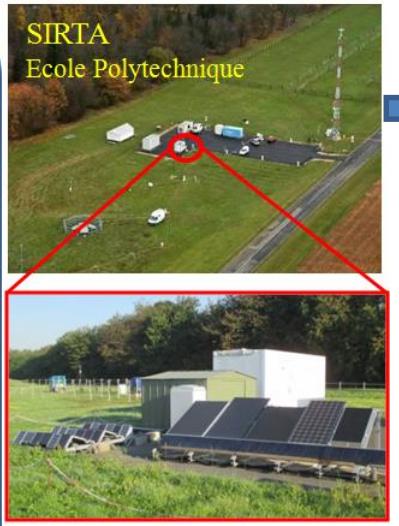
SIRTA experimental platform
LPICM, LSI, PMC, LadHyX, LMD, CMAP, …

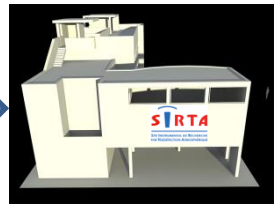
Project implementation

A renewable energy initiative for Research, Transfer, Education

Integrated renewable energy experimental platform at SIRTA on Ecole Polytechnique campus







Dedicated building in 2018

It will be used to:

- **test, understand and optimize new energy harvesting systems in real conditions**,
- to set up a **local production and distribution network**
- to be used as a **technology showcase**.

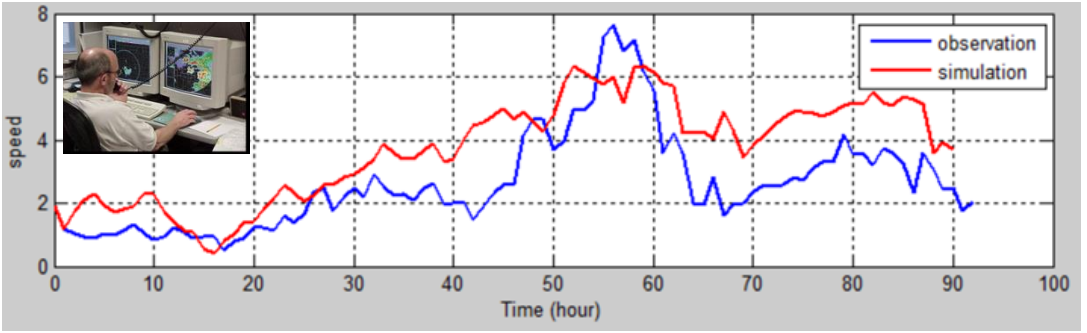
Link with Paris-Saclay University
GT Energy & LiveGrid

Project implementation

A renewable energy initiative for Research, Transfer, Education

Innovation and transfer

The project should be seen as a **renewable energy lab in the frame of X-entrepreneurship** and should contribute to the **incubator and prototyping area (with a fab lab, an e-lab, and equipped laboratory areas)** of the Ecole Polytechnique.



Education

The project should also be the direct **support to courses:**

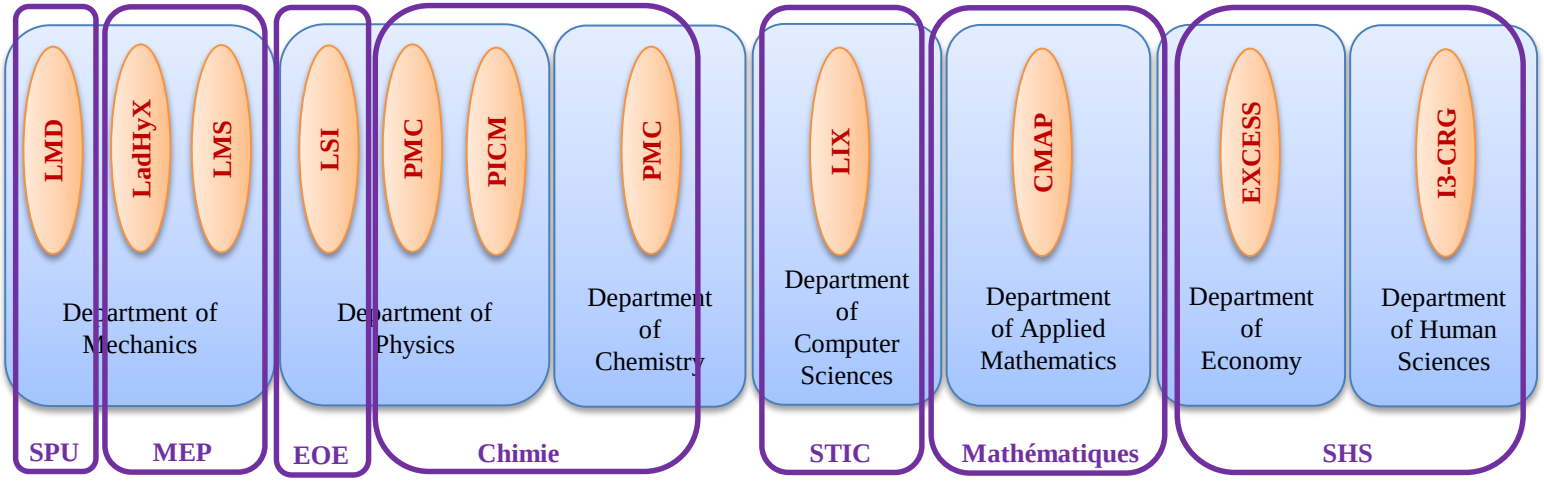
- in the frame of several "Parcours d'Approfondissement" (PA) at Ecole Polytechnique and Masters at Paris-Saclay University (e.g. “Energy”, “Materials science”, “E3A”)
- in the frame of **MOOC**: Existing **MOOC** on photovoltaic can be extended to cover wind energy, storage and grid integration
- in the frame of the IDEX “**plateforme de TP innovante**”: experimental photovoltaic plateform at SIRTA is already labelled by IDEX and results form the collaboration with GeePs (Paris-Sud, Supelec, Cachan), ILV (Versailles-Saint Quentin) and LIMSI (Paris-Sud).

It should also contribute to **professional training** in relation with industry and stakeholders'needs.

Project implementation

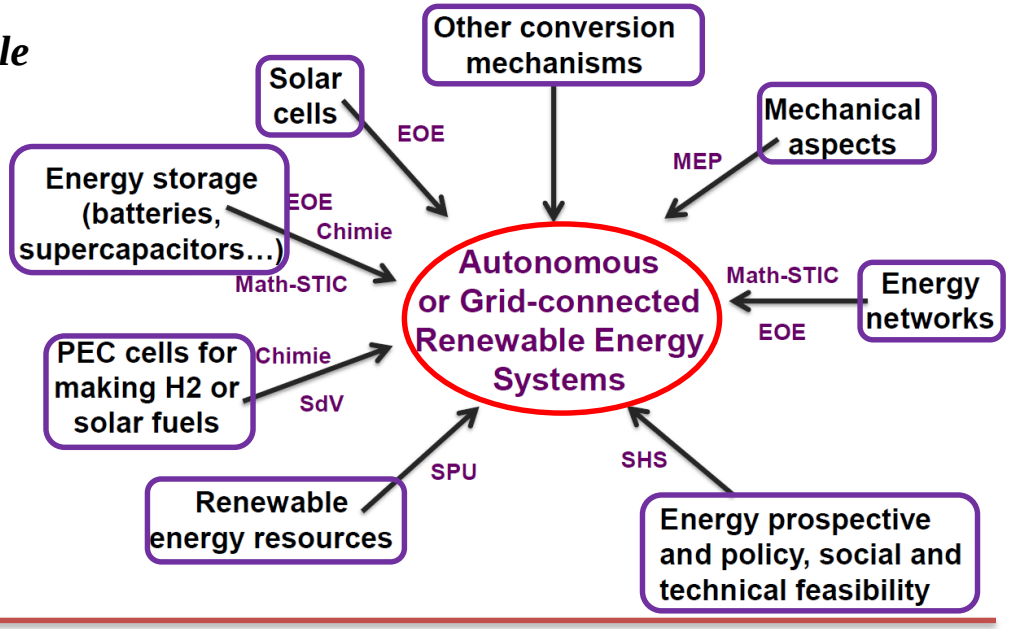
The Paris-Saclay University context

Relation with Research Units and Departments at Ecole Polytechnique and Paris-Saclay University



Backbone for an integrated project on renewable energy at Paris-Saclay University level

- CNRS, Ecole Polytechnique, CEA, Université Paris-Sud, CentraleSupelec, ENS Cachan (GeePs, LIMSI, ILV, IMMCO, LCP, L2S, …)
- Topical Expertise Centers:
- SIRTA: Transdisciplinary Integration Center



Thank you for your attention