

## SOME OF OUR INDUSTRIAL PARTNERS:



Air Liquide

AREVA H<sub>2</sub>Gen



storengy



MONOLITH



## ONE CONTRACT MANAGEMENT ORGANIZATION:



## CONTACTS

first.name.name@...

- IMT MINES Albi-Carmaux (@mines-albi.fr)**
  - RAPSODEE: Doan Phamminh, Ange Nzihou
- IMT MINES Alès (@mines-ales.fr)**
  - C2MA: Belkacem Otazaghine, Aurélie Taguet
  - LGEI: Luc Malhautier, Frédéric Heymes (EUREQUA), Guillaume Junqua (ERT)
- IMT Atlantique (@imt-atlantique.fr)**
  - GEPEA: Pascaline Pré
- IMT Lille-Douai (@imt-lille-douai.fr)**
  - CERI EE: Rémi Gautier, Daniel Bougeard
- MINES ParisTech (@mines-paristech.fr)**
  - PERSEE: Christian Beauger, Patrick Achard
  - MAT: Alain Thorel, Yazid Madi, Anthony Chesnaud
  - CES: Rodrigo Rivera\_Tinoco, Chakib Bouallou
  - CTP: Christophe Coquelet, Elise El\_Ahmar
  - Géosciences: Faouzi Hadj\_Hassen
  - OIE: Paula Perez\_Lopez
  - CSI: Madeleine Akrich
  - ISIGE: Jasha Oosterbaan, Daniel Florentin
  - CMA: Gilles Guerassimoff
  - CERNA: François Lévêque
  - CRC: Franck Guarnieri
- IMT MINES Saint-Etienne (@mines-stetienne.fr)**
  - SPIN: Mathilde Rieu, Jean-Paul Viricelle
  - Fayol: Valérie Laforest
  - SMS: Cédric Bosch
- ENSTA Paris (@ensta-paris.fr)**
  - UCP: Laurent Catoire, Didier Dalmazzone, Johnny Deschamps
- Sigma Clermont (@sigma-clermont.fr)**
  - I. Pascal: Jean-François Cornet

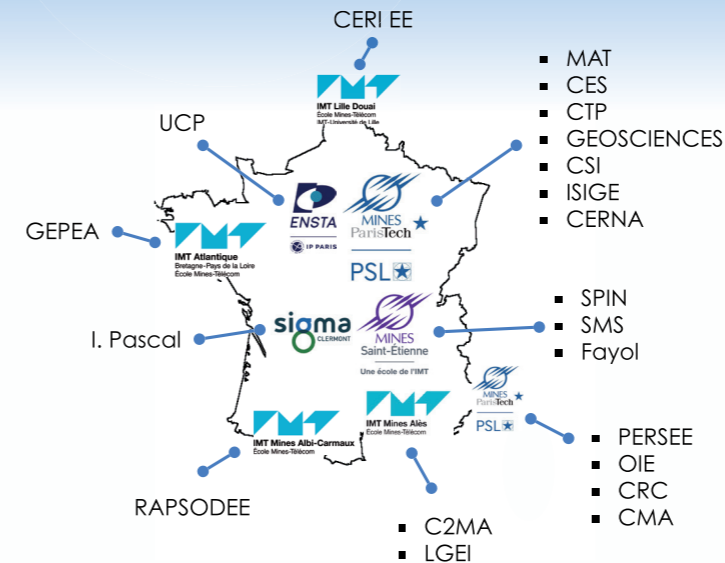
**Coordinator: Christian Beauger**  
christian.beauger@mines-paristech.fr



## OUR NETWORK FOR THE H<sub>2</sub> ENERGY SECTOR

RESEARCH & DEVELOPMENT | EDUCATION

Carnot M.I.N.E.S. research centres involved in H<sub>2</sub>MINES



www.carnot-mines.eu/fr

## H<sub>2</sub>MINES TAKES PART IN:

### NETWORKS

- Hydrogen Europe Research
- EERA
- France Hydrogène
- GDR (Solar Fuels, Thermod. moléc. et proc.)
- FRH2 (CNRS)
- Géodénergies
- SFGP
- SFT
- SEE
- Mission H<sub>2</sub> Pays de Loire
- Climate KIC

### CLUSTERS

- CAPENERGIES
- DERBI
- MOVEO
- AXELERA
- EMC2
- ASTECH
- TENERRDIS

### PROJECTS (ANR, EU, PIA...)

- FluidStory, Rostock-H, Waveincore, Stopil-H2, Citeph20, Comehte, Anima, Ingopint-Pacos, Moise, Pretzel, Pegasus, Comet, Momentom, Minerve, Endemat, HyCOMP, FiBreMoD, Osirhys, Chaire industrielle Messiah... & HyTREND (AMI Carnot)

### TECHNOLOGICAL PLATFORMS

- Fuel Cell test benches
- H<sub>2</sub> storage, purification test benches
- Gas sensors test benches
- Burners, flash pyrolyzers, gasifiers, HP reactors, methanation...
- Materials synthesis and characterization
- Shaping processes
- Fluids thermophysical properties
- Rock geomechanical characterization
- Power to gas

### EDUCATION PROGRAMS

- Conferences, courses and student projects in the framework of the different education programs of the partner schools.

PRODUCTION

STORAGE/DISTRIBUTION

END USES

SUSTAINABLE DEVELOPMENT



• Biomass gasification  
• Biogas reforming

**RAPSODEE**

• Compression and distribution: simulation

**RAPSODEE**

• Fisher-Tropsch synthesis  
• Methanation

**RAPSODEE**



• PEMFC membrane materials: functionalization of clays **C2MA**  
• Biological methanation **LGEI/EUREQUA**

• Risk analysis  
• Eco-industrial synergy **LGEI/EUREQUA/ERT**



• Purification (PSA, membrane, absorption)

**GEPEA**

• Porous materials  
• Solid storage tank

**GEPEA**

• Power to gas: methanation, CO<sub>2</sub> capture

**GEPEA**



• Modeling & Optimization: Porous media, adsorption, storage, topology optimization

**CERI EE**



• Electrolysis (LT PEMWE)  
• Plasma cracking, reforming  
• Electrochemical purification (LT)  
• Photocatalysis

**PERSEE**

• Electrochemical compression  
• Porous materials

**PERSEE**

• PEMFC: MEA materials (catalysts and composite membranes), system studies (Transport, stationary, H<sub>2</sub> recirculation, hybridization...)  
• CO<sub>2</sub> reduction  
• Renewable Energy coupling  
• Multi-energy systems

**PERSEE**

• Future energy systems and markets **PERSEE**  
• Prospective & optimization of energy systems **CMA**  
• Life cycle assessment **OIE**  
• Socio-technical controversies **CSI**

• Phase diagrams / measurement of thermophysical properties  
• Selection of solvents

**CTP**

• Electrolysis (SOEC, PEMWE, MCEC)  
• System analysis

**CES**

• Methanation (coelectrolysis)  
• Power to gas  
• CO<sub>2</sub> recycling  
• Biogas

**CES**

• Process economics **CES**  
• The economics of H<sub>2</sub> (cost benefit analysis, public policy assessment, innovation and competition) **CERNA**

• Electrolysis (HT)  
• Reforming  
• Electrochemical purification (HT)

**MAT**

• HP composite tanks: tests/calculations  
• Pipeline protection: cold spray coating

**MAT**

• SOFC: MEA materials, new regenerative systems

**MAT**

• Territorial planning and public policies in energy transition **ISIGE**  
• Safety and reliability assessment, public perception of safety **CRC**

• Salt caverns: integrity/reactivity

**GÉOSCIENCES**

• Underground storage environmental impact **GÉOSCIENCES**



• Gas sensors: CO, H<sub>2</sub>, safety/process control

**SPIN**

• Environmental analysis: qualitative assessment and absolute sustainability evaluation

• Electrode material: modeling /simulation (image analysis)

**SPIN**

• Pipeline integrity and durability

**SMS**

• SOFC single chamber

**SPIN**

• Decision aid support for territorial planning **FAYOL**



• Biomass flash pyrolysis

**UCP**

• Doped MOFs (C, metal, metal+C)  
• Liquid carriers (LOHC)  
• Hydrides

**UCP**

• Combustion  
• Reactivity/Risk

**UCP**

• Tech-eco evaluation of the distribution chain **UCP**



• Solar photoreactive processes

**I. PASCAL**

