
*Pitching session
for project ideas and proposition of competencies*

07/02/2023 – Webinaire Horizon Europe/Clean Hydrogen



Session de pitches

1. SAKOWIN
2. ALBATROS
3. HYSILABS
4. BALLARD
5. CRIStaAL-University of Lille
6. SOFRESID
7. CNRS ICARE-University of Orléans
8. AFNOR
9. French Corrosion Institute
10. PRISME-University of Orléans
11. DE VINCI Research Center
12. IRT Jules Verne
13. CETIM
14. CAPGEMINI
15. UNISTRA CNRS



« Let's change our perspective on carbon-free hydrogen
thanks to an innovative technology: (bio)methane plasmalysis »

European
Innovation
Council



SAKOWIN Green Energy (SME)

www.sakowin.com

Mathieu SCHMITT | Head of Strategic Partnerships & BD | mathieu@sakowin.com | +33 7 68 53 87 33

Lydia ALTES | Marketing & Communication PMO | lydia.altes@sakowin.com | +33 7 66 87 06 83

IMAGINE...

THE NEXT-GENERATION
OF COMPETITIVE SUSTAINABLE
HYDROGEN PRODUCTION





OUR GOAL

On-site / on-demand
Without CO₂
Competitive cost

- Energy Efficiency driven
- Cost competitive without valorization of Carbon
- On-site & on-demand process
- Scalable equipment

OUR TECHNICAL CHOICE

CH₄ decomposition through
microwaves plasmas

- 20 experts, 8 PhDs members, 6 scientific R&D partners
- Microwave plasma
- Reliable technology / no-catalyst needed

OUR BUSINESS MODEL

OEM business model

- 6 signed partners since 2021
- Partnerships on H2 and solid carbon
- Faster go-to-market & regulation

1

2

3

Examples of use cases

Industrial process

- Ex Application 1. Combined Heat & Power (CHP)
- Ex Application 2. CO₂-free Oil & Gas Flaring (power generation)
- Ex Application 3. Heat for industrial process (glass, aluminum, ...)

Power Generation

- Ex Application 1. Gas/H₂ Turbines / Engines
- Ex Application 2. FuelCells Applications (SOFc, Alkaline, PEM...)
- Ex Application 3. Electrical BackUp (DataCenter, remote facilities...)

Mobility

- Ex Application 1. Heavy mobility (CO₂-negativ H₂ HRS for long distance truck, aeronautics with)
- Ex Application 2. Onboard energy generation (H₂ for ships)
- Ex Application 3. New mobility usages (drones, UAV...)

Solid Carbon use

- Ex Application 1. Agriculture
- Ex Application 2. Building materials (cement, tarmac...)
- Ex Application 3. Current usages of black carbon (0 CO₂ black carbon)

Partners roles

Feedstock provider (optional)	Technology provider (Sakowin)	University / Laboratory	End User
Supplier of the feedstock (biomethane)	Supplier of the technology <i>Help the implementation of the sold prototypes and demonstrator</i>	R&D study of carbon usage <i>Lead the R&D behind the integration of the solid carbon into the soil (impact study, test, ...)</i>	User of the global innovation* <i>Supply the facilities and the operating environment. Provide feedback data to demonstrate the innovation.</i>
Integrator / Innovation (can be the end user)			
Integrate and industrialize the global innovation* / Project coordinator <i>Lead the technical, economical and environmental feasibility studies and demonstrations. Can be the IP owner.</i>			

*Global innovation = finished innovation integrating Sakowin's solution that fulfills the project goal



AWARDS

		Co-funded by the European Union
 gazelle accelerator aerospace valley		

- 06/2021 - H2 Hub Airport Winner
- 05/2021 - Forum National Eco-entreprises (Energy award)
- 10/2021 - Energy for Smart Mobility Forum (Energy award)
- 11/2021 - Pollutec (special jury prize)
- 11/2021 - BlueInvest readiness
- 2021 - Award World Impact Summit
- 12/2021 - Gazelle Accelerator - Aerospace Valley - EIT Manufacturing (finalist, 2nd)
- 03/2022 - Réseau Entreprendre member
- 03/2022 - BPI - DeepTech label
- 03/2022 - World Material Forum (finalist)
- 05/2022 – EIC Accelerator

MEMBER OF

	MEMBRE DE 	

FINANCIAL SUPPORT

	REGION BOURGOGNE FRANCHE COMTE	



2. Pitching session for project ideas and proposition of competencies

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Competence offer

- Expertise of the team: Process and materials for **high productivity filament winding cell** (H2 tanks)
- Call for proposal: HORIZON-JTI-CLEANH2-2023-03-01: **Real environment demonstration of Non-Road Mobile Machinery (NRMM)**
- The offer: manufacturing tailor-made hydrogen tanks for the demonstrators
- Current participations in projects in this field: French-State-funded R&D project developing a disruptive solution (currently at TRL6)



Speaker:



- Name: Maxime EZEQUEL
- Organization: GIE Albatros (industrial cluster) **representing a French manufacturing SME**
- Team: R&D department of the member company
- Expertise:
 - Robotics
 - Composite materials
- Email: m.ezequel@gie-albatros.fr
- Phone number: +33 7 85 91 98 63
- Web page: <https://www.gie-albatros.com/>



3.HYSILABS

3. Pitching session for project ideas and proposition of competencies

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Company presentation:

- HySiLabs, SME based in Aix-en-Provence
- Marie Sorensen Guillaume, Account Executive
- Business department
- Development of non-organic hydrogen carrier

Contact:

- msorensenguillaume@hysilabs.com ; +33 6 16 93 19 32
- www.hysilabs.com



Competence offer:

- HySiLabs has developed and patented an **innovative hydrogen carrier** called “HydroSil”, a liquid silicon hydride derivative, which is stable, non-toxic, non-explosive and non-dangerous. It enables to release hydrogen at the consumption site easily, on-demand and without any external energy input. This enables a full logistic supply chain that is similar to the other existing liquid fuels: it can be transported safely at ambient temperature and air pressure.
- Among all the H₂ usages, HSL Solutions are unbeatable on these three:
 - Green H₂ transportation and H₂ hubs: transportation of HydroSil
 - Heavy-duty on-board applications (boats, trains): hydrogen released on-board
 - Strategic storage: underground storage





Competence offer:

- We are interested into topics relatives to transportation and storage of H₂
 - For example, HORIZON-JTI-CLEANH2-2023-02-01 (underground storage)
- Current participation in European project :
 - Coordinator of RESHIP (Redefine energy Efficiency solutions for hydrogen powered SHIPs in marine and inland waterway), Horizon Europe, 12 participants
 - With the novel and energy efficient hydrogen carrier technology HydroSil, RESHIP links the ESD technology to the research of the energy efficient **onboard hydrogen utilisation** technology to systematically reshape the hydrogen driven ships with a holistic energy saving solution.



4.BALLARD

4. Pitching session for project ideas and proposition of competencies

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About us

Ballard Power Systems is a global leader in fuel cells for heavy duty motive applications



Buses &
Coaches



Lorries



Stationary /back-
up power

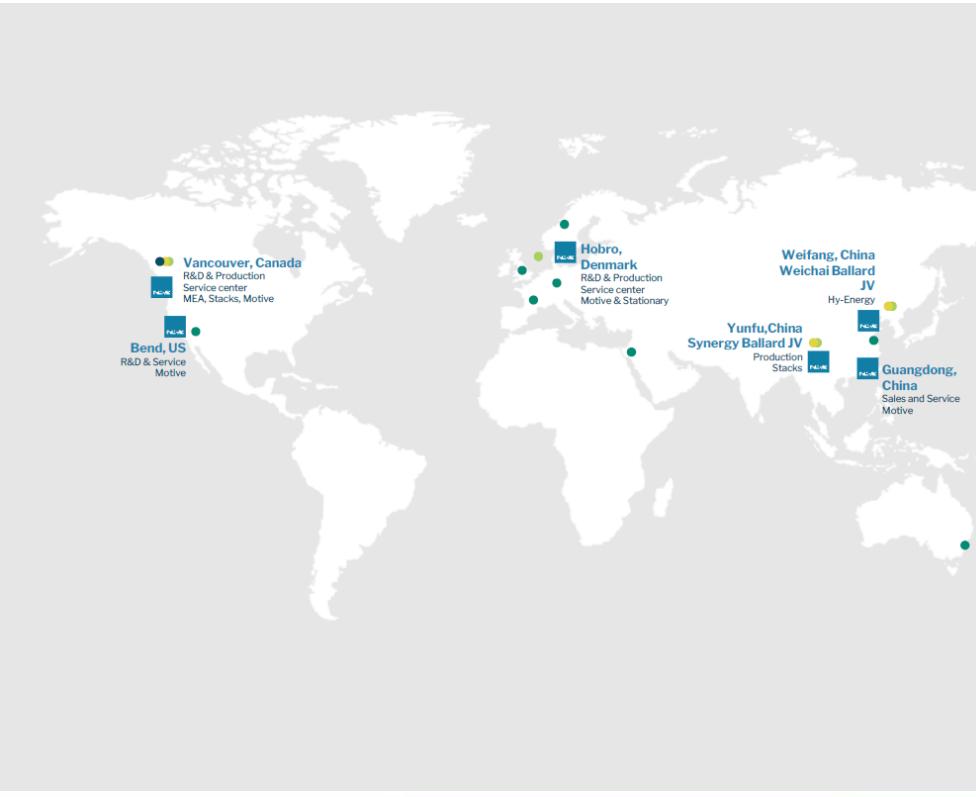


Trains



Vessels

- 43 years experience in building fuel cells
- 250+ employees in Europe, 1400 globally
- 100 million kilometres of on-road fleet experience for heavy-duty vehicles worldwide
- 200+ fuel cell electric buses currently in operation across Europe



Florian Chapalain
Public Affairs & Market
Development Manager
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www.ballard.com

Ballard's experience with EU-funded projects

Participation in 10+ EU-funded projects over the last 10 years, including:



3Emotion

Demonstration of 29 hydrogen fuel cell buses in 5 cities across Europe (Pau, Versailles, London, Aalborg, Rotterdam).

<https://3emotion.eu/>



Clear Gen

Development, demonstration and operation of a megawatt scale fuel cell system in a chemical plant

<https://www.cleargen.eu/>



Stashh

StashH will develop an open standard for heavy-duty fuel-cell modules in terms of size, interfaces, control and test protocols, with the objective of kickstarting the use of fuel cells and hydrogen in the heavy-duty mobility sector, where electrification with batteries is impractical.

<https://www.stashh.eu/>



Flagships

Demonstration of two commercially operated hydrogen fuel cell vessels. The demo vessels included are one cargo in France (Paris) and a barge in the Netherlands (Rotterdam).

<https://flagships.eu/>



2023 Clean Hydrogen Partnership calls: Ballard's focus

- Large-scale Hydrogen valley (HORIZON-JTI-CLEANH2-2023-06-01)
- Small-scale hydrogen valley (HORIZON-JTI-CLEANH2-2023-06-02)

Our value proposition

- Leverage Ballard's offering to boost hydrogen demand in new hydrogen valleys:
 - Either by bringing existing Ballard's partners into the project
 - Working with local integrators to build new vehicles and applications powered by Ballard fuel cells
- Extensive FCEV deployment experience enables Ballard to advise project partners on best way to plan fleet deployment.



5. CRIStaAL-University of Lille

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*Pr. Jean-Yves Dieulot
CRISTAL UMR 9189 CNRS, University of Lille*

Team Perennisation of Industrial Systems

Research interests: Modelling & supervision of multiphysics systems, fault detection, control, prognosis

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Contact: jean-yves.dieulot@univ-lille.fr

mahdi.boukerdja@univ-lille.frr

<https://pro.univ-lille.fr/jean-yves-dieulot/>

+33 3 28 77 85 95

e-maintenance and support of Offshore green hydrogen production

- Develop and test a fully marinized electrolysis system.
- Demonstrate how an offshore electrolysis system can connect to multi-MW scale offshore wind turbines.
- Optimise design concepts for future offshore wind-to-hydrogen production systems.

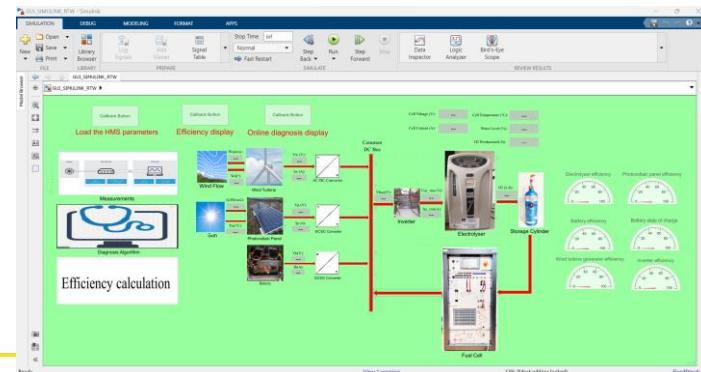


Our Contribution

- . Develop an offshore maintenance center that uses an advanced decision tool.
- Develop a fault diagnosis (detection, isolation and fault identification).
- . The methodology will merge machine learning and physical approaches

The decision tool will be based on a digital twin (physical based model) of the EL coupled with the wind farm, online data transmitted to the maintenance center, and historical data.

What is sought is monitoring degradation and efficiency.





Needs / partners

Data from wind farms (e.g. North sea, atlantic coast)

Researches on the evaluation / modelling of long-term membrane degradation under conditions that replicate saline/marine environment. (Topic 1)

Experimental validation (in general) of fault and ageing of Electrolyzers and membranes

HORIZON-JTI-CLEANH2-2023-07-02: Increasing the lifetime of electrolyser stacks

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**HORIZON-JTI-CLEANH2-2023-03-02: Development of a large
fuel cell stack for maritime applications**



Contacts:

Gwenaelle BENOIT - gwenaelle.benoit@sofresid.com
Stéphane GOURET - stephane.gouret@sofresid.com



Activities



Engineering



R&D support



Project
Management



Construction
follow-up

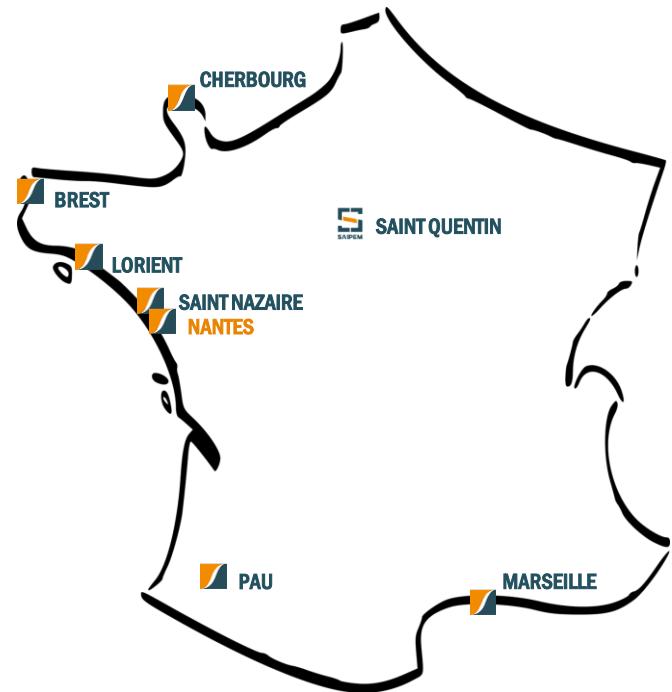


Innovation



Procurement
services

Subsidiary of SAIPEM



Business Lines



Plant



Green



Naval



Offshore
Wind

Identified call HORIZON-JTI-CLEANH2-2023-03-02: Development of a large fuel cell stack for maritime applications

Project title To be defined with future consortium

Topic(s) foreseen Development of large FC for marine use, including:

- Definition of FC and system requirements
- Prototype manufacturing and testing (marine environment, vibration, ...)
- Feasibility studies for integrating a large FC system within a typical vessel
- Development plan
- → See Workpackages proposal for details

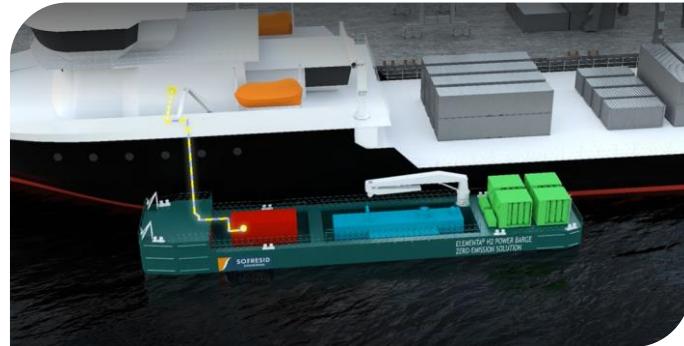
Current consortium None at this stage, but several contacts from previous Call EU application / participation by SOFRESID, as well as SOFRESID's Clients (end-users)

Type of partners we need

- Technology providers (in particular, FC stack developer)
- Laboratory (for testing)
- End-user(s) (for operational data and interest in the future product)

Previous or current participations in projects in this field

- ELEMANTA® H2 PowerBarge / ROUEN Project - Grants awarded by ADEME 2022
- HyBATROSS® (offshore H2 production) / ...
- Integration studies for clients
- Previous EU Call application

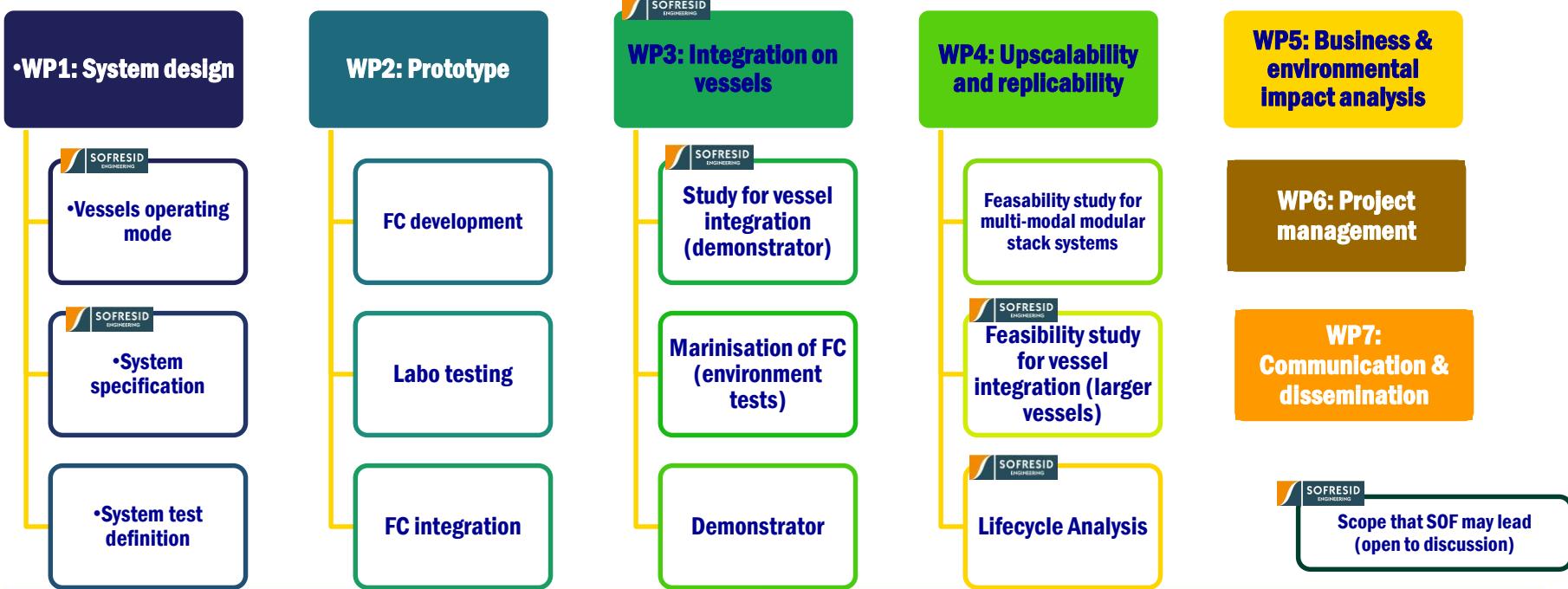


ELEMANTA® H2 power barge



HyBATROSS® 500MW offshore H2 production

Preliminary work packages





7.CNRS ICARE-University of Orléans

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Information

- Toufik BOUSHAKI, associate professor
- CNRS ICARE & Université d'Orléans, academic
- ICARE Laboratory, Orléans. Team: Combustion of biomass and biofuels
- Expertise: combustion of different fuels, optical diagnostics, pollutant emissions

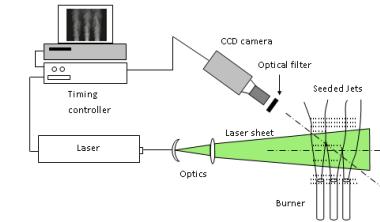
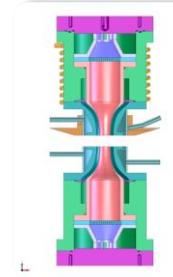
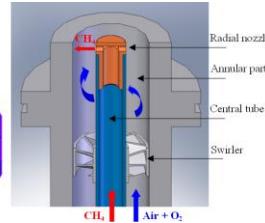
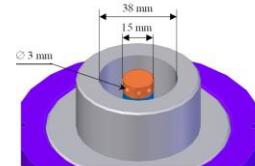
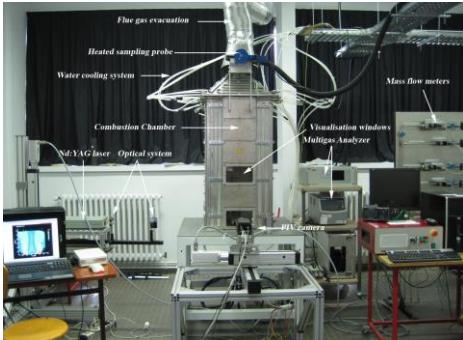
Contact

- E-mail: toufik.boushaki@cnrs-orleans.fr / +33 (02) 38 25 50 70 / +33 (06) 24 05 16 13
- Scholar google: <https://scholar.google.fr/citations?user=kFAgJRoAAAAJ&hl=fr>
<https://www.researchgate.net/profile/Toufik-Boushaki>

Expertise/Competencies

Research topics: Turbulent combustion, Control of flames, Pollutant emissions, Plasma assisted combustion, Optical diagnostics, Heat transfer

Experimental setups: Combustors (up to 30 kW), burners, Measurement techniques



- **Interested by topics**

Scientific priorities and challenges: *Hydrogen end uses - clean heat and power*

HORIZON-JTI-CLEANH2-2023-04-01: Development and validation of high power and impurity tolerant fuel cell systems ready to run on industrial quality dry hydrogen	103
HORIZON-JTI-CLEANH2-2023-04-02: Research on fundamental combustion physics, flame velocity and structure, pathways of emissions formation for hydrogen and variable blends of hydrogen, including ammonia	106
HORIZON-JTI-CLEANH2-2023-04-03: Retrofitting of existing industrial sector natural gas turbomachinery cogeneration systems for hydrogen combustion	109
HORIZON-JTI-CLEANH2-2023-04-04: Hydrogen for heat production for hard-to-abate industries (e.g. retrofitted burners, furnaces).....	113

- **Interested for participating to projects on H2 combustion**

- **Previous projects:** Eranet MED II (H2-CO), Project with Renault (H2-CH4)....



*8. Pitching session
for project ideas and proposition of competencies*

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Association loi 1901, reconnue d'utilité publique

Missions principales :

- Conseiller et élaborer les stratégies de normalisation de nos clients partenaires au niveau national, européen et international
- Animer la normalisation nationale et représenter la France au niveau européen et international
- Elaborer les normes volontaires sur des produits, des services ou des pratiques, par consensus avec les acteurs concernés

250
collaborateurs

19 000
clients

2^{ème}
organisme
de normalisation
européen (CEN)

Top 5
dans le monde, (ISO)



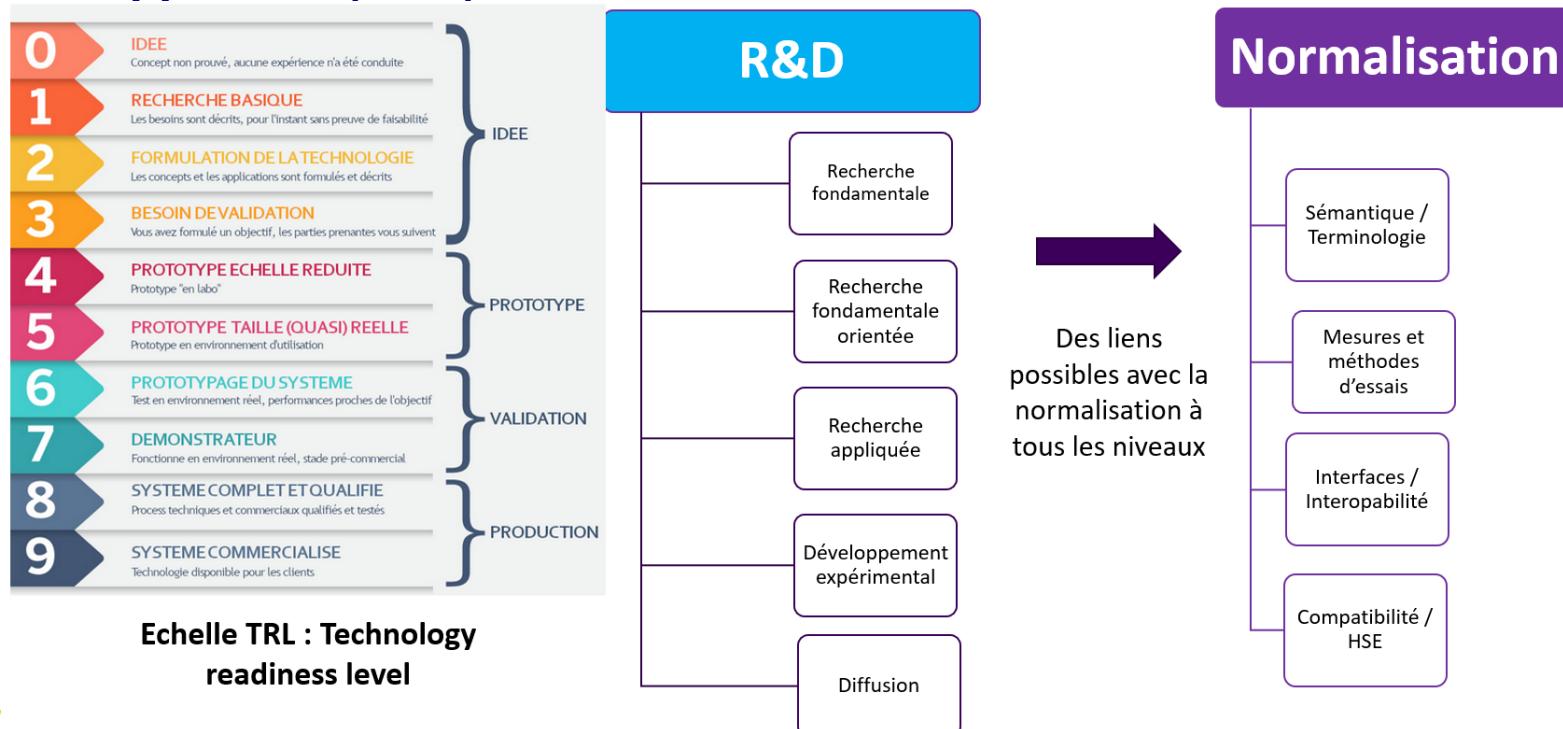
34 525
normes volontaires existent.
Elles concernent **tous les secteurs** de l'économie mondiale.

Source : données AFNOR 2017

Contacts:

- Marie-Emmanuelle CROZET
- Emilie LANGLOIS-BERTRAND
emilie.langloisbertrand@afnor.org
- <https://normalisation.afnor.org/>

Une place pour la normalisation tout au long du processus de recherche et de développement (R&D)



Notre offre de prestations dans le cadre des projets de recherche :

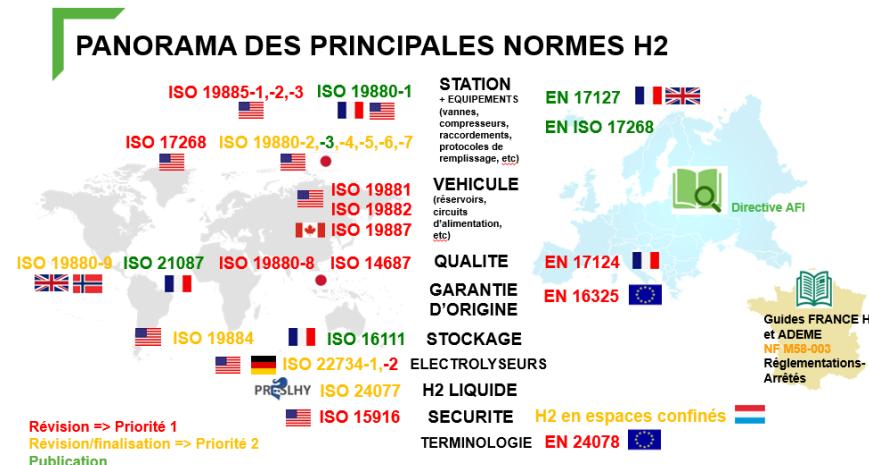
- Une sensibilisation et un accompagnement des membres du consortium à la normalisation tout au long du projet de recherche
- Un état de l'art et des bonnes pratiques au début du projet
- L'établissement de liaisons avec le ou les comités techniques de normalisation européens pertinents
- Une analyse du potentiel de normalisation des données de sortie du projet de recherche
- Accompagnement à la rédaction de documents de référence (en amont de la normalisation)
- Communication et valorisation des résultats du projet

Un socle de normes fondamentales

- Stations et équipements (vannes, compresseurs, raccordements, protocoles de remplissage, etc.)
- Véhicule (réservoirs, circuits d'alimentation, etc.)
- Qualité
- Garantie d'origine
- Stockage
- Electrolyseurs
- Hydrogène liquide
- Sécurité
- Terminologie

Les perspectives de nouveaux projets de normes

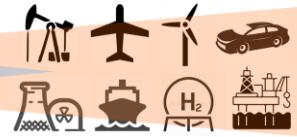
- Autres modes de transports
- Interface avec les réseaux électriques
- Pipelines
- Production d'hydrogène vert
- Mélange gaz naturel
- Durabilité : norme Franco-Brésilienne « Méthodologie de calcul de l'empreinte carbone de la production, du stockage et du transport de l'H2 »



9. French Corrosion Institute

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- Priority: TC01-01 “Innovative electrolysis cells for hydrogen production”, TRL 2-4.
- Possibly: integrating a consortium for SRC-02 “Increasing the lifetime of electrolyzer stacks”, TRL 2-5.
- French Corrosion Institute (IC), SME (Brest, Saint-Etienne & Lyon, 55 employees), non-profit private research organization.
- Industrial (mostly) and academic research in many industrial sectors involving metals/alloys, including hydrogen.
- Large experience in European projects, low to intermediate TRL.
- Brest site (headquarters): R&D activities on corrosion in PEM water electrolyzers (PEMWE).

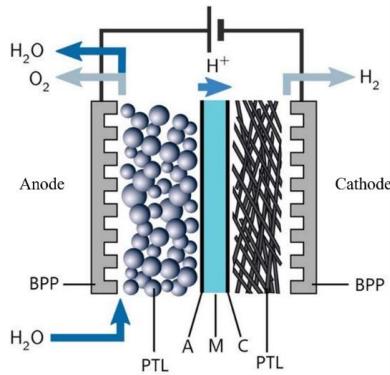


Dr. Michel Prestat (Brest, leader PEMWE activity, michel.prestat@institut-corrosion.fr)

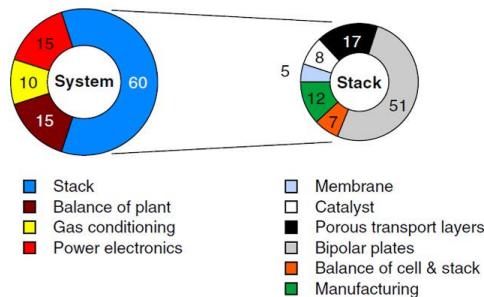


- 16 years of experience in hydrogen technologies (mainly solid oxide fuel cells).
- Thin film engineering: PVD, PLD, CVD, electrodeposition... (corrosion protection, catalysts).
- Coordinator of the French-Swiss project “PROTIS” (ANR, 2023-2026, 3 partners) on novel porous transport layers (PTL) based on stainless steels for PEMWE → **expand to European level (CHP call)**

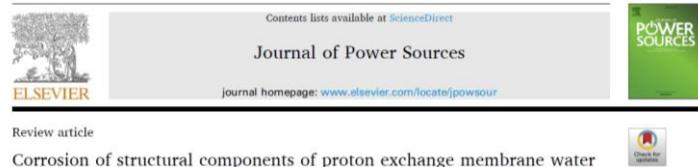
PEMWE working principle



PEMWE costs breakdown



IC's recent review on BPP/PTL corrosion in PEMWE (2023, open-access)



Review article

Corrosion of structural components of proton exchange membrane water electrolyzer anodes: A review

Michel Prestat

French Corrosion Institute - RISE, 220 rue Pierre Rivière, 29200, Brest, France

- Currently: Bipolar plates (BPP) and porous transports layer(PTL) made of expensive titanium protected by precious metal coatings to withstand corrosion on the anode side. BPP + PTL > 50-60% of the stack capex. **Understudied R&D topic in the field PEMWE.**
- **Next-gen PEMWE with stainless steels BPP/PTL (large capex reduction)** with protective coatings (from industrially scalable processes).
- Expertise of IC: corrosion behavior and corrosion protection of stainless steels, selection of stainless steel and coating materials
- Consortium partners: PEM electrolysis (catalysts, membrane, stacks), BPP/PTL manufacturers, thin films/coatings experts ...
- **Role of IC:** from partner to coordinator (depending on the consortium).

Main message: looking for PEM electrolysis partner (with PEMWE stack setups)



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Christine ROUSSELLE

Université d'Orléans, Laboratoire PRISME

Christine.rousselle@univ-orleans.fr

Phone : 0033630977949

Research field : Zero carbon fuel combustion from fundamental to applications

<https://www.univ-orleans.fr/fr/prisme/les-projets/en-cours/ammoniac-comme-carburant>



PRISME

Laboratoire Pluridisciplinaire de Recherche
Ingénierie des Systèmes, Mécanique, Énergétique



- AHGATE : Ammonia-Hydrogen GAs Turbine

- Research on fundamental combustion physics, flame velocity and structure, pathways of emissions formation for hydrogen and variable blends of hydrogen, including ammonia

TOPIC ID: HORIZON-JTI-CLEANH2-2023-04-02

- TRL 2 to TRL 4 Fundamental combustion knowledge improvement for Dried Low emissions gas turbine

- Short description of the project :

- Ammonia will be the main hydrogen carrier due to its low cost of storage and transport.

- H₂/NH₃/N₂ blend from Partial cracking of ammonia could be attractive in comparison to 100%H₂ or 100%NH₃

- Reduction of NOX ? Needs more EGR ?

- Flame stability ? Different combustors technologies (plasma, Mild combustor,...)

- Accurate simulation tools ?

- Materials for H₂/NH₃/N₂ combustors?

- Thermoacoustics? Novel injection technologies (stratified, localized diffusive, etc.)



PRISME

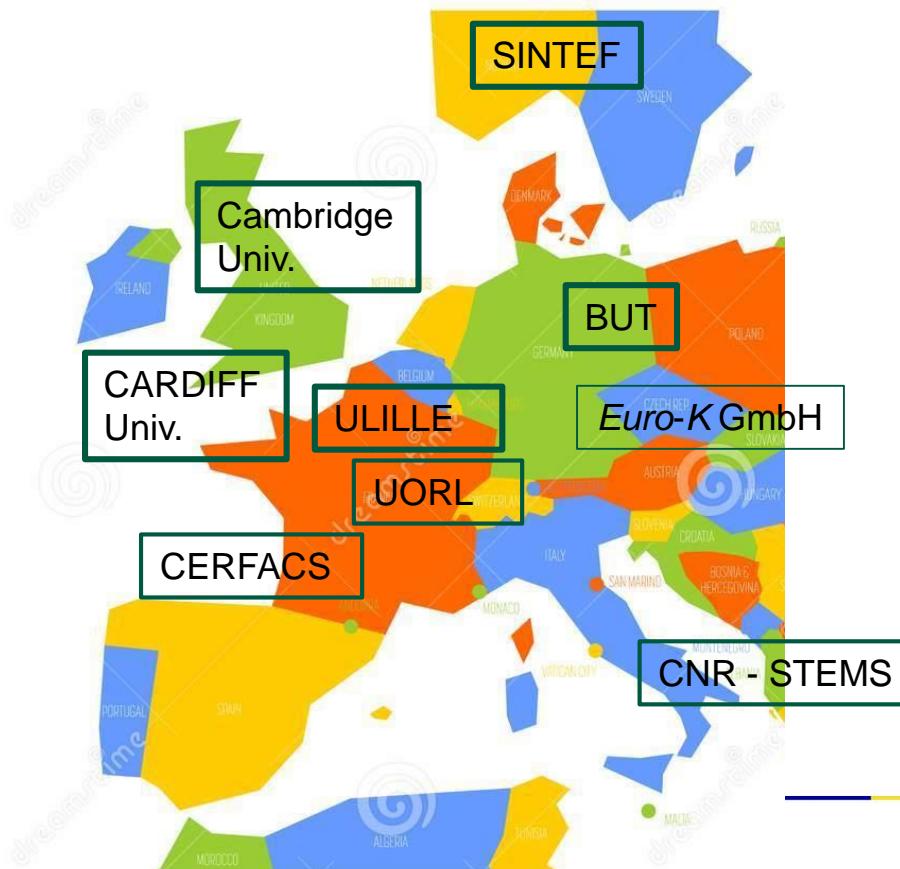
Laboratoire Pluridisciplinaire de Recherche
Ingénierie des Systèmes, Mécanique, Énergétique



- AHGATe : Ammonia-Hydrogen GAs Turbine
- **Research on fundamental combustion physics, flame velocity and structure, pathways of emissions formation for hydrogen and variable blends of hydrogen, including ammonia**
TOPIC ID: HORIZON-JTI-CLEANH2-2023-04-02
- TRL 2 to TRL 4 Fundamental combustion knowledge improvement for Dried Low emissions gas turbine
 - WP1 : Kinetics of ammonia/hydrogen/nitrogen oxidation and pollutant formations (NO)
 - WP 2 : Partially cracked ammonia combustion characteristics
 - WP3 : Lab -scale burners for gas turbine applications: improvement and comprehensive impact assessment of partially cracked ammonia from experimental database
 - WP 4 : Improvement of simulation tools for gas turbine applications
 - WP 5: Materials development for combustion components using H₂/NH₃/N₂



AHGATE : Ammonia-hydrogen Gas Turbine



4 universities
3 research centers
1 Sme - μ GT
1 Gas manufacturer (not yet ?)

Interdisciplinary : chemist, physics,
engineers



11.De Vinci Research Center

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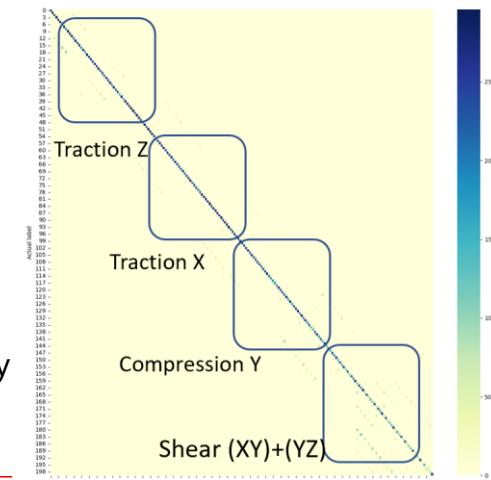
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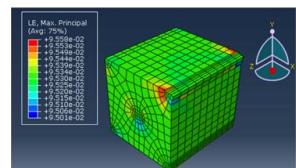
- Achraf KALLEL
- DeVinci Research Center (academic)
- Modelling of structures and materials behaviors, Machine learning
- achraf.kallel@devinci.fr , +33 1 81 00 27 36
- <https://www.linkedin.com/in/achraf-kallel-27592320/>

If you want to present a project idea, on slide 2 and 3 please indicate:

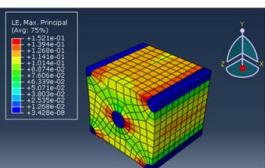
- Project title : Study of composite polymer degradation under high pressure for hydrogen vessel by machine learning approach
- Study and multi-scale modeling of the behavior and damage of materials and composite structure of hydrogen tanks: Digital twin of the vessel subjected to extreme thermomechanical stresses.
- Type of partners you need : Composite manufacturer, Automotive companies, Energy field company...



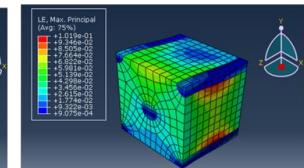
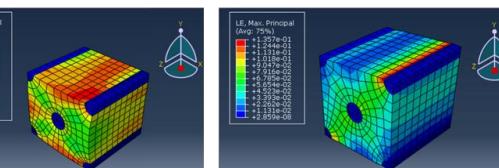
Traction



Compression



Shear





If you want to present a competence offer, on slide 2 and 3 please indicate:

- Your expertise and competencies and those of: your organisation /department /team
- The topics you are interested in (one or some topics)
- Your previous or current participations in projects in this field



12. Pitching session for project ideas and proposition of competencies

07/02/2023 – Webinaire Horizon Europe/Clean Hydrogen



Who we are?

IRT Jules Verne (Nantes, France), RTO

Website: <https://www.irt-jules-verne.fr/en/>



The industrial and collaborative research centre dedicated to manufacturing:

- >100 R&D projects
- 18 EU projects
- ~50 Industrial Members
- 25 M€ Annual Revenue

Bianca Dibari, European Project Expert

bianca.dibari@irt-jules-verne.fr

+33 7 48 13 68 93 | +33 2 55 11 21 05

Topic of interest:

HORIZON-JTI-CLEANH2-2023-07-01: Advanced materials for hydrogen storage tanks

Our Work in this field: LH2 Onboard Storage Tank

- Participation in the French project NOMADE focusing on the LH2 tank thermal insulation optimization
 - Thermal simulation of the LH2 tank with a focus on the insulation
 - MLI (Multi-Layer-Insulation) material optimization with modelling support
 - Automatization of the MLI lay-up process
 - Optimization of the vacuum packing step of the tank double wall
 - Definition of the optimum assembling set-up and parameters
 - Development of non-destructive methodologies to control the insulation performances

IRT Jules Verne Added Value

- Thermal and thermomechanical simulation with Modelica (open source)
- Composites and metallic processes
- Non-destructive control and SHM (Structural Health Monitoring) of tank
- Robotic and process automatization



*13. Pitching session
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Program HyMEET (Hydrogen Materials & Equipments Engineering & Testing)

- Material characterization, Qualification of Fluids systems components (pumps, valves, piping systems, tanks ...)
- R&D support toward H2 roadmap ; Training, Consulting, LCA, Risk analysis

Clean Hydrogen Partnerships Team

- Djea DJEAPRAGACHE – Manager for European Projects
 - Djea.Djeapragache@cetim.fr
 - +33 6 70 01 53 11

Jeremy VIALE – Partnership Manager for Hydrogen
Jeremy.viale@cetim.fr
+33 6 45 32 48 84

Example of Eu Project : Clean Hydrogen 2022 : H2REF-DEMO

- Developpment of innovative compression systems for refueling station
- Consortium : Cetim (coord) ; H2NOVA ; UTC ; HRS ; FABER ; HYDAC ; UNIMORE

Topics of interest for Cetim on Clean Hydrogen Partnerships 2023

- HORIZON-JTI-CLEANH2-2023-02-02: Pre-Normative Research about the compatibility of transmission gas grid steels with hydrogen and development of mitigation techniques
- HORIZON-JTI-CLEANH2-2023-02-05: Demonstration of LH2 HRS for Heavy Duty applications
- HORIZON-JTI-CLEANH2-2023-03-01: Real environment demonstration of Non-Road Mobile Machinery (NRMM)
- HORIZON-JTI-CLEANH2-2023-07-01: Advanced materials for hydrogen storage tanks

Description of Cetim activities on Hydrogen

R&D Roadmap

WP1: Material characterization in H₂ environment

WP2: Design & manufacturing tools development

WP3: Qualification & control of equipment in H₂

WP4: Materials & equipments in environment related to H₂ applications

WP5 : Standardization

WP6: Dissemination

Scope of activities

System Performance Mastering

Sealing characterization



Qualification Fluids Systems

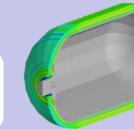


Materials Products Processes Engineering

Manufacturing process and Monitoring



Characterization Materials & Surfaces



Modelling Design and Sizing

Sustainable Industrial Transformation



Standard, Regulation, Safety



Consulting, Expertise, Training





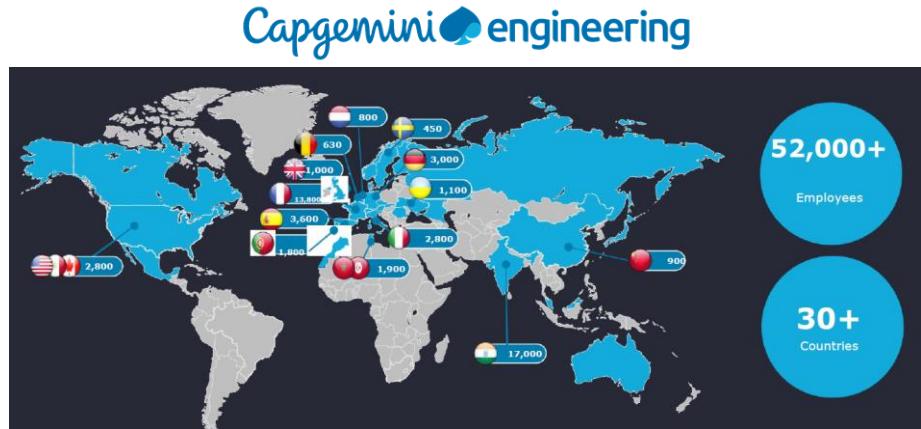
Capgemini Engineering Expertise for Clean Hydrogen topics

07/02/2023 – Webinaire Horizon Europe/Clean Hydrogen



Capgemini Engineering :

- Large Business Company with 55,000 engineer and scientist team members in many countries in Europe and other areas
- Many technical fields covered among Horizon Europe destinations
- Today's presentation : Capgemini Engineering – Research and Innovation department (200 researchers) in Toulouse (**France**)
- My name : Sylvain RAYNAL, local focal point of co-funded projects in R&I department
- sylvain.raynal@capgemini.com





Our expertises

Systems Engineering & Architecture	Physical & Mechanical Engineering	Embedded systems and software	E2E Supplier & Customer Management	Quality, Manufacturing & Infrastructure	Industrial performance
<p>45 engineers</p> <ul style="list-style-type: none">Requirement Based Systems Engineering (RBSE)Model Based Systems Engineering (MBSE)Architecture tradeoffs Multidisciplinary optimization(MDO)Verification & Validation Strategy (V&V)	<p>470 engineers</p> <ul style="list-style-type: none">Mechanical Engineering (incl. eco design)Fluid & Thermal EngineeringMaterials Chemistry & ProcessSystem Installation & IntegrationAcoustics & VibrationsFlight ScienceMulti-physics Modelling & Optimization	<p>360 engineers</p> <ul style="list-style-type: none">Electrical EngineeringElectronic equipment, Mechatronics & RoboticsControl, Monitoring & Display SystemsConnectivity & TelecommunicationRAMS & Health MonitoringSystem modelling & Simulation	<p>215 engineers</p> <ul style="list-style-type: none">Purchasing & Cost improvementsQuality Supply ChainSupply Chain performanceOrdering & SchedulingLogisticsCustomer Support and Services	<p>400 engineers</p> <ul style="list-style-type: none">Quality Management SystemQuality Assurance for Process & ProductManufacturing Operations & Lean ManufacturingProduction line simulation & flow modellingIndustrial Asset & maintenanceCostingIndustrial Operations Engineering	<p>320 engineers</p> <ul style="list-style-type: none">Project ManagementCommunication & MarketingDigital LearningHealth, Safety & Environment

Dedicated Research and Innovation Center – 200 PhDs, 30% engineers involved

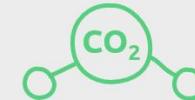
R&I Center:

- Large experience in National and European projects (coordinator or participants)
- 28 internal research projects
- Many partnerships



1+1=3

Collaboration at the heart of our research approach



We are committed to reduce our own and our clients' CO2 footprint



Capgemini engineering

R&I CENTER

We pioneer intelligent & sustainable mobility & energy to create amazing assets via partnerships

R&I projects to reshape industries

7

21

R&I projects to redefine engineering



1 FabLab To prototype & test



8 national and European co-funded projects



Topics of interest:

Turbomachinery, energy systems

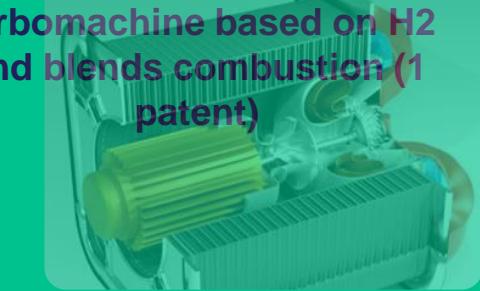
H2 storage

Training content on H2

- Topic 2023-01-06 : Valorisation of by-product O₂ and/or heat from electrolysis
- Topic 2023-04-02: Research on fundamental combustion physics, flame velocity and structure, pathways of emissions formation for hydrogen and variable blends of hydrogen, including ammonia
- Topic 2023-04-03: Retrofitting of existing industrial sector natural gas turbomachinery cogeneration systems for hydrogen combustion
- Topic 2023-04-04: Hydrogen for heat production for hard-to-abate industries (e.g. retrofitted burners, furnaces)

What we have and can offer?

- H2 modelling and simulation (combustion, leaks, ...)
- Expertise in thermodynamics
- National project HyPropE with turbomachine based on H2 and blends combustion (1 patent)



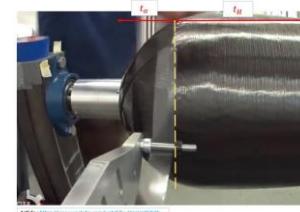
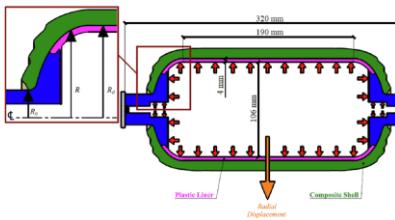
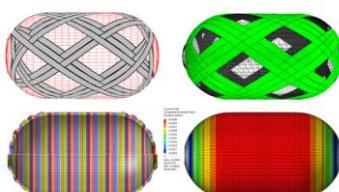
Topics of interest:

Turbomachinery, energy systems

H2 storage

Training content on H2

- Topic 2023-07-01: Advanced materials for hydrogen storage tanks
- Topic 2023-05-03: Pre-Normative Research on the determination of hydrogen releases from the hydrogen value chain



What we have and can offer?

- **H2 modelling and simulation (leaks, multiphase...)**
 - Materials and structural modelling calculation, simulation
- Internal projects on hydrogen storage



Topics of interest:

Turbomachinery, energy systems

H2 storage

Training content on H2

- Topic 2023-05-02: European Hydrogen Academy

What we have and can offer?

- Existing certified training on H2 in collaboration with ISAE-Supaero
 - Expertise on e-learning trainings
 - Network to train professionnals

Conclusion

- **Looking for partners with shared interest on these topics**
- Non-exhaustive list! Other Capgemini entities also interested

- My contact: sylvain.raynal@capgemini.com

- Main website : <https://capgemini-engineering.com/nl/en/services/engineering-and-rd/>





*15. Pitching session
for project ideas and proposition of competencies*

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Production d'hydrogène

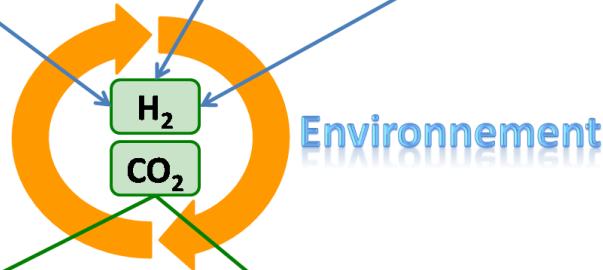
Gazéification de la **biomasse**
intensifiée par la réaction
de Water Gas Shift

Reformage du CH₄
avec/sans
capture de CO₂

Reformage à la
vapeur des
bio-alcools

Energie

Environnement



Power-to-X

Dr Ksenia PARKHOMENKO

ICPEES, UMR 7515 CNRS – Unistra

Département « Catalyse et Matériaux »

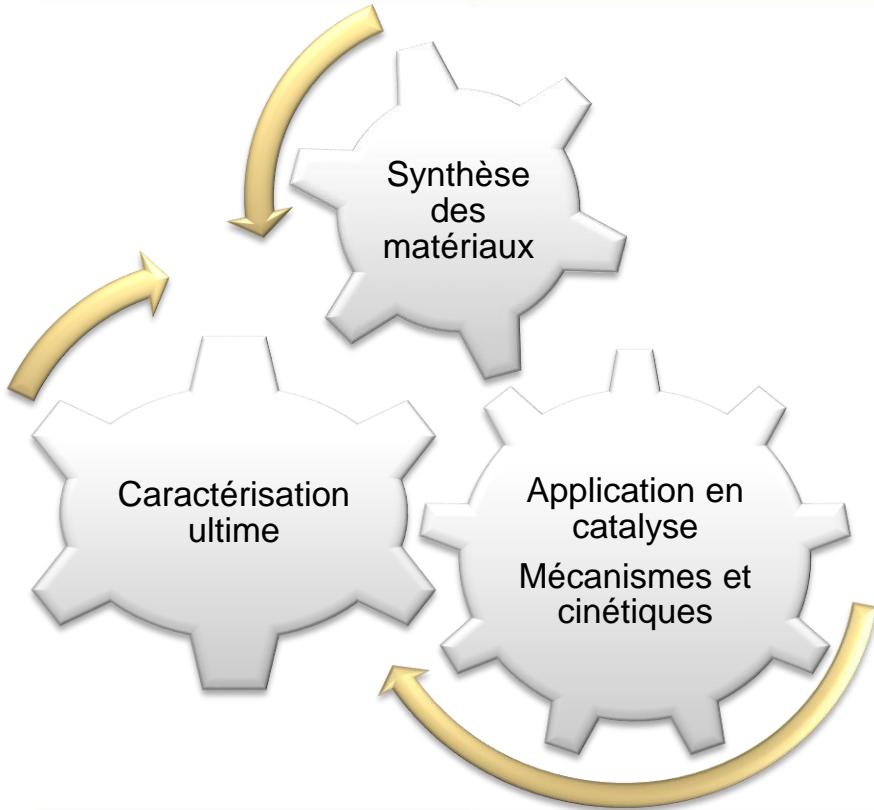
Equipe « Energie et Carburants pour un Environnement Durable »

5 projets en cours : 2 projets ANR,
3 projets CPER et 2 projets MICA

5 chercheurs et enseignants-
chercheurs, 1 technicien,
7 doctorants, 4 stagiaires master

<http://icpees.unistra.fr/>

parkhomenko@unistra.fr



ANR CHEEC 2021-2025 – couplage de HTE et catalyse hétérogène (CO_2 vers éthylène)
<https://anr.fr/Projet-ANR-20-CE05-0023>

- 1) Valorisation of by-product O_2 and/or heat from electrolysis
- 2) Innovative electrolysis cells for hydrogen production (high or intermediate temp.)
- 3) Waste to Hydrogen demonstration plant
- 4) Small and Large-scale Hydrogen Valley
- 5) European Hydrogen Academy