



# **EuroTech Winter School**

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**9<sup>th</sup> to 13<sup>th</sup> October 2023**

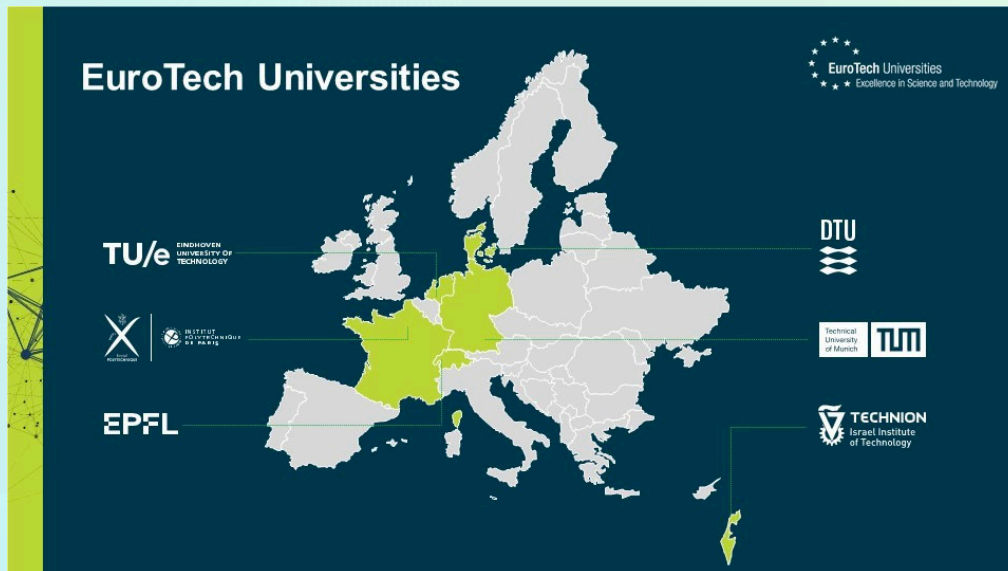
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**ACCELERATING HYDROGEN:  
TOWARDS SUSTAINABLE PRODUCTION, STORAGE,  
AND CONVERSION TECHNOLOGIES**

## About the EuroTech Universities Alliance

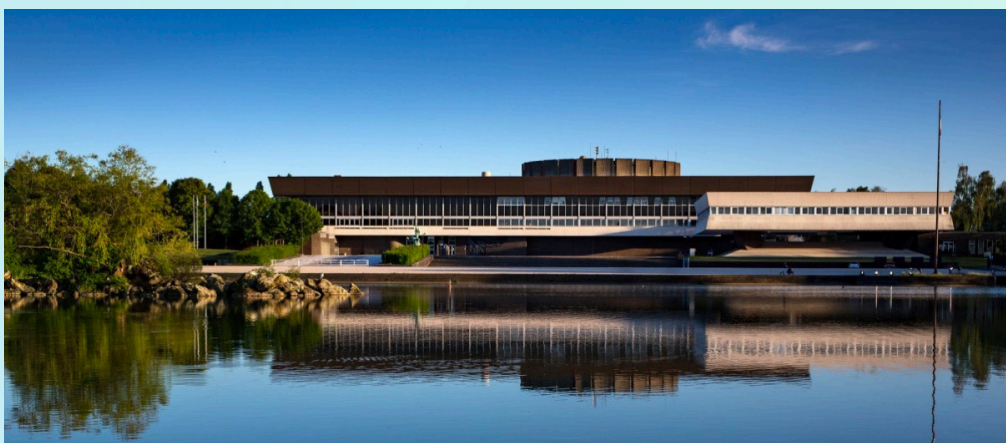
The EuroTech Universities Alliance is a strategic partnership of leading European universities of science and technology joining forces to build a strong, sustainable, sovereign, and resilient Europe. The partners bring their excellence in research and education, their active engagement in vibrant eco-systems and service to society. Together, they join forces to accelerate their research in high-tech focus areas and advocate for change, through dedicated partners and a strong presence in Brussels.

Based on the EuroTech values, the partners aspire to a new level of cooperation by bringing together their inclusive, diverse and sustainable campuses. The EuroTech Universities create a unique environment for international talents to lead a new generation of change agents in research, entrepreneurship, industry and society.



## About École Polytechnique

École Polytechnique, also known as L'X, is the leading French institution combining top-level research, academics, and innovation at the cutting-edge of science and technology. Its various undergraduate and graduate-level programs – Bachelor of Science, Ingénieur Polytechnicien (Master's level program), Master's, and PhD – are highly selective and promote a culture of excellence with a strong emphasis on science, anchored in humanist traditions. As a widely internationalized university, École polytechnique offers a variety of international programs and attracts a growing number of foreign students and researchers from around the globe (currently 41% of students and 40% of faculty members). École polytechnique offers an exceptional education to prepare bright men and women to excel in top-level key positions and lead complex and innovative projects which meet the challenges of 21st century society, all while maintaining a keen sense of their civil and social responsibilities. With its 23 laboratories, 22 of which are joint research units with the French National Center for Scientific Research (CNRS), École polytechnique Research Center explores the frontiers of interdisciplinary knowledge to provide major contributions to science, technology, and society. École polytechnique is a founding member of Institut Polytechnique de Paris.





## ***The Hydrogen Winter School***

The EuroTech Universities Alliance offers PhD candidates of its six partner institutions the opportunity to organise a winter school to meet their peers from the other partner institutions while getting together for a week full of scientific lectures on a specific scientific topic, industry visits, leisure, and networking moments.

This year, the Hydrogen life cycle was chosen as topic to allow the participants to learn more on Hydrogen production, conversion and storage and therefore, continue the growing process of the scientific community specialising on Hydrogen within EuroTech.

Hosted by École Polytechnique and coordinated by PhD candidates of École Polytechnique, this second edition **ACCELERATING HYDROGEN: TOWARDS SUSTAINABLE PRODUCTION, STORAGE, AND CONVERSION TECHNOLOGIES** will take place from October 9<sup>th</sup> to 13<sup>th</sup>, 2023.

## ***The coordinators of the Winter School 2023***



**MARIE-SOPHIE DIAS FERNANDES**

PhD candidate, École Polytechnique

Research project: Study of the electrocatalytic properties of porous heterofunctional materials by electrochemistry and X-ray absorption spectroscopy



**CATHERINE HARVEY**

PhD candidate, École Polytechnique

Research project: Shielded Carbon-Supported Iridium Nanoparticles for the Catalysis of Seawater Electrolysis



**SEBASTIAN VALLEJO JIMENEZ**

PhD candidate, École Polytechnique/ENSTA

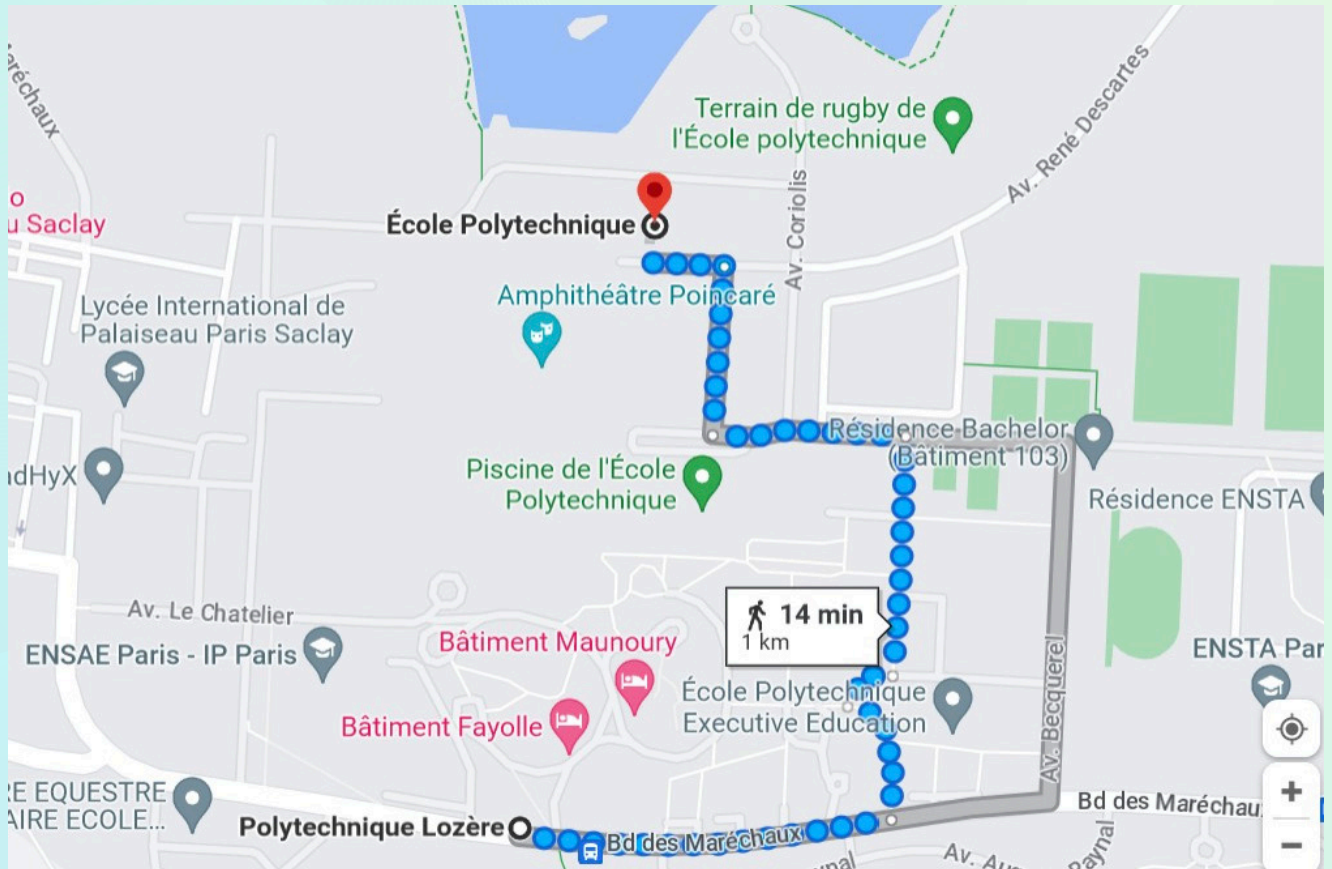
Research project: Valorization of carbon dioxide and hydrogen extracted from an aquatic environment

## Winter School on École Polytechnique's campus

Meeting Point on Monday, October 9<sup>th</sup>, 2023:

11:45 – 12:00 CET

Cour Vaneau (the large courtyard opposite the lake, indicated by the red dot)



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# Agenda of the Hydrogen Winter School

## Monday, 9<sup>th</sup> October 2023

### Day 1: The hydrogen value chain and the geo-economics context

<b>11h45 - 12h00</b>	<p><b>Arrival</b> Meeting point: Cour Vaneau (see map on the previous page)</p>
<b>12h00 - 13h15</b>	<p><b>Welcome Coffee</b> Salle à manger des Cadres</p>
<b>13h30-14h00</b>	<p><b>Opening speech</b> Dominique Rossin, Provost of École Polytechnique Amphitheater Poisson</p>
<b>14h00-14h30</b>	<p><b>Presentation of École Polytechnique, host of the winter school 2023</b> -Introduction of the organizers: Catherine Harvey, Marie-Sophie Dias Fernandes, Sebastian Vallejo Jimenez, PhD candidates at the Molecular Chemistry Laboratory (LCM), École Polytechnique</p>
<b>14h30-15h30</b>	<p><b>Lecture – The Quest for a Viable and Sustainable Hydrogen Value Chain</b> (followed by 15min Q&amp;A) <b>Dr. Nouaamane Kezibri</b>, Design &amp; Modeling Project Manager –Total Energies <i>Amphitheater Poisson</i></p>
<b>15h30</b>	<p>Coffee break</p>
<b>15h45-16h45</b>	<p><b>Lecture – Introduction to hydrogen geopolitics and geoeconomics:</b> The political economy of globalized hydrogen value chains, from hydrogen strategies to market dynamics. (followed by 15minQ&amp;A) <b>Mr. Mikaa Blugeon-Mered</b>, Lecturer on Hydrogen Markets, Diplomacy and Geopolitics –Sciences Po <i>Amphitheater Poisson</i></p>
<b>17h00</b>	<p><b>Q&amp;A Roundtable Session</b></p>
<b>17h30</b>	<p><b>Logistical Information for the following day</b></p>
<b>19h00</b>	<p><b>Dinner</b> Restaurant: <b>Restaurant 19</b> 19 Cours Gilbert Simondon, 91120 Palaiseau</p>



# Agenda of the Hydrogen Winter School

**Tuesday, 10<sup>th</sup> October 2023**

## **Day 2 : Industry Visit: Synchrotron**

Address Synchrotron: L'Orme des Merisiers Départementale 128, 91190 Saint-Aubin

<b>8h00</b>	<b>Meeting Point : Bus stop "Polytechnique Lozère"</b> (in front of the ENSAE building)
<b>8h20-8h45</b>	<b>Arrival at Synchrotron</b> Distribution of the badges
<b>8h45-9h00</b>	<b>Morning Coffee</b>
<b>9h00-10h00</b>	<b>Industry Visit: Synchrotron</b> General Introduction by a representative of Communications Committee at Synchrotron Soleil
<b>10h00-13h00</b>	<b>Group A (15 people):</b> - 10h00 – 12h00: Site guided tour - 12h00 – 13h00: Poster Session – 3 min presentation per participant <b>Group B (15 people):</b> - 10h00 – 13h00: Beamline Experiments
<b>13h00-14h00</b>	<b>Group A (15 people) &amp; Group B (15 people):</b> - <b>Lunch and poster session</b>
<b>14h00-17h00</b>	<b>Group A (15 people):</b> - Beamline Experiments <b>Group B (15 people):</b> - 14h00 – 15h00: Poster Session – 3 min presentation per participant - 15h00 – 17h00: Site guided tour
<b>17h00</b>	<b>End of the visit</b>
<b>19h00</b>	<b>Dinner</b> - <b>Restaurant: Gramophone</b> Address: 27 Bd Dubreuil, 91400 Orsay

# Agenda of the Hydrogen Winter School

Wednesday, 11<sup>th</sup> October 2023

## Day 3 : Hydrogen production

<b>8h30-8h45</b>	<b>Meeting Point:</b> at the main reception ("Accueil") of École Polytechnique
<b>08h45 - 09h00</b>	<b>Welcome coffee</b> Amphitheater at Drahi-X Novation Center
<b>09h00 - 09h45</b>	<b>Lecture – Hydrogen production from water electrolysis: an overview</b> (followed by 15min Q&A)  Focus on the concept of water electrolysis, recalling some of the underlying scientific aspects (thermochemistry, kinetics, efficiency), describing some key technologies, and putting into perspective research and development efforts aimed at overcoming current constraints and limitations. (followed by 15min Q&A)  <b>Professor Loïc Assaud</b> Maître de Conférences – HDR, Recherche et Innovation en Electrochimie pour l’Energie, Université Paris-Saclay  <i>Amphitheater at Drahi-X Novation Center</i>
<b>09h45 - 10h30</b>	<b>Lecture – LT Alka Electrolysis</b>  Focus on the understanding and development of electrocatalysts and electrodes with improved performance and durability, employing advanced and high throughput electrochemical testing as well as operando spectro-electrochemical techniques, with emphasis on accessing technologically relevant operating conditions. (followed by 15min Q&A)  <b>Professor Christodoulos Chatzichristodoulou</b> Senior Researcher, Department of Energy Conversion and Storage, Technical University of Denmark (DTU)  <i>Amphitheater at Drahi-X Novation Center</i>
<b>10h30</b>	<b>Coffee break</b>
<b>10h45 - 11h30</b>	<b>Lecture – Natural hydrogen: from the generation to its use</b> The lecture will present the different natural sources of H <sub>2</sub> and will question whether natural hydrogen can be of economic interest. (15min Q&A)  <b>Dan Levy</b> , post-doctoral researcher at the Institut de physique du globe de Paris  <i>Amphitheater at Drahi-X Novation Center</i>

# Agenda of the Hydrogen Winter School

Wednesday, 11<sup>th</sup> October 2023

## Day 3 : Hydrogen production

<b>11h30 – 12h15</b>	<p><b>Lecture - Hydrogen Production by Proton Exchange Membrane Water Electrolysis</b> (followed by 15min Q&amp;A)</p> <p>First thermodynamic and kinetic data on water decomposition will be provided to produce clean hydrogen in an electrolysis cell. The energy efficiency of the process will be discussed in the light of some laboratory results. Finally, some electrolyzer platforms manufactured in the industry will be considered.</p> <p><b>Professor Claude Lamy, Institut Charles Gerhardt de Montpellier (ICGM), UMR 5253 CNRS – University of Montpellier, ELFE (Electrochemistry for Energy)</b></p> <p><i>Amphitheater at Drahi-X Novation Center</i></p>
<b>12h15-13h00</b>	Lunch at the internal location "Salle des cadres"
<b>13h00 – 15h30</b>	<p><b>Industry visit: Elogen</b> Address: 8 Av. du Parana, 91940 Les Ulis</p> <p><b>Group A</b> (15 people): - 13h00 – 13h45: Travel to Elogen - 14h00- 15h30: Elogen Presentation and Production Facility Visit - 15h30- 16h30: Return to École Polytechnique</p> <p><b>Group B</b> (15 people): Drahi-X Novation Center, Amphitheater - 13h00 – 13h45: Seminar with Professor Pierre Millet, R&amp;D Director of Elogen - 13h45 – 14h30: Seminar with Jean-Baptiste Choimet, CEO of Elogen</p>
<b>15h30-18h00</b>	<p><b>Industry visit: Elogen</b> Address: 8 Av. du Parana, 91940 Les Ulis</p> <p><b>Group A</b> (15 people): Drahi-X Novation Center, Amphithéâtre - 16h30 – 17h15: Seminar with Elogen R&amp;D Director Professor Pierre Millet - 17h15 – 18h00: Seminar with Elogen CEO Jean-Baptiste Choimet</p> <p><b>Group B</b> (15 people): - 14h30 – 15h30: Travel to Elogen - 15h30- 17h00: Elogen Presentation and Production Facility Visit - 17h00- 18h00: Return to École Polytechnique</p>
<b>19h00</b>	<p><b>Dinner:</b> - <b>Restaurant 19</b> 19 Cours Gilbert Simondon, 91120 Palaiseau</p>



# Agenda of the Hydrogen Winter School

Thursday, 12<sup>th</sup> October 2023

**Day 4** : Downstream of the value chain: conversion and applications

Industry visit: Engie

Address: 4, rue Joséphine Baker 93240 Stains

<b>8h40</b>	<b>Meeting Point:</b> at the main reception ("Accueil") of École Polytechnique
<b>08h45 - 09h00</b>	<b>Welcome coffee</b> Amphitheater Sauvy
<b>09h00 - 09h45</b>	<b>Lecture (hybride mode) – Predictive Chemical Kinetics: Methods and Applications</b> How to use automated open-source software tools to study reactive chemical systems, predict their behavior, and require less experimental trial and error. Examples taken from the worlds of ammonia as an alternative fuel, sustainable aviation fuels, and fuel cells for power generation from hydrogen. (followed by 15min Q&A)  <b>Professor Alon Grinberg Dana, Head of the Kinetics and Chemical Technology Lab, Technion – Israel Institute of Technology</b>  <i>Amphithéâtre Sauvy</i>
<b>09h45 - 10h30</b>	<b>Lecture – CO<sub>2</sub> Conversion Seminar</b> (followed by 15min Q&A)  <b>Professor Olivier Guaitella, Research Engineer, HDR. Low Temperature Plasmas Team, Plasma Physics Laboratory, École Polytechnique</b>  <i>Amphithéâtre Sauvy</i>
<b>10h30-10h45</b>	<b>Coffee break</b>
<b>10h45 - 11h35</b>	<b>Lecture (hybride mode) – Solid Oxide Fuel Cells</b> (followed by 15min Q&A)  <b>Professor Anke Hagen, Professor, Department of Energy Conversion and Storage · Solid State Electrochemistry, Technical University Denmark (DTU)</b>  <i>Amphithéâtre Sauvy</i>

# Agenda of the Hydrogen Winter School

**Thursday, 12<sup>th</sup> October 2023**

**Day 4** : Downstream of the value chain: conversion and applications

*Industry visit: Engie*

*Address: 4, rue Joséphine Baker 93240 Stains*

<b>11h35-12h30</b>	<b>Lunch</b> at École Polytechnique's canteen (Le Magnan)
<b>12h30-14h00</b>	<b>Industry Visit: Engie</b> Address: 4, rue Joséphine Baker. 93240 Stains  - 12h30 – 14h00: Travel to Engie - 14h00 – 17h00: Presentation of the work with Hydrogen and visit of a production site - 17h00 – 18h00: Return to Paris
<b>18h00-19h15</b>	<b>Leisure Activities</b> <b>Visit Paris by boat</b> : Bateau Mouche, Porte de la Conférence, 75008 Paris
<b>20h00</b>	<b>Dinner</b> <b>Restaurant Buisson Ardent</b> Address : 25 Rue Jussieu, 75005 Paris

# Agenda of the Hydrogen Winter School

Friday, 13<sup>th</sup> October 2023

## Day 5: Hydrogen Storage

<b>8h40</b>	<b>Meeting Point:</b> at the main reception ("Accueil") of École Polytechnique
<b>08h45 – 09h00</b>	<b>Welcome coffee</b> Amphitheater Lagarrigue
<b>09h00 – 09h45</b>	<b>Lecture – Modeling and Handling Hydrogen based systems with Modelica</b> (followed by 15min Q&A) <b>Dr. Dina Irofti and Dr. Luis Corona Mesa-Moles, Research Engineers, EDF R&amp;D</b>  <i>Amphithéâtre Lagarrigue</i>
<b>09h45 – 10h30</b>	<b>Lecture – Subsurface H2 storage and natural reservoirs</b> (followed by 15min Q&A) <b>Professor Maja Rücker, Assistant Professor, Mechanical Engineering Department at the Eindhoven University of Technology(TU/e)</b>  <i>Amphithéâtre Lagarrigue</i>
<b>10h30-10h35</b>	<b>Coffee break</b>
<b>10h45 – 11h35</b>	<b>Lecture – Hydrogen Storage: gas phase, physisorption, chemisorption, metal hydrides, complex hydrides</b> (followed by 15min Q&A)  <b>Lecture 2 - Lecture – Hydrogen Production: electrolysis, alkaline, PEM, SOE, steam reforming of methane, coal and thermal reduction</b> (followed by 15min Q&A)  <b>Professor Andreas Züttel, Laboratory of Materials for Renewable Energy (LMER), EPFL</b>  <i>Amphithéâtre Lagarrigue</i>
<b>11h45-12H30</b>	<b>Lecture – Unleashing Porous Materials Potential: Atomistic Insights for Efficient Hydrogen Storage.</b>  Explore the hydrogen frontier with atomistic simulations as we delve into the science behind optimizing porous materials for hydrogen storage. Discover short 'Good practices' guidelines for your research. (followed by 15min Q&A)  <b>Professor Azahara LunaTriguero, Assistant Professor, Energy Technology Department of Mechanical Engineering, TU/e</b>  <i>Amphithéâtre Lagarrigue</i>



# Agenda of the Hydrogen Winter School

Friday, 13<sup>th</sup> October 2023

**Day 5: Hydrogen Storage**

<b>12h30 – 13h00</b>	<b>Lunch</b> ( <i>Salle des Cadres</i> )
<b>13h15 – 14h00</b>	<b>Lecture – Hydrogen Storage</b> (followed by 15min Q&A) <b>Professor Alexandre Dimanov, researcher at the Solids Mechanics Laboratory, CNRS/ École Polytechnique</b> <i>Amphithéâtre Lagarrigue</i>
<b>14h00- 15h00</b>	<b>Fête de la Science, École Polytechnique</b>

