

MSCA PhD opening in advanced Life Cycle Assessment of next-generation low-fossil-carbon chemicals

Do you dream of carrying out research with real impact? Do you want to contribute to Europe's transition towards greener, electrified industrial processes and help shape the chemical industry of tomorrow? You want to be part of a Europe-wide consortium of PhD students working on the same challenge under a variety of different angles, also including academic leaders as well as European companies engaged in the transition towards a low fossil carbon economy?

Here is your chance!

Basic information

MSCA Doctoral Network: PRIME LEAP - *Next-generation intensified chemical processes integrating plasma and single-atom catalysis*

Doctoral Candidate (DC) position: DC 11

PhD title: *Drivers of Environmental Performance in Low-Fossil-Carbon Chemical Pathways: Prospective LCA Methods to Compare Plasma–Catalytic Methane Valorisation with Fossil and Bio-Based Alternatives*

Research fields: Engineering > Chemical -, Process -, System -, Environmental -

Type of contract: Temporary

Job status: Full-time

Duration: 36 months

Host institution: INSA Toulouse, Toulouse Biotechnology Institute, Toulouse, France

Doctoral enrolment: INSA Toulouse / University of Toulouse doctoral programme / MEGEP PhD School

Expected start date: As soon as possible and no later than 30 December 2026, after completion of recruitment, MSCA eligibility checks, visa procedures if applicable, HR procedures and PhD admission.

Application deadline for full consideration: 30th August 2026, 23:59 Brussels time

Reference number: 101227012

EU funding programme: Horizon Europe / Marie Skłodowska-Curie Actions Doctoral Network

Application mode: By email; see instructions

Offer description

PRIME LEAP, *Next-generation intensified chemical processes integrating plasma and single-atom catalysis*, is a Horizon Europe Marie Skłodowska-Curie Doctoral Network dedicated to pioneering next-generation electrified chemical processes. It is positioned in the context of a highly decarbonised future in Europe, where the chemical industry will need to reduce its dependence on fossil carbon and fossil energy. For industries producing platform chemicals such as ethylene, a major precursor for polymers and other chemical intermediates, this transition may involve the progressive electrification of steam crackers. Instead of burning fuel to provide the required heat, electrified crackers would use electricity, ideally from very low-carbon sources. Although such electrification can reduce direct fuel combustion and associated CO₂ emissions, methane-rich by-products currently used as internal fuels may require alternative valorisation routes. This creates a need to assess technologies capable of converting methane into higher-value chemicals rather than simply combusting it.

The PRIME LEAP network thus brings together leading experts from plasma chemistry, single-atom catalysis, data-driven process control, modelling, process engineering and life cycle assessment to tackle the challenge of converting methane selectively and energy-efficiently into value-added chemicals using integrated plasma and catalytic technologies. While directly making ethylene from methane in plasma is difficult, the plasma/catalyst integration makes it possible to use plasma where it is relatively strong: activating methane and forming acetylene + hydrogen.

The catalyst step is then used where catalysis is strong: selective conversion of acetylene into ethylene or other value-added chemicals.

PRIME LEAP's objective is to train a new generation of researchers able to work across disciplinary boundaries and contribute to greener, more resilient and more resource-efficient chemical manufacturing. One key scientific hypothesis of PRIME LEAP is that integrating plasma conversion with single-atom catalysis could, under suitable process conditions and low-carbon electricity supply, reach energy efficiencies competitive with or exceeding those of traditional steam cracking.

Within PRIME LEAP, **INSA Toulouse** is recruiting **one Doctoral Candidate** to work on **advanced Life Cycle Assessment of next-generation low-fossil-carbon chemicals, including through the PRIME LEAP processes**. The position will be hosted at the **Toulouse Biotechnology Institute**, within a research environment combining Life Cycle Assessment (LCA), process engineering, circular bioeconomy and low-fossil-carbon transition strategies, and potential use of machine learning. The doctoral project will be supervised by **Prof. Lorie Hamelin** at INSA Toulouse, with **Prof. Livia Giordano** at the University of Milano-Bicocca as co-supervisor. A secondment of minimum 3 months will take place.

Doctoral project

The doctoral project will aim to uncover the drivers shaping the sustainability of low-fossil-carbon platform-chemical production in future European systems. Ethylene, as a key platform chemical, is particularly targeted.

Key drivers may include: the specific targeted chemical and displaced incumbent route; methane source; plasma/catalyst configuration; process-specific parameters such as conversion, yield and selectivity; electricity and heat mixes; degree of electrification; temporal deployment; and resource criticality, among others. While the focus is on the PRIME-LEAP integrated plasma/catalyst methane-to-chemicals pathways, comparison with known bio-based pathways (e.g. bioethanol dehydration route, biomass gasification-to-biomethanol-to-olefins route, or bio-naphtha or upgraded biooil steam-cracking routes) and current petrochemical pathways will also be made on the basis of in-house inventories, in order to provide a comprehensive overview of the performance of available alternatives against current petrochemistry.

The doctoral project will develop advanced Life Cycle Assessment methods to (i) quantify the environmental consequences of a variety of emerging integrated plasma/catalysts pathways for methane-to-chemicals, including aspects of resource criticality, (ii) compare the performance of methane-to-chemical routes with relevant bio-based and petrochemical routes and (iii) determine how, where in Europe, when and under which conditions investments in low-fossil-carbon platform chemicals production should be prioritized to meaningfully contribute to sustainable chemical production in the context of future highly decarbonized European economies.

The doctoral candidate will work on the following objectives:

1. Develop modular, prospective and parametric Life Cycle Inventories (LCI) of frontier integrated plasma/catalysts processes converting methane into platform chemicals.
2. Perform dynamic and prospective Life Cycle Assessments, including uncertainty and global sensitivity analysis, to quantify the environmental performance of selected pathways and identify their key performance dependencies.
3. Perform resource criticality assessment of selected methane-to-chemicals pathways.

The expected outputs include open-access datasets, scientific publications and evidence-based guidance to support investment and policy decisions for European chemical industries, towards low-fossil-carbon chemicals.

Research environment and training

The selected candidate will join a vibrant international doctoral network and will collaborate closely with leading plasma physics, catalysis, modelling and sustainability-assessment teams. PRIME LEAP includes Politecnico di Milano, University of Antwerp, Maastricht University, University of Milano-Bicocca, University College London, INSA Toulouse, and associated partners including Plenesys, AGC Glass Europe, C2CAT, VITO, INEOS, Lund University and ETH Zurich.

The candidate will benefit from:

- interdisciplinary training in plasma science, catalysis, process engineering, modelling, sustainability assessment and transferable skills;
- access to data generated within PRIME LEAP laboratory and pilot-scale research activities;
- participation in network-wide training schools, workshops, seminars and dissemination activities;
- supervision by academic and industrial experts;
- integration into a cohort of doctoral candidates working on complementary dimensions of methane conversion, plasma process design, catalysis, modelling and sustainability assessment.

Candidate profile

We are looking for a motivated, rigorous and independent candidate interested in advancing and using quantitative sustainability science to guide the development of emerging industrial technologies.

Required qualifications

Applicants must have:

- A Master's degree or equivalent in Chemical Engineering, Process Engineering, Environmental Engineering, Industrial Ecology, Energy Systems, Applied Chemistry, Applied Physics, Materials Science, or a closely related discipline – An Engineering degree will be considered an asset;
- Excellent command of English, written and spoken;
- Strong analytical and quantitative skills;
- Ability to work with mass and energy balances;
- Motivation for interdisciplinary research involving sustainability scientists, process engineers, plasma physicists, catalysis researchers and industrial partners;
- Capacity to work independently while contributing to an international doctoral network
- Interest in open science, transparent modelling and reproducible research.

Valuable additional skills

The following skills are not mandatory but will be considered assets:

- Experience with Life Cycle Assessment, techno-economic assessment or process modelling;
- Experience with Python or other scientific programming tools;
- Familiarity with LCA tools such as Brightway, Activity Browser, openLCA, and with databases such as ecoinvent;
- Familiarity with prospective LCA, consequential LCA, dynamic LCA, uncertainty analysis or global sensitivity analysis;
- Experience handling incomplete or uncertain data from emerging technologies
- Ability to work with scenarios and numerical models.

Candidates are not expected to already master all these methods, tools and skills. The position is suitable for a candidate with strong quantitative foundations, intellectual curiosity and the ability and willingness to learn and apply new skills across disciplinary boundaries. Capacity for self-directed learning is expected.

MSCA eligibility criteria

Applicants must comply with the Marie Skłodowska-Curie Doctoral Network eligibility rules.

At the date of recruitment, applicants must:

1. Not be in possession of a doctoral degree and must not have successfully defended a doctoral thesis;
2. Comply with the MSCA mobility rule: they must not have resided or carried out their main activity — work, studies, etc. — in France for more than 12 months during the 36 months immediately before the recruitment date. Compulsory national service, short stays such as holidays, and time spent as part of a procedure for obtaining refugee status under the Geneva Convention are not counted;
3. Meet all admission requirements for the doctoral programme at INSA Toulouse / MEGEP doctoral school (Mechanics, energy, civil engineering, processes);
4. Be willing and understand they will need to undertake international mobility during the fellowship, including secondments, which are mandatory and may account for up to 30% of the contract duration.

Candidates of all nationalities and genders are welcome to apply.

Specific requirements

The selected candidate will be expected to:

- Commit full-time to the research and training activities of the project, unless authorisation is granted by the European Commission for personal or family reasons;
- Carry out the research activities related to the specified doctoral project;
- Comply with the rules of the PRIME LEAP Grant Agreement, Consortium Agreement and local employment contract;
- Sign the necessary agreements concerning intellectual property rights, confidentiality and data protection;
- Comply with the principles of research integrity and open science.

Employment conditions and benefits

The selected Doctoral Candidate will be employed full-time by **INSA Toulouse** under a temporary employment contract for 36 months, with full social security and pension rights according to French regulations. PhD enrolment is mandatory, and the candidate will be physically hosted at INSA Toulouse / Toulouse Biotechnology Institute.

The MSCA financial package for this position is calculated according to the MSCA Doctoral Networks 2024 rules. For France, the living allowance uses the Country Correction Coefficient applicable to the call, 118.1%.

The gross MSCA financial package, before applicable deductions, includes:

- Living allowance: 4,735.81 €/month, corresponding to 170,489.16 € over 36 months;
- Mobility allowance: 710 €/month, corresponding to 25,560 € over 36 months;
- Family allowance: 660 €/month, if applicable according to MSCA rules and the candidate's family situation.

All allowances are subject to applicable French social security contributions and taxation. The exact contractual gross salary, net salary and net salary after income tax will be determined by INSA Toulouse according to French employment rules and the candidate's personal situation.

Selection process

The recruitment will follow an open, transparent and merit-based process in line with MSCA requirements and the European Code of Conduct for the Recruitment of Researchers.

The selection process will include:

1. Eligibility check against MSCA and doctoral enrolment rules;
2. Assessment of eligible applications by the recruitment committee;
3. Shortlisting of candidates for interview;
4. Interview and scientific discussion with shortlisted candidates;
5. Final ranking and selection;
6. Possible establishment of a reserve list.

The evaluation criteria will be:

Criterion	Points
Pre-interview, all candidates	
Relevance of overall education and acquired skills	20
Quality of overall application package	10
Relevance and quality of submitted scientific outputs (see application documents)	5
Graduation mark / academic record	5
Candidate's CV and profile in terms of specific outstanding accomplishment	5
Candidate's CV and profile in terms of motivation for the specific PhD position	5
Post-interview, interviewed candidates	
Candidate's analytical skills / based on interview	25
Candidate's motivation and fit with the position / based on interview	25
Total	100

Application deadline

Applications will be reviewed on a rolling basis until the position is filled, but those received by **August 30th, 2026** will be guaranteed full consideration. Later applications may be considered only if the position remains open. Due to the expected number of applications, only candidates shortlisted for interview will be contacted individually. Applicants who have not been contacted by 30 September 2026 should consider that their application has not been retained for the next stage of the selection process.

Application documents

Applications must include the following documents, preferably combined into a single PDF file:

1. Cover letter describing motivation, scientific interests and fit with the position, maximum 1 page;
2. Curriculum vitae, maximum 2 pages;
3. Transcripts of grades for Bachelor's and Master's degrees, with explanation of the grading system. Provide the original document, and if not in English or French, also provide a translation. For the application stage, a self-made translation is sufficient; certified translations may be requested later for administrative or doctoral-enrolment purposes;
4. Full Master's thesis, and if not available in English or French, provide either:
 - i. A short description or abstract of the Master's thesis work, or
 - ii. If deemed relevant, the candidate may instead submit another thesis-like research work (other than scientific publications), e.g. from a specific course or possibly from undergraduate /B.Sc. level. This, in any case, should be in English or French and accompanied by an explanation (of why it is preferred to an abstract of the M.Sc work).
5. Names and contact details of two referees;
6. List of scientific publications, if any
7. List of links to publications, reports, code repositories or datasets, if applicable;

Applications should be submitted via e-mail to hamelin@insa-toulouse.fr with the following e-mail subject: **PRIME-LEAP DC11 application**.

For scientific questions, contact: **Prof. Lorie Hamelin** — hamelin@insa-toulouse.fr

Personal data provided by applicants will be processed by INSA Toulouse solely for recruitment and doctoral-admission purposes, in accordance with applicable data-protection regulations. Data will be accessible only to authorised members of the recruitment process and retained only for the period necessary for recruitment and audit obligations.

Equal opportunities

INSA Toulouse and the PRIME LEAP consortium are committed to equal opportunities, diversity and inclusive recruitment. Applications from all qualified candidates are welcome, irrespective of nationality, gender, disability, ethnic or social origin, religion or belief, sexual orientation, family situation or any other protected characteristic.

Research in France

For information about life and research in France, you may refer to the Campus France website: <https://www.campusfrance.org/en/living-in-france> or to the Business France website: <https://welcome.businessfrance.fr/en/>

Why join us

Our group is internationally recognized for advancing spatially and temporally explicit consequential LCA and for designing environmentally robust transition roadmaps for greenhouse gas (GHG) neutrality in Europe. We address all three pillars of achieving GHG neutrality: mitigation, negative emissions, and substitution of fossil carbon. We publish in top journals (e.g. *Energy & Environmental Science*, *Nature Food*, *Progress in Energy and Combustion Science*), are involved in multiple Horizon Europe and national flagship programmes (e.g. ALIGNED, NEGEM, Cambioscop, SLAM-B), and collaborate closely with leading European institutions.