Position Description

1. General Information

Name of the position	**Photovoltaic integration in urban environment**
Foreseen enrolment date	1 October 2023
Position is funded by	• COFUND, Marie Skłodowska-Curie Actions (MSCA), Horizon Europe, European Union • Université Claude Bernard Lyon 1 (UCBL) • University of New South Wales (UNSW)
Research Host	Université Claude Bernard Lyon 1
PhD awarding institutions	University Université Claude Bernard Lyon 1 & University of New South Wales
Locations	Primary: Villeurbanne, France Secondary: Sydney, Australia
Supervisors	Stéphanie Giroux—Julien (UCBL) Victoria Timchenko (UNSW)
Group of discipline	Fluid mechanics, Energy, building engineering

2. Research topics (only one of these projects will be funded)

Project 1: *Impact of urban PV systems on atmospheric flows and heat island effect*

The purpose of the PHD-thesis relies on impacts of massive integration of photovoltaic (PV) panels and PV power plants within urban environment. Indeed, urban areas are the seat of complex and nonlinear physical phenomena: time variability and intermittency of the solar resource, atmospheric pollution conditions, wind channeling effect and turbulent intensities as well as inter building effects.

Developing an integrated methodology taking into consideration urban multi-physics (including solar radiation and atmospheric boundary layer) and multi-scales (spatial heterogeneities) features appears then as a crucial issue for the evaluation of PV contribution to the heat Island effect.

The objective of the proposed PhD study is to investigate the interaction between the atmospheric boundary layer usually modeled as a logarithmic velocity profile and building integrated PV power systems. In particular, the zero plane displacement (ground) and the roughness length needs to be redefined in accordance.

The work will be based on LES simulations and on data processing methods such as proper orthogonal decomposition in order to identify dynamical and thermal coherent structures that may affect locally turbulent mixing and in consequence the parameters of the atmospheric boundary layer.

Skills: computational fluid dynamics, heat and mass transfer, physics, numerical modelling and processing.

Supervisors: Stéphanie Giroux—Julien (UCBL), Victoria Timchenko (UNSW), Marjorie Musy (CEREMA)

Research Fields: Fluid mechanics, Energy, Urban Physics, renewable energy

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Project 2: *Investigation of influence of the Urban assemblies and surface radiative properties on city climate*
The purpose of the PHD-thesis relies on impacts of massive integration of photovoltaic (PV) panels and PV power plants within urban environment. Indeed, urban areas are the seat of complex and nonlinear physical phenomena: time variability and intermittency of the solar resource, atmospheric pollution conditions, wind channeling effect and turbulent intensities as well as inter building effects. Developing an integrated methodology taking into consideration urban multi-physics (including solar radiation and atmospheric boundary layer) and multi-scales (spatial heterogeneities) features appears then as a crucial issue for the evaluation of PV contribution to the heat Island effect. The objective of the proposed PhD study is to investigate the contribution of PV systems and their layout (on facades and roofs) on the local urban warming. The effects of radiative coatings to enhance cooling of PVs in order to mitigate environmental impact will be also investigated. The work will be based on LES simulations, the air being modeled as a gray gas, and on data processing methods such as proper orthogonal decomposition in order to identify dynamical and thermal coherent structures that may affect locally turbulent mixing and in consequence the urban climate mitigation. Skills: computational fluid dynamics, heat and mass transfer, radiation, numerical modelling and processing.
Supervisors: Stéphanie Giroux—Julien (UCBL), Victoria Timchenko (UNSW), Marjorie Musy (CEREMA)
Research Fields: Fluid mechanics, Energy, Urban Physics, renewable energy

Project 3: *Impact of BIPV configuration on buildings and local climate*
The purpose of the PHD-thesis relies on impacts of massive integration of photovoltaic (PV) panels and PV power plants within urban environment. Indeed, urban areas are the seat of complex and nonlinear physical phenomena: time variability and intermittency of the solar resource, atmospheric pollution conditions, wind channeling effect and turbulent intensities as well as inter building effects. Developing an integrated methodology taking into consideration urban multi-physics (including solar radiation and atmospheric boundary layer) and multi-scales (spatial heterogeneities) features appears then as a crucial issue for the evaluation of PV contribution to the heat Island effect and of the energy savings of buildings. The objective of the proposed PhD study is to investigate building integrated photovoltaic and thermal components (BIPV-T) that meet electricity and heating demand of buildings. In particular, research will be undertaken to find optimal conditions to maximise energy generation without large impact on local urban warming. The work will be based on LES simulations, data processing and optimization methods in order to assess the global balance according to typologies of buildings and districts. Skills: computational fluid dynamics, heat and mass transfer, physics, numerical modelling and processing, optimization methods
Supervisors: Stéphanie Giroux—Julien (UCBL), Victoria Timchenko (UNSW), Marjorie Musy (CEREMA)
Research Fields: Fluid mechanics, Energy, Urban Physics, renewable energy

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3. Employment Benefits and Conditions

The Université Claude Bernard Lyon 1 offers a 36-months full-time work contract (with the option to extend up to a maximum of 42 months). The total number of worked hours per week is 37h30.

The remuneration, in line with the European Commission rules for Marie Skłodowska-Curie grant holders, will consist of an estimated gross annual salary of 28,080.00 EUR. Of this amount, the estimated net salary to be perceived by the Researcher is 1,870.00 EUR per month. However, the definite amount to be received by the Researcher is subject to national tax legislation.

Benefits include

- Access to both universities educational resources, as well as ILM/CETHIL and UNSW research facilities and laboratories.
- Tuition fee waiver at both PhD awarding institutions.
- Yearly travel allowance to cover flights and accommodation for participating in AUFRANDE events.
- 10,000 EUR allowance to cover flights and living expenses for 12 months in Australia.
- 47 days paid holiday leave.
- Sick leave.
- Parental leave.

4. PhD enrolment

Successful candidates for this position will be enrolled by the following institutions and must comply with their specific entry requirements, in addition to AUFRANDE's conditions.

UCBL

The Applicant must have a bac+5 diploma or equivalent (Master 2 in France).

More information: https://phd-physics.universite-lyon.fr/ed-52-phast/site-francais/navigation/pendant-la-these/inscriptions-reinscriptions/ and website of the doctoral school.

UNSW

The minimum entry requirement for admission to a PhD includes:

- an appropriate UNSW bachelor degree with upper second-class honours; or
- a completed Masters by Research from UNSW with a substantial research component and demonstrated capacity for timely completion of a high-quality research thesis; or
- an equivalent qualification from a tertiary institution as determined by the Faculty Higher Degree Committee (HDC).

If English is not your first language, you will be required to provide evidence your English language proficiency. Note that your English test needs to be completed no more than two years before your enrolment at UNSW. The English language test scores requirements can be found here: https://www.unsw.edu.au/study/how-to-apply/english-language-requirements

More information: https://research.unsw.edu.au/higher-degree-research-programs

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