EUROPEAN DOCTORAL NETWORK

2nd CALL FOR RECRUITMENT

Research Fields. Control Engineering, Energy Engineering, Electrical Engineering, Thermal Engineering, Mathematics, Computer Science, Data Science.

Recruiting Organisations. The training and research of the 12 doctoral candidates (DCs)/PhDs will be carried out across **12 different main hosting and recruiting organizations and related Departments, please** visit the DENSE webpage for more details**:** https://dense-dn.eu**.**

All academic and research institutions that will recruit DCs have all the academic, administrative, technical, and human resources staff needed to help the candidates as they advance their careers as scientists focused on energy systems.

Overview of the research and training objectives. DENSE (Dependable Smart Energy Systems) is a 4-year Marie Skłodowska-Curie Actions-Doctoral Network (HORIZON-TMA-MSCA-DN) funded within the framework of the HORIZON EUROPE Programme. It brings together 12 partners from applied research, academia and industry in 6 different countries with the aim of implementing 12 doctoral research projects. 11 PhDs selected and, in the process, to be recruited. **This call for applicant is opened for the recruitment of 1 PhD (DC7)**.

DENSE is addressing individual research projects and training of early-stage researchers in the innovative dependable engineering of Smart Energy Systems (SESs) with the main focus on robustness as well as preventive and corrective actions under uncertainty. Dependability of complex networks, such as SESs, characterizes their ability to deliver service that can justifiably be trusted. Thus, dependability comprises system attributes, such as availability, reliability, safety, integrity and maintainability. A key requirement of dependability is the desire for providing justifiable trust in the system performance. Hence, rigorous systems engineering yielding provable performance guarantees throughout the system's life time is already required at the design stage. This challenge is tackled in DENSE, through 12 cutting edge research and training projects at doctoral level (www.dense-dn.eu/recruitment/) with a focus on operational robustness as well as preventive and corrective actions in SESs. These research projects span many disciplines, including *control engineering, energy engineering, electrical engineering, thermal engineering, computer science, data science, and mathematics.*

Doctoral Candidates' eligibility criteria. The DENSE consortium invites applications of highly-motivated, outstanding candidates, of any nationality, age and gender that respect all the following eligibility rules at the date of the Call deadline:

1.MSCA Eligibility requirements	Applicants must satisfy the MSCA definition of Doctoral Candidates (DC): The applicants should not be in possession of a doctoral degree at the time of the call deadline. Candidates who have successfully defended their PhD thesis but have not received their degree will not be accepted.
2.MSCA Mobility requirements	Applicants must not have lived or carried out their main activity in the main host and recruiting country for more than 12 months in the past 3 years immediately prior to the Call deadline.
3.DENSE Academic qualifications	Applicants must hold a relevant Master degree or equivalent at the time of the application. The educational background should fit with the required skills announced for each DC. Exception: In case a candidate has not obtained yet their Master's degree at the Call closing date (by the 7th of July 2024), they can nevertheless apply. If a candidate is then part of the final ranking list and to be selected for one of the DENSE positions, before being offered a contract of employment, they will be required to provide the Master's degree certificate (or, alternatively, a formal preliminary certificate) before the starting date of the employment..
4.DENSE Proof of English	Very good knowledge of English (speaking and writing) is expected. Students need to meet the requirement of the institutions of enrolment. Language requirements details must be checked on the DC description.

To be considered eligible:

- The complete application pack is received by the Call deadline date and timing.
- The application pack is submitted with all the requested documents and templates.
- It is a strict admissible condition for applicants to use the template application documents (CV, reference and motivation letters) easily accessible in Word format below from **https://www.dens-dn.eu/recruitment/**. Applications submitted without using the due applications documents will be deemed as ineligible.

What is funded. The 12 selected DCs will be recruited with a full employment contract of 3 years (36 months), which will comprise:

- A living allowance of 3400 € (multiplied by a country correction coefficient), corresponding to the gross salary (employer/employee) paid in monthly instalments to the DC fellows, inclusive of all social security coverage, contribution to pension funds and unemployment indemnity;

- A mobility allowance of 600 € for fellows' expenses linked to their mobility (e.g., relocation and accommodation expenses);

- A family allowance of 660 € (if applicable);

- For each DC fellowship a contribution to costs needed to carry out research projects (e.g. consumables, publications, others) and a contribution to the training activities (e.g. local and network trainings as well as conference and workshop participations) managed directly by the main hosting organisation is provided;

- Fiscal treatment, social security (SSC) and sick/maternity or paternity leave will be fully covered according to the national Social Security regulation of the country of recruitment.

The DENSE project started on the 1st of January 2024 and will last 48 months. A second call for recruitment for selecting 1 international Doctoral Candidates (DC)**, as a part of a consortium of 12 doctoral researchers in total,** has opened the **10th of June 2024**, with an application deadline of the **7th of July 2024** (5 pm CET).

This second call for recruitment is open to select **1 doctoral candidate/PhD** for the project listed in section 4. The call planning is detailed in the table below:

Activity	Dates
Call opening	10/06/2024
Call closing	07/07/2024 (5pm CET)
Eligibility check of candidates and organisation of evaluation panels	By 08/07/2024
Short list and invitation for interviews	08/07/2024
Interviews	From 15/07/2024 to 16/05/2024
Final ranking list	17/07/2024
Offer of contract/enrolment	18/07/2024
Duration of each fellowship	36 months

How to Apply. Applications need to be submitted through the email address **recruitment-dense@ec-nantes.fr**, by the given deadline. In order to be eligible, the online application form must be submitted together with a set of due application documents, each using the templates provided. **The email object and the attached Pdf file must include the specific DC code(s) that you apply for**. To this end, specific **Guidelines for Applicants** will guide candidates for the application stage, available for easy downloading from the **recruitment page https://www.dense-dn.eu/recruitment/**

Further information and contact. Please visit DENSE website at**: https://www.dense-dn.eu/recruitment**

DC Number	DC7
Title of the PhD Project	Robust and optimal planning of district heating networks for next-generation energy systems
Keywords	District heating networks, Topology optimization, Robust optimal design
Recruitment organisation	[Flemish Institute for Technological research](#) (VITO)
Enrolling university	[KU Leuven](#)
Supervisors names and contacts	Robbe Salenbien (robbe.salenbien@vito.be) and Maarten Blommaert (maarten.blommaert@kuleuven.be)
Scientific context and objectives	Heating networks are considered one of the core technologies to enable renewable space heating, and to overcome the current reliance on gas and oil. Using thermal storage, they offer a cost-effective way to provide flexibility for electrical grids that become more and more subject to the intermittency of renewables like wind and PV. In addition, next-generation heat networks that operate at low temperatures, are able to incorporate high shares of renewable-based heat sources and waste heat sources. However, the planning of such systems is no straightforward task, especially in existing systems that were built for high-temperature, fossil fuel-based operation. Moreover, the physics of the system is nonlinear in nature and their optimal planning is case specific and involves several uncertain parameters that impact the viability of the project. Therefore, automated design methods can seriously facilitate this process. To fundamentally tackle the design problem, the PhD student starts from the novel optimal design approach that was recently developed in a collaboration between KU Leuven and VITO in the framework of [EnergyVille](#), which is the first to realize physics-based optimal design of network topologies for heating networks of practical size [1-3]. On this basis, a framework will be developed for the optimal retrofitting of existing infrastructure to robust, flexible, and energy-efficient low-temperature networks. By considering heat production, network changes, and redesign of substations as part of the optimization, the limits of waste heat integration are aimed for through an optimal decrease of operational temperatures. Simultaneously, robust operation has to be guaranteed to ensure user comfort. The PhD student will be part of VITO's THES group in EnergyVille and will work in close collaboration with KU Leuven's [IDEAL group](#) [4]. Through the strong collaborations between researchers of both groups, the PhD research keeps a close link to both the development of model-based optimal design algorithms, as well as to the application in district heating development projects in Belgium. Moreover, the successful applicant for this position will be enrolled in the excellent doctoral training program of KU Leuven's [Arenberg Doctoral School](#).
Required skills	You are a highly motivated, enthusiastic and communicative researcher, and you are strongly interested in the development of models and optimization procedures for the design of next-generation district heating networks. Moreover, you are a team player that enjoys collaborating with people within the research group, the project, and beyond, and have: • A master's degree in Engineering with a background in mechanical engineering, computer science, or related field, from a reputable institute, with outstanding study results, • A background in numerical modelling, • The qualities to carry out independent research, demonstrated e.g., by the grades obtained on your MSc thesis, • A critical and practical mindset, • [Very good knowledge of English.](#)

	Additional research/educational experience in any of the following topics is considered a strong advantage: • Coding in languages such as MATLAB or python. • (Gradient-based) numerical optimization, • District heating and cooling, • Flow and heat transfer modelling, • Topology optimization.
References	[1] Wack, Y., Sollich, M., Salenbien, R., Diriken, J., Baelmans, M., Blommaert, M. (2024). A Multi-Period Topology and Design Optimization Approach for District Heating Networks. Preprint in arXiv:2401.15976 [2] Wack, Y., Baelmans, M., Salenbien, R., Blommaert, M. (2023). Economic topology optimization of District Heating Networks using a pipe penalization approach. *Energy*, *264*, Art.No. 126161. doi: 10.1016/j.energy.2022.126161 [3] Blommaert, M., Wack, Y., Baelmans, M. (2020). An adjoint optimization approach for the topological design of large-scale district heating networks based on nonlinear models. *Applied Energy*, *280*, Art.No. 116025. doi: 10.1016/j.apenergy.2020.116025