

Expression of Interest (EoI)

MSCA Postdoctoral Fellowships 2026

Host Institution: Åbo Akademi University - Faculty of Science and Engineering - Department of Engineering and Information Technology (ITI)

Project

Energy-Proportional Computing for Efficient Data Center Operations

Hosting Information: Åbo Akademi University

Offer Deadline: June 26, 2026

EU Research Framework: Horizon Europe - MSCA Postdoctoral Fellowships 2026

Country: Finland

City: Turku

Organisation/Institute

Organisation/Company: Åbo Akademi University

Department: Department of Engineering and Information Technology (ITI)

Secondment Opportunity: Software Engineering Research Group, University of L'Aquila (Italy) - Prof. Henry Muccini (up to eight months)

Contact Information

Organisation / Company Type: Higher Education Institution

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Description

Project Title: Energy-Proportional Computing for Efficient Data Center Operations

Research Context & Motivation

Energy efficiency of computing is a research topic with a long history at Information technology at Åbo Akademi University. The emphasis has been on understanding the interactions between the applications and the underlying hardware to better enable control of consumption, and scalability of applications. The focus has previously been on single applications, or small computing systems. But through the acquisition of the WSTAR (Wasa Zero Emission Data Centre) infrastructure we are now expanding this research to look at large scale computations in the datacenter.

The specific focus of the MSCA postdoctoral fellowship is flexible but the fellow is expected to contribute to the work on developing a notion of "energy proportionality" for that aims to

better match the available compute to the computational requirements of the application. The goal is to create a tool to improve the energy efficiency of data centers. The supervisors' main area of expertise is in:

- Code and operating system schedule optimisation
- Processor architecture power management
- Optimisation of cloud applications for energy

Supervisors: Professor Sébastien Lafond and Professor Johan Lilius

Goal & Objectives

Develop methods, models, and tools for energy-proportional computing in large-scale data centers, enabling compute resources to dynamically adapt to workload demands while minimizing energy consumption and maintaining performance.

The main objectives are:

- Define a Formal Model of Energy Proportionality
- Analyze Application–Hardware Interactions at Scale
- Develop Energy-Aware Scheduling Techniques

Research Method

The research will apply a mixed experimental and analytical methodology combining large-scale systems experimentation, workload profiling, energy monitoring, and optimization techniques to study energy proportionality in data centers. Real-world experiments will be conducted on the WSTAR (Wasa Zero Emission Data Centre) infrastructure to analyze interactions between applications, operating systems, and hardware under different workloads and resource-management strategies.

The study will use performance profiling, hardware telemetry, and statistical modeling to identify energy inefficiencies and characterize workload behavior. Based on these findings, energy-aware scheduling and resource-allocation methods will be developed and evaluated using optimization algorithms, simulation, and possibly machine-learning approaches for predictive workload management.

Prototype tools and scheduling mechanisms will then be implemented and validated through comparative benchmarking to assess improvements in energy efficiency, scalability, and performance in large-scale computing environments.

Technology & Infrastructure

For this research topic, Åbo Akademi University can provide a combination of advanced computing infrastructure, experimental platforms, software ecosystems, and interdisciplinary research expertise that are highly relevant to energy-efficient and sustainable computing research.

The most significant infrastructure is the WSTAR (Wasa Zero Emission Data Centre) platform, which enables experimentation on large-scale computing systems in a real data-center environment. This infrastructure supports research on energy proportionality, workload scheduling, cloud optimization, and scalable energy-aware computing. It provides access to servers, cluster-based computing resources, monitoring systems, and operational data necessary for conducting realistic experiments on energy consumption and performance behavior.

We offer access to a comprehensive HPC and data infrastructure hosted by the university and CSC – IT Center for Science. It includes access to large-scale supercomputing resources such as the LUMI supercomputer, one of the most powerful systems in Europe, which enables advanced simulations, artificial intelligence research, and data-intensive computing.

Åbo Akademi can also provide high-performance computing and distributed computing environments for testing cloud-native, parallel, and data-intensive applications. These environments may include virtualized and containerized platforms such as Kubernetes- and Linux-based systems, allowing experimentation with workload orchestration, dynamic resource allocation, and energy-aware scheduling strategies. The research environment further benefits from access to low-level hardware and operating-system profiling technologies, including processor power-management interfaces, telemetry systems, hardware performance counters, and energy-monitoring tools. These technologies enable detailed analysis of CPU utilization, memory behavior, thermal characteristics, and power consumption across applications and infrastructures.

In addition, the supervisors' expertise in operating-system scheduling, processor architecture power management, and cloud application optimization provides a strong methodological and technical foundation for developing energy-efficient runtime systems and optimization tools. The project can also leverage software engineering support, benchmarking frameworks, simulation tools, and data-analysis platforms for evaluating scalability and performance-per-watt efficiency.

Expected Output

The postdoctoral project is expected to produce new scientific understanding and practical solutions for energy-proportional computing in large-scale data centers, supported by experimental validation on the WSTAR infrastructure. Key outcomes include:

- Energy proportionality framework/model
- Scheduling algorithms
- Data-center optimization prototype
- Experimental validation on WSTAR
- Peer-reviewed publications in high-impact journals and conferences focused on systems and energy-efficiency topics

Proposing University

Åbo Akademi University is the Swedish-language multidisciplinary university in Finland, with campuses in Turku and Vaasa. Due to its mandate to safeguard and advance Swedish-language higher education and research, while actively contributing to Finland's bilingual academic ecosystem, ÅAU plays a leading role in initiatives addressing minority perspectives, inclusiveness, accessibility, and multilingualism. It has 5,500 undergraduate students, 840 postgraduate students, and 1,200 employees, 675 of whom work in education and research. Research and education are organized within two faculties—the Faculty of Human and Social Sciences and the Faculty of Science and Engineering—and supported by four strategic multidisciplinary research areas: the Sea, Minority Research, Technology for a Sustainable Future, and Solutions for Health. A portfolio of international master's programmes taught in English further strengthens AAU's capacity to operate effectively in international education and research. Since its launch in 2020, the Erasmus Mundus Joint Master Degree in Engineering of Data-intensive Intelligent Software Systems (EDISS) has firmly established Åbo Akademi University as a leading institution in computer engineering and artificial intelligence education.

Our Support for Your Proposal

We don't just host you; we help you win. Candidates selected for this topic will receive:

- **Expert supervision and collaboration** within a thriving research environment with access to datacenter research infrastructure for experiments.

- **Support in preparing for the MSCA Postdoctoral Fellowship application**, including individual consultation, proposal review, and guidance from experienced mentors at ÅA and former MSCA fellows.

Candidate Requirements

- A recent PhD (preferably awarded in 2021 or later) in Electrical Engineering, Computer Science, Software Engineering or a closely related field.
- Maximum of 8 years of full-time research experience after PhD
- Compliance with the MSCA mobility rule
- A strong publication track record (e.g., high-impact IEEE journals, IEEE conferences)
- Proficiency in at least one of the following domains: Computer Architecture, Compilers, Operating systems, Cloud Computing
- Excellent command of spoken and written English, strong interpersonal skills, and the ability to work both independently and in a team.

Interested?

Interested candidates should send the following to sebastien.lafond@abo.fi by **August 15, 2026**, with subject “MSCA Postdoctoral Fellowships 2026”:

1. A brief CV (max 2 pages).
2. A motivation letter (1 page) outlining research alignment.
3. A 2-page summary of your proposed research idea.

We look forward to building a winning proposal with you!