

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-Efficient Software Control and Grid-Aware 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-Efficient Software Control and Grid-Aware Data Center Operations

Research Context & Motivation

Energy efficiency of computing is a research topic with a long history at Information technology at ÅA. 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 MCSA postdoctoral fellowship is flexible but the fellow is expected to contribute to the work aiming at developing ways to control the energy requirements created by the software running in the datacenter to make the datacenter an active participant in the

balancing of the grid, and also to understand better the QoS tradeoffs caused by this from the point of view of the datacenter customer.

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

To develop intelligent software- and system-level methods that reduce data center energy consumption while enabling data centers to actively support electrical grid balancing without unacceptable degradation of Quality of Service (QoS).

The main objectives are:

- Improve Energy Efficiency of Large-Scale Computing
- Quantify QoS–Energy Tradeoffs
- Enable Grid-Aware Data Center Operation

Research Method

The research will apply a combination of experimental systems research, performance modelling, and data-driven optimisation methods to investigate energy-efficient and grid-aware data center operations.

Empirical experiments will be conducted on the WSTAR infrastructure using representative cloud and high-performance computing workloads to measure energy consumption, resource utilisation, and Quality of Service (QoS) under varying operating conditions. Software-level techniques such as operating system scheduling, workload orchestration, dynamic resource allocation, and processor power-management mechanisms will be designed and evaluated to enable adaptive energy control.

The study will further employ monitoring and telemetry tools to collect runtime data, which will be analysed using statistical methods and machine learning techniques to model workload behaviour, predict energy demand, and estimate QoS impacts. Multi-objective optimisation approaches will then be used to balance competing goals such as energy efficiency, grid responsiveness, performance, and operational cost. Finally, the proposed methods will be validated through simulation and real-world deployment experiments to assess scalability, reliability, and effectiveness in supporting sustainable and flexible data center operation.

Technology & Infrastructure

For this research topic, Åbo Akademi University can provide a strong combination of research infrastructure, computing facilities, experimental environments, and interdisciplinary expertise that directly support energy-efficient and grid-aware data center research.

A central asset is the WSTAR (Wasa Zero Emission Data Centre) infrastructure, which serves as a real-world experimental platform for studying sustainable and large-scale computing. WSTAR enables experimentation with energy-aware workload management, cloud orchestration, hardware power control, renewable-energy integration, and grid-responsive operation under realistic data center conditions. Unlike purely simulated environments, this infrastructure allows validation of scheduling and optimisation techniques on operational systems with measurable energy and QoS impacts.

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.

The research environment further benefits from interdisciplinary collaboration opportunities with energy technology stakeholders and industrial partners connected to the Vaasa energy cluster, one of the major Nordic hubs for smart energy and sustainable infrastructure research.

Expected Output

The expected outcomes of the postdoctoral research would include scientific, technological, and societal contributions that advance sustainable computing and intelligent energy management in large-scale data centers.

We expect contributions on:

- Novel models describing the tradeoffs between energy efficiency, grid responsiveness, and Quality of Service (QoS).
- New optimisation algorithms and adaptive control mechanisms for energy-aware cloud and data center operations.
- Peer-reviewed publications in high-impact journals and conferences

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!