JOINT CALL High Performance Computing

CALL DESCRIPTION

The Ministry of the Economy, the National Research Fund ("granting authorities") and Luxinnovation have joined forces to offer companies and research institutions a new funding opportunity that supports consortia to take advantage of high-performance computing (HPC) capacities in their research field.

Context of the call

High-performance computing is an innovation accelerator that offers enormous potential for companies of all sizes in different sectors. HPC can reduce the costs of companies' R&D processes thanks to simulations and virtual prototyping, thereby providing the ability to stay ahead of the competition and to significantly reduce the time to market. HPC is thereby particularly useful for performing simulations that require high-resolution and -precision results in order to be able to look into the granularity of large and complex problems with many parameters, to be tuned at the same time. HPC also offers great value in big data analytics and training of artificial intelligence algorithms with millions of data points. This kind of endeavour would take a very long time or would even not be possible to realize on common laptops or workstations, whereas HPC is able to analyse data with unmatched speed and impressive precision.

Nevertheless, there is not one single metric that can be used across all sectors to measure the benefits of HPC. The reasons for using supercomputing tend to be individual for each organisation and related to its strategic priorities. HPC can already today be an essential driver of business and research competitiveness, and will be increasingly important in the future, as the amount of data available doubles every two years.

However, HPC is still only rarely used in the private sector, often due to a lack of the necessary skills and expertise to scale numerical simulations or perform big data analyses on large computing systems, which may be intimidating at first sight. To fill this gap, the Ministry of Economy, the National Research Fund (FNR) and Luxinnovation are launching a joint call for proposals aimed at encouraging close and interactive collaborations between private companies and public research institutes to carry out innovative research projects on HPC infrastructures. It is a strategic priority of the FNR to turn public research into a competitive advantage for Luxembourg and to open up the opportunities for researchers to sustain a high-impact research strategy while engaging with the most innovative private players. To this end, the FNR supports the advancement of Luxembourg's knowledge-based economy by supporting applied research, by reinforcing cooperation between public research and innovative economy, and by facilitating the potential commercial exploitation of research results.

This joint call for projects (red box in the Figure below) will be accompanied by a dedicated portfolio of aid schemes (green boxes) offered by the Ministry of Economy, which takes into account the different skill levels of private players in the use of computer-aided R&D. The goal is to create a general awareness of the use of simulation and modeling tools and techniques in companies' R&D activities and to support a sustainable evolution towards an ecosystem of HPC use. Together, the dedicated portfolio of aid schemes intends to accelerate the digital transformation process in companies by integrating computer-aided engineering and design as well as high-performance computing into their internal innovation process. A more detailed explanation of the additional aid schemes that, unlike the call for proposals, are non-competitive and have no fixed submission deadline, and how they fit into this call initiative can be found at the end of this document.

Purpose of the call:

The purpose of this joint funding call for projects is to accelerate the digital transformation process in companies by integrating computer aided engineering, design and analytics as well as high-performance computing into their internal innovation process. The joint funding call therefore supports the implementation of high quality, high impact and innovative applied research projects that aim to benefit from high-performance computing.

Objectives:

As a pillar of a company's performance, the R&D department must offer innovative products while controlling development costs. To be effective, the R&D strategy has to rely on cutting-edge technologies that are perfectly in line with the latest scientific and technical advances in the field. The digital transformation of R&D departments is therefore a key element in the establishment of a high-performance, forward-looking private innovation ecosystem in Luxembourg.

To achieve this, the present call for projects aims at facilitating collaborative projects between public research institutions and companies to jointly produce applied research results that are valuable for both parties. Public research institutions will have the opportunity to address new or different research questions, and companies can improve their innovation capabilities and gain access to high-level public research expertise in computational R&D and HPC.

The specific objectives of the HPC joint call are:

- to support innovation and sustainable value creation by stimulating strong partnerships between public research institutes and companies in the field of high-performance computing;

- to increase the company's expertise in HPC applications in order to enhance their use of complex calculations in areas such as modeling and simulation, data analysis, virtual testing, machine learning and artificial intelligence;
- to increase the attractiveness of Luxembourg as an innovation hub based on advanced technological research on HPC.

Call topic:

The projects to be carried out within the framework of this call must be innovative, of the highest quality and in the field of industrial research[1]. They must also have a positive and sustainable effect on the future development of the companies' computer-aided R&D competencies, knowledge and expertise.

The research projects must address innovative problems that require large allocations of computing and data storage resources. Applications must clearly state why the work requires access to an HPC structure and cannot be performed on a smaller computing system.

The joint call for projects targets industrial research projects in the following HPC application fields:

- Complex simulations with multiple parameters
- Virtual testing and optimisation (of new product designs, processes, complex materials)
- Big Data analytics and visualisation of millions of data points
- Artificial intelligence and machine learning algorithms
- Predictions and forecasting of complex models

The thematic areas thereby include manufacturing, advanced engineering, materials, energy and environmental technology, and telecommunications.

In this first edition, the HPC call for projects targets private stakeholders with substantial expertise in the field of computer-aided R&D, big data analytics or training of AI algorithms, but little or no expertise in the use of HPC infrastructures. Hence, companies that need to rely on strong support from a public research institute to realize the successful transfer to HPC.

General eligibility criteria and instruments of the joint call:

1) Consortia are expected to involve at least one participating company and one participating research organisation. In the consortium, the contribution of the private and public parties should be as close to equal as possible, whereas no party shall bear more than 70% of the total project cost. Companies must fulfil the general eligibility criteria of article 2 of the RDI law [1] and the respective criteria of the specific state aid scheme they apply for as set out in the R&D schemes

[1] 'industrial research' means the planned research or critical investigation aimed at the acquisition of new knowledge and skills for developing new products, processes or services or for bringing about a significant improvement in existing products, processes or services. It comprises the creation of components parts of complex systems, and may include the construction of prototypes in a laboratory environment or in an environment with simulated interfaces to existing systems as well as of pilot lines, when necessary, for industrial research and notably for generic technology validation

[2]. Research organistions must be eligible under article 3-(2) of the FNR statute (*Loi modifiée du 31 mai 1999 portant création d'un fonds national de la recherche dans le secteur public*) and be registered at the FNR.

2) The project must be in the field of industrial research[1], as defined in article 1 of the RDI law [1], and in line with the call topic.
3) For industrial research activities under the joint call for projects, public institutions should comply with the general principles set forth in the FNR Guidelines, such as the formal requirements to qualify as PI (Principal Investigator) of an FNR-funded project and/or as supervisor of an FNR-funded PhD student, the FNR Research Integrity Guidelines, and the FNR data management plan, as well as those included in the FNR BRIDGES Programme description.
4) The consortium must have the software or methods capable of taking advantage of available HPC capabilities. The project description should specify the type of HPC infrastructure being targeted and the consortium's experience with HPC infrastructures.
5) The consortium must have the necessary expertise to carry out tasks on HPC systems.

The FNR will fund the costs of the eligible research organisations in Luxembourg, up to 400.000 € per project covering all project specific costs.
The Ministry of the Economy will co-finance costs borne by Luxembourg eligible companies up to ±700.000 € per project, using the R&D aid scheme [1].

It is expected that the projects will be considered as industrial research projects. In this case, the maximum co-financing rates for companies through collaboration are as follows:

- Small company: 80%;
- Medium company: 75%;
- Large company: 65%.

Project durations are targeted for a 24 to 36 month period.
Self-funded partners are permitted to participate in the consortium.

Evaluation criteria and scoring system of the joint call:

The project proposals will be evaluated in a balanced manner based on the following criteria:

1. Relevance (33.3%)

This criterion aims to evaluate the quality and the innovative character of the project through the following aspects:

- project idea; clarity and pertinence of the objectives;
- level of innovation, including advance on state of the art;
- soundness of the research approach and methodology;
- scientific and technical maturity of the project;
- clarity, coherence and adequacy of the application regarding the theoretical framework, objectives, methodology, work plan and expected results and impacts.

2. Implementation: quality and efficiency of the project plan (33.3%)

This criterion is intended to assess the quality and feasibility of the project work plan to ensure its success. Proposals will need to demonstrate a balanced distribution of HPC resource utilisation over the duration of the project. The following aspects are taken into consideration:

- coherence and effectiveness of the work plan, including appropriateness of the allocation of tasks and resources;
- realistic timing taking into account computational time allocations within HPC infrastructures;
- competences, experience and complementarity of the individual participants, as well as of the consortium and collaboration as a whole;
- the level of ambition of the collaboration and commitment of the participants in the proposed programme;
- appropriateness of the management structures and procedures, quality of the risk management plan and soundness of the risk mitigation plan.

3. Impact (33.3%)

This criterion is intended to assess the potential impacts and contributions of the project. The following aspects are taken into consideration:

- Added value of the proposed industrial research;
- strengthening of the competitiveness and growth of the companies involved by developing innovations;
- effectiveness of the proposed measures to exploit and disseminate the results of the project;
- contribution of the project to the advancement of knowledge and expertise of companies in the field of high-performance computing in areas such as modeling and simulation, data analysis, machine learning and artificial intelligence.

Call process:

The submission and evaluation process will be composed of 2 phases.

- **<u>Submission process</u>:**

Phase-1: (*15th of September 2022 9am – 15th of November 2022 2pm)*
Project outline (PO) to be submitted on the research-industry-collaboration platform of Luxinnovation.

The PO shall provide information on:

- Project description;
- Project outcomes;
- Expected technical contributions of the different partners
- Estimation of requested HPC resources;
- Statement explaining the benefits of using an HPC system;
- Intellectual Property Rights for collaborative project proposals (in view of a draft collaboration agreement in phase 2);

- Preliminary project costs;
- CV of the main investigators;
- For companies: Organisational chart of the group, 2020 and 2021 balance sheets and P&L accounts of the applicant and the group, simplified cash-flow forecast.

Phase-2: ***(2nd of January 2023 9am – 28th of February 2023 2pm)***

Full project proposal (FPP) to be submitted by each project participant either to the Ministry of the Economy (Myguichet platform) for companies and to FNR (FNR Grant system) for accredited research organisations. The FPP as well as the financial annexes to be appended by each partner to the aid application can be downloaded from the platform *www.research-industry-collaboration.lu*.

The FPP shall provide information on:

- Detailed description of the research project;
- Different activities of the project (Work packages);
- Description of the technical challenges and implementation of the project;
- Description of the expected outcome and the economic impact;
- Milestones;
- Timeline;
- Resources;
- Description of costs;
- Collaboration agreement (draft ready for signature) including agreement on intellectual property[2];
- GDPR aspects: data flow and ownership, delegations to data processors.

- **Evaluation process:**

Phase-1:

Based on the Project Outlines (PO) and the annexes submitted via the research-industry-collaboration platform, the granting authorities in collaboration with Luxinnovation will check:

- Eligibility of all parties and co-funding capacity of the company;
- If the project description is in line with the call topic;
- If the technical capabilities and benefits of using an HPC system are consistent with the topic and the objectives of the call.

Participants will obtain a written feedback from the granting authorities on Luxinnovation's research-industry-collaboration platform. In case of a high number of POs, the granting authorities reserve the right to make a pre-selection based on the budget of the joint call. In case of a positive pre-evaluation,

[2] Any intellectual property (IP) rights that result from the collaboration should be allocated to the different collaboration partners in a manner which adequately reflects their contributions and respective interests in the project. The main IP terms of the collaboration agreement between the company and the public research institute should thereby comply with the "Framework for State aid for research and development and innovation (2014/C 198/01)", paragraph 2.2.2. "Collaborations with undertakings" [3].

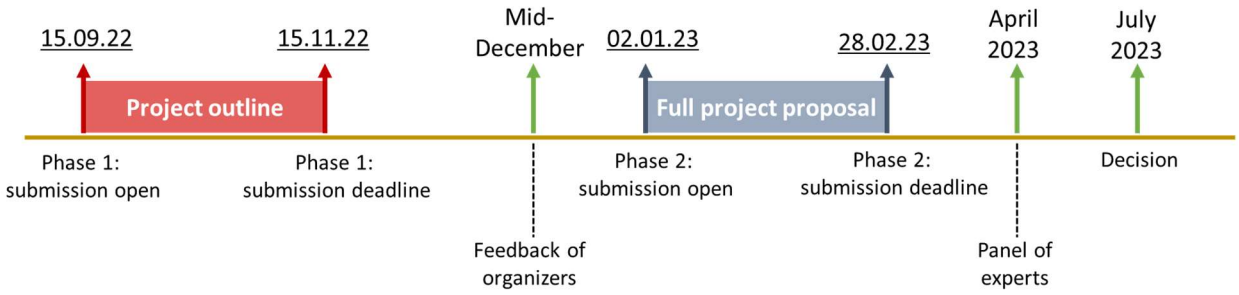
applicants will be invited to proceed to Phase-2, possibly with some recommendations from the organisers.

Phase-2:
Full project proposals (FPP) prepared in Phase-2 will be reviewed by an independent expert panel ("panel") that will assess FPPs from a scientific/technical and economic point of view. The panel will establish a ranking list based on the criteria set in the "Evaluation criteria and scoring system" section above. The highest ranked projects will be recommended for funding to FNR and Ministry of the Economy. In the case of companies, all projects will need to undergo an additional consultation at the State Aid Commission. The decision on the company's grant is subject to a further positive recommendation by the State Aid Commission.

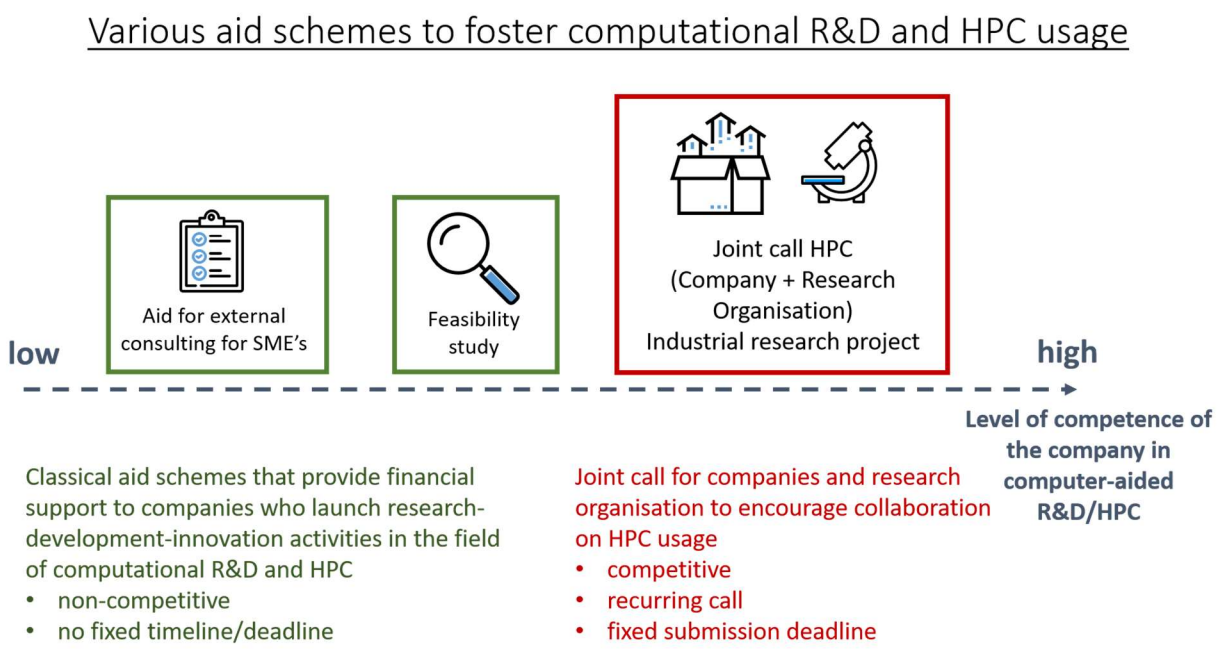
A project can only be funded by a concurring decision of FNR and the Ministry of the Economy.

The results of the evaluation will be communicated in July 2023, at the latest. Projects are expected to start in July 2023.

Joint Call HPC timeline:



Portfolio of dedicated aid schemes complementing the joint call for projects:



As emphasised in the "context of the call" and visualised in the dedicated figure, the joint call for projects is accompanied by a portfolio of dedicated aid schemes from the Ministry of Economy that takes into account the different skill levels of the private stakeholders in the use of computer-aided R&D or HPC. The goal is to create a general awareness in the use of simulation and modeling techniques in companies' R&D activities and to help companies to innovate at different computer-aided R&D/HPC maturity stages. Unlike the main call for projects, these aid schemes are for companies only, have no fixed deadline and are non-competitive. The aid schemes are defined in the RDI law [1] and companies that want to benefit must fulfil the general eligibility criteria of article 2 of that law and the respective criteria of the specific state aid scheme they apply for as set out in the R&D [2] or SMEs aid schemes [4].

- **Aid scheme 1:** Aid for external consulting for SME's to demonstrate the potential of simulation-based R&D, data exploitation or HPC usage in company's innovation or business processes.
  This aid scheme targets SMEs that have no, or only very little expertise and knowledge, in the above mentioned fields. External expertise should be solicited from associated external consultancies in order to analyze the innovation processes and provide specific recommendations, as well as to propose tools and methods for the applicant to implement computer-aided R&D or HPC use in its innovation or business processes.

- **Aid scheme 2:** Aid for a technical feasibility study for the evaluation and analysis of the potential to implement R&D projects based on simulation and modeling.

  The aid scheme intends to support private actors (SME or large company) to assess the potential of a computer-aided R&D or HPC project. The study should include all the preliminary analyses necessary to define the key elements to be implemented, in order to carry out industrial research

activities based on simulation, modeling or data analysis requiring intensive computing power. This includes project design, assessment of the challenges and skills needed to successfully transfer physical R&D processes to virtual prototyping, data availability to train AI algorithms, software needs, etc. to demonstrate the technical feasibility of the project. Evaluation of the transformation of existing software, codes and tools to open source and HPC may be part of the feasibility study as well. External expertise may be sought from DIH, NCC-HPC, academic or private partners.

Note, that for aid scheme 1 and aid scheme 2, projects can benefit from innovation support for SMEs to finance the detachment of highly qualified personnel who will contribute to the implementation of digital programmes and software in innovation processes.

- **Aid scheme 3:** Joint call for projects (as defined above) to support the implementation of industrial research projects that aim to benefit from high-performance computing.

Note that companies that have already a considerable level of competencies in the use of HPC applications can make use of the aid for industrial research or experimental development projects under the RDI law [1] to carry out innovative research and development projects.

References:

[1] Modified law of May 17, 2017, on the promotion of research, development and innovation.

[2] *https://guichet.public.lu/en/entreprises/financement-aides/aides-recherche-developpement/rdi/aides-rdi.html*

[3] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52014XC0627(01)&from=EN

[4] *https://guichet.public.lu/en/entreprises/financement-aides/aides-recherche-developpement/rdi/aide-innovation-pme.html*