

HPC4Mfg Program: Collaborations for U.S. Manufacturers

Special Call: Steel and Aluminum

The High-Performance Computing for Manufacturing (HPC4Mfg) Program seeks qualified industry partners to participate in short-term, collaborative projects with the Department of Energy's (DOE's) National Laboratories. Through support from the Advanced Manufacturing Office of the DOE Office of Energy Efficiency and Renewable Energy (EERE), selected industry partners will be granted access to High Performance Computing (HPC) facilities and experienced staff at DOE National Laboratories. *For this special topic call, we are interested in collaborations that will address key manufacturing challenges in the production of primary and secondary steelmaking and aluminum production processes* by applying modeling, simulation, and data analysis with the intent to improve energy efficiency, increase productivity, reduce cycle time, enable next-generation technologies, test control system algorithms, investigate intensified processes, lower energy cost, and accelerate innovation.

Eligibility for this program is limited to entities that manufacture steel and aluminum products in the U.S. for commercial applications and the organizations that support them. Selected Demonstration projects will be awarded up to \$300,000 to support compute cycles and work performed by the national lab partners. The industry partner must provide a participant contribution of at least 20% of the DOE funding for the project.

In addition, we will consider Follow-on projects to previously-awarded, successful Demonstration projects in these areas. These projects should focus on the further implementation of the demonstrated HPC application in the industrial setting; taking it closer to operational use and broad national impact. Selected Follow-on projects will be awarded up to \$300,000 to support compute cycles and work performed by the national lab partners. The industry partner must provide a participant contribution of at least 50% of the DOE funding for the project; of this, at least half should be in cash to support the national laboratory work.

The HPC4Mfg Program anticipates making multiple awards subject to the availability of funding.

Background

DOE maintains world-class HPC expertise and facilities, currently hosting five of the top twelve most powerful computers in the world. From detailed atomic-level simulations to massive cosmological studies, researchers use HPC to probe science and technology questions inaccessible by other experimental methods. Scientific insights gained from these computational studies have drastically impacted research and technology across industrial sectors and scientific fields. Examples include additive manufacturing, oil recovery, drug development, climate science, genomics, and exploration of fundamental particles that make up our universe. From industry to academia, the scientific need for compute power pushes the limits of current computers and continues to drive innovation and development for future high-performance computers and their capabilities.

There is high potential for the U.S. manufacturing industry to utilize the power of HPC. The HPC4Mfg Program is intended to provide HPC expertise and resources to manufacturing industries to lower the risk of HPC adoption and broaden its use to support manufacturing. The DOE Advanced Manufacturing Office (AMO) within EERE sponsors this HPC4Mfg Program.

AMO partners with private and public stakeholders to support the research, development and deployment of innovative technologies that can improve U.S. competitiveness, save energy, and ensure global leadership in advanced manufacturing. AMO supports cost-shared research, development, and demonstration activities in support of crosscutting next generation technologies and processes that hold high potential to significantly improve energy efficiency and reduce energy-related emissions, industrial waste, and the life-cycle energy consumption of manufactured products.

Program Objective

The objective of the HPC4Mfg Program is to enable targeted collaboration between the DOE National Laboratories and the U.S. manufacturing industry to investigate, improve, and scale methods that will accelerate the development and deployment of innovative energy efficient manufacturing. This solicitation is aimed at demonstrating the benefit of HPC toward these goals within one year.

Improved energy efficiency across the manufacturing industry is one of the primary goals of the HPC4Mfg Program. We solicit proposals that require HPC modeling and simulation to overcome impactful manufacturing process challenges resulting in reduced energy consumption and/or increased productivity. In this area, we solicit proposals that identify a specific key technical challenge in primary and secondary steel and aluminum manufacturing processes and that articulate the unique ways in which high performance computing can be used to overcome that challenge.

Proposals should provide a realistic assessment of the energy impact as well as the improvement in U.S. manufacturing competitiveness and increase in U.S. manufacturing jobs that a successful outcome of the project could have across the industrial sector.

Successful applicants will work collaboratively with staff from one or more of the DOE laboratories to conduct project activities across the various HPC areas of expertise, including development and optimization of modeling and simulation codes, porting and scaling of applications, application of data analytics, as well as applied research and development of tools or methods.

To make the broadest impact across the industry, the project teams will present their non-proprietary results at appropriate venues including technical conferences, trade shows and journals, and various industrial engagement activities as sponsored by the HPC4Mfg Program.

The DOE national laboratory system provides the HPC expertise and capabilities for the HPC4Mfg Program. Lawrence Livermore National Laboratory (LLNL) administers the program with Lawrence Berkeley National Laboratory (LBNL) and Oak Ridge National Laboratory (ORNL) as managing principal laboratories. Computing resources at these three laboratories, along with those at EERE's National Renewable Energy Laboratory (NREL) and Argonne National Laboratory (ANL) are available for participant use. Personnel at all DOE national laboratories are eligible to participate in project execution.

Eligibility

Eligibility is limited to U.S. manufacturers, defined as entities that are incorporated (or otherwise formed) under the laws of a particular State or territory of the United States, and which manufacture products in the United States. U.S. universities, institutes, and other non-profit

organizations are also eligible to participate as collaborators.

Funding Requirements

For both Demonstration and Follow-on projects, the DOE monetary contribution for each project will not exceed \$300,000. For Demonstration projects, an industry partner must provide a participant contribution of at least 20% of the DOE funding for the project to support industry expertise to the project. The participant contribution can take the form of monetary funds-in or “in-kind” contributions and must come from non-federal sources unless otherwise allowed by law. For Follow-on projects, an industry partner must provide a participant contribution of at least 50% of the DOE funding for the project; of this, at least half must be in cash to support the efforts of the national laboratory staff. The DOE funding will be provided to the national laboratory (or laboratories) in support of their work under the HPC4Mfg Program. On a limited basis, students at U.S. universities may also be supported.

Note: THIS IS NOT A PROCUREMENT REQUEST.

Solicitation Process and Timeline

This solicitation comprises a two-stage process consisting of the submission and evaluation of a two-page concept paper submitted by the industrial PI. These will be evaluated by a technical review committee on the technical challenge to be overcome; how this advances the state of the art for the industrial sector; how HPC can uniquely contribute to the solution of the technical challenge; and the impact a successful project can have. To the extent known, the technical plan should be articulated as well. The program recognizes that those industrial PIs who have not yet identified a national laboratory partner to work with will necessarily not have a complete picture of the technical solution techniques that are possible.

Successful concept papers will be paired with a national laboratory partner for the development of the full proposal. Full proposals will be reviewed by a technical committee against the criteria given below. The portfolio of proposals recommended by the committee will be submitted to DOE senior managers for final selection, subject to the availability of funding. All DOE funding decisions shall be final. Upon approval from DOE, the HPC4Mfg Program Director will issue a response to each applicant and successful applicants will begin CRADA initiation. Once both parties approve the CRADA, the projects can begin execution. Failure to engage promptly in CRADA negotiations can result in rejection of the project. The portfolio of projects will be posted on <http://hpc4mfg.org/>. The HPC4Mfg Program reserves the right to select all, a portion, or none of the submissions.

Note that if a concept paper or full proposal is technically strong, but is not selected for funding, the program management team may share them with other program offices in DOE for consideration for possible funding through those offices.

Timeline

Estimates will be replaced by firm dates as the solicitation progresses. Please see the program web site for updates.

Event	Date (2018)
Call for proposal	August 23
Concept paper due	September 18
Request for full proposal	Late October
Full proposal due	Late November
Finalists notified	January 2019
Expected project start	Late January 2019

Concept Paper Guidelines

Interested parties will first submit a concept paper by the due date that describes the objectives of the project. The concept paper will be evaluated against the documented criteria. Successful concept papers will be invited to submit a full proposal.

The concept paper template can be downloaded from the web site and should be used to prepare your submission. For new demonstration projects, the concept paper should not exceed two (2) single-spaced pages using 12-point font (Times New Roman preferred), should be in PDF file format, and **must include** the following components under heading corresponding to the bullets below. A concept paper that does not meet the Guidelines may be rejected.

- **Title Page:** *(not included in page limit)* Project title, company name, description and U.S. manufacturing location(s), and company principal investigator(s) (PI) contact information. Include national lab PI contact information, if known. Acknowledgment of the required 20% cost-share that the use of the DOE short form Cooperative Research and Development Agreement (CRADA) is acceptable. Indication of business sector and process category (list provided).
- **Abstract (150 words or less):** *Non-proprietary summary of problem being addressed, why problem is important to the energy future of the U.S., plan to address problem, and the national impact the solution will have on energy efficiency and manufacturing competitiveness.*
- **Background:** *Explain the technical challenge to be addressed, the state-of-the-art in this area and how this work advances the state-of-the-art, how solving this problem will meet the goals of the HPC4Mfg Program, the relevant expertise of the industry partners, what national lab expertise is needed, and why national laboratory HPC resources are required and how they will be used.*
- **Project plan and objectives:** *Describe the technical scope of work to be performed, how this project fits into an overall solution strategy for the challenges being addressed. Describe how the results of the project will be validated, including availability of data. If possible, describe specific simulation codes to be used in this effort.*
- **Impact:** *Describe how this effort will result in long-term energy savings across the industry and/or the ability of an industry to accelerate the development and deployment of innovative energy-efficient manufacturing. Of particular interest are projects with a national-scale impact on energy efficiency and manufacturing competitiveness. Metrics include cost savings, energy savings and/or improvements in energy intensity, and U.S. manufacturing jobs.*

For Follow-on projects, the concept paper should not exceed three (3) single-spaced pages using 12-point font (Times New Roman preferred), should be in PDF file format, and should include all of the components described above. In addition, the following component is required:

- **Results from the prior funded project (one page maximum with figures):** *Review the results and knowledge gained from the Demonstration project. Explain how these results will be used to address the objectives of this proposal. If you believe that the current proposal is distinctly different from the previous project and should not be considered as a Follow-on project, please articulate the differences.*

Completed concept papers, derived from the provided template, must be submitted in PDF file format by email to hpc4mfg-submissions@llnl.gov by 11:59pm PDT on the deadline indicated. The subject line should include: HPC4Mfg Concept Submission. Receipt of concept papers will be confirmed within one week of submission. Concept papers will be evaluated against the criteria described below.

Full Proposal Guidelines

Successful concept paper submissions will be notified and paired with a Principal Investigator (PI) from one of the DOE National Laboratories, or a combination of these national laboratories, to collaborate on development of a full proposal. Full proposals will be evaluated against the criteria described below.

The proposal template can be downloaded from the web site and should be used to prepare your submission. Proposals for new Demonstration projects should not exceed six (6) single-spaced pages using 12-point font (Times New Roman preferred), should be in PDF file format, and **must include** the following components under headings corresponding to the bullets below. Proposals that do not meet the guidelines may be rejected.

- **Title Page:** *(not included in page limit)* Project title, company name, description and U.S. manufacturing location(s), and company principal investigator(s) (PI) contact information. Include national lab PI contact information. Acknowledge the need to provide 20% cost-share and the agreement to enter into the DOE Short Form CRADA.
- **Abstract (150 words or less):** ***Non-proprietary, publishable*** summary of problem being addressed, why problem is important to the energy future of the U.S., plan to address problem, and the national impact the solution will have on energy efficiency and manufacturing competitiveness. *If selected for the HPC4Mfg Program, this abstract will appear on award announcements sent to the press.*
- **Background:** *Explain the technical challenge to be addressed, the state-of-the-art in manufacturing in this area and how this work advances the state-of-the-art, how solving this problem will meet the goals of the HPC4Mfg Program, the relevant expertise of the industry partners, what national lab expertise is needed, and why national laboratory HPC resources are required and how they will be used. Indicate if the proposed project will accelerate transformational technological advances in areas that industry by itself is not likely to undertake because of technical and financial uncertainty.*
- **Project plan and objectives:** *Describe the technical scope of work to be performed and how this scope will fit into the broader solution for the challenges being addressed. Describe a set*

of tasks to be performed and define what work industry partners will perform and what work laboratory partners will perform. Describe how the results of the project will be validated, including availability of data. If possible, describe specific simulation codes to be used in this effort and any modifications to the software that are needed to solve the proposed problem.

- **Tasks, Milestones, Deliverables, Schedules:** *Goals, timelines and due dates throughout the life of project. Not every milestone needs to have a deliverable. Include deliverables from all partners, not just the national lab partner(s). Indicate responsible party(ies) for each deliverable. Include deliverables from one partner to another as well as those to AMO.*
- **Impact:** *Estimate how this specific HPC effort will result in national-scale, long-term energy savings across the industry and/or the ability of an industry to accelerate the development and deployment of innovative energy efficient manufacturing. Describe how this specific HPC work contributes to a transformational change in the energy sector and enduring economic impact. Describe the alternative actions if this effort is not funded including reliance on experimental technologies or other courses of action. Metrics include cost savings, energy savings and/or improvements in energy intensity, and U.S. manufacturing jobs.*
- **Implementation:** *Describe how this work will be incorporated into company and industry-wide operations. Describe the follow-on activities to extend this effort to solve the broader problem being addressed.*
- **Appendix A: Project Summary of Tasks and Schedule (not included in page count):** *Provide a summary of the tasks and subtasks in a table format that provides the milestones, deliverables, and schedule. Please also provide a schedule summary in Gantt chart format.*
- **Appendix B: Project Budget (not included in page count):** *Summarize project costs including amount and source of participant contribution in the table below. Indicate in-kind and/or cash contribution for Industry funding. Include a description of how this funding will make a large difference relative to existing funding from other sources, including the private sector and why the government should fund this work.*
- **Appendix C: Computational Resources (not included in page count):** *Describe the computational approach, the performance of the codes, and the resources requested (platform and number of core hours).*
- **Appendix D: Pictures for publication (not included in page count):** *Include one or two **non-proprietary** pictures/images that can be used in a press release should this project be funded.*
- **Appendix E: Discussion of how this work benefits the laboratory (not included in page count):** *Briefly discuss new or enhanced capabilities that will be gained by the partner laboratory. Or explain how this will help to maintain existing laboratory capabilities.*
- **Resumes (not included in page limit):** *Include resumes of participants.*

Follow-on project proposals should not exceed eight (8) single-spaced pages using 12-point font (Times New Roman preferred), should be in PDF file format, and should include all the components described above. In addition, the following component is required:

- **Results from the prior funded project (two pages maximum with figures):** *Review the results and knowledge gained from the Demonstration project. Explain how these results will be used to address the objectives of this proposal. If you believe that the current proposal is distinctly different from the previous project and should not be considered as a follow-on project, please articulate the differences.*

Completed proposals, derived from the provided template, must be submitted in PDF file format by email to hpc4mfg-submissions@llnl.gov by 11:59pm PDT on the deadline indicated above or given on the submission web site. The subject line should include: HPC4Mfg Proposal Submission. Receipt of proposals will be confirmed within one week of submission.

Evaluation Process and Criteria

Both concept papers and full proposals will be evaluated by a Technical Merit Review Committee consisting of experts in the application of HPC modeling, simulation, and data analysis from each of the principal DOE national laboratories, and members of the DOE program offices with knowledge of the U.S. industry. Subject Matter Experts will be consulted to verify claims, including description of current state-of-the-art and estimate of project impact (e.g. cost and energy savings).

Concept papers will be evaluated primarily on the technical challenge and potential impact of using HPC to solve the industrial challenge. Concept papers should articulate, to the extent the possible, the technical plan for performing the work. The committee recognizes that those industrial PIs who have not yet identified a national laboratory partner to work with may not have a complete picture of the technical solution techniques that are possible.

Full proposals will be evaluated against all of the criteria listed below. Because the industrial partner will have been assigned a laboratory partner to work with to develop the full proposal, the technical plan and feasibility will be expected to be well articulated. In addition, strong evidence of communication and planned collaborations between the national lab and industrial participants is expected in the full proposals.

The portfolio of proposals recommended by the committee will be submitted to AMO senior managers for final funding approval, subject to the availability of funding. All AMO funding decisions shall be final. Upon approval from AMO, the HPC4Mfg Program Director will issue a response to each applicant and successful applicants will begin CRADA initiation. Once both parties approve the CRADA, the projects can begin execution. Failure to engage promptly in CRADA negotiations can result in rejection of the project. The portfolio of projects will be posted on <http://hpc4mfg.org/>. The HPC4Mfg Program reserves the right to select all, a portion, or none of the submissions.

Note that if a concept paper or full proposal is technically strong but does not meet the stated goals of HPC4Mfg Program, the program management team may share them with other program offices in DOE for consideration for possible funding through those offices.

Evaluation Criteria

- **Advances the State-of-the-Art in the Industrial Sector:** Does the proposed work take the industrial sector to a new level; provide a wholly new capability or make an existing, energy intensive technology obsolete in the manufacturing sector.

- **Technical feasibility:** Does the proposal have a clearly stated technical approach, a description of the software to be used, including any needed modifications, clear roles and responsibilities for the participants (both industrial partner and national laboratory), realistic time frames for each technical step, and, if necessary, validation data available to the team.
- **Relevance to high-performance computing:** Does the proposed work fully utilize the unique expertise and capabilities at the DOE national laboratories to solve a problem that could not be solved in any other way. Does it demonstrate the ability to use large fractions of the machine to solve a truly large-scale problem and provide clear estimates the compute cycles necessary for the work to be performed.
- **Impact, including Lifecycle Energy Impact:** Does the proposal provide clear, evidence-based energy savings that will *have broad (national-scale) industrial impact* through development and/or improvement of energy efficient manufacturing technologies, as well as impact on employment and manufacturing in the United States. Does the proposal have a clearly stated plan for broad deployment of project artifacts or knowledge gained.
- **Project management and team:** Does the proposal match team expertise to the problem to be solved; have modeling expertise on both the national laboratory and industry sides, and process experts for the model validation if necessary. The proposal clearly states roles and responsibilities for the participants and provides evidence of a strong collaboration between the industrial and national partners through joint milestones and deliverables.

Point of Contact

During the period of the call for proposals, all questions relating to this announcement should be directed to the HPC4Mfg Director at hpc4mfg-submissions@llnl.gov. Answers will be posted on <http://hpc4mfg.org/>. Industrial partners that are interested in submitting applications should refrain from contacting national laboratory proposal partners during the call for proposals.

Intellectual Property and Proprietary Data

The HPC4Mfg Program respects the importance of industry's intellectual property and data security.

Awardees are expected to enter into a DOE Model Short Form CRADA with the national laboratory or laboratories that will be performing the work. This CRADA contains provisions relating to proprietary information and intellectual property. Because of the need for accelerated placement and execution of the projects, terms of the CRADA will not be subject to negotiation. To review the proposed terms that make up the DOE Model Short Form CRADA, please see the example posted on the HPC4Mfg solicitation website.

For academic awardees IP and Proprietary Data terms, as needed, will be defined in the subcontracts issued to the U.S. university.

A Non-Disclosure Agreement can be put into place during development and submission of the proposal to facilitate discussions while protecting the partner's proprietary information.

To the extent possible, it is preferred that proprietary information NOT be included in the submitted proposal. If company proprietary information is included in the proposal, the specific information should be marked as such, and HPC4Mfg Program officials will utilize reasonable

efforts to treat the information as business sensitive.

Significant delays by the industry partner to finalize the CRADA could result in rejection of the proposal.