HPC4Mfg Program: Collaborations for U.S. Manufacturers

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. The collaborations will address key challenges in U.S. manufacturing by applying modeling, simulation, and data analysis to the manufacturing of materials 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. Projects must demonstrate potential impact to energy efficiency in manufacturing and/or the development of new clean energy technologies with a potential for broad national impact. We solicit proposals in the following primary areas:

1. Proposals that require HPC modeling and simulation to overcome impactful manufacturing process challenges resulting in reduced energy consumption and/or increased productivity.
2. Proposals that uniquely exploit HPC modeling and simulation to reduce energy consumption through improved clean energy technology design and clean energy manufacturing.

Eligibility for this program is limited to entities that manufacture 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. 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 in one or both of these categories, 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 advanced clean energy 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 and clean energy technologies. 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 or enable the production or adoption of clean energy technologies. 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 in the following primary areas:

1. 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 a manufacturing process and that articulate the unique ways in which high performance computing can be used to overcome that challenge.
2. Proposals that uniquely exploit HPC modeling and simulation to reduce energy consumption through improved clean energy technology design and clean energy manufacturing. In this area, we solicit proposals that demonstrate the use of HPC to help develop new, innovative clean energy technologies, optimize device design, predict device performance, shorten time to market, and reduce the number of testing cycles in product development.

In both cases, proposals should articulate the national scope of impact 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 additional national laboratories are eligible to participate in the execution of demonstration projects.

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 manufactures 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.

Concept Paper Guidelines
Interested parties will first submit a concept paper by the due date provided below 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 impact the solution will have on the national energy.*

- **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, the production or deployment of clean energy technologies with broad industrial application, and/or the ability of an industry to accelerate the development and deployment of innovative energy-efficient manufacturing. Of particular interest are projects that with a national-scale impact. Metrics include cost savings, energy savings and/or improvements in energy intensity.*

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 PST on the deadline indicated below. 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 LLNL, LBNL, ORNL, other participating 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 impact the solution will have on national energy consumption or production. 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, the production or deployment of clean energy technologies with broad industrial application, 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.

- **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 PST on the deadline indicated below 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.

Proposal evaluation will be conducted 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 AMO with knowledge of the U.S. Manufacturing 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).

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 results 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 new clean energy technology development and/or 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.

Timeline
Estimates will be replaced by firm dates as the solicitation progresses.

Event	Date (2018)
Call for Proposal	February 1
Concept Paper due	March 15
Request for full proposal	Late April
Full proposal due	Mid June
Finalists notified	Late July
Expected project start	October

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.