



ENERGY INNOVATION



MANUFACTURING



MATERIALS

National Laboratories Partner with U.S. Manufacturers to Increase Innovation and Energy Efficiency

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Lawrence Livermore National Laboratory is operated by Lawrence Livermore National Security, LLC, for the U.S. Department of Energy, National Nuclear Security Administration under Contract DE-AC52-07NA27344 LLNL-PRES-852034



Energy Efficiency & Renewable Energy



Fossil Energy and Carbon Management



Office of Science



DOE RFI on the HPC4EI Program

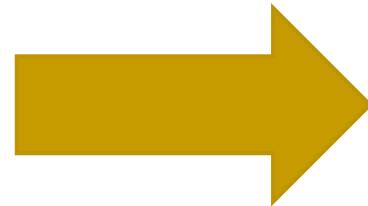
The screenshot shows the HPC4EI website header with navigation links: SOLICITATIONS, EVENTS, COMPUTING RESOURCES, SUCCESS STORIES, PROJECTS, FAQs, CONTACT, and Now Accepting Applications. The main banner reads "High Performance Computing for Energy Innovation" with the tagline "In partnership with industry, leveraging world-class computational resources to advance the national energy agenda." Below the banner are three cards: "Request for Information" (circled in red with an arrow), "OPEN" (Summer 2023 funding opportunity), and "Learn More" (High Performance Computing for Manufacturing).

- ▶ Asking industry partners to fill out a questionnaire
- ▶ Understand how we are impacting industry and look for ways we can do more
- ▶ Use this feedback to help shape the program.
- ▶ A broader stakeholder workshop is being planned for October in Livermore

Webpage has RFI document, a template to fill out, and email to us: hpc4ei-rfi@llnl.gov

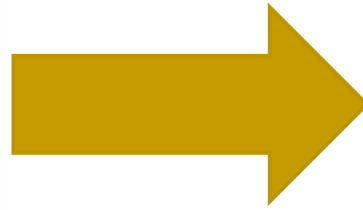
Industry partners please take the time to fill out the questionnaire

U.S. industry is undergoing a technological revolution



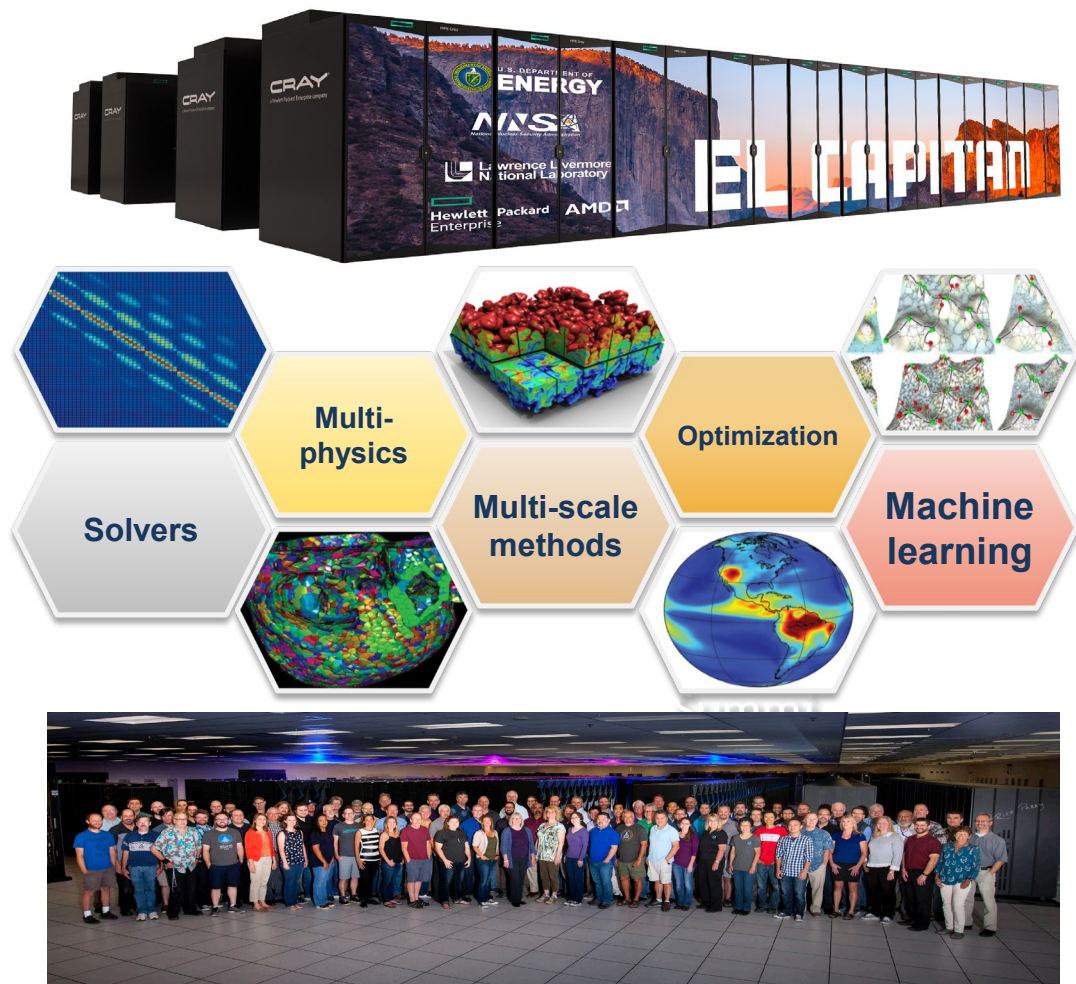
Computer Simulation – Data Analytics/AI – Material Discovery

We are advancing the energy agenda through advanced simulation



Computer Simulation shortcuts the Edisonian approach

HPC4EI connects the DOE HPC ecosystem to US industry



World-class supercomputers
Unique software
Subject Matter Experts





Utilizing DOE computing capabilities to help us Industry:

- ▶ Accelerate innovation
- ▶ Optimize design
- ▶ Reduce testing cycles
- ▶ Shorten the time to market
- ▶ Quality processes
- ▶ Reduce waste/reduce rejected parts
- ▶ Lower energy costs
- ▶ Reduced carbon emissions

The HPC4 Program is building an ecosystem to support HPC adoption by industry/government

- ▶ Showing what is possible with HPC through initial projects
 - ▶ DOE program office funds < \$400K to laboratories
 - ▶ Industry funds at least **20% of total project funding**; either in-kind support or optional cash contribution
 - ▶ Project duration one year
- ▶ Building the HPC4 community
 - ▶ Student intern programs
 - ▶ Hosting virtual and hybrid events



HPC 4 ENERGYINNOVATION

HPC 4
MANUFACTURING

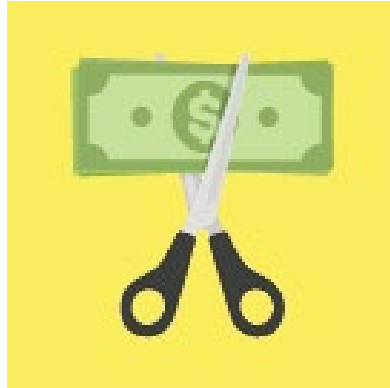
 U.S. DEPARTMENT OF **ENERGY** | Energy Efficiency & Renewable Energy

HPC 4
MATERIALS

 U.S. DEPARTMENT OF **ENERGY** | Fossil Energy and Carbon Management

Program Approach

Companies apply to program through a solicitation process



- DOE funds 2 solicitations a year
- \$400K / Project funded
- ~\$7M /yr Budget
- 11 National laboratories participating
- 150+ projects funded with 90+ companies over 7 years

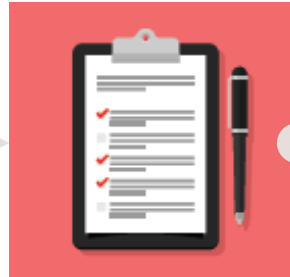
Industry
Concept Paper



PI Match
Full Proposal



Technical
Review



Signed
Agreement



PI obtains HPC
resources



Over 150 projects have been funded with over 90 manufacturers in US



- ▶ Aerospace leading edge companies
- ▶ Legacy industries
- ▶ Innovative small companies

Rapid-Prediction AI for Hot-Rolled Steel

Rolling hot, cast ingots into sheet steel is a tricky business.

At each deformation stage, cooling requirements must be predicted to yield the right grain structure, material properties, quality, and final control.

LLNL and AK Steel developed an HPC version of a legacy prediction tool. The “HSMM-HPC” completes a full-coil simulation in under a minute, predicts properties and quality based on ~1000 control variables, and trains an AI system that makes real-time predictions in fractions of a second.



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WITH AKS, INC.



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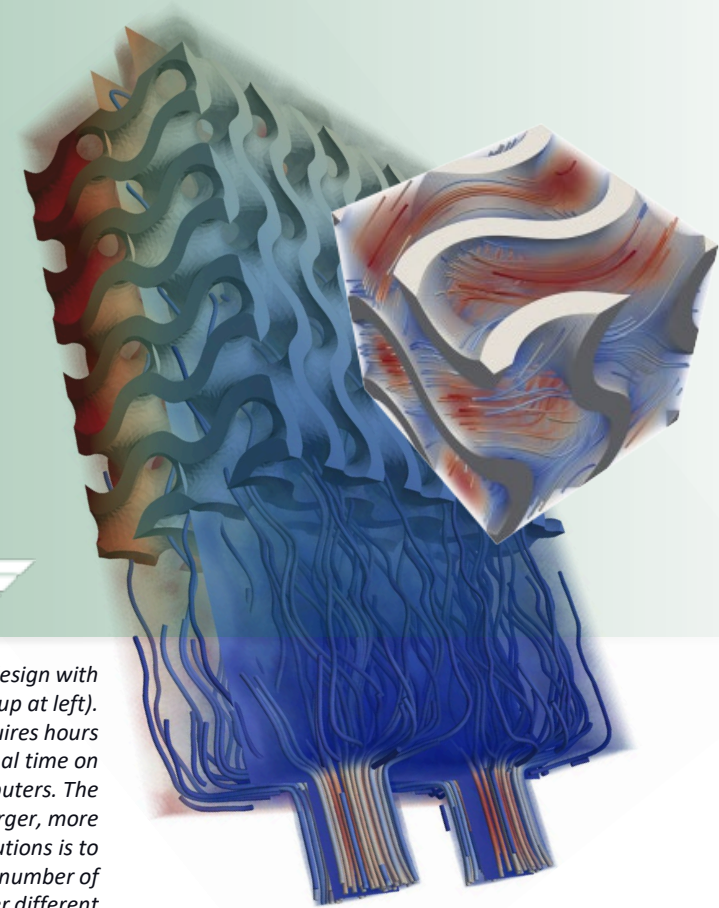
- Typical mill may save 10% of 145,000 MBTUs used annually
- Besides direct E conservation, enormous savings from improved productivity expected
- Remakes drastically reduced—waste of time, energy, money, trust avoided

Energy Savings for Automotive AC Heat Exchangers

Air conditioning guzzles fuel—up to 30% in internal-combustion engines and 40% of battery range in electrics.

This long-recognized problem was tackled by Materials Sciences, LLC, and Lawrence Livermore National Laboratory with breakthrough results.

The team deployed topology optimization, additive manufacturing, machine learning, and ultra-high-powered computers to optimize exchanger physics and slash compressor energy consumption by 30%.



3D heat-sink design with periodic cells (blowup at left). Detailed analysis requires hours of computational time on LLNL's biggest computers. The solution for larger, more realistic cell distributions is to analyze an extensive number of small unit cells under different flow regimes and wall-thickness parameters and derive a homogenized model for simulating the response of the exchanger

- Decreases fuel consumption in gas engines by 10%, extends e-car battery range by 13%.
- Adopted nationally by car makers, could yield annual 9.2% gas savings.
- Technology is adaptable to many heat-exchange applications.

Energy Savings for Nonwoven Manufacturing

Nonwoven materials are unrivaled for many uses, notably medical protective gear such as N95 masks. Industry leader 3M joined Argonne National Lab to slash energy consumed in manufacturing through high-powered computing.



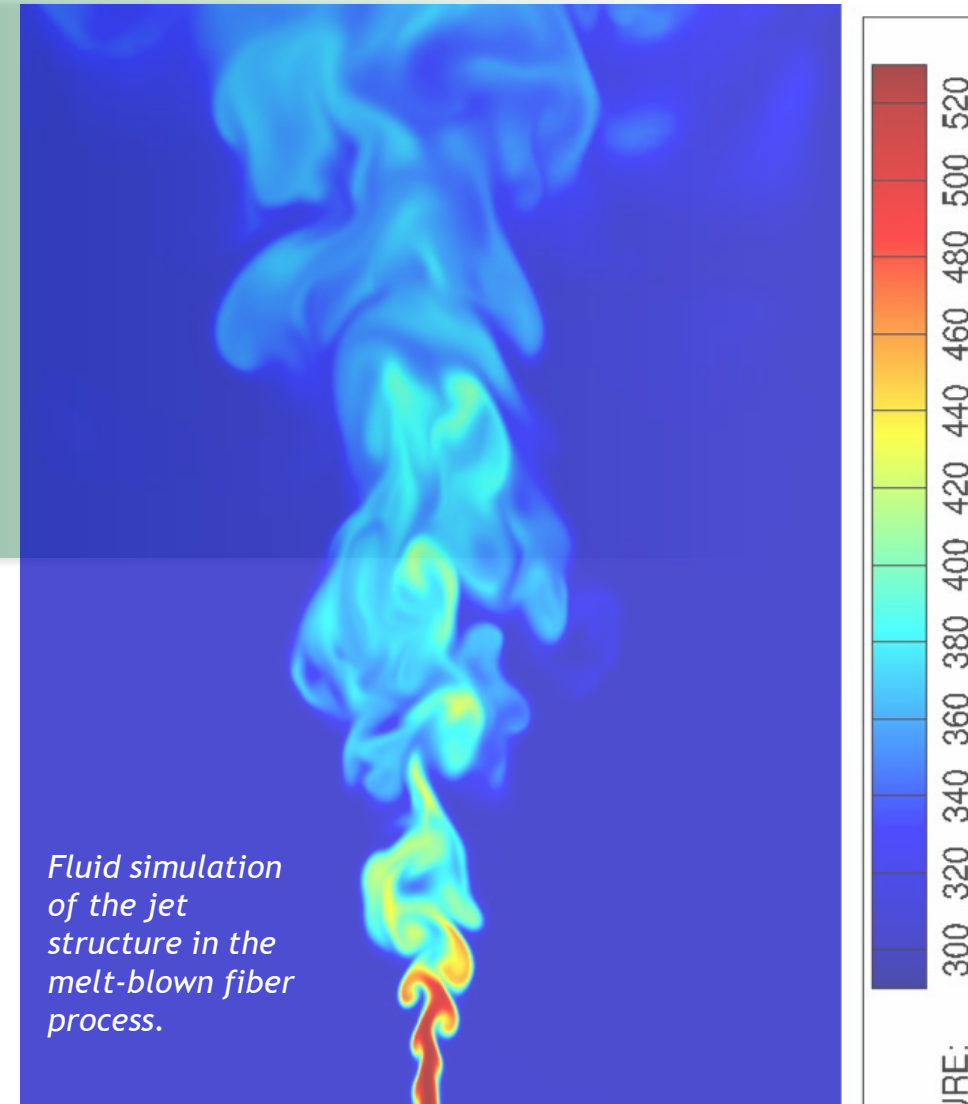
ARGONNE NATIONAL LABORATORY
3M COMPANY & U CHICAGO



Funded through the HPC4 Energy Innovation Program
hpc4energyinnovation.llnl.gov

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- Energy goal of 20% savings well within reach—could be as high as 50%.
- 49 GWH savings expected annually from 3M alone
- HPC-driven computational fluid dynamics quickly resolves the wickedly complex physics of nonwoven-materials production.
- New energy and cost-cutting methods expected to revolutionize entire industry.



Program Details: If Awarded DOE Model Short Form CRADA

- ▶ Used for accelerated placement and execution
- ▶ Scope and IP protection defined
- ▶ Industry awardees required to sign DOE Model Short Form CRADA
- ▶ Standard DOE Model Short Form CRADA available on the web site
 - ▶ Individual labs may have some variances
 - ▶ If concept paper is selected to go forward; you can ask your laboratory partner for a copy of the specific CRADA



Required!

DOE O 483.1A
11-6-2013

Attachment 5
Page 1

ATTACHMENT 5

This Attachment provides information and/or requirements associated with DOE O 483.1A as well as information and/or requirements applicable to contracts in which the associated CRD (Attachment 1 to DOE O 483.1A) is inserted.

MODEL SHORT FORM CRADA

This Model Short form CRADA is designed to be offered to entities as means for streamlining and simplifying the CRADA process for certain circumstances. In order to ensure expedited CRADA development and approval, this document must be adopted in its entirety, as written, by both/all parties with no exceptions. The language of this document is pre-approved by DOE; however, the DOE Field Office can approve minor changes specific to a Laboratory or other facility. The goal is for uniformity across the DOE complex with this CRADA with limited differences between Laboratories and other facilities.

The Short Form CRADA may be offered to entities that meet the following criteria:

- a) The Participant should be clearly advised that this CRADA must be adopted in its entirety, as written, by both/all parties and, at the same time, advised of the alternative to use the DOE Model CRADA if the total terms of the Short Form CRADA are not agreeable.
- b) The dollar value of the entire project (including amendments) does not exceed \$500,000. This dollar value may be periodically adjusted by the HQ Office of Procurement Policy (MA).

The Short Form CRADA package will be subject to the same process used for DOE Model CRADA package review and approval at the local DOE Field Offices.

Guidance for the DOE Model CRADA applies to clauses unchanged in the Short Form CRADA.

For each project, a Statement of Work (SOW) is required that details the nature, scope, roles, responsibilities, and costs of activities to be conducted by both parties together with an estimated timeline for completion of identified tasks. The SOW will be incorporated into the CRADA as Annex A.

What is new this solicitation?

- ▶ This solicitation will include HPC4Mfg and HPC4Mtls.
- ▶ Unique Entity ID (UEI) Number: The Unique Entity ID is the official identifier for doing business with the U.S. Government. This number is required for the CRADA agreement process. Companies register for a UEI through the SAM.gov website. If company is applying for a number or renewing a UEI, allow time for processing. We recommend ensuring your UEI number is active before full proposal submission.
- ▶ Project budgets will now be \$400k - see updated budget tables.
- ▶ No blackout period - Applicants are encouraged to reach out to DOE National Laboratory Point of Contacts to ask questions regarding their facility's HPC system capabilities and subject matter experts. List of POCs are available on the HPC4EI website.

Program Details: Eligibility and Funding

- ▶ Eligibility for call
 - ▶ Companies manufacturing or developing materials in the U.S.
- ▶ Who can be funded from the program
 - ▶ DOE National Laboratories
 - ▶ **University collaborators can be funded by the industry partner or DOE National Laboratory**
 - ▶ If the funding for a university or non-profit participant is to be provided by DOE through the DOE laboratory partner, funding requests must be less than half of the total DOE funds. Funding provided to a university and/or non-profit by the industrial partner can be considered a component of the industrial partner's in-kind funding contribution.
 - ▶ Encourage partnerships with universities and non-profit organizations located in federally-designated Opportunity Zones and or/Historically Black Colleges and Universities (HBCU)
- ▶ Industry participant cost share
 - ▶ At least 20% of **total** project funding (can be in kind)
 - ▶ Follow on projects require at least half of cost share in cash
 - ▶ Can be used to support internal staff
 - ▶ *Source cannot be other federal funding*



Updated budget table on full proposal template

Phase I project



Cost Category	DOE Funds	Industry Partner Cash Contribution	Industry Partner In-kind	Total Project Funding
National Lab Labor	368,000			
National Lab Travel	2,000			
National Lab HPC (include platform and #core hours)				
National Lab Procurements (include licenses)				
University and/or Non-profit Funding	30,000			
Industry Partner Labor			100,000	
Industry Partner Travel				
Industry Partner Procurements (include licenses or subcontracts)				
Totals	400,000		100,000	500,000

- Sum of Cash and In-kind must be 20% of total project funding $(100,000 + 0)/500,000 = 0.2$
- For initial projects cash contributions are not a requirement

Updated budget table on full proposal template

Phase II project



Cost Category	DOE Funds	Industry Partner Cash Contribution	Industry Partner In-kind	Total Project Funding
National Lab Labor	368,000			
National Lab Travel	2,000			
National Lab HPC (include platform and #core hours)				
National Lab Procurements (include licenses)				
University and/or Non-profit Funding	30,000			
Industry Partner Labor			50,000	
Industry Partner Travel			50,000	
Industry Partner Procurements (include licenses or subcontracts)				
Totals	400,000		100,000	500,000

- At least half of the contribution in Phase II projects must be cash
- Sum of Cash and In-kind must be 20% of total project funding $(50,000 + 50,000)/500,000 = 0.2$

HPC4 Manufacturing focuses on topic areas of interest to DOE's Advanced Materials and Manufacturing Office (AMMTO) and Industrial Efficiency and Decarbonization Office (IEDO)



- New materials and manufacturing processes in support of clean energy technology
- Improvements in the energy/carbon efficiency of manufacturing processes
- Improvements in the operational performance of energy storage and conversion technologies
- Emission reductions or efficiency improvements to energy intensive industries

Projects should address one or more of the topic areas listed in the solicitation

HPC4Materials focuses on topic areas of interest to DOE's Office of Fossil Energy and Carbon Management



Improvements to materials and designs for carbon removal systems including:

- Direct Air Capture,
- Biomass Carbon Removal and Storage
- Marine CO₂ removal
- Mineralization techniques

Projects should address one or more of the topic areas listed in the solicitation

Concept papers are the first step:

- ▶ Two-pages; single spaced; 12 pt. font - Use the template provided on HPC4EI website and HPC4EI Proposal System
- ▶ Key Elements
 - ▶ Title page
 - ▶ Abstract (150 words or less) - must be a **non-proprietary, publishable** summary
 - ▶ Background
 - ▶ Technical challenge to be addressed
 - ▶ State of the art in manufacturing and how this work advances the state of the art
 - ▶ Why national laboratory expertise and HPC resources are needed
 - ▶ Project Plan and Objectives
 - ▶ Technical scope of the work and how this project fits into the overall solution strategy
 - ▶ How results will be validated including availability of data
 - ▶ Specific simulation codes that will be used if known
 - ▶ Impact
 - ▶ How this effort results in long-term energy savings or
 - ▶ Ability to accelerate innovative energy-efficient manufacturing
 - ▶ Metrics include cost savings, energy savings, and improvement in energy intensity

*You do not need to identify a laboratory partner up front!
Just an interesting and difficult problem that HPC can help address!*

Full proposals provide much more detail

- ▶ Seven-pages; single spaced; 12 pt. font - **Template will be available in the HPC4EI Proposal System after Concept Paper review notifications are sent.**
- ▶ **Key Elements**
 - ▶ **Title page**
 - ▶ **Abstract** (150 words or less) - must be non-proprietary, publishable summary
 - ▶ **Background**
 - ▶ Similar to concept paper
 - ▶ **Project Plan and Objectives**
 - ▶ Similar to but more detailed than concept paper with specific tasks; specific simulation codes; modifications to the software needed etc.
 - ▶ **Tasks, Milestones, Deliverables and Schedules**
 - ▶ Goals, timelines and due dates of milestones and deliverables from all partners, including who is the responsible party for each deliverable and what will be communicated between the partners
 - ▶ **Verification and Validation Plan**
 - ▶ How do you intend to validate the findings of the model
 - ▶ **Impact**
 - ▶ Similar to concept paper but more detailed; is this transformational for an industrial sector and how; what is the enduring impact; how will results be disseminated
 - ▶ **Implementation**
 - ▶ How will this be incorporated into company and industry-wide operations; and follow-on activities to extend this effort to solve the broader problem being addressed
 - ▶ Various appendices (see next slide)

Appendices provide additional information

- ▶ Used in the review process; CRADA development process; compute resource determination, etc.
- ▶ Not included in the six-page limit
- ▶ **Appendix A:** References (not included in page count)
- ▶ **Appendix B:** Project summary of tasks and schedule (similar to project tasks in main proposal, but used for CRADA development)
- ▶ **Appendix C:** Project budget: costs, amount and source for participants, cost share (in-kind or cash); how funding makes a difference relative to existing funding
- ▶ **Appendix D:** Computational resources: computational approach, performance of the codes, resources requested (platform and core/node hours)
- ▶ **Appendix E:** Pictures for publication (Photos are used for program announcements)
- ▶ **Appendix F:** How the work benefits the laboratory
- ▶ **Appendix G:** Paragraph biographies of industry and lab lead PIs
- ▶ **Appendix H:** Resumes of key participants

Proposal Application - Submit Paper Electronically!

Access the electronic proposal system at proposalshpc4.inl.gov or HPC4EI Solicitation website

Log on here



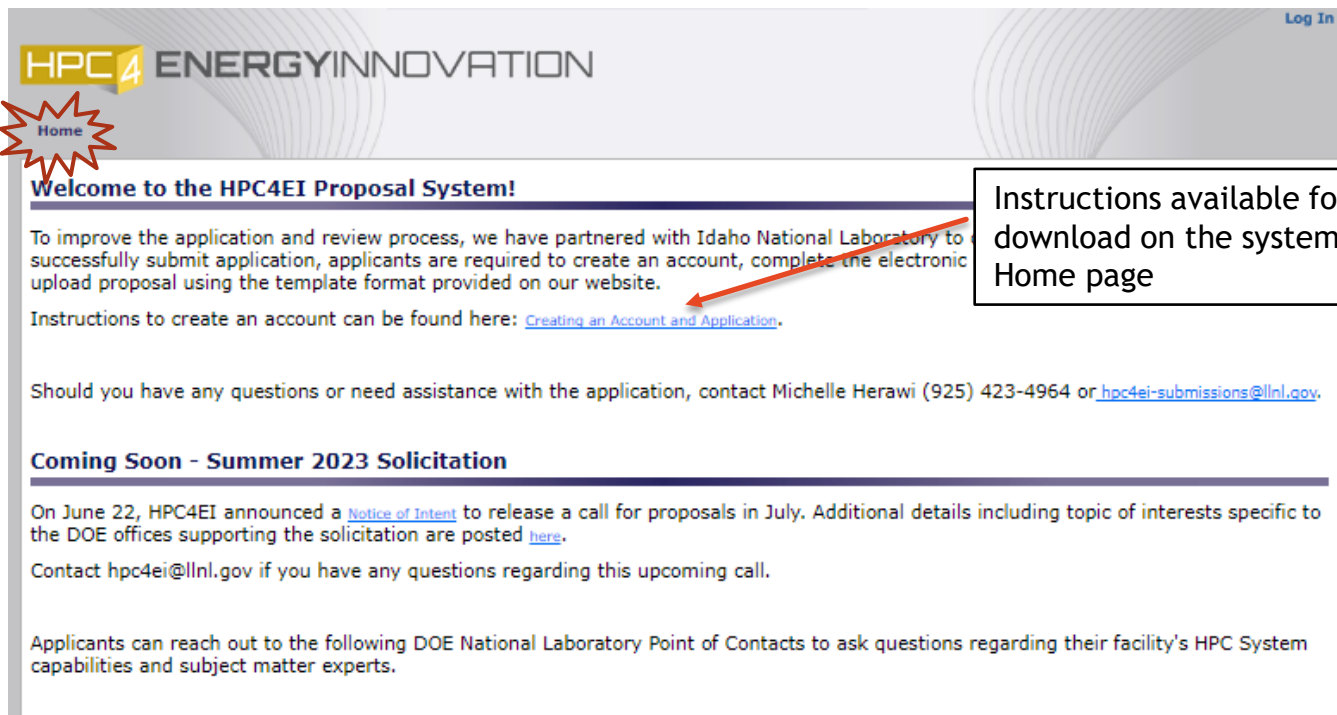
Summer 2023 solicitation will focus on topic areas associated with the HPC4Manufacturing (HPC4Mfg) and HPC4Materials (HPC4Mtls) Programs.

[Learn more about the application process.](#)

Create account and complete general account information



Click here



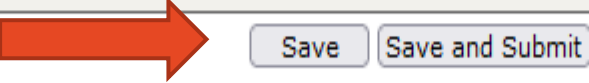
Instructions available for download on the system's Home page

Electronic Proposal Application

Proceed to Application tab to view Current Open Calls. Select “Create New Application”. Application form will appear in new window. Directions are displayed for each section.

After completing and saving this form, the applicant may edit the saved version until Thursday, August 17, 2023 5:00 PM PT. To submit the proposal for final review, the applicant **MUST** click on the "Save and Submit" below. **Forms in the system that are "Saved" but not "Submitted" are considered incomplete and will not be reviewed.**

For assistance please contact Michelle Herawi at 925-423-4964 or hpc4ei-submissions@llnl.gov.



Application must be saved before PI, Co-PIs, Proposal POC, and National Laboratory PIs sections can be populated. Forms may be saved, revisited, and edited until the deadline.

Electronic Proposal Application - Upload Submission and Delegate Access

Concept Paper



Before uploading submission, ensure concept paper file is formatted per provided [Summer 2023 Concept Paper Template](#).

Click to download
Concept Paper Template

Instructions:

1. Remove all instructional boxes from template.
2. **Cover page:** List only Tracking ID, Project Title, and Company Name.
3. **File name format:** Tracking ID_Company *Example: CP-G-21.2-26421 LLNL*
4. **Submission format:** Single spaced pages using 12-point Times New Roman, 1" margins, and converted to a PDF file. Template instructional boxes should be removed from the document.

After completing and saving this form, the applicant may edit the saved version until Thursday, August 17, 2023 5:00 PM PT. To submit the proposal for final review, the applicant **MUST** click on the "Save and Submit" below. **Forms in the system that are "Saved" but not "Submitted" are considered incomplete and will not be reviewed.**

For assistance please contact Michelle Herawi at 925-423-4964 or hpc4ei-submissions@llnl.gov.

Save Save and Submit

	Tracking ID	Call Name
	CP-F-20.1-25098	Fall 2020 Concept Paper
	CP-E-20.1-23758	Spring 2020 Full Proposal
	CP-E-20.1-23758	Spring 2020 Concept Paper
	CP-E-20.1-23867	Spring 2020 Concept Paper
	CP-D-20.1-23864	Winter 2020 Concept Paper

Other applications you have been delegated rights to

Tracking ID	Call Name

Delegated Rights

First Name	Middle Name	Last Name	Email	Permission
None				

New and Pending Delegation Requests

+ Create New Request

First Name	Middle Name	Last Name	Email	Permission
None				

List of applications are displayed on the Applications page. To delegate access to another user in the system, click on the 'lock' icon next to application record. Delegate must have an active system account to be assigned access.

Delegated applications will be displayed in the "Other applications you have been delegated rights to" section.

Electronic Proposal Application - Proposal Status

Current Open Calls

Call Name
Fall 2019 Concept Paper

Your Applications

Tracking ID	Call Name	Title	Proposal Status
CP-19.2.F-21573	Fall 2019 Concept Paper	Test	Working

Notifications of review results are generated from the proposal system and addressed from hpc4ei-submissions@lnl.gov. It is highly recommended to add the email address to your contact list to avoid notification directing to spam.

Visit the Applications page to view proposal status and Technical Merit Review Committee comments.

Tracking ID	Call Name	Title	Proposal Status	Delegated Rights	Reviewer Comments
CP-D-20.1-23563	Winter 2020 Concept Paper		Working		
FP-C-19.2-21573	Fall 2019 Full Proposal	Test	Working	Proposal Admin -	
CP-C-19.2-21573	Fall 2019 Concept Paper	Test	Submitted		See Comments

Visit our website for solicitation details

**Concept Paper Deadline
August 17, 2023 by 5:00 p.m. PT**

www.hpc4energyinnovation.org

Aaron Fisher, Acting HPC4EI Director
fisher47@llnl.gov

Send questions to hpc4ei@llnl.gov

Be the first to receive program announcements by joining the hpc4ei-info@llnl.gov distribution lists. Subscribe on our website!

Proposal Application Portal
<https://proposalshpc4.inl.gov>

The screenshot shows the HPC4 Energy Innovation website homepage. At the top, there is a navigation menu with links for SOLICITATIONS, EVENTS, COMPUTING RESOURCES, SUCCESS STORIES, PROJECTS, FAQs, CONTACT, and a red link for Now Accepting Applications. The main header features the HPC4 Energy Innovation logo and the text "High Performance Computing for Energy Innovation". Below this is a quote: "In partnership with industry, leveraging world-class computational resources to advance the national energy agenda." The main content area is divided into three columns. The left column is titled "Request for Information" and includes a small icon of a document and the text "HPC4EI Initiative is seeking public input" with a "Learn More" button. The middle column is titled "OPEN" and features a yellow header. It contains the text "Summer 2023 focusing on topic areas associated with the HPC4Manufacturing (HPC4Mfg) and HPC4Materials (HPC4MTIs) Programs." Below this is a red button labeled "START HERE Funding Opportunity" and a note "*up to \$3 million in funding". The right column is titled "Learn More" and includes an image of a tablet displaying data and the text "High Performance Computing for Manufacturing" with a "View Brochure" button.

Request for Information

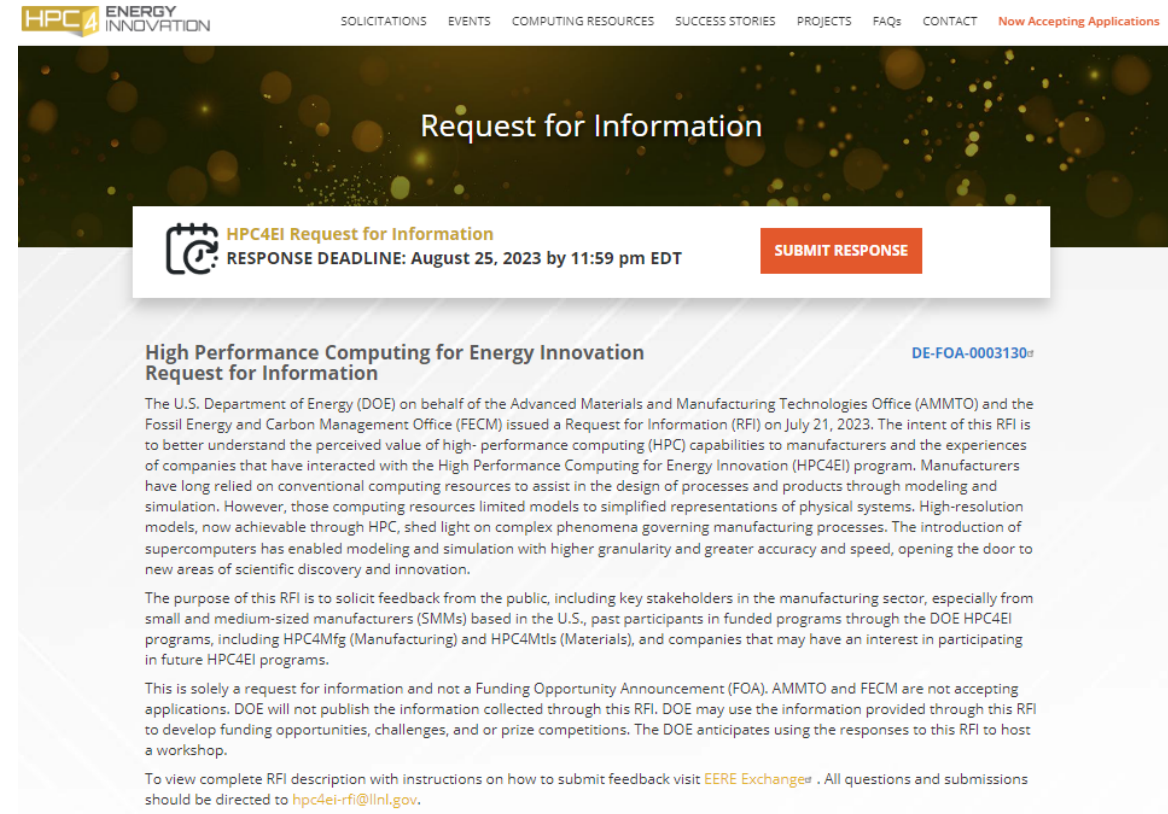
HPC4EI Initiative is seeking public input to better understand the perceived value of HPC capabilities to small-and-medium-sized manufacturers and companies who have participated in the initiative in the past.

Response Deadline
Friday, August 25, 2023, by 11:59 EDT

RFI Document Download
[DE-FOA-0003130](#)

To view complete RFI description with instructions on how to submit feedback, visit the [HPC4EI website](#) or the [EERE Exchange site](#).

Questions and submissions can be directed to hpc4ei-rfi@llnl.gov



The screenshot shows the HPC4EI Request for Information webpage. At the top, there is a navigation bar with links for SOLICITATIONS, EVENTS, COMPUTING RESOURCES, SUCCESS STORIES, PROJECTS, FAQs, CONTACT, and a 'Now Accepting Applications' button. The main header features the HPC4EI logo and the text 'Request for Information'. Below this, a white box contains the HPC4EI logo, the title 'HPC4EI Request for Information', the response deadline 'RESPONSE DEADLINE: August 25, 2023 by 11:59 pm EDT', and a red 'SUBMIT RESPONSE' button. The main content area has a title 'High Performance Computing for Energy Innovation Request for Information' with the ID 'DE-FOA-0003130'. The text describes the RFI's purpose: to understand the perceived value of HPC capabilities to manufacturers and the experiences of companies that have interacted with the HPC4EI program. It notes that while conventional computing resources assist in design, high-resolution models achieved through HPC provide more accurate and detailed insights. The RFI is open to small and medium-sized manufacturers (SMMs) based in the U.S., past participants in funded programs, and companies interested in future HPC4EI programs. It is a request for information, not a funding opportunity announcement, and the information collected will be used to develop funding opportunities, challenges, and prize competitions. A link to the EERE Exchange site is provided for more details and submission instructions.