



ENERGY INNOVATION



MANUFACTURING



MATERIALS

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

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U.S. DEPARTMENT OF ENERGY

Energy Efficiency & Renewable Energy



U.S. DEPARTMENT OF ENERGY

Fossil Energy and Carbon Management

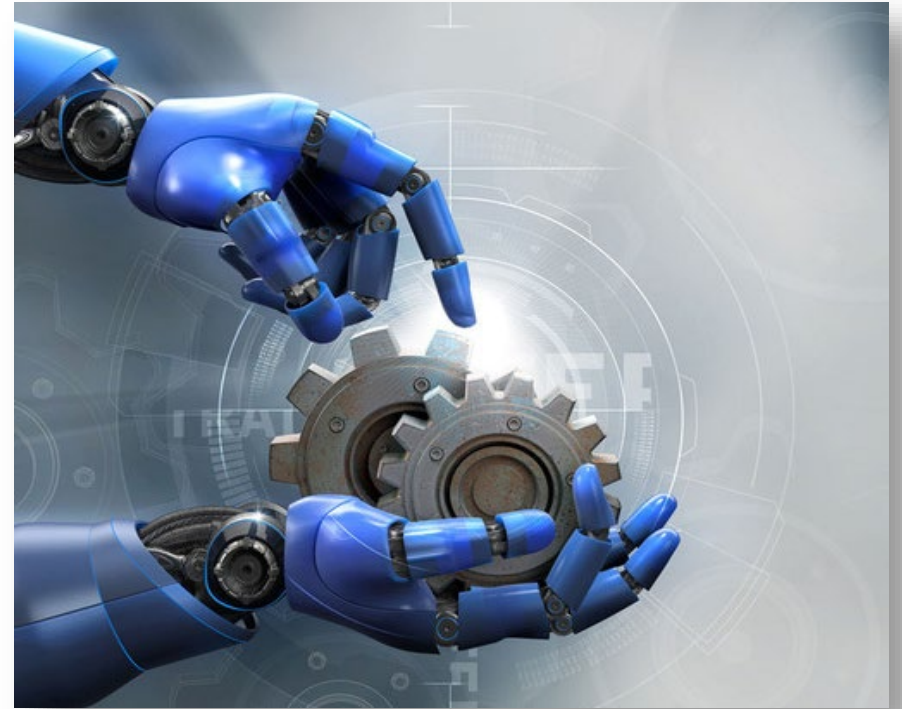
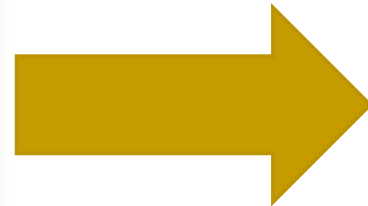


U.S. DEPARTMENT OF ENERGY

Office of Science

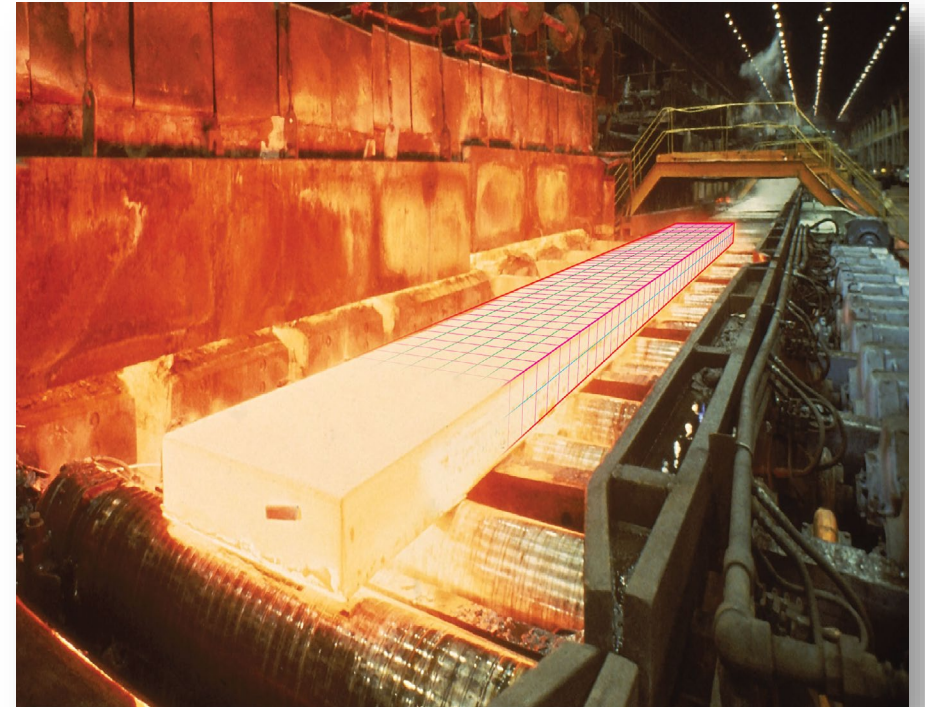
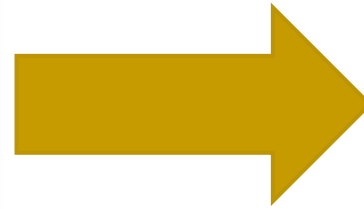


U.S. industry is undergoing a technological revolution



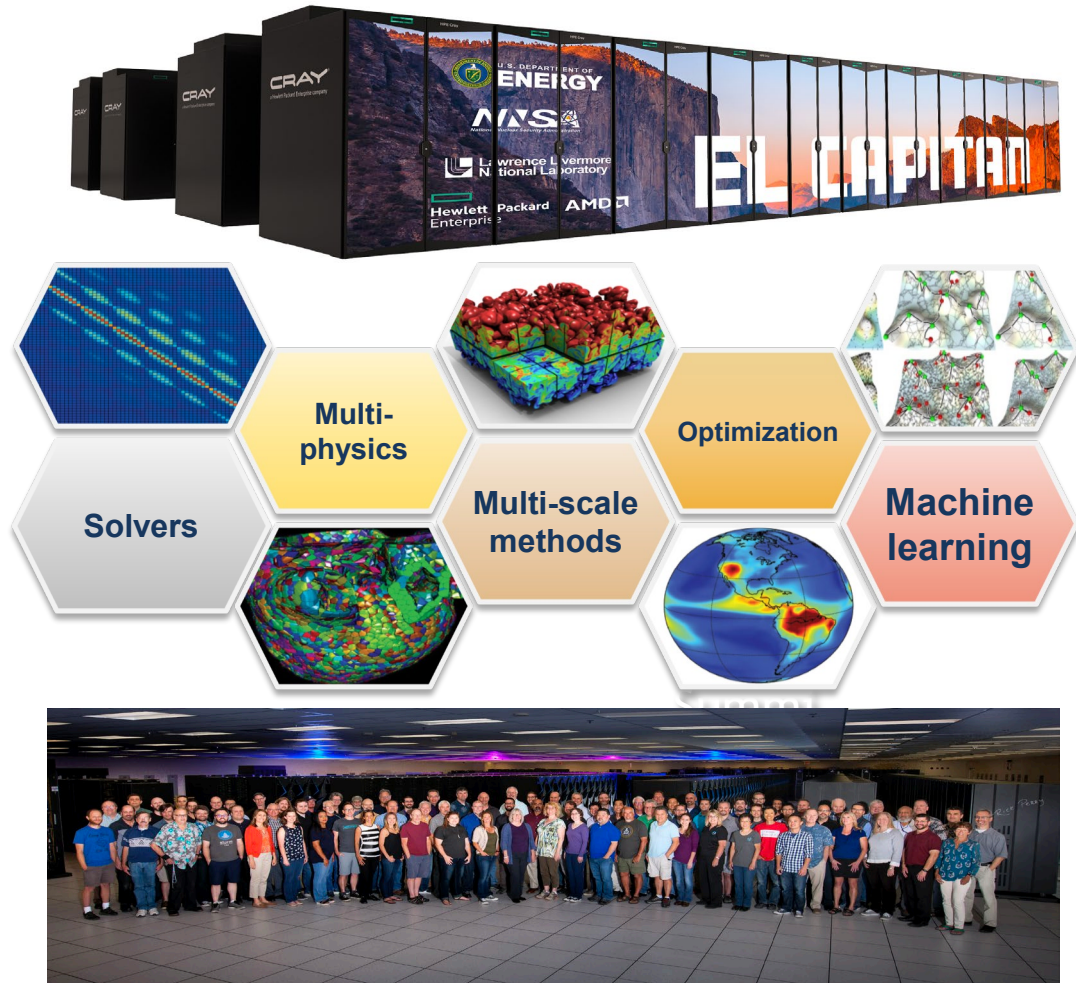
Computer Simulation – Data Analytics/AI – Material Discovery

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 U.S. 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

HPC 4
MATERIALS

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

 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
- ~\$9M /yr Budget
- 11 National laboratories participating
- 150+ projects funded with 100+ companies over 8 years

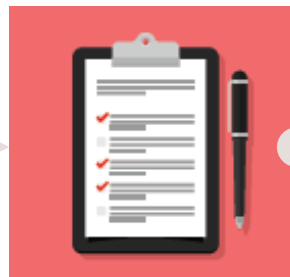
Industry
Concept Paper



PI Match
Full Proposal



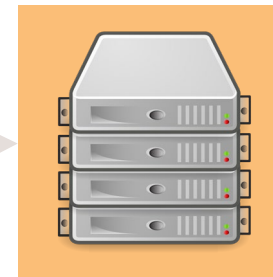
Technical
Review



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.



LAWRENCE LIVERMORE NATIONAL LABORATORY
WITH AKS, INC.



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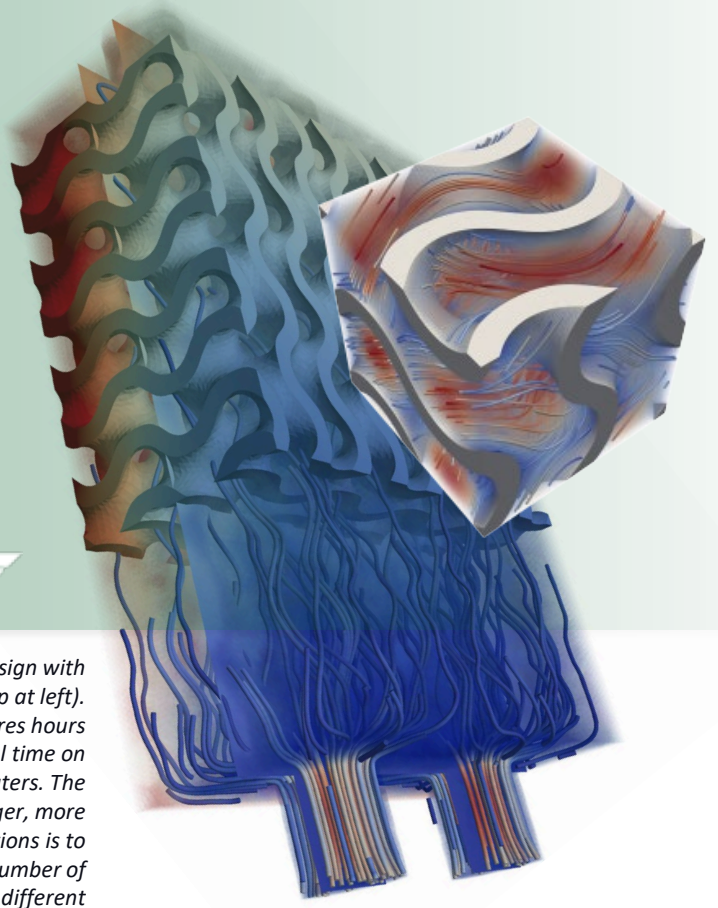
- Typical mill may save 10% of 145,000 MBTUs used annually
- Besides direct E conservation, enormous savings from improved productivity expected
- Remakes drastically reduced—waste of time, energy, money, trust avoided

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

IMPACT

- 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.



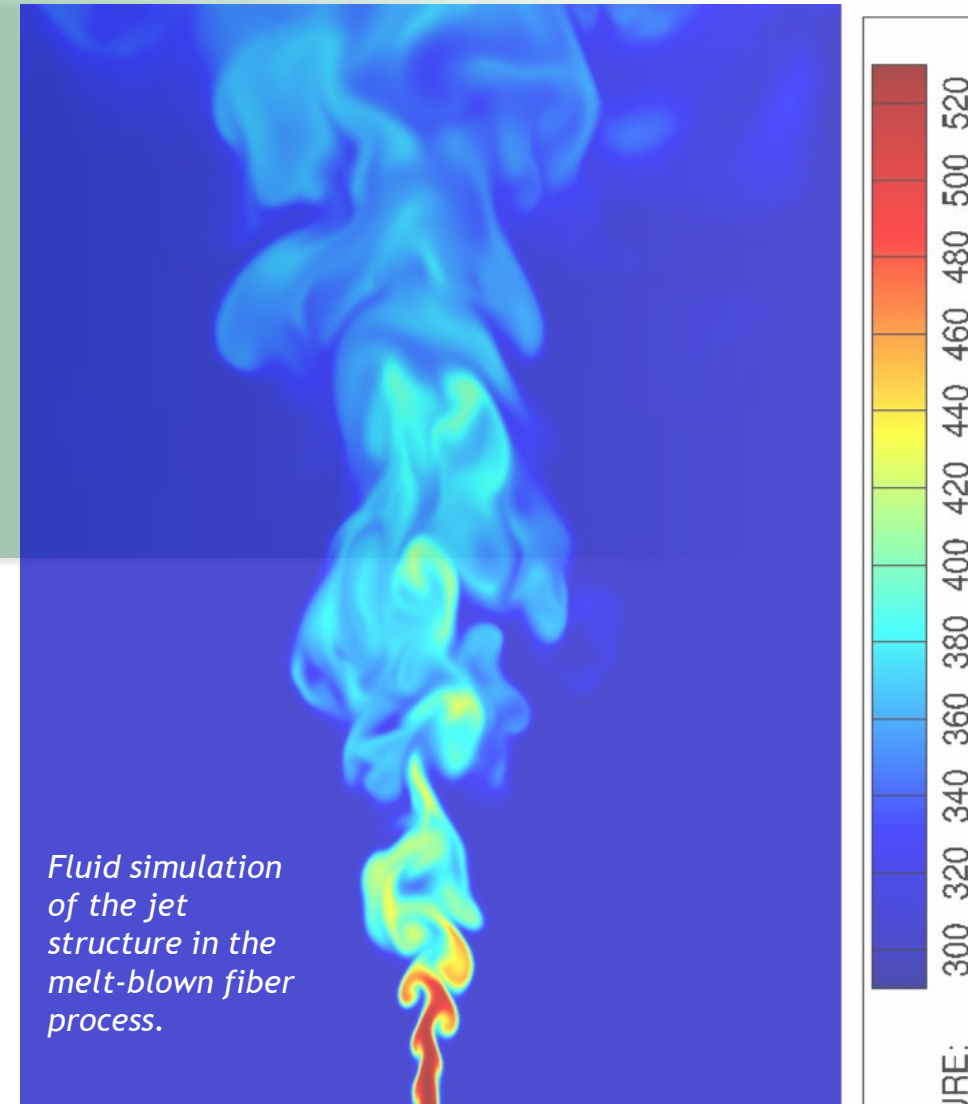
ARGONNE NATIONAL LABORATORY
3M COMPANY & U CHICAGO



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 website
 - ▶ 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



Attachment 5
Page 1

DOE O 483.1A
11-6-2013

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.

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				
National Lab Licenses				
National Lab Subcontracts (University and/or Non-profit Funding)	30,000			
Industry Partner Labor			100,000	
Industry Partner Procurements				
Industry Partner Subcontracts				
Industry Partner Licenses				
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

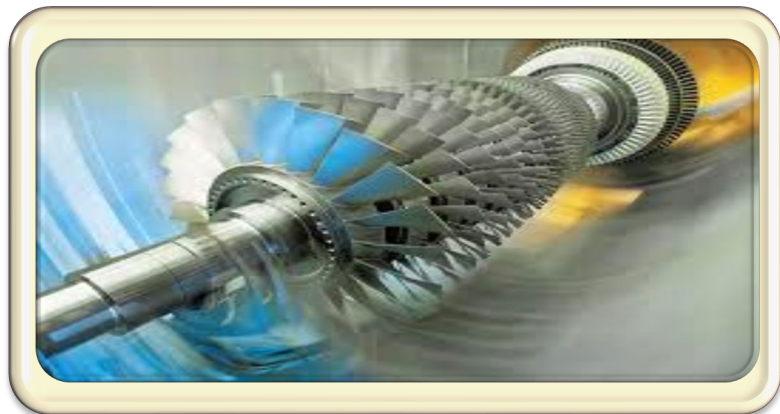
Phase II project



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				
National Lab Licenses				
National Lab Subcontracts (University and/or Non-profit Funding)	30,000			
Industry Partner Labor		50,000	50,000	
Industry Partner Procurements				
Industry Partner Subcontracts				
Industry Partner Licenses				
Totals	400,000	50,000	50,000	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 $(50,000 + 50,000)/500,000 = 0.2$

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



HPC4
MATERIALS



Of particular interest to FECM's Hydrogen with Carbon Management program:

- Understanding welded joints with novel austenitic materials in a hydrogen environments.
- Understanding hydrogen effects on material including embrittlement.
- Development of ceramic metal composites for use in flex fuel turbines.
- Assessment of AM techniques for the production of CMC turbine parts
- Improving degradation performance and thermal damage resistance for reversible solid oxide fuel cells

Of particular interest to FECM's Point Source Carbon Capture program:

- Development of tools for identifying optimal deployment locations for reactive carbon capture
- Modeling approaches to increase operational flexibility of reactive carbon capture systems
- Tools manage and mitigate non-CO2 emissions from installing carbon capture on industrial and electricity generation sources.

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

HPC4Manufacturing focuses on topic areas of interest to DOE's Industrial Efficiency and Decarbonization Office (IEDO)



Of particular interest to EERE's Industrial Efficiency and Decarbonization Office (IEDO)

- Improving processes that contribute to DOE's Industrial Heat Shot
- Advancements of technologies that reduce emissions from energy- and emissions-intensive industries
- Advancements in technologies that enable flexible industrial energy use and grid edge capabilities
- Improvements in energy efficiency and/or emissions reductions for water and wastewater treatment.

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
 - ▶ **Follow-on Projects** (one additional page)
 - ▶ Review results and explain how the results will be used to address the objectives of the current proposal
 - ▶ **Appendix A: Energy/CO2 Savings Estimates** (not included in page count)
 - ▶ Include numerical estimates for the annual energy and carbon savings
 - ▶ **Appendix B: Changes from Previous Submission (Reapplication)**(not included in page count)
 - ▶ **Appendix C: References** (not included in page count)

***You do not need to identify a laboratory partner up front!
Just need 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
 - ▶ **Energy Savings Estimates**
 - ▶ Numerical estimates for annual energy and carbon (equivalent) savings
 - ▶ **Implementation and Adoption**
 - ▶ 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 seven-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!

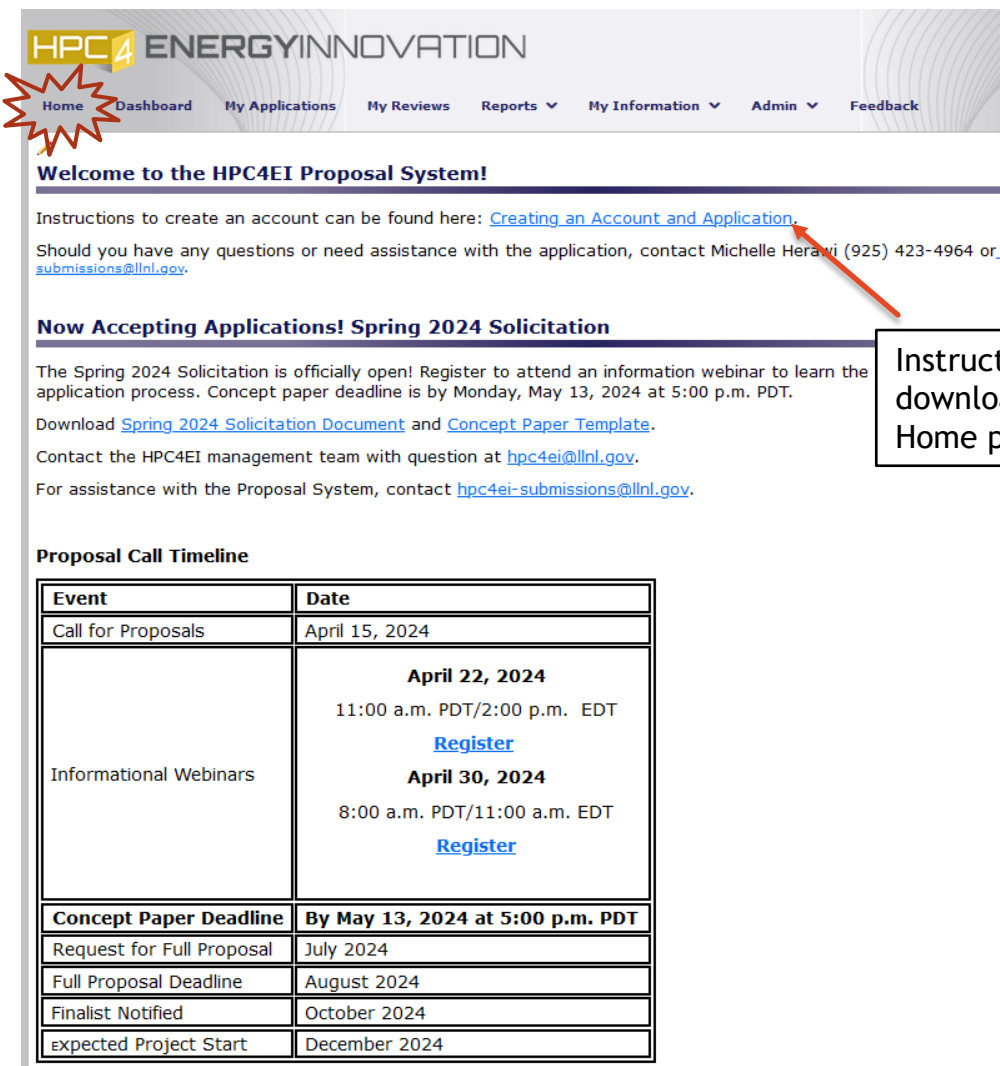
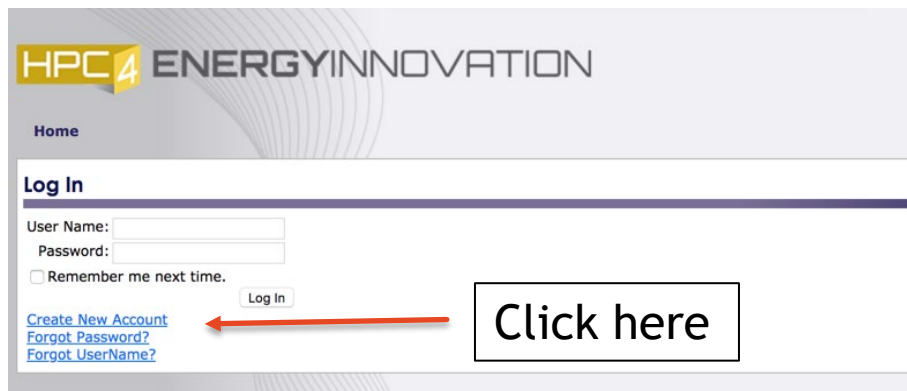
Access the electronic proposal system at proposalshpc4.inl.gov or HPC4EI Solicitation website



Spring 2024 solicitation will focus on topic areas associated with the HPC4Materials (HPC4Mtls) and HPC4Manufacturing (HPC4Mfg) Programs.

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

Create account and complete general account information



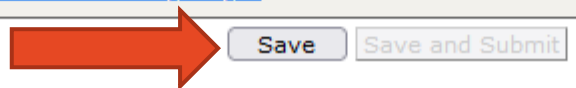
Instructions available for download on the system's Home page

Event	Date
Call for Proposals	April 15, 2024
Informational Webinars	April 22, 2024 11:00 a.m. PDT/2:00 p.m. EDT Register
	April 30, 2024 8:00 a.m. PDT/11:00 a.m. EDT Register
Concept Paper Deadline	By May 13, 2024 at 5:00 p.m. PDT
Request for Full Proposal	July 2024
Full Proposal Deadline	August 2024
Finalist Notified	October 2024
expected Project Start	December 2024

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 Monday, May 13, 2024 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 [Spring 2024 Concept Paper Template](#).

Click to download
Concept Paper Template

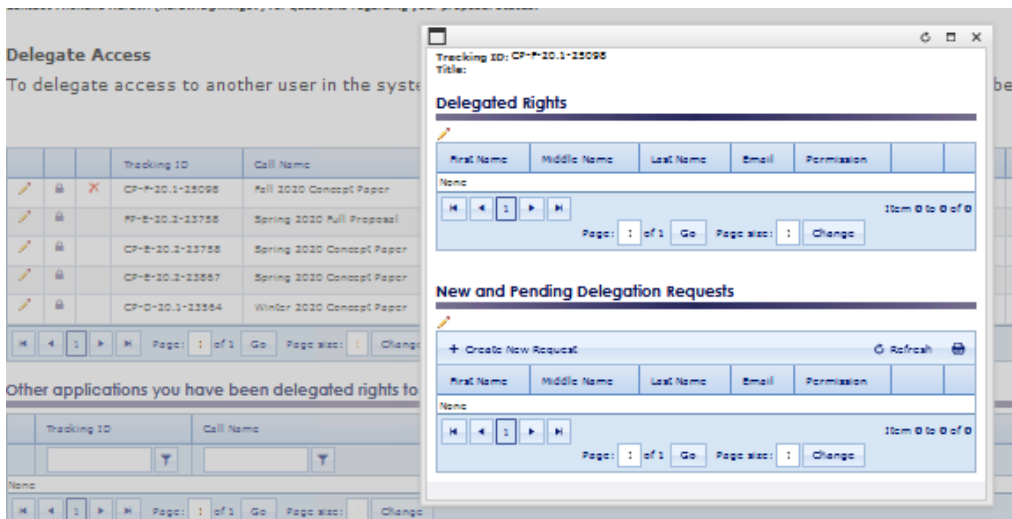
Instructions:

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 Name *Example: CP-G-21.2-26421_ABC Company*
4. **Submission format:** Single spaced pages using 12-point Times New Roman, 1" margins, and converted to a PDF file.

After completing and saving this form, the applicant may edit the saved version until Monday, May 13, 2024 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.**

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Save Save and Submit



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

View Applications and Proposal Status

Call Name
Fall 2019 Concept Paper

Notifications of review results are generated from the proposal system and addressed from hpc4ei-submissions@inl.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.

Link to view Reviewer Comments

Proposal Status

Tracking ID	Call Name	Title	Proposals 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 HPC4EI website for solicitation details

Concept Paper Deadline
May 13, 2024 by 5:00 p.m. PT

www.hpc4energyinnovation.org

Aaron Fisher, 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>

HPC4 ENERGY INNOVATION

SOLICITATIONS EVENTS COMPUTING RESOURCES SUCCESS STORIES PROJECTS PUBLICATIONS FAQs CONTACT

High Performance Computing for Energy Innovation

In partnership with industry, leveraging world-class computational resources to advance the national energy agenda.

Spring 2024 Solicitation Informational Webinars

Monday, April 22, 2024
11:00am-12:00pm PDT:
[Register](#)


Tuesday, April 30, 2024
8:00am-9:00am PDT:
[Register](#)

NOW OPEN

HPC4EI is now accepting applications for Spring 2024 Solicitation focused on topic areas for HPC4Mtls and HPC4Mfg.

START HERE
Funding Opportunity

Learn More



High Performance Computing for Manufacturing

[View Brochure](#)