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DOE's Exascale Computing Project: Promising First Steps in Ambitious Plan

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IDC's Quick Take

The U.S. Department of Energy's (DOE's) Exascale Computing Project (ECP) — a recently established effort to accelerate delivery of an exascale computing system to deliver 50 to 100 times more performance than current high-end machines — just announced its first round of funding for 15 application development proposals for full funding and 7 proposals for seed funding. The ECP is, to date, the largest, most ambitious, and most comprehensive U.S. national project to develop exascale technologies, and it is a collaborative effort that directly involves 6 of the DOE's major national labs and, ultimately, support from all 17 DOE labs; technology issue aside, managing such a complex research agenda will require significant coordination among the DOE labs and their commercial and academic partners, and these leadership issues will be key to the ultimate effectiveness of the project.

News Highlights

The U.S. Department of Energy's Exascale Computing Project — a recently established DOE effort to accelerate delivery of a capable exascale computing system that integrates hardware and software to deliver 50 to 100 times more performance than current high-end machines — just announced its first round of funding with the selection of 15 application development proposals for full funding and 7 proposals for seed funding, representing teams from 45 research and academic organizations.

The 15 awards total $39.8 million, targeting advanced modeling and simulation solutions to key challenges supporting key DOE missions in science, clean energy, and national security, as well as advanced research collaborations, such as the Precision Medicine Initiative with the National Institutes of Health's National Cancer Institute. ECP scheduling calls for additional funding to support HPC vendor R&D on node and systems better suited for such applications to roll out soon.

The ECP is a collaborative effort of two DOE organizations — the Office of Science (DOE-SC) and the National Nuclear Security Administration (NNSA) — and it will directly involve six of the DOE's major national labs — DOE-SC's Oak Ridge, Argonne, and Lawrence Berkeley national labs and NNSA's Lawrence Livermore, Los Alamos, and Sandia national labs. Project planners indicated that eventually ECP research efforts could tap into the collective expertise of all 17 DOE labs.

The ECP's multiyear mission is to maximize the benefits of high-performance computing for U.S. economic competitiveness, national security, and scientific discovery. In addition to applications development, the DOE project addresses hardware, software, platforms, and workforce development needs critical to the effective development and deployment of future exascale systems. Project planners provided some technical details on their vision for achieving exascale computing capabilities:

- Support applications solving science problems at least 50 times faster or more complex than today's 20PF systems.

- Operate in a power envelope of 20–30MW.
- Are sufficiently resilient with an average fault rate no worse than weekly.
- Explore at least two diverse system architectures.
- Possess a comprehensive software stack that meets the needs of a broad spectrum of applications.
- Adopt a holistic project approach that uses codesign to develop new platform, software, and computational science capabilities at heretofore unseen scale.

IDC's Point of View

This recent announcement highlights that the ECP is to date the largest, most ambitious, and most comprehensive U.S. national project to develop the entire range of technologies needed to not only foster the development of exascale technologies but ensure that they can be used effectively to address some of the nation's most demanding national challenges in science and engineering.

There are many moving parts to this project — as evidenced by first-round funding going to 45 different research organizations — that include a broad range of diverse missions, a large number of U.S. government labs, and what could turn out to be significant involvement from a number of U.S. commercial vendors and academic partners. Managing such a process will require significant coordination among the many participants. Leadership issues will be complex but key to the ultimate effectiveness of the project. Early indications are that the ECP leadership understands these issues and is working hard to enlist the best management team it can.

In addition, project managers have stressed that this is a project that will not itself directly develop or acquire exascale HPCs for specific DOE missions but rather one that is geared toward developing a wide base of HPC-related capabilities that could ultimately feed into future DOE exascale HPC acquisitions made by the individual DOE national laboratory facilities. As such, the ECP leadership will need to ensure that the research directions walk a fine line between advancing the state-of-the-art and developing capabilities that will have immediate and positive benefits to a wide range of DOE lab mission requirements.

Finally, as the ECP leadership has stated on a number of occasions, this is not a DOE program but a project, and as such, it has a stated lifetime. For this project, it's 10 years. IDC analysts are optimistic that, despite the ambitious and diverse research agenda, with a sufficient and regular flow of funds and the full cooperation of the DOE collective research community and its non-government partners, the project stands a strong chance of realizing many of its important goals.

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