

DOE SCIENCE FOR THE FUTURE

A Discussion Paper

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Introduction

The role of science and technology in maintaining the well being of our nation is growing and changing rapidly. Because of the extent and speed of these changes, it is essential to reexamine the ways in which support for scientific research is organized within the US government. The advent of a new Administration and Congress provides an opportunity to address emerging problems in ways that may not be possible at other times.

We, the authors of this discussion paper, are especially concerned about the future of the scientific research supported by the Department of Energy. The DOE is the federal government's third largest sponsor of basic research, and the largest sponsor of research in the physical sciences.

The DOE Office of Science oversees outstanding national laboratories whose capabilities for solving complex interdisciplinary problems are not easily matched elsewhere. It also builds and operates large-scale user facilities of importance to all areas of science. In large part, it has been enormously successful in these efforts. Thus, the vitality of the U.S. scientific enterprise is strongly dependent upon DOE support.

For about a decade, however, DOE Science budgets have been declining in purchasing power, and have fared significantly less well than those of other agencies. These difficulties have been exacerbated by weakness in overall federal support for the physical sciences (as compared to biology and medicine) and by the perception of management and security problems throughout the Department.

The decline in funding for DOE Science implies that our nation has seriously underinvested in the research that it will need to sustain its health, security, and economic prosperity in the 21st Century.

We believe that this situation has reached crisis proportions, and that future US leadership in many essential areas of science is in jeopardy. Our purpose in these remarks is to suggest actions to strengthen DOE Science that might be taken jointly by the new Administration and Congress.

We have considered alternatives ranging from keeping the status quo to major rearrangements of the existing science agencies. Of these various alternatives, we believe that two kinds of solutions to these problems – depending upon circumstances – may be feasible and effective.

The Problems of Science at DOE

The DOE Science budget has stagnated and declined, in part, because the DOE roles in civilian basic research and in the support of university faculty and students are neither adequately understood in Washington nor appreciated by the public at large.

DOE as a whole has four main missions: national security, environmental restoration, science and technology, and energy. Its role in national security is to maintain our nuclear deterrent. The environmental role is to correct problems left behind under the pressures of the Cold War. The mission in science and technology uncovers new knowledge and propels the growth of our economy. The energy mission is to secure some degree of independence from fluctuations in the fossil fuel supply, and to develop environmentally sound energy technologies for sustainable development. In principle, the four missions can support each other.

It is inevitable in a complex national-security program as large as that of the DOE that there will be problems from time to time. It is also inevitable that new environmental problems will be uncovered. These problems in the DOE weapons and environmental programs have given the overall agency a negative image that, in practice, has proved damaging to all of DOE, including its missions in science and energy. In particular, DOE Science has not received the support that it badly needs.

The question of leadership is an essential part of the problem. The Director of the DOE Office of Science has responsibilities comparable to those of the director of the NSF and not very different from those of the directors of NIH and NASA; but he or she does not have comparable authority or visibility. Without that authority, it has become very difficult for DOE Science to make its case for necessary long-term investments in research.

In considering responses to this situation, we have agreed upon the following guidelines:

- The DOE missions in national security, environmental clean-up, science and energy are each important in their own ways. Any solution to present problems within DOE should tailor management, facilities, and budgets so as to optimize the performance of each of these missions rather than applying “one-size” solutions to all.
- Science and technology in the United States has prospered greatly from diversity of funding sources and modes of support. For example, the fact that the NSF differs from the mission agencies in both purpose and style has made it possible for U.S. scientists to take risks and tackle challenging and important problems. Similarly, the DOE has developed great expertise in building and operating large facilities, and in overseeing important interdisciplinary national laboratories. That expertise has been extremely valuable throughout all of the US scientific and technological community – in government, industry, and universities. The diversity of funding sources should be maintained.
- The primary responsibility of the DOE’s science and energy programs should be to provide the new knowledge needed for ensuring the scientific and technological base of our nation’s economic prosperity in the 21st Century. The mode in which those programs assume this responsibility should take advantage

of the DOE's experience with large facilities and multi-disciplinary research efforts.

Alternative Strategies

Starting from these guidelines, we propose two alternative kinds of solutions, without indicating a preference for one over the other. Alternative A is a restructuring of the DOE based on the assumption that the Department will remain essentially intact in the next Administration. Alternative B is based on the assumption that it may become feasible or inevitable that some or all of the present responsibilities of DOE be shifted to other agencies. After discussing both of these alternatives, we mention, for the sake of completeness, two other strategies that we believe are highly undesirable.

Alternative A

Enhance the leadership and visibility of DOE science and energy by revising the management structure within the Department.

One way to accomplish this goal would be to elevate the Director of the DOE Office of Science to the rank of Under Secretary for Science and Energy, with additional responsibilities as Science Adviser to the Secretary. This scheme would improve the visibility and influence of science in DOE, and would place the person in charge of science at a level above the large number of staff offices that are inevitable in such a complex agency. A primary objective would be to have a widely respected and influential scientist in a position where he or she can be an effective leader and spokesperson for DOE science and energy.

A variant of this scheme, which goes part of the way toward our more ambitious Alternative B described below, would be to remove some administrative and regulatory responsibilities from DOE and convert it into a sub-cabinet agency. The director of this agency, like the directors of NSF and NASA, would be chosen for scientific and technical leadership, and would have clear responsibility for guiding the agency in directions consistent with long-term national goals.

Alternative B

Combine DOE science and energy programs with NIST, NOAA, and possibly USGS to form the major part of a new 21st Century Department of Commerce.

The idea here is to create a "National Institutes of Science and Advanced Technology" (NISAT) within a cabinet-level department in analogy to the National Institutes of Health within HHS. An alternative would be to combine these same entities; that is, "NISAT," into an independent sub-cabinet agency analogous to NASA in structure and governmental status.

The major feature of Alternative B is that it would simultaneously reorganize both DOE and DOC in a way that would be consistent with the scientific and technological challenges of the next decades. The new agency would be a visible recognition by the US government that long-term research drives economic progress. Its primary mission would be the initiation and management of large-scale and/or multidisciplinary research.

While many of the specific responsibilities of this agency would be closely related to national needs, its style of operation would reflect our modern understanding of the essential connections between applications and fundamental new knowledge; thus this agency would support both basic and applied research. The existence of such an agency might provide a sharpened focus on the needs of the physical sciences in federal budgeting processes. As before, scientific leadership at the highest level would be necessary for the success of this new agency.

Finally, we mention two alternatives that have been suggested by others that we consider to be highly **UNDESIRABLE**.

Move DOE Science into NSF

Merging DOE Science and the NSF would double the size and complexity of the NSF. There would be a serious mismatch between the science and management activities, and it might be difficult to establish a culture that would maintain the strength of the national laboratories and that would allow both single-investigator “small science” and multidisciplinary, multi-investigator “big science” to thrive.

Whether this merger could happen without degrading what works very well in DOE or NSF is highly questionable. Diversity of funding sources for research would be substantially reduced. Many scientific fields would be limited to one possible federal funding source, and innovative scientists whose research projects did not fit into NSF programs would have no other sponsors to whom to appeal.

Most importantly, the NSF is the only federal agency whose sole responsibility is the support of science, unconstrained by specific missions. In its fifty years of existence, the NSF has served this nation extraordinarily well. We believe that it is essential to maintain the unique quality of this agency.

Create a Department of Science, including all Federal R&D programs .

The creation of a federal Department of Science has been proposed several times in recent years as a means for concentrating federally funded research and development and making it easier to track and manage. Presumably,

a Department of Science would be a civilian agency, perhaps including the 6.1, 6.2. and 6.3 programs of the Department of Defense. This consolidation would have the very major disadvantage of completely eliminating the diversity of funding sources as well as destroying the unique nature of the NSF. Other serious disadvantages have been discussed in previous analyses of this proposal.