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CONGRESSIONAL TESTIMONY

Oversight and Management of Department of Energy National Laboratories and Science Activities

Testimony before
Committee on Science, Space and Technology Subcommittee on Energy
United States House of Representatives

9:30 am
July 11, 2013
Rayburn House Office Building
Room 2318

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Chairman Lummis, Ranking Member Swalwell, and Members of the Subcommittee:

Thank you for inviting ITIF and The Heritage Foundation to speak to the Committee this morning about maximizing the potential of our national labs. The views expressed in this testimony of those of the authors, and should not be construed as representing any official positions of The Information Technology & Innovation Foundation or The Heritage Foundation.

We provide alongside this written testimony our joint study, written with a colleague from the Center for American Progress, entitled, *Turning the Page: Reimagining the National Labs in the 21st Century Innovation Economy.* The study coauthors represent a diverse set of three organizations from across the ideological spectrum with different perspectives. We may not agree on funding levels, funding priorities, or the specific role of government in technological innovation, and nothing in our joint report or this written testimony should be construed as support for or opposition to those ideas. Instead, the purpose of our efforts was to put forth a set of recommendations that will bring greater efficiency to the DOE lab system, produce more relevant research, and increasingly allow the private sector to pull value out of that research. These recommendations are as relevant to a large, highly funded research agenda as they are to a much more limited one.

Summary

That said, after more than a year of research and engagement with the labs, DOE, industry, and academia, as well as countless hours of discussion, we do agree that:

- Federally funded research results in scientific discovery that can play a positive role in America's economic future,
- Federally funded research at the labs should not replace or crowd out private-sector and university-based research,
- Research should be driven by science and national needs, and not by special interest politics,
- Washington should oversee the labs, and not micromanage them,
- Barriers preventing the movement of research from the lab to the market should be minimized,
- Taxpayer resources should be used as efficiently and effectively as possible,
- Market forces can help bring efficiency and rationality to the lab system, and
- The current system needs substantial reform

Both ITIF and Heritage believe that even in a time of policy gridlock in Washington, these nonpartisan reforms simply make sense. The labs have been largely running on autopilot for too long. A jolt to the system is needed now more than ever. It is our goal to spur debate on lab reform but, more importantly, to facilitate and support tangible and constructive changes from Congress, the White House, the Department of Energy, and the labs themselves. In summary, we call on Congress to:

1. Congress should allow labs to use flexible pricing – i.e. charge above full cost recovery - for proprietary use of user facilities and special capabilities.

2. Congress should facilitate merging the existing Offices of Science, Energy Efficiency and Renewable Energy, Fossil Energy, and Nuclear into a new Office of Science and Technology.

3. Congress should direct the Secretary of Energy to facilitate a stakeholder discussion to inform how the new coordinated program offices under the new Office of Science and Technology should be structured.

4. Congress should instruct DOE to remove prescriptive overhead accounting rules and instead provide broad categories of funding that the labs can spend as necessary.

5. Congress should remove the 8 percent cap on Lab-Directed Research and Development (LDRD) funds.

6. Congress should provide a less vague description of technology transfer that allows labs to spend overhead funds on early-stage demonstrations that either remove technology barriers limiting private-sector interest or repurpose original research for new problems.

7. In absence of DOE action, Congress should expand ACT agreements beyond a pilot program as well as remove restrictions that prevent labs from partnering with entities that receive federal funding.

8. In absence of Administration action, Congress should create a high-level task force with representatives from all key stakeholders in the lab system, to address two issues, which must be actionable by DOE:

- How to devolve greater authority from centralized DOE control to the labs themselves.
- To develop better technology-transfer metrics to be implemented in an expanded PEMP process that explicitly includes technology-to-market evaluation as a key metric for M&O contractor success.

9. In absence of DOE action, Congress should spur DOE to develop a more aggressive contractor accountability system that follows the recommendations made by the aforementioned task force.

10. In absence of DOE action, Congress should allow the labs autonomy in forging third party partnership agreements without DOE pre-approval, first on a pilot program basis.

11. Congress should require DOE to prominently include technology transfer in the expanded PEMP process, with a significant evaluation weight the merits its importance to the labs meeting their mission.

Why the National Labs Matter to America

The Department of Energy (DOE) National Laboratory system represents 17 facilities and more than $18 billion in public research in fiscal year 2011.[1] Originally created in the late 1940s by the Atomic Energy Commission—the precursor to the modern DOE—to manage the United States' nuclear-weapons research and development, or R&D, the labs are distinctive in three ways.

Hubs of Mission-Driven Research in the Public Interest.

Public support for science and technology research can play a significant role in helping society seize opportunities to advance national, social, economic, and environmental well-being. The labs are tasked with conducting research in support of the public good that universities or private companies are unwilling or incapable of doing. This includes: (1) addressing unique national imperatives such as research for national defense; (2) capturing positive externalities from technology innovation that are not easily appropriated by any one firm and for which private incentives for investment are not commensurate with the potential for public good; (3) conducting scientific research with very long time horizons for which an immediate commercial application is unclear, but has significant potential; and (4) solving unexpected national and international challenges that require rapid or unique research-based solutions.

Centers of Multidisciplinary Research

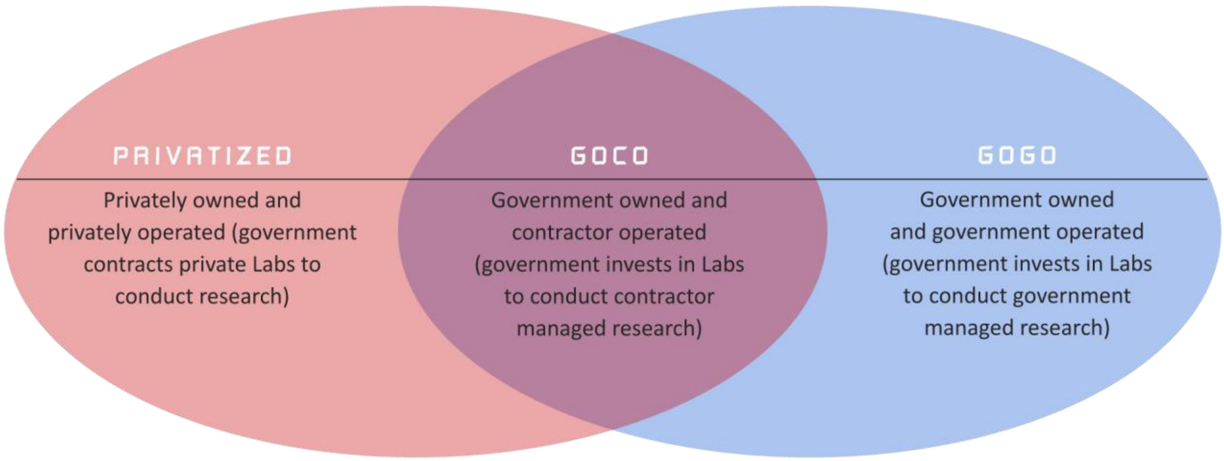
Today, rather than singularly focused research facilities, the labs respond to the needs of modern-day science by serving as platforms where multidisciplinary work can be coordinated on a large scale to tackle national goals. For these reasons, the labs should not be thought of specifically as energy, science, or weapons facilities, despite the fact that the system is housed within DOE. These multidisciplinary national institutions support the scientific and technology missions of government and society writ large.

Few of the labs are restricted to fulfilling their original research purposes. Energy labs also conduct fundamental research in material science, while science labs shepherd sophisticated applied-research programs in everything from energy efficiency to cyber security to genetics. And weapons labs conduct research in both science and applied research. Sandia National Laboratories, for example, which stewards the blueprints for more than 6,300 of the 6,500 components of U.S. nuclear weapons, also has robust, interdisciplinary research programs and user facilities, such as the National Solar Thermal Test Facility, where the broader academic and industrial research communities are invited to collaborate on issues unrelated to nuclear weapons.[2]

Government Owned, Contractor Operated

Sixteen of the 17 National Labs operate as government owned, contractor operated, or GOCO, federally funded research and development centers, or FFRDC.[3] The Atomic Energy Commission carefully chose the GOCO model as an alternative to creating either an entirely government-controlled lab system or an entirely private-sector-based system.[4] The GOCO model was meant to provide the best of both worlds: flexible access to highly specialized technical talent and business-tested management practices, as well as the ability to direct complex, risky research unique to national needs. (see Figure 1)

FIGURE 1: Spectrum of lab ownership and management models.



Bridges to the Marketplace

The labs facilitate moving research into the market largely through research collaborations with universities and industry, as well as by licensing patented innovations to the private sector. In 2010 the DOE labs earned more than $40 million in licensing revenue from roughly 3,500 active technology licenses and participated in nearly 700 cooperative research and development agreements, or CRADAs, with non-DOE entities.[5] And in 2011, $500 million in research was subcontracted by the labs to universities in instances where academic researchers needed specialized facilities and equipment or larger multidisciplinary teams were needed to solve complex problems.[6]

Another key place for collaboration is through the labs' user facilities, which are facilities with state-of-the-art advanced equipment, skilled staff, and technical capabilities that are made available to the greater government and public research community.[7] The Princeton Plasma Physics Laboratory, for example, is one of only a handful of facilities in the world with a working fusion reactor that scientists can use to advance the understanding of fusion energy.[8] The Los Alamos National Laboratory hosts scientists from around the world to use its ion-beam materials, electron microscopy, proton radiography, and high-energy laser-physics facilities.[9] In 2011, 350 American firms, including 47 Fortune 500 companies, took advantage of lab user facilities to conduct research supporting the creation of new products in industries as diverse as pharmaceuticals, advanced materials for semiconductors and vehicular batteries, telecommunications, and consumer goods.[10]

The Need for Reform

Without a doubt, the labs have created market-changing, nationally important science and technology since their founding. Technology developed in the labs has seeded new American industries and products as diverse as CDs and DVDs, satellite communications, advanced batteries, supercomputing, resilient passenger jets, and cancer therapeutics, all at a cost of about 0.03 percent of gross domestic product, or GDP, annually.[11] The question we pose, therefore, is not whether the United States is getting *any value* from spending public dollars in the labs; rather, it is whether the United States can get *more value* from spending public dollars in the labs than it currently is. Our answer is yes.

The labs were born out of the single-minded focus on building the atomic bomb. Since the end of the Cold War, however, the nation has struggled to develop a new mission for the labs that effectively harnesses their unique capabilities as part of a comprehensive or rational public scientific enterprise. While the labs have served the public well in the past, the status quo is ill adapted for the needs of the 21st century innovation economy.

The sad truth is the labs institutional and management structure is outdated, inflexible, and weakly connected to the marketplace, inhibiting U.S. innovation when we need it most. We found three issue areas ripe for reform.

Issue 1: Troubled Relationship Between DOE and the Labs

The most pervasive issue with the labs is the slow transformation from their unique stewardship and management model toward a more restrictive system that concentrates decision making in Washington. The GOCO model that provides operational flexibility for managers to creatively pursue national missions has gradually weakened over time. DOE has instead created layers of central control that have shifted lab management to more closely resemble a fully federalized system than ever before. As a result, flexibility is constrained, accountability is no longer the principal method of oversight, and the innovation process is muddled.

In many instances, DOE has replaced contractor accountability with direct regulation of lab decisions—including hiring, worker compensation, facility safety, travel, and project management—in an effort to avert future congressional scrutiny such as hearings and budget cuts. While the merits of reducing government waste are laudable, the reality is that DOE has gradually replaced contractor accountability with an increasingly rigid form of micromanagement, which has created inefficiencies with little to show for it.

In practice, this means DOE has added duplicative layers of safety, security, human-relations and environmental regulations in addition to those already mandated by federal and state law. Rules from DOE, the Office of Management and Budget, or OMB, and the Occupational Safety and Health Administration, or OSHA, overlap and often require lab managers to repeatedly jump through similar hoops.

The DOE Inspector General's Office has estimated the cost of complying with these multiple layers of bureaucratic requirements to be well into the millions for an individual lab. A study produced by Perspectives, Inc., found that DOE site offices added 16 days to the processing time of collaborative R&D agreements with industry partners on average.[12] Additionally, the study found that this figure did not include the time spent by the contractor to "prepare" the agreement packages in order to maximize likelihood of site-office approval, and that "much time is spent by the laboratories in addressing Site Office requirements and concerns that is not captured in the cycle time estimates."[13] The reason site-office interference is so burdensome is because DOE, according to respondents in the study, "manage[s] the agreement process with *inflexibility* in mind." [emphasis in original][14]

The DOE (as well as Congress and the OMB) micromanages lab expenditures as well. Lab budgets are divided into individual accounts with restrictions on how each tranche of funding can be used. These restrictions make it difficult for lab managers to make strategic decisions because they must manage many separate accounts that cannot be mixed.

While the majority of money goes into congressionally mandated research operations, a small percentage of research budgets—defined as "overhead"—goes into other accounts to cover management costs, facility upkeep, and other lab-directed science and technology spending. Tight restrictions on these overhead accounts limit contractor flexibility and make it difficult for managers to strategically invest in advancing promising research or strengthening lab infrastructure or capabilities.

In the private sector, businesses have the flexibility to react to changing circumstances and new developments by reallocating funds as necessary among various activities, products, and programs. Congress provides the labs similar opportunity by allowing for laboratory-directed research and development, or LDRD—an overhead account that lab managers can pull from to invest across research projects within very strict regulations.[15]

Studies conducted by DOE and the Government Accountability Office have found that projects funded by LDRD, despite its small budget, are often the most productive.[16] LDRD-funded projects, according to one lab, are the "most important single resource for fostering excellent science and technology for today's needs and tomorrow's challenges," and have been "extremely successful in supporting research at the forefront of science, providing new concepts for core missions, and creating an exciting research environment that attracts outstanding young talent."[17] Under today's rules, however, the labs are not allowed to actively manage their own budgets, resources, and priorities to more efficiently meet research objectives, despite the potential merits of this system.

Issue 2: Stovepiped Finances and Stovepiped Vision

The labs are beholden to Congress for continued support, but this support is delivered through a complex system of separate but interconnected funding "stovepipes." Money is categorized or recategorized repeatedly as it moves from a congressional appropriation to DOE's budget, through six stewardship offices, and finally through dozens of programs and thousands of specific contracts to end up in the hands of lab managers and researchers. This long and complicated resource-allocation process offers a number of opportunities to leverage efficiency gains.

Over the past several decades, Congress and DOE have increasingly micromanaged lab finances from a distance. Budget atomization is largely due to overly prescriptive DOE and congressional oversight that emphasizes "how" research is being conducted rather than "what" the end goal of the research is. Because each institutional and research category is tasked with funding its own portfolio of technologies, the labs become locked into prearranged research pathways that may not be the cheapest, most direct, or most effective way to solve problems. Program managers focus on short-term research objectives tied to their appropriated grants at the expense of pursuing more promising but longer-term avenues of research.

This results in two immediate impacts: (1) the labs are not well equipped to engage in long-term planning to strategically support promising areas of research unless they lie within existing atomized technology categories, and (2) the labs must spend increasingly more time and overhead bidding on and managing small contracts and grants, which takes resources away from supporting promising research.

Not only is research funding inefficiently allocated, it is also disconnected from lab stewardship. There are six different offices responsible for stewarding the 17 labs. From a bureaucratic point of view, allocating stewardship in this way may make sense—labs are closely associated with the office tasked with conducting research most closely tied to the mission and core competencies of lab researchers and infrastructure. The National Renewable Energy Laboratory, or NREL, for example, conducts translational renewable-energy research; therefore, it is stewarded by EERE.

Lab portfolios, however, have evolved over time due to changing national needs and infrastructure, which has resulted in a growing divide between labs, their associated offices, and their primary funding sources. This disconnect produces the perverse effect of splitting up DOE offices charged with overseeing the labs from the government agencies, programs, and offices that provide a significant portion of the funding. In many cases, the offices providing the bulk of research funding are not the offices providing oversight, potentially leading to uncoordinated and inefficient results (see Figure 2). In fact, five of the labs receive 55 percent or less of their funding from the stewarding office. The result is that lab "minority shareholders" are providing the majority of stewardship, potentially decreasing the lab managers' flexibility to interact with other funding sources and do long-term planning for non-stewarding agencies.

The growing gaps between lab stewardship and funding have reinforced a lack of lab-wide strategic planning. Because each lab receives funding—often more than half of its research budget—from offices and agencies other than its stewarding office, lack of strategic planning potentially leads to redundancy and missed opportunities to leverage the full research base toward solving problems. According to the National Academy of Public Administration, "[T]here is no comprehensive mechanism to integrate DOE's planning processes to ensure that the Department is optimizing the labs capabilities to meet the most critical needs of the Nation."[18]

FIGURE 2: Funding sources for research conducted in DOE labs.[19]

LAB STEWARD	FUNDING FROM STEWARD (%)	FUNDING FROM OTHER DOE OFFICES (%)	FUNDING FROM NON-DOE OFFICES (%)	TOTAL FY 2011 COST (MILLIONS)
Ames (SC)	70.5%	15.3%	14.2%	$34
Argonne (SC)	55.3%	29.3%	15.4%	$763
Berkeley (SC)	70.1%	14.5%	15.4%	$824
Brookhaven (SC)	83.7%	9.9%	6.4%	$750
Fermi (SC)	99.6%	0.0%	0.4%	$437
Idaho (NE)	55.2%	22.0%	22.8%	$1,063
Lawrence Livermore (NNSA)	74.7%	6.9%	18.3%	$1,584
NETL (FE)	42.3%	53.9%	1.8%	$1,400
Los Alamos (NNSA)	70.7%	18.5%	10.7%	$2,551
NREL (EERE)	89.4%	6.1%	4.5%	$521
Oak Ridge (SC)	48.5%	34.6%	16.9%	$1,542
Pacific Northwest (SC)	20.8%	52.0%	27.3%	$945
Princeton (SC)	98.1%	0.0%	1.9%	$87
Sandia (NNSA)	55.1%	9.5%	35.4%	$2,438
Savannah River (EM)	55.1%	43.7%	1.3%	$2,540
SLAC (SC)	97.1%	0.8%	2.0%	$375
Thomas Jefferson (SC)	93.8%	0.3%	5.9%	$214
Average / Total	**69.4% (average)**	**18.6%**	**11.8%**	**$18,068 (Total)**

Finally, the separation of labs into so-called basic and applied program offices further complicates the funding and management issue. The reality is that most of the large basic labs within the Office of Science conduct significant amounts of applied research. We disagree on the need for continued funding for many of the applied programs but do agree that creating organizational designations within the DOE bureaucracy that fractures research is counterproductive.

Issue 3: The Missing Link Between Lab and Market

Applying federal lab research to solving real problems is ultimately one of the most realistic metrics available to determine the success of publicly funded research at the labs. The goal of research, publicly or privately funded, is, *ipso facto*, to advance the capabilities of the government and private sector to respond to specific mission requirements and support technology-based economic activity.

Industry collaboration with the labs should not be thought of as a dirty phrase when industry is picking up the tab. Today, if industry wants to purchase time on high-value machinery or partner with specialized laboratory experts to conduct proprietary research, lab management can only charge the total research, facility, and overhead cost of doing so, rather than charge more for high-demand infrastructure and services. Nonproprietary research such as that typically conducted by universities and published in peer-reviewed journals is not charged. In most cases, partnering with an outside entity goes through a merit-review process, which places nonproprietary research at a higher level of priority than paid proprietary research.

While this system works reasonably well to ensure that lab assets are available to all on a fair basis, it does not provide a strong mechanism to either capture the true value of an asset for the taxpayer or to incentivize lab managers to maximize the productivity of the labs' assets.

From industry's perspective, interacting with the labs is not as simple as negotiating within the framework of the five or six different DOE-lab-industry agreements. Over the years DOE has implemented increasing layers of requirements needed to process agreements. And nearly all technology-industry partnership or technology-transfer agreements require preapproval from the Department of Energy. By one account, the Idaho National Laboratory catalogued 110 requirements that the lab and researchers must meet to facilitate technology transfer.[20]

DOE site offices add yet another layer of interpretation that industry must navigate. As a result, partnering with industry can be as complex as negotiating within the four agreements interpreted 17 different ways (or 68 different agreements in addition to site-office interpretations). This leads to significantly different forms and industry payments for lab research, indemnification provisions, liability, and intellectual property, among other areas of negotiation.

DOE has partially responded to these issues by creating the Agreements to Commercialize Technology (ACT) pilot program, which ameliorates many negotiating issues by allowing the labs to agree to more flexible partnership terms, which dramatically shortens negotiating turnaround time. Most importantly, it allows the labs to offer performance standards at the contractor's own risk in exchange for a fee.

Under ACT, DOE receives advanced payment for research costs, and lab contractors are allowed to collect an additional fee for taking on specific performance risks above what

DOE is typically willing or able to take. In essence, it incentivizes the labs to interact with industry and provides a simpler system in which to do so.

Unfortunately, the ACT agreement—unlike CRADAs and WFOs—is limited to lab research partners that do not receive federal funding. In other words, if a company receives federal funding—such as a defense contractor, small business innovation research grantee, or biotechnology company working with National Institutes of Health funding—it is not eligible for the more flexible, performance-based ACT agreement. This limits the potential impact of ACT, since the kinds of technology companies would typically want to partner with the labs also tend to be the kinds of companies that are working within the federally funded R&D system.

Finally, conflict-of-interest laws and lab evaluation metrics quash culture of entrepreneurship. Conflicts of interest are a serious problem, and proper enforcement of laws to ensure that taxpayers support research for the common good above private profit is a must. An example of a conflict of interest is if a lab researcher simultaneously owns a stake in a company that stands to profit from the research he or she is doing for the lab. But overly conservative interpretations of conflict-of-interest laws effectively prohibit many forms of potentially useful collaboration between researchers and industry partners, prevent researchers from doing their best work in their field of expertise, and create a barrier between research and practice.

Part of the problem stems from lab legal counsels' different interpretations of conflict-of-interest laws. Similar to industry-partnership agreements, this disconnection results in different labs adopting divergent policies based on a reading of the same legal text. The Stevenson-Wydler Technology Innovation Act is clear about encouraging the labs to be proactive in resolving conflict-of-interest issues.[21] Yet many restrictive conflict laws remain on the books, and interpretations of how to enforce these laws vary from lab to lab. This makes it difficult for researchers to form innovative partnerships and creates the misconception that such partnerships are morally or ethically dubious.

In addition to weak incentives for individual researchers, the lab managers themselves do not have strong incentives to think creatively about the commercial applicability of their research and capabilities. Two issues with lab metrics complicate technology transfer: the lack of weight placed on technology transfer in lab-wide evaluation procedures and the lack of good metrics used within these evaluation procedures to measure technology transfer. Despite the congressional mandate to promote technology transfer and economic outcomes, DOE holds technology transfer as a relatively low priority on the annual PEMP report cards.[22] What little measurement of technology transfer does take place is measured in terms of intermediate research *outputs*—number of licenses, CRADAs, etc.—rather than mission *outcomes*—meeting research goals, problems solved, or market impact.

What Should Congress Do?

ITIF, Heritage, and CAP built consensus on a set of policy reforms to address the three issues discussed above. Each will be summarized below and more detailed descriptions of each can be found in the report offered alongside this written testimony.

Congress should implement a performance-based lab-management accountability system

DOE should transition to a contractor-accountability model that places less emphasis on DOE oversight and more emphasis on transparent expectations and rigorous performance evaluation. In absence of DOE action, Congress should spur DOE action. This should include DOE adopting an expanded Performance Evaluation Management Plan (PEMP) process that becomes the focal point for lab stewardship and performance evaluation. Instead of requiring DOE review and approval for every transaction, lab management would assume decision-making authority and be held accountable through the PEMP. Contractors would be entrusted with the ability to make decisions for their labs while continuing to share all relevant information with DOE as requested under the Management and Operation (M&O) contract, the chief agreement and guidelines between the federal government and a third party to manage the labs.

Under these conditions, the labs would still follow federal workplace safety standards and meet environmental regulations, but additional oversight—such as rules governing the use of public research dollars for conference attendance, building construction and management, and human-capital management—would be negotiated as part of the M&O contract and then managed first and foremost by the labs themselves, rather than by site-office staff.

To execute this management realignment, Congress (or DOE) should take a two-step approach. First, the White House Office of Science and Technology Policy, or OSTP, and DOE either on its own or in response to Congressional mandate should create a task force to begin unraveling duplicative DOE regulation of the labs, including the size or need of DOE site offices. This task force would include representatives from key stake-holders, including lab directors, relevant sponsoring agencies and offices, lab contractors, and major outside science and industry users, and it would be tasked with reporting to the secretary of energy on how DOE can maintain necessary oversight of lab operations while removing excessive rules and accelerating bureaucratic processes. The task force should take one year to conclude its findings, at which point it would disband. The Secretary of Energy and OMB should then enact each recommendation within a reasonable amount of time set by the administration not to exceed six months.

Second, DOE should carefully change the annual performance-evaluation process through M&O contract negotiations, per the recommendations made by the task force. Negotiating the M&O contracts would fall under the proposed Office of Science and Technology (proposed below) in a consistent manner for at least the 14 non-NNSA labs and potentially for all 17 labs, given NNSA buy-in as M&O contracts come up for renewal or competitive rebidding. New language should be negotiated into the contract that clearly states the management practices lab contractors must follow.

Congress should increase lab budgeting flexibility

The labs should be given more leeway to direct their own overhead investments and decision making. To allow the labs greater flexibility in decision making, Congress should replace the existing accounting system with a single, accessible overhead account for lab managers. Congress could provide very broad rules on the types of investments that can be made but should move away from creating rigid accounting "buckets" that reduce budget flexibility.

This includes removing the existing 8 percent cap on LDRD spending and allowing the labs greater flexibility to spend their overhead to advance research.[23] DOE would then negotiate additional details on how lab managers can flexibly leverage overhead funds within the M&O contracts.

Congress should also increase budget flexibility by broadening the set of allowed activities that fall under overhead to include more aggressive technology-demonstration projects. In practice, this would enable the labs to spend overhead funds on projects that either removes technology barriers that limit private-sector interest or repurpose original research for new problems. In either case, these funds would leverage previous publicly funded research—that would normally sit on the lab shelf— and advance it closer to achieving potentially successful market outcomes.

To be clear, we do not propose that DOE and Congress give up control over federally funded research. Awarding the labs more authority and autonomy to decide how best to allocate overhead resources, however, would focus the interests of science and the nation on how to effectively meet short- and long-term goals. Devolving the decision-making process to those with the specialized knowledge to make the best decisions would also increase both the efficiency and effectiveness of the labs.

In some cases, OMB guidelines and statutory conflict laws may also play a role in preventing lab managers from having an efficient level of autonomy and resource flexibility, such as limits on how M&O contractors can finance infrastructure and building improvements outside of congressional appropriations.[24] In these cases, OMB and Congress should also act to modernize provisions identified by the proposed DOE task force through legislation and reform of OMB guidance.

Congress should restructure DOE by creating a unified Office of Science and Technology

Congress should merge the under secretaries of science and energy into one under secretary of science and technology and include relevant budget and stewardship authority (see Figure 3). In practice, this reform would place 13 of the 17 labs under one leadership office, instead of splitting control of the majority of the labs between many authorities.

Unifying both silos allows for two important changes. First, Congress should task the new under secretary for science and technology to develop and implement a single, expanded PEMP process for its 13 labs. This would allow a single DOE negotiating partner to work with 13 M&O contractors, and it would establish a coherent and unified set of program-management and performance guidelines that could instill the expanded contractor accountability, or trust-but-verify system described earlier.

Second, Congress should task the new under secretary for science and technology to develop a unified strategic planning process across its 13 labs, so that the strategic plan of each individual lab is incorporated into a system-wide effort that produces annual 5- and 10-year research and facility plans and budgets. These reforms will only be functionally institutionalized under unified leadership for all science and technology labs.

Congress should facilitate DOE leading a stakeholder discussion on how best to combine the research functions under the new Office of Science and Technology

Institutionalizing a unified under secretary for science and technology opens the door to integrating the research functions managed by the existing Office of Science and undersecretary of energy structure. There are six basic research programs managed by the director of the Office of Science, for example, and five applied research programs managed by assistant secretaries underneath the Office of the Under Secretary of Energy. Unifying the research conducted among these entities would lead to new synergies across intrinsically related fields.

Congress should therefore replace the basic and applied research offices that artificially divide programs with a set of new offices focused on broad innovation areas (see Figure 3). These might include the Offices of Energy Innovation, Computing Innovation, Biological Innovation, Physics, and Environmental Research. Within these, grant makers and program managers can award funding to the best projects based on merit regardless of where they sit within the innovation lifecycle. While we are not recommending how to specifically combine the research functions, we are recommending that a larger stakeholder discussion take place with academia, the labs, and industry to inform the institutional changes and makeup of the new combined innovation offices. The goal would remain the same though: a more integrated approach to science and technology would help improve the mission impact of the office, compared to the stovepipe structure perpetuated today.

Congress should expand ACT agreements to federally funded entities

ACT provides many of the flexible terms and conditions absolutely necessary for the labs to increase their interactions with industry. In fact, ACT has the potential to bridge many of the gaps left by existing partnership agreements. For that to happen, DOE needs to first move ACT from pilot stage to availability for all labs. Second, the DOE should expand the application of ACT agreements to collaborations between a lab and a company that receives other federal funding. This would allow the labs to partner with private entities that receive other federal funding, as well as provide more negotiating flexibility for the labs in terms of risk, fee, and intellectual property with DOE preapproval. This would immediately provide the labs with a more customizable tool for working with industry and boost the number of lab-industry research collaborations. In absence of DOE action, Congress should do so independently.

FIGURE 3: Existing organizational structure of the Department of Energy, organized by office or program leadership.

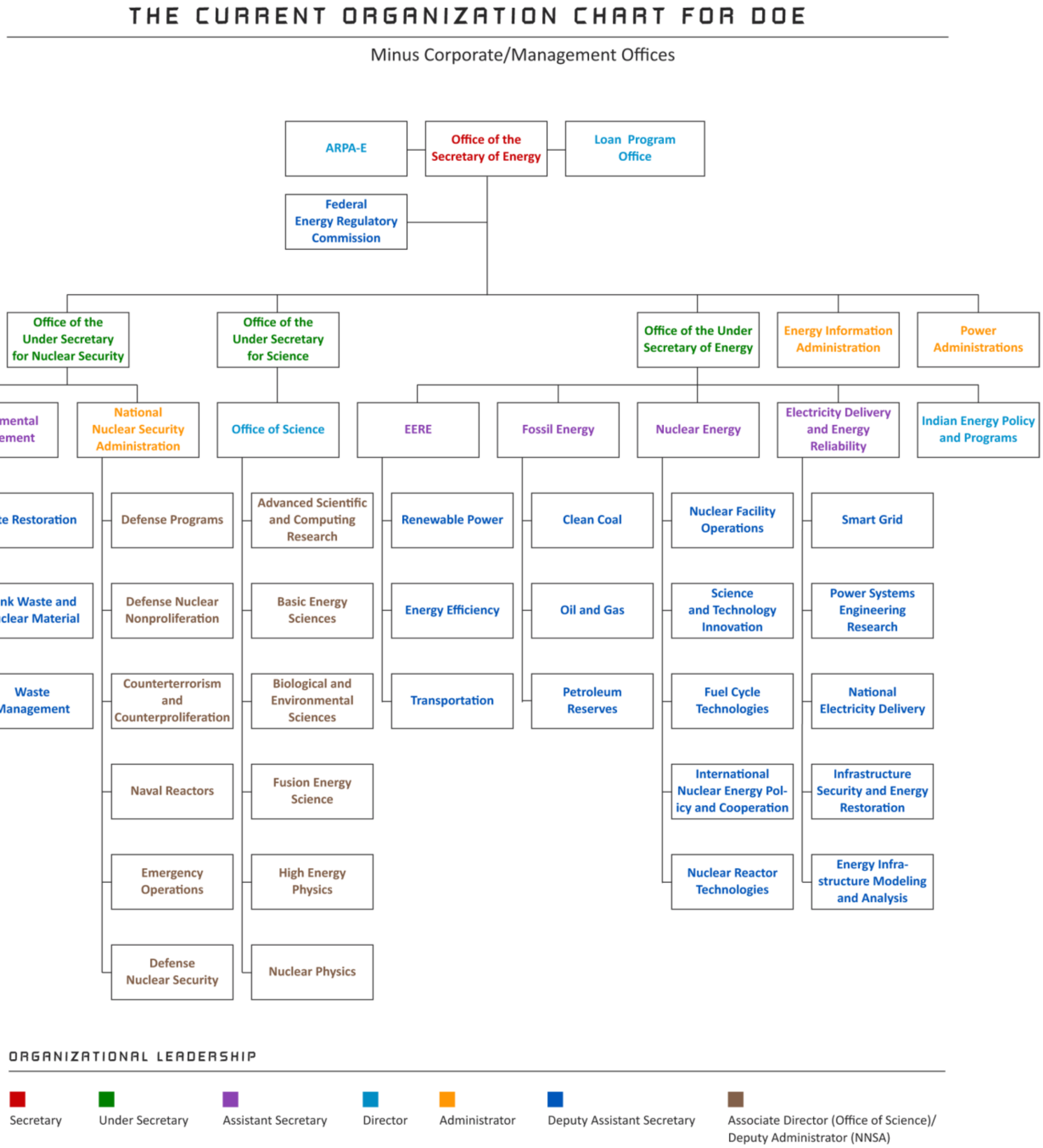
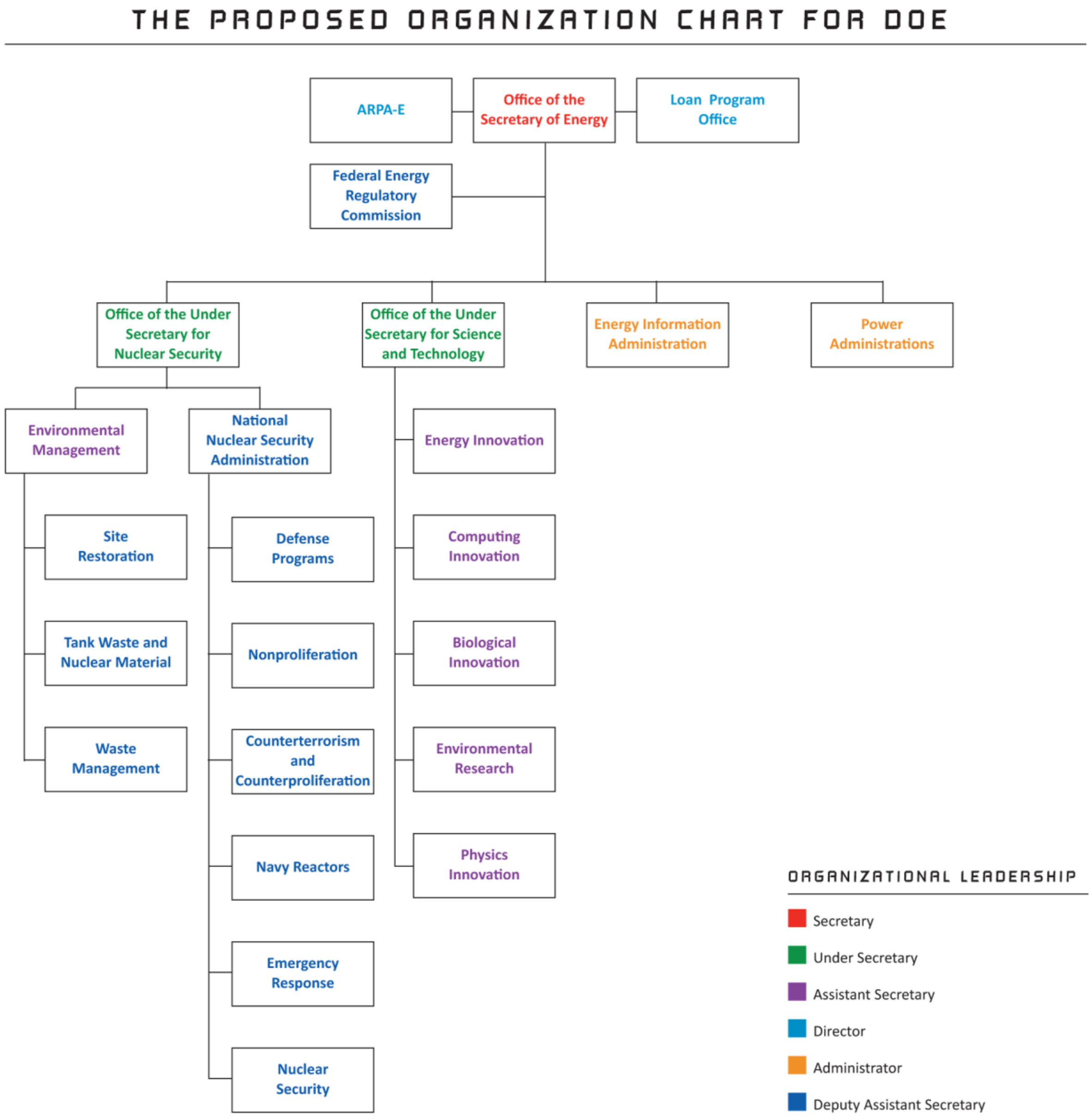


FIGURE 4: Proposed DOE organizational structure, organized by office and program leadership.



Congress should allow the labs to pilot new partnership models without DOE preapproval

With the shift toward a trust-but-verify accountability model, the secretary should grant labs the authority to pilot all of the partnership agreements without transactional DOE preapproval. To protect the national interest, only those existing agreement types would be included, but DOE should work collaboratively with labs to develop entirely new contracting templates if and where necessary and make the process of doing this simpler.

The lab managers would hold ultimate responsibility, liability, and accountability for any cooperative efforts negotiated under this program.

In accordance with other recommendations we make, these activities may not take precedence over government-needed research. And to ensure that national security is protected, foreign partners should be subjected to the same scrutiny that they come under when cooperating with the Department of Energy on any other project.

At first, such a program should operate within a limited size and scope of allowable arrangements, financial risk, and liability terms. Beyond those basic restrictions, the M&O contractor and its negotiating partner(s) should be free to determine other conditions of the agreement such as scope of activity, fees, personnel, and ownership of any intellectual property or physical products as a result of the research. The approach would maximize the lab's ability to meet market demand for its capabilities while minimizing the bureaucratic drag caused by DOE. But over time and in accordance with successful implementation, the pilot program could be expanded and eventually made permanent, giving the lab contractors much greater flexibility to actually manage the technology assets they are hired to manage.

Congress should allow the labs to use flexible pricing for user facilities and other assets

The labs have the tools to interact with industry—albeit they are complex, uneven, and often onerous to implement. But the labs have little motivation to *proactively do so*. In addition to providing the labs with greater flexibility in how they partner with outside parties, a new lab-stewardship philosophy should also provide greater incentives for the labs to do so. Congress should allow the labs to charge flexible rates for services regardless of full cost recovery. This would motivate the labs to pursue technology transfer and other cooperative efforts where the private-sector willingness to pay exceeds the accounting cost of lab capabilities. It goes without saying that any additional flexibility in pricing should not preclude any existing national-security protections.

Congress should increase the weight and implement better metrics for technology transfer in the expanded PEMP process

Instead of waiting to see what technologies emerge from the black box of research, the labs should involve market rationale in the research planning process. The annual PEMP process currently treats successful transfers of technology to market as mere afterthoughts. Elevating this important function to its own category would have significant impacts on the management philosophy of the labs and help reverse the buildup of decades of skepticism and intransigence toward commercialization.

Importantly, the new Office of Science and Technology could do this within the existing DOE authority, though in absence of DOE action Congress should act accordingly. The expanded PEMP contractor-accountability system proposed earlier could be made to include a new, ninth category of explicit evaluation, titled "Technology Impact." This category would evaluate the economic impact of lab-developed technology, creating a stronger incentive for lab managers to focus on market implementation of valuable government intellectual-property assets and technical capabilities. Traditional metrics pertaining to CRADAs, WFOs, UFAs, and licensing would be used as a basis for this evaluation.

In addition, the previously proposed Office of Science and Technology Policy task force described above should be tasked with developing better metrics to measure technology transfer. Things such as economic impact, job-creation impact, revenue generating from spinoff technologies, and other market impacts of lab-developed research could be included among the traditional metrics of CRADAs and patents. Implementing these changes could likely be done through executive authority alone, in the context of better implementation of the Stevenson-Wydler Act, which already calls for labs to maximize commercial outcomes of publicly funded research to the greatest degree possible without compromising the government mission of the labs.

Conclusion

The reforms we propose above are designed to better position the labs to address the realities of innovation in an increasingly competitive, globalized, and knowledge-driven 21st century economy. They will provide the labs with the increased flexibility that they need to better engage with the private sector while still ensuring strong congressional oversight and stewardship of taxpayer dollars.

In the 21st century, as the speed and breadth of innovation increases and as the public sector and the private sector increasingly rely upon each other to solve problems and create solutions to shared challenges, the labs must evolve. Today’s scientific and technological challenges and approaches rarely fit within narrowly defined boxes, and effective research and development management requires a big-picture view of the entire technology-development lifecycle. Now more than ever, basic research methods are informing critical industrial and commercial interests, while a fast-moving marketplace is informing the questions that scientists must ask of their research.

Implementing these reforms would be an important step toward better positioning the labs to tackle 21st century challenges. Increased management flexibility will allow the labs to do more with less. Better alignment between stewardship and funding will improve the ability for DOE to better articulate and implement strategic plans and system-wide missions. And more operating flexibility will allow the labs to make smarter decisions more informed by market realities, enter into productive partnerships, and contribute more fully to the U.S. innovation economy. We believe the end result will be more impactful research, more economic impact, more jobs, and wiser use of taxpayer dollars.

Endnotes

1. Estimates on National Lab budgets vary depending on whether totaling only Department of Energy research expenditures or also counting non-DOE and industry investment in lab research. The National Science Foundation Statistical Tables, for example, estimated that labs represented $12.632 billion in FY 2011, including stimulus spending but not NETL and SRNL. See National Science Foundation, "Federal Funds for Research and Development: Fiscal Years 2009–11" (2012), p. 46, available at http://www.nsf.gov/statistics/nsf12318/pdf/nsf12318.pdf. The National Academy of Public Administration estimated a total FY 2011 lab budget of $14.128 billion, not including NETL and SRNL. See National Academy of Public Administration, "Positioning DOE's Labs for the Future: A Review of DOE's Management and Oversight of the National Laboratories" (2013), p. 23, available at http://www.napawash.org/wp-content/uploads/2013/01/DOE-FINAL-REPORT-1-2-13.pdf. The Department of Energy disclosed SRNL's budget as $2.54 billion in FY 2011. See Doug Hintze, "Presentation to the SRS Citizens Advisory Board: Budget Update and Integrated Priority List" (U.S. Department of Energy, 2013), available at http://cab.srs.gov/library/meetings/2010/fb/hintze_cab_budget_ipl_update.pdf. NETL disclosed a FY 2012 budget of $815 million in addition to $600 million for managing EERE's Project Management Center. See National Energy Technology Laboratory factsheet at http://www.netl.doe.gov/publications/factsheets/corporate/NETL_flyer.pdf. The working group estimates a FY 2011 labs budget of $18.068 billion, which represents their budget appropriations as well as stimulus funding. Please note that because of stimulus spending, the labs budget in FY 2011 was larger than in previous funding years.
2. For information on the National Solar Thermal Test Facility, see Sandia National Laboratories, "National Solar Thermal Test Facility," available at http://energy.sandia.gov/?page_id=1267 (last accessed June 2013).
3. The National Energy Technology Laboratory is designated a Government-Owned, Government Operated facility, or GOGO, and is not managed by a contractor.
4. Homer Neal, Tobin Smith, and Jennifer McCormick, *Beyond Sputnik: U.S. Science Policy in the 21st Century* (Ann Arbor, Michigan: University of Michigan Press, 2008), p. 123.
5. National Institute of Standards and Technology, "Federal Laboratory Technology Transfer 2010, Summary Report to the President and Congress, Fiscal Year 2010" (2012), available at http://www.nist.gov/tpo/publications/upload/Fed-Lab-TT_FINAL.pdf.
6. Ibid. at 20.

7. National User Facility Organization, “Participation by Industrial Users in Research at National User Facilities: Status, Issues, and Recommendations: Preliminary Report” (2009), available at http://www.nufo.org/handlers/report.ashx?id=3.

8. PPPL, for example, hosts the National Spherical Torus Experiment, or NSTX, which is a unique magnetic fusion device that produces spherical plasma, which is a likely candidate for use in commercial fusion reactors. For more information, see Princeton Plasma Physics Laboratory, “National Spherical Torus Experiment (NSTX),” available at http://www.pppl.gov/NSTX (last accessed June 2013); Office of Science, *The U.S. Department of Energy's Ten-Year Plans: Fiscal Year 2012* (U.S Department of Energy, 2012), available at http://science.energy.gov/~/media/lpe/pdf/2012-SC-Laboratory-Plans-for-Web.pdf.

9. Specifically, LANL hosts users across three facilities: the Center for Integrated Nanotechnologies, Los Alamos Neutron Science Center, and the National High Magnetic Field Laboratory. For more information on these facilities, see Los Alamos National Laboratory, “User Facilities,” available at http://www.lanl.gov/collaboration/user-facilities/index.php (last accessed June 2013).

10. Suzy Tichenor, “Utilizing the Tools of Science to Drive Innovation through Fundamental Research,” Statement before the Subcommittee on Energy and Environment, Committee on Science, Space, and Technology, U.S. House of Representatives, June 21, 2012, available at http://science.house.gov/sites/republicans.science.house.gov/files/documents/hearings/HHRG-112-%20SY20-WState-STichenor-20120621.pdf.

11. Sean Pool and Jennifer Erickson, “The High Return on Investment for Publicly Funded Research” (Washington: Center for American Progress, 2012), available at http://www.americanprogress.org/issues/technology/report/2012/12/10/47481/the-high-return-on-investment-for-publicly-funded-research/.

12. Bruce Harrer and Cheryl Cejka, “Agreement Execution Process Study: CRADAs and NF-WFO Agreements and the Speed of Business” (Richland, Washington: Pacific Northwest National Laboratory, 2011), available at http://www.pnl.gov/main/publications/external/technical_reports/PNNL-20163.pdf.

13. Ibid. at 8.

14. Ibid. at 10.

15. For the U.S. Department of Energy's directive on LDRD spending, see Office of Information Resources, “DOD O 413.2B Admin Chg 1, Laboratory Directed Research and Development,” available at https://www.directives.doe.gov/directives/0413.2-BOrder-badmchg1/view (last accessed June 2013). For a brief legislative history of LDRD, see “Legislative History of the LDRD Program,” available at http://science.energy.gov/~/media/lpe/word/LDRD-Legislative-History-07-01-2011.docx.

16. See William Craig, “Laboratory Directed Research and Development Annual Report FY2012” (Livermore, California: Lawrence Livermore National Laboratory, 2012), available at https://st.llnl.gov/content/assets/docs/LLNL_12LDRD.pdf; General

Accounting Office, "Federal Research: Information on DOE's Laboratory-Directed R&D Program," Report to the Subcommittee on Energy and Water Development, Committee on Appropriations, House of Representatives, April 30, 2004, available at http://www.gao.gov/products/GAO-04-489.

17. Craig, "Laboratory Directed Research and Development Annual Report FY2012," p. 4.
18. National Academy of Public Administration, "Positioning DOE's Labs for the Future," p. 25.
19. Figure data sourced from aggregate budget data described in endnote 2 using U.S. Department of Energy and National Academy of Public Administration budget disclosures for FY 2011.
20. Harrer and Cejka, "Agreement Execution Process Study: CRADAs and NF-WFO Agreements and the Speed of Business."
21. Stevenson-Wydler Technology Innovation Act of 1980, Public Law 96-480.
22. For a list of all the Office of Science report cards, see Office of Science, "SC Laboratory Appraisal Process: FY 2011 SC Laboratory Performance Report Cards," available at http://science.energy.gov/lpe/performance-appraisal-process/fy-2011/ (last accessed June 2013).
23. Section 309, Division C of the Consolidated Appropriations Act of 2008, Public Law 110-161, available at http://www.gpo.gov/fdsys/pkg/PLAW-110publ161/pdf/PLAW-110publ161.pdf. This authorizes the secretary of energy to authorize LDRD investments up to 8 percent of research funding provided to the labs by DOE.
24. National Academy of Public Administration, "Positioning DOE's Labs for the Future," p. 17.

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