Localizing the Economic Impact of R&D and Technology Transfer

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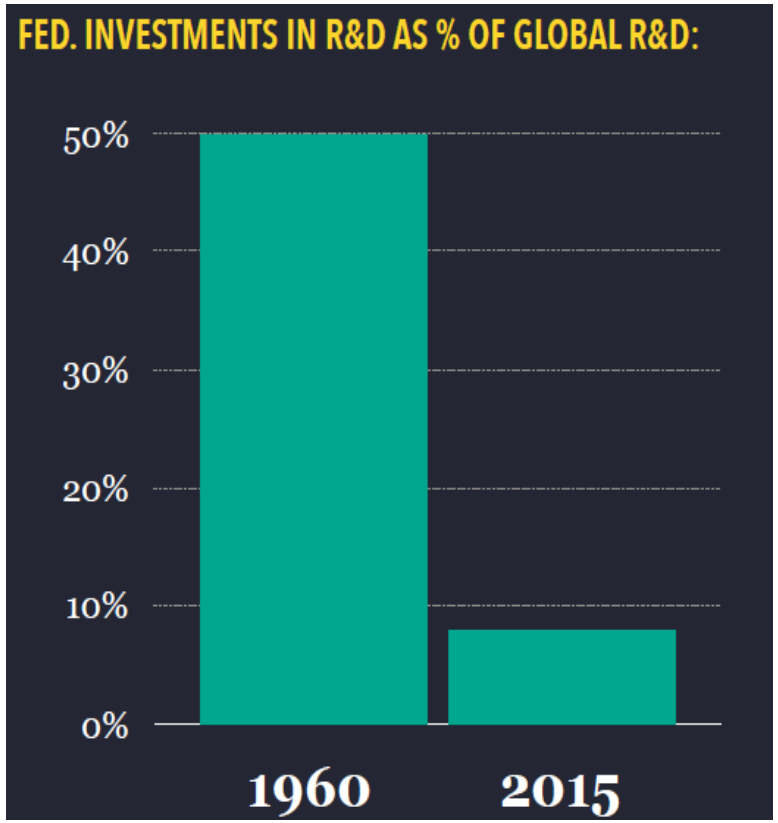
About ITIF

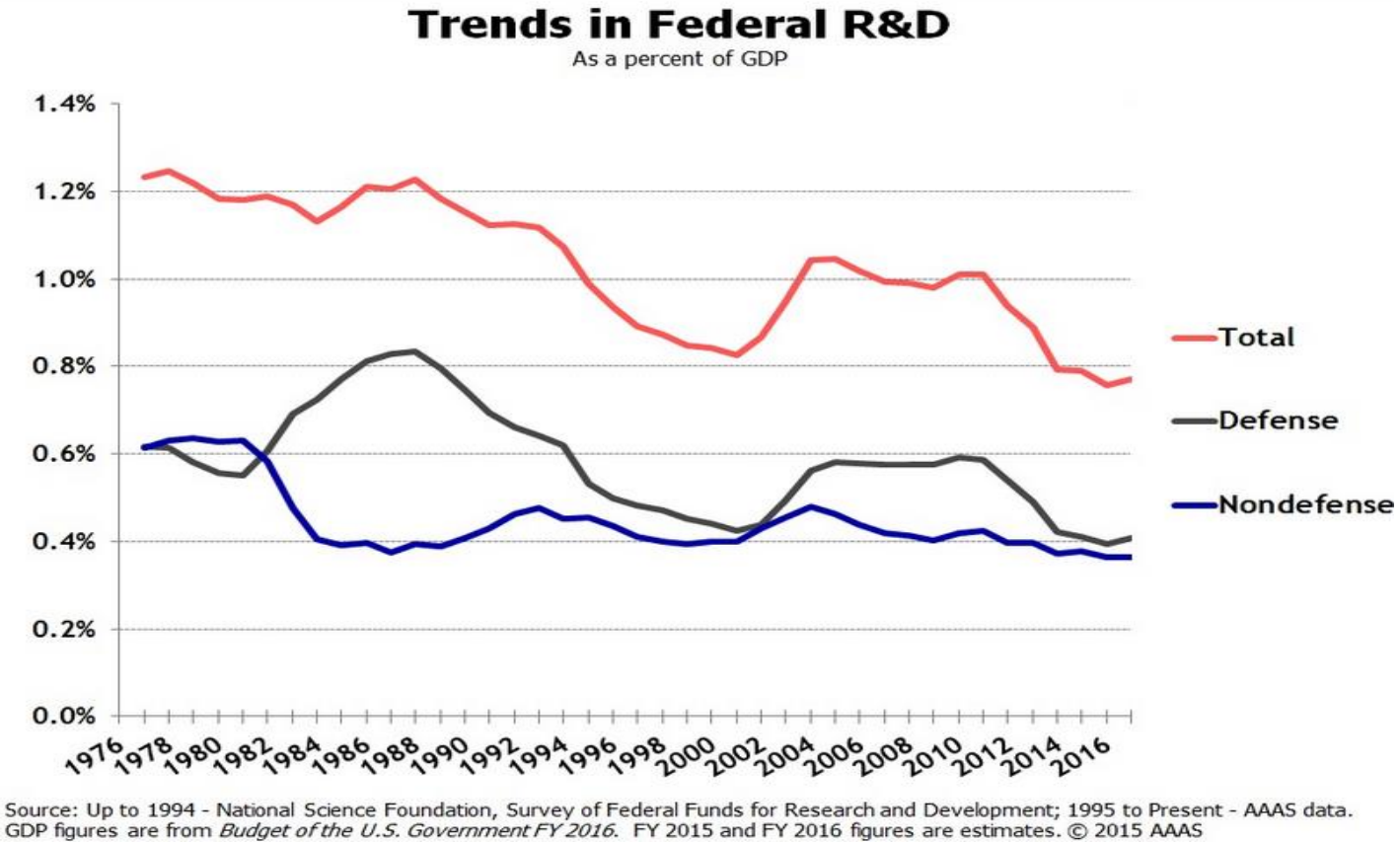
- Independent, nonpartisan research and education institute focusing on intersection of technological innovation and public policy, including:
  - Innovation and competitiveness
  - IT and data
  - Telecommunications
  - Trade and globalization
  - Life sciences, agricultural biotech, and energy
- Mission to formulate and promote policy solutions that accelerate innovation and boost productivity
- Ranked by University of Pennsylvania as top science and technology think tank in United States and number two in world

Today's Presentation

1. **Changes and Challenges in the U.S. National Innovation System**
2. Technology Transfer Challenges in the Federal Laboratories
3. Technology Transfer Solutions and Recommendations

Federal R&D Funding Has Substantially Decreased





Source: Up to 1994 - National Science Foundation, Survey of Federal Funds for Research and Development; 1995 to Present - AAAS data. GDP figures are from *Budget of the U.S. Government FY 2016*. FY 2015 and FY 2016 figures are estimates. © 2015 AAAS

The Innovation Process Has Evolved…

WWII
"Connected
Model"

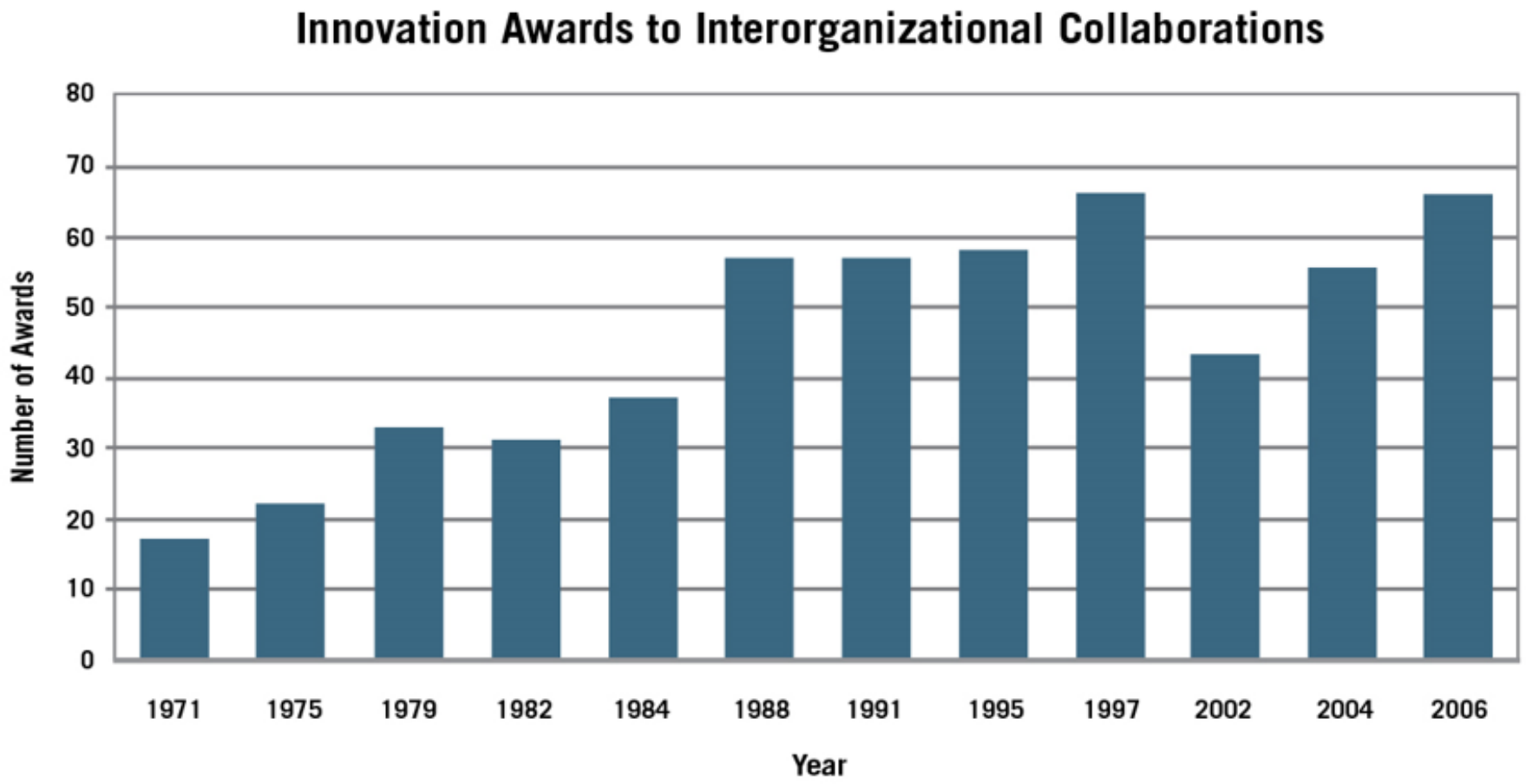
Post-war Pipeline
& Internal R&D
Labs Model

P&G | connect + develop℠

Los Alamos
NATIONAL LABORATORY
EST. 1943

Modern Collaborative,
Open Innovation
Models

Becoming More Collaborative in Nature



Source: Fred Block and Matthew Keller, ITIF, *Where Do Innovations Come From? Transformations in the U.S. National Innovation System, 1970-2006*

U.S. Innovation Model Successful in Fewer Sectors

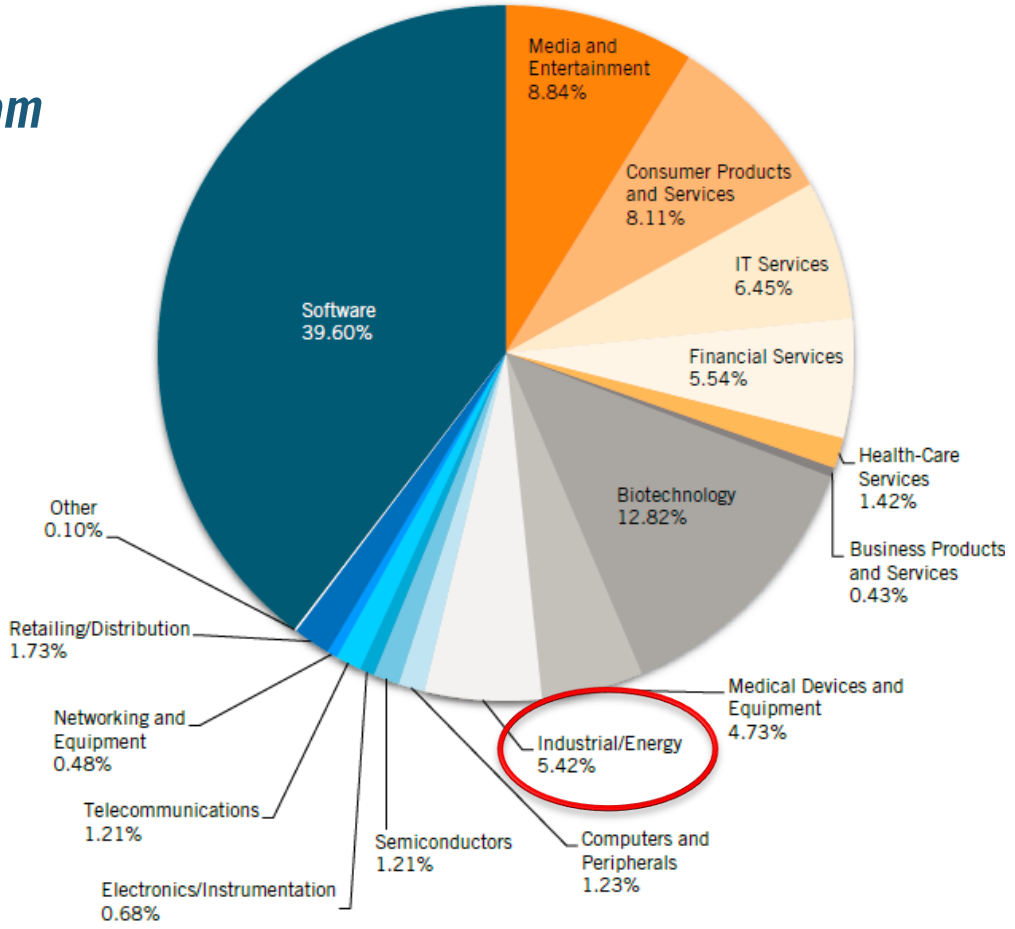
- U.S. relies on entrepreneurial startups to bring innovation into its system.
- U.S. developed a $60B/year venture capital system to seed startups.
- But that increasingly supports mainly the software and biotech sectors.

Innovation in Legacy Sectors Increasingly Difficult

Point: Venture Capital is increasingly withdrawing from "hard" technology.

We're going to need new approaches to innovate in these sectors.

Federal labs will play a vital role.



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"Innovation Orchards": Helping Tech Start-Ups Scale

BY PETER L. SINGER AND WILLIAM B. BONVILLIAN | MARCH 2017

An "orchard" would bring together university, industry, and potentially government partners to create a space that provides start-ups with the know-how, access to technology, equipment, and bridge funding to scale up their new technologies.

EXECUTIVE SUMMARY

Federal support for R&D has fallen precipitously in recent years as a share of gross domestic product (GDP), and because of this, the United States risks slipping significantly as a global innovation competitor. More federal investment is needed to avoid falling behind. But it will be difficult to find political support for more funding, since Democrats are reluctant to reduce entitlement spending, and Republicans want to cut budgets, including science budgets. So America will likely be forced to make the best out of a bad situation. One way to do that is to focus more effectively on spurring innovation commercialization—and one emerging idea is the creation of "innovation orchards."

MIT President Rafael Reif coined the term "innovation orchard" in 2015, proposing a new mechanism to address a growing gap in the U.S. innovation system.[1] An "orchard" would bring together university, industry, and potentially government partners to create a space that provides start-ups with the know-how, access to technology, equipment, and bridge funding to scale up their new technologies. With existing gaps in innovation financing, the aim is to leverage strengths in a region's innovation system to help start-ups develop advanced prototypes, then demonstrate, test, and bring them to the manufacturing stage. In effect, the orchard would substitute space for capital.

Even with its decline, federal support for research at universities does continue to help create many new innovative technologies. New business start-ups have played a crucial role in translating innovative technologies into market-ready products, often with strong support from venture capital. The venture-capital system rose to prominence during the information-technology revolution, supporting computing and semiconductors, and has played a pivotal role in the U.S. innovation system for decades. Innovative start-ups,

INFORMATION TECHNOLOGY & INNOVATION FOUNDATION | MARCH 2017 PAGE 1

Source: Peter L. Singer and William B. Bonvillian, ITIF, *"Innovation Orchards": Helping Tech Start-Ups Scale*

Today's Presentation

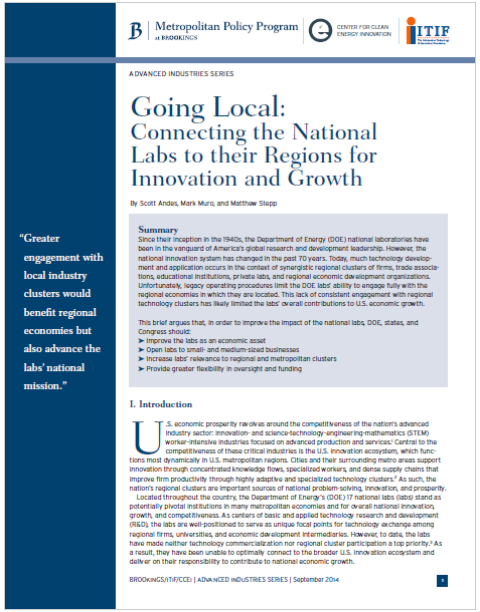
1 Changes and Challenges in the U.S. National Innovation System

2 **Technology Transfer Challenges in the Federal Laboratories**

3 Technology Transfer Solutions and Recommendations

Labs Challenges for Tech Transfer and Regional Connectivity

1. DOE's economic strategy inconsistent.
2. Smaller firms find it difficult to work with lab system.
3. Labs aren't incentivized to commercialize.
4. Micromanagement restricts lab engagement.



"Greater engagement with local industry clusters would benefit regional economies but also advance the labs' national mission."

Metropolitan Policy Program at BROOKINGS | CENTER FOR CLEAN ENERGY INNOVATION | ITIF

ADVANCED INDUSTRIES SERIES

Going Local: Connecting the National Labs to their Regions for Innovation and Growth

By Scott Andes, Mark Muro, and Matthew Stepp

Summary

Since their inception in the 1940s, the Department of Energy (DOE) national laboratories have been in the vanguard of America's global research and development leadership. However, the national innovation system has changed in the past 70 years. Today, much technology development and application occurs in the context of synergistic regional clusters of firms, trade associations, educational institutions, private labs, and regional economic development organizations. Unfortunately, legacy operating procedures limit the DOE labs' ability to engage fully with the regional economies in which they are located. This lack of consistent engagement with regional technology clusters has likely limited the labs' overall contributions to U.S. economic growth.

This brief argues that, in order to improve the impact of the national labs, DOE, states, and Congress should:

- Improve the labs as an economic asset
- Open labs to small- and medium-sized businesses
- Increase labs' relevance to regional and metropolitan clusters
- Provide greater flexibility in oversight and funding

I. Introduction

U.S. economic prosperity rests as around the competitiveness of the nation's advanced industry sector: innovation- and science-technology-engineering-mathematics (STEM) worker-intensive industries focused on advanced production and services.[1] Central to the competitiveness of these critical industries is the U.S. innovation ecosystem, which functions most dynamically in U.S. metropolitan regions. Cities and their surrounding metro areas support innovation through concentrated knowledge flows, specialized workers, and dense supply chains that improve firm productivity through highly adaptive and specialized technology clusters.[2] As such, the nation's regional clusters are important sources of national problem-solving, innovation, and prosperity.

Located throughout the country, the Department of Energy's (DOE) 17 national labs (labs) stand as potentially pivotal institutions in many metropolitan economies and for overall national innovation, growth, and competitiveness. As centers of basic and applied technology research and development (R&D), the labs are well-positioned to serve as unique focal points for technology exchange among regional firms, universities, and economic development intermediaries. However, to date, the labs have made neither technology commercialization nor regional cluster participation a top priority.[3] As a result, they have been unable to optimally connect to the broader U.S. innovation ecosystem and deliver on their responsibility to contribute to national economic growth.

BROOKINGS/ITIF/CCEI | ADVANCED INDUSTRIES SERIES | September 2014

Source: Scott Andes, Mark Muro, and Matthew Stepp, Brookings and ITIF, *"Going Local: Connecting the National Labs to their Regions for Innovation and Growth*

DOE's Economic Strategy Inconsistent

DOE's efforts "*did not demonstrate any planning or foresight…and did not sufficiently implement the Congressional intent.*"

-Inspector General audit of DOE lab system, 2013

Smaller Firms Find It Difficult to Work with the Labs

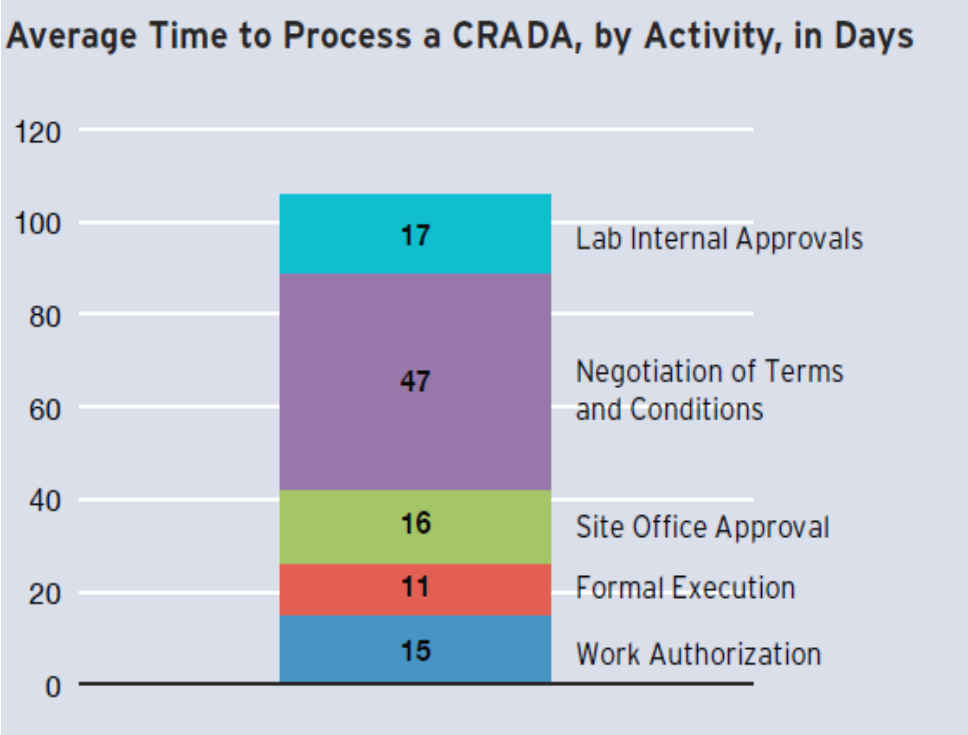


Figure 2. Agreement Execution Cycle Time

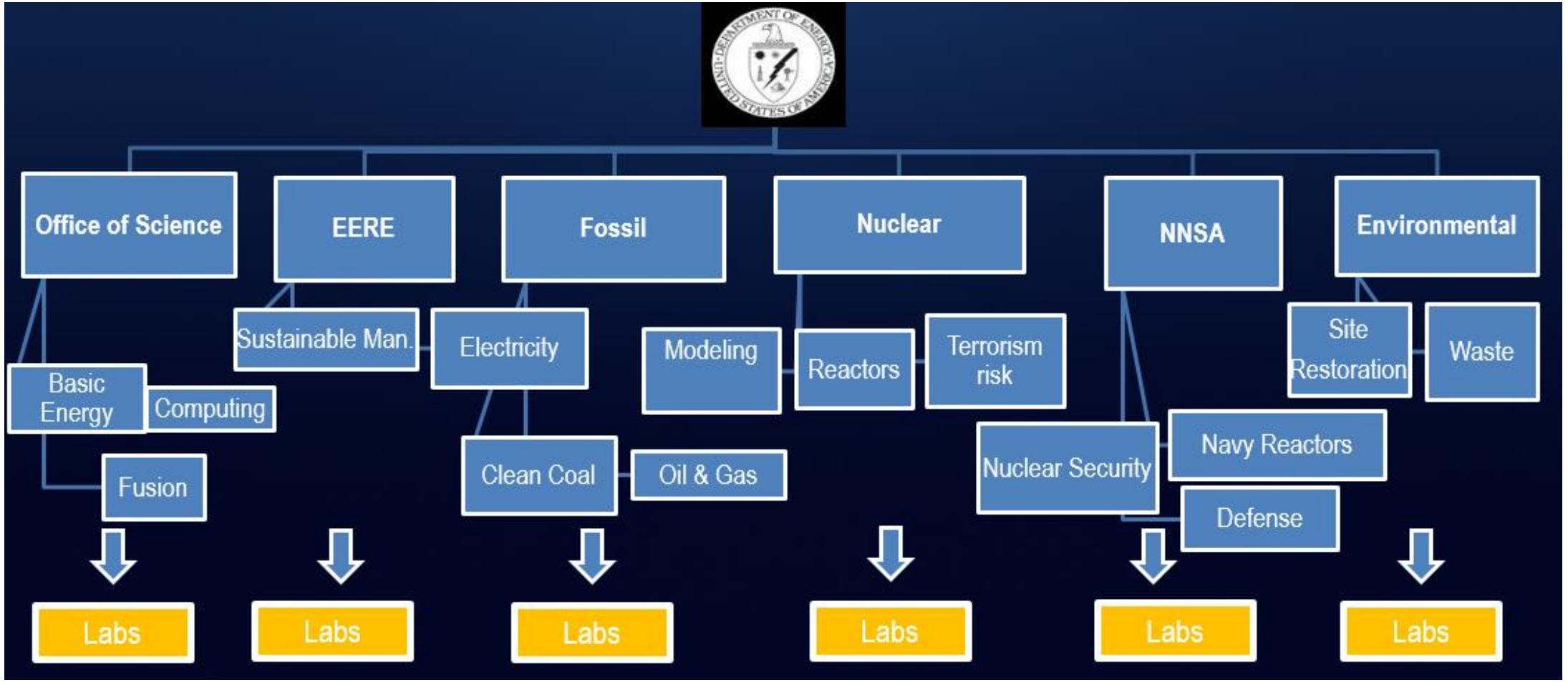
Type	Mean # of Days	Range
Laboratory CRADA	110	46 to 192 days
Laboratory NF-WFO	81	52 to 135 days
Federal Site Office CRADA	12	3 to 20 days
Federal Site Office NF-WFO	14	4 to 40 days

Source: Scott Andes, Mark Muro, and Matthew Stepp, Brookings and ITIF, *"Going Local: Connecting the National Labs to their Regions for Innovation and Growth*

Labs Not Incentivized to Engage Regional Industry Clusters

- Technology transfer and regional interaction scarcely recognized or incentivized in the PEMPs.
- Energy Policy Act directed DoE to develop “a comprehensive plan for use of qualitative metrics to evaluate tech transfer,” but no action yet.
- Rigid budget rules make it difficult to repurpose existing funding, causing missed regional research opportunities.

DOE/Congressional Micromanagement Restricts Labs



DOE/Congressional Micromanagement Restricts Labs

- Restrictive oversight forces lab managers to be “rule followers” instead of leaders responsible for overall lab outcomes.
- Few flexibilities: lab overhead expenses come with extremely tight restrictions.

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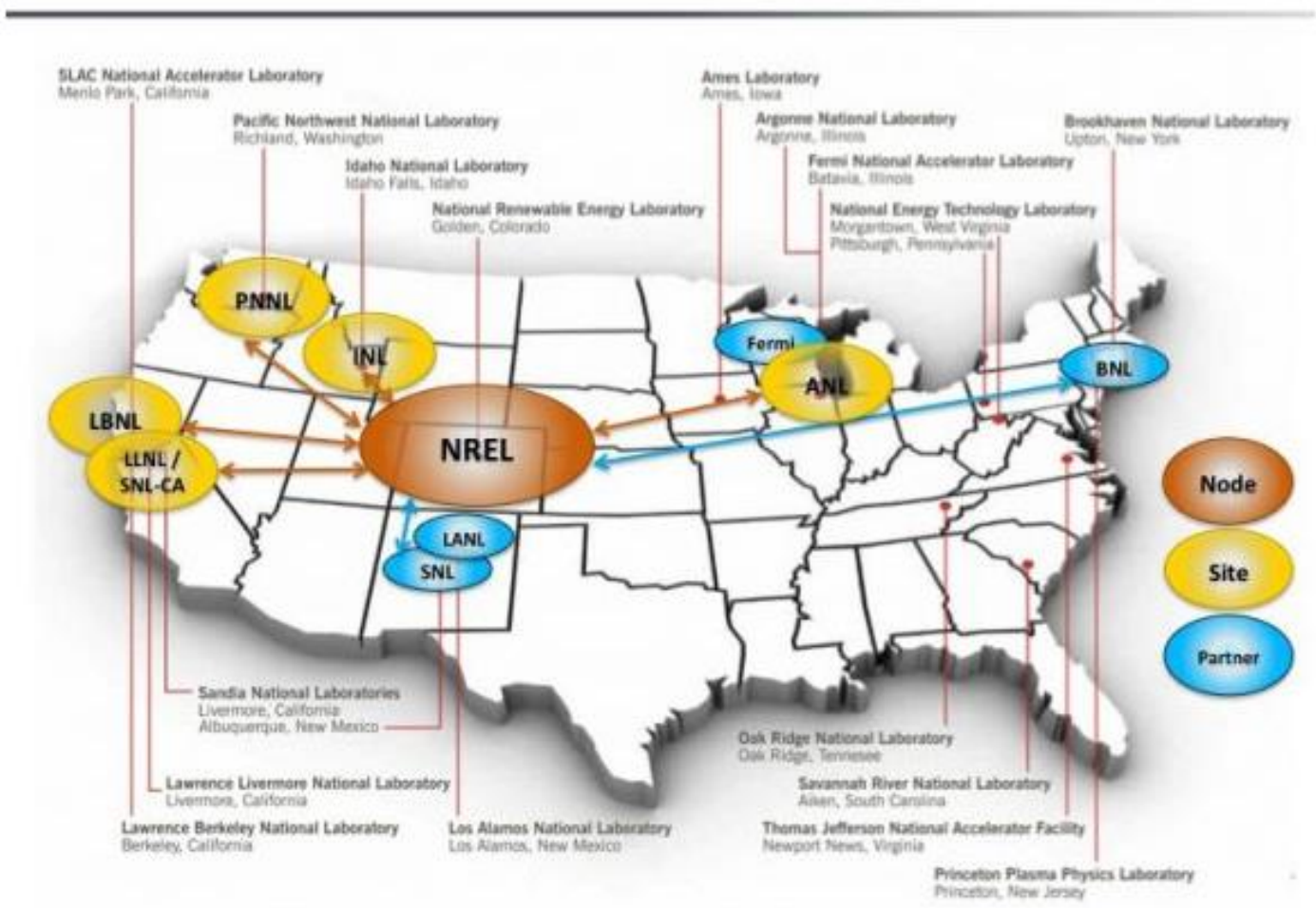
Policy Solutions

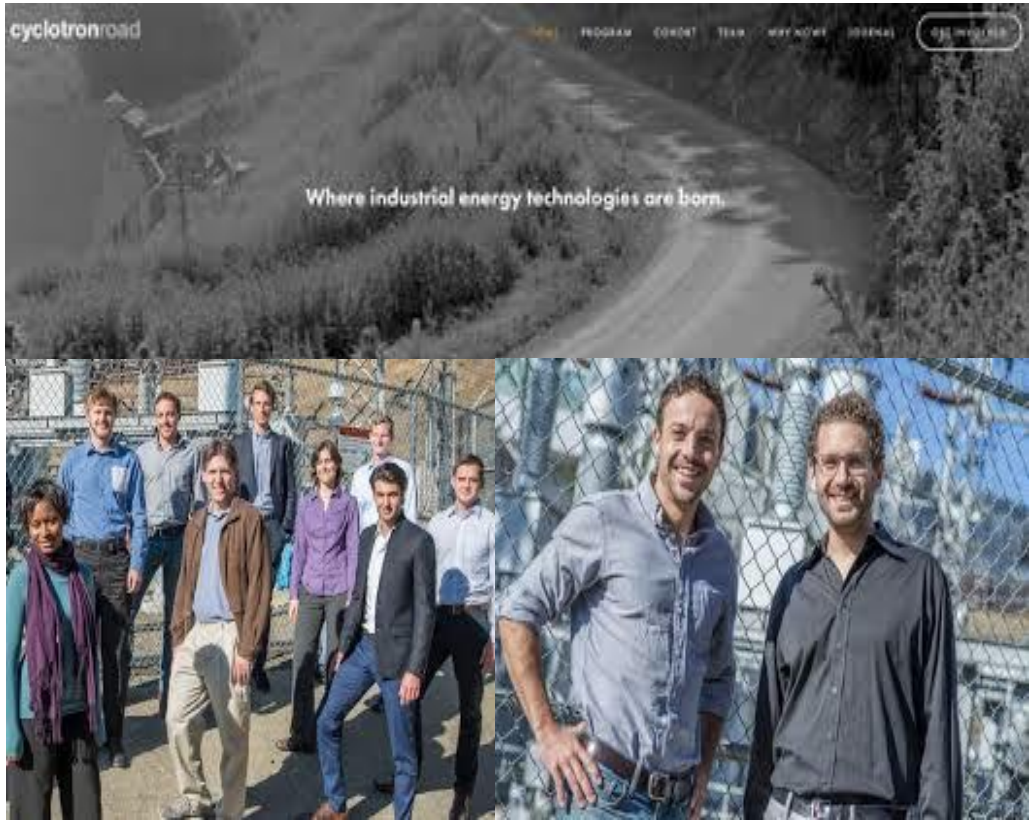
1. Empower the labs as engines of innovation and tech transfer.
2. Create new pathways to engage the labs, including novel approaches to open them to SMEs and industry partners.
3. Provide greater flexibility in terms of oversight and funding.
4. Improve the labs as economic assets.

Energy I-Corps: A National Network to Unleash Lab Impact

- $2.3M pilot program.
- Teaches “entrepreneurial scientists” lean startup and customer discovery methodologies.
- Provides seed funding for lab researchers to identify commercialization paths or new industry partners.



Create Off-campus "Microlabs" as a Front Door to the Labs



- IDEA: Park a bunch of energy tech startups (16) outside fence of Lawrence Berkeley Lab in intermediary space
- Pay them salaries
- Give them the keys – let them invade
- Access to advanced technology, equipment, know-how.
- New tech transition model:
  - *Old model* – inside/out - get the labs to transition their own technologies
  - *New Model* – outside/in

Expand Manufacturing Development Facilities (MDFs)

- Bridges basic research at Oak Ridge and the real time needs of industry.
- Assists industry's adoption of new manufacturing technologies lowering costs and energy consumption.
- Should create 20 MDFs that can help bring to market the fruits of federal labs' scientific and technical research discoveries.

Innovation Vouchers

- E.g. Tennessee/Oak Ridge collaborated to launch RevV: a $2.5 million manufacturing innovation program.
- Pilot program offers vouchers allowing Tennessee manufacturers to access world-class researchers and facilities available at ORNL.
- EERE's Small Business Voucher Pilot (SBV) has provided vouchers to 33 small business across 20 states working with nine national labs.
- Congress should extend vouchers to entire federal lab system by authorizing $50M that would be state-matched.

“Phase 0” REACH Hub Expansion

- Initial NIH Evaluation and Commercialization Hub (REACH) Hub program accelerated translation of biomedical innovations into commercial products.
- SBIR Reauthorization legislation includes funding to expand the REACH program beyond NIH to NSF, NASA, and DoE, providing $3M/yr per agency.
- Essentially represents funding for “Phase 0” proof of concept activities, creates new pathways to translate promising technologies to the private sector.

Impact Energy Foundation Act – Create a DOE Foundation

- Builds on Foundations at NIH, CDC, and Department of Agriculture.
- Establishes 501(c)3 nonprofit foundation to provide a more flexible source of private funds for technology transfer, entrepreneurship, and regional economic development.
- Facilitate PPPs that could administer prize competitions engaging private sector to invest in commercial solutions to large problems.

EERE Tech-to-Market *Innovative Pathways* Program

- $7.8 million program funding 11 innovative projects designed to develop and test new ways to integrate emerging techs into energy industry.
- Doesn't fund technologies themselves, but provides funding for development, testing, and evaluation of new models for bringing new tech to market.
- E.g. DOE's SunShot Initiative

SunShot U.S. Department of Energy

IP Bundling

Outsiders have traditionally had to negotiate one-off IP rights across the labs, making it difficult to identify the IP assets available.

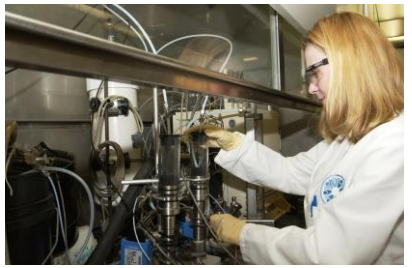
- DoE proactively identifying "IP bundles" related to emerging energy technologies such as lithium-ion batteries, solar, energy storage, etc.
- Another approach: Create an "International Patent Consortium."

CRADA Streamlining

- DoE working to develop a lab-wide, online, interactive, easy-to-understand guide to using CRADAs.
- Cooperative Research and Development Fund Authorization Act (Rep Lujan)
  - Authorizes a dedicated fund to provide the government's share of CRADAs th maturing lab technology and transfers it to the private sector.

Supporting Labs Workforce Development

- The DoE National Lab Job Access Program (Rep. Lujan)
- Pilot program focusing on apprenticeships for skilled technicians/ machinists (i.e., skilled crafts) in the federal labs.
- Will enable intermediaries like MEP to form collaborations with national labs, community colleges, to identify critical workforce needs and develop training curriculum.



Increasing Lab Flexibilities

- Implement performance-based, rather than rule-based, management approaches.
- Allow DoE labs to engage in non-federal funding partnerships that do not require DoE approval (i.e., $1M signature authority).
- Allow labs to repurpose a small portion of existing funds (up to 5%) for timely regional collaborations.

Prioritize Technology Transfer/Regional Economic Development

- Add a ninth, “Technology Impact” category to the PEMPs.
- Task the labs with a regional economic development mission.
- Create a tangible, fully funded Commercialization Fund, to support expanded technology transfer efforts within the labs.

In Conclusion

- The federal lab system continues to be a unique advantage to the United States.
- Yet more can be done within their economic regions.
- The call for “cultural” reform may be less important than establishing specific policies.

Thank You!

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