U.S. DEPARTMENT of ENERGY | Office of Energy Efficiency and Renewable Energy

IEPEC

Impact Evaluation of Federal Energy R&D Through Small Businesses and Startups

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Why does federally funded energy research and development (R&D) matter?

- R&D in energy has driven some of the most dramatic technological revolutions in history (e.g. the steam engine, electricity, nuclear power)
- Innovations can also reduce costs, improve system reliability, other value propositions
- The U.S. federal government has historically played a leading role funding energy innovation relative to other governments worldwide [1] and DOE patents are known to be highly influential on subsequent technology development [2]
- DOE's Office of Energy Efficiency and Renewable Energy's (EERE's) funding is known anecdotally to have contributed to disruptive innovations (e.g. solar, wind, EV batteries)

1 https://www2.itif.org/2019-global-energy-innovation-index.pdf

2 https://www.bing.com/ck/a?!&&p=d349e4db93215a5f57d8ee70d5fa1e65b6c2178b4c9b6ed1d051fe019bc36326JmltdHM9MTc1OTEwNDAwMA&ptn=3&ver=2&hsh=4&fclid=362b23a1-08c5-68eb-2f4b-3590094e6979&psq=1790+Analytics+LLC+2022.+The+Influence+of+Patents+in+Twenty+R%26D+Portfolios+Funded+by+the+U.S.+Department+of+Energy%e2%80%99s+Office+of+Energy+Efficiency+and+Renewable+Energy.+Energy.gov.&u=a1aHR0cHM6Ly93d3cuZW5lcmd5Lmdvdi9lZXJlL2FuYWx5c2lzL2luZmx1ZW5jZS1wYXRlbnRzLXR3ZW50eS1yZC1wb3J0Zm9saW9zLWZ1bmRlZC11cy1kZXBhcnRtZW50LWVuZXJneXMtb2ZmaWNlLWVuZXJneQ

Why evaluate DOE EERE funding to small businesses?

- Among other investments, EERE awarded roughly $7.1 billion in funding for R&D to small businesses and startups - known to be major drivers of innovation - between years 2006 and 2024
- To date few systematic evaluations of EERE's impact on small businesses have been conducted
- Evidence of the efficacy of these investments is needed to justify future investment
- Transparency, reporting results to the public
- Informing EERE and DOE investment strategy
- Informing energy R&D strategy and evaluation approaches for other governments and agencies
- Assess options for ongoing evaluation, performance measurement of EERE's small businesses awards

EERE Impact Evaluation of Funding to Small Businesses

Population: Several thousand EERE financial assistance, SBIR and STTR awards, and prizes executed between 2006 to 2024

Questions this Evaluation will seek to Answer

- To what extent do small businesses that receive funding from EERE commercialize products, achieve greater revenue streams, grow to become larger companies or exhibit other indicators of economic success compared to similarly qualified companies that did not receive EERE funding?
- Do small businesses funded by EERE attract greater follow-on investment, achieve higher sales, or have higher survival rates than similarly qualified companies that did not receive EERE funding?
- Is there any relationship between the magnitude, duration, or number of awards received from EERE by small businesses and these businesses' long-term rates of growth?
- To what extent does EERE's funding through Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) awards achieve the four stated goals of these programs?

Near-Term Outcome Metrics

- Product sales achieved (commercialization)
- Follow-on funding obtained
- Follow-on projects conducted
- Patents executed
- Citations achieved
- Job growth
- Speed to market
- Company survival

Note that energy savings are not a common near-term outcome of these investments – it may take a decade or two for a new technology in R&D to achieve broad adoption and result in high energy savings for end users

…but through this evaluation EERE will identify some innovations that have gained broad adoption and may evaluate energy impacts of these innovations as part of a future study

Approach, Building on Past Studies

- An influential 2017 evaluation of DOE's SBIR awards by Sabrina Howell offers a model for evaluating impacts using a quasi-experimental sharp regression discontinuity design (RDD) and a counterfactual of meritorious funding applications that were not funded
- Hypotheses tested through the 2017 study and others conducted by EERE, researchers at U. Oregon and elsewhere will be tested on EERE awards in particular through this new evaluation
- Patent tracing methodologies used by PNNL and others
- Sales data information collection from small business award recipients and non-recipients, Paperwork Reduction Act (PRA) approval
- Other data sources expected to include Pitchbook, Dun and Bradstreet, U.S. Census Bureau, the US Patent and Trademarking Office, Web of Science
- Evaluation plan and results independently reviewed by non-government researchers and experts

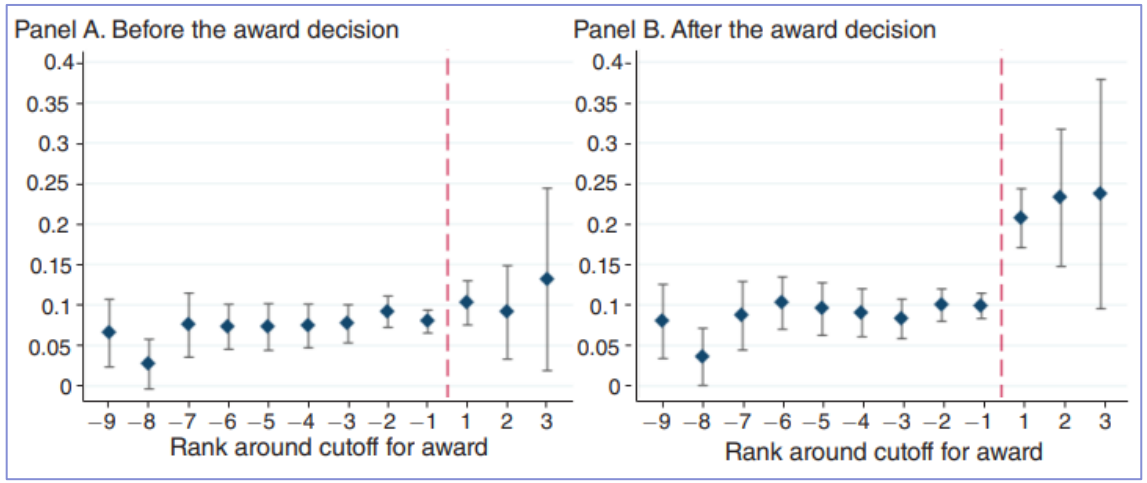

Figure: Probability of Venture Capital Before and After DOE SBIR Grant By Rank, results from Howell's study of DOE SBIR grants 2017. This figure shows the fraction of DOE SBIR applicants who received venture capital (VC) before and after their grant. Ninety-five percent confidence intervals shown. Panel A represents applicants found meritorious but not ultimately funded and Panel B represents awarded applicants.

Source:
https://www.bing.com/ck/a?!&&p=5cdbc8597603ee859f858e326c55c13b6b53a5faf4b6ee6caa4210561e64b3cfJmltdHM9MTc1OTEwNDAwMA&ptn=3&ver=2&hsh=4&fclid=362b23a1-08c5-68eb-2f4b-3590094e6979&psq=Howell%2c+S.+2017.+%22Financing+Innovation%3a+Evidence+from+R%26D+Grants.%22+American+Economic+Review+107+(4)%3a+1136-64.&u=a1aHR0cHM6Ly93d3cuYWVhd2ViLm9yZy9hcnRpY2xlcz9pZD0xMC4xMjU3L2Flci4yMDE1MDgwOA

Results to be Published in CY 2027

- Publicly reported results will focus on summary data; reported results will not characterize individual companies without their consent
- Characterization of EERE funding, outputs of funding and outcomes of funding by program year, sector, funding mechanism (regular financial assistance vs. SBIR/STTR vs. prizes)
- Assessment of the causal impact of EERE's funding on various outcomes
- Analysis of award recipient and non-recipient journeys through technology development
- Proposed approach for EERE to conduct subsequent evaluations of and/or measure performance of its small business investments longitudinally
- Internal/confidential reporting to DOE identifying highly successful individual technologies and companies, which may be used as subjects for future case study evaluations
- Recommendations for programmatic improvements and future investments
- **EERE program evaluation reports are published here: https://www.energy.gov/eere/analysis/eere-evaluation-publications**

Who will use the results? How will they use them?

Audiences

- The public, private researchers
- EERE and DOE leadership, Office of Science, Office of Technology Commercialization, Congress
- Other federal agencies (e.g. SBA, NIST, DOD, DOD, NSF)
- Other governments...

Table 4. Option generation, Indicator 1: Public investment in clean energy RD&D, per GDP and total amount

2019 Rank	Country	RD&D per 1,000 units GDP	RD&D amount (millions)	2019 Rank	Country	RD&D per 1,000 units GDP	RD&D amount (millions)
1	Finland	0.81	$212	13	Italy	0.21	$536
2	Norway	0.69	$234	14	Netherlands	0.20	$194
3	Japan	0.50	$2,756	15	China	0.15	$3,809
4	France	0.43	$1,301	16	Australia	0.09	$120
5	Canada	0.40	$707	17	Mexico	0.08	$200
6	Austria	0.37	$180	18	Brazil	0.08	$255
7	South Korea	0.34	$718	19	Saudi Arabia	0.05	$90
8	Denmark	0.34	$109	20	India	0.03	$109
9	UK	0.33	$1,023	21	Chile	0.02	$8
10	US	0.33	$6,775	22	Indonesia	0.01	$30
11	Germany	0.29	$1,311	23	UAE	0.004	$12
12	Sweden	0.28	$149		**MI Average**	**0.26**	

Source: https://www2.itif.org/2019-global-energy-innovation-index.pdf

Usefulness

- **Proving the value of government funding for energy R&D**
- Answering simple questions like “what types of work did EERE conduct during this period?”
- Comparing impact of SBIR/STTR grants vs. prizes vs. regular financial assistance to inform mechanism selection
- Informing approaches taken by other governments managing performance of R&D portfolios

Thanks!

Questions?

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