

The Value of Innovation: Assessing the Impact and Multiplier Effect of Financial Awards on Advanced Materials and Manufacturing

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# **Background on EERE's Fundings**

- Investments in research and development (R&D) made by the federal government play a critical supporting role in America's economic growth
- The U.S. Department of Energy's (DOE's) Office of Energy Efficiency and Renewable Energy (EERE) invests in a broad range of R&D and startup projects in various areas, including advanced material manufacturing, energy efficiency, and renewable energy sources, to address challenges and gaps in technology development
- These federal investments aim to promote new technological advances, as well as stimulate and enable the private sector to accelerate the transfer of research into commercial technologies



## **Prior Impact Evaluation Methodologies Focused** on the Impacts on Recipients

**Problem:** previous studies were designed to assess the EERE funding's impacts on recipients. They mainly used patent analysis approaches, econometric models, and financial metrics such as benefit-cost ratio and return on investment to evaluate the program's impacts on recipients

Gap: consequently, these approaches provided a very limited view of the broader macroeconomic impacts of the funding on the economy

**Goal:** We aim to use IMPLAN to provide a more holistic assessment of the EERE investments to show that they cascade through the economy



# **Overview of IMPLAN**

What is IMPLAN? economic impact analysis software that uses input-output(I-O) modeling to analyze the impacts of economic events. It combines a set of comprehensive databases, economic factors, demographic statistics, and multipliers with a customizable modeling system

**Frequent IMPLAN Users:** Researchers, Local governments and agencies, Business professionals, academics, and associations for economic analysis, impact evaluation, and planning

**IMPLAN Output:** identifies direct impacts by industry and develops indirect and induced impacts by industry. Each type of impact is broken down by jobs, labor income, value added, output, and tax revenue based on the area of study: country, region, or state.



# The Input-Output (I-O) Model in IMPLAN

**Traditional I-O model:** the I-O model captures a snapshot of the inter-industry transactions within an economy in a given period

**IMPLAN use of the I-O model:** IMPLAN enhances the traditional I-O approach by incorporating transactions between industries and institutions and between institutions themselves. Consequently, IMPLAN effectively captures all monetary transactions in an economy during a specific period

• Institution in IMPLAN: an entity that creates a final demand in an economy, such as households, various types of government institutions

## Assumptions of the I-O Model (not an exhaustive list):

- **Constant return to scale:** a 10% increase in input leads to a 10% increase in output.
- No supply constraints: inputs are always available in any amount
- Fixed input structure: the mix of inputs required to produce an output remains the same
- Static Model: the relationship among industries remains the same in a given year

Source: https://blog.implan.com/implan-io-analysis-assumptions





# **Data & IMPLAN Analysis Methodology**

## Data:

From 2019 to 2024, EERE, through its various offices, awarded more than \$1.5 billion in grants to 1,656 companies. The grants directly supported economic activities in 15 different industries in the national economy

## **Methodology:**

- Parsed grants by Office (12 offices under EERE) and year
- Translate titles and descriptions to the closest North American Industry Classification System (NAICS) code match
- Match IMPLAN sectors to identified NAICS codes
- Generate annual IMPLAN activities and events based by year and office
- Run the IMPLAN national-level impacts for each year and Office



# **Example of Processed Data for IMPLAN Modelling**

**Illustrative Data** 

NAICS	IMPLAN Code	Industry	2019	2020	2021	2022	2023	2024
221117	40	Biomass Electric Power Generation	0.2	0.4	7	23.5	20.5 16.2	
325193	155	Ethyl Alcohol Manufacturing	-	3.9	-	-	-	
325199	155	All Other Basic Organic Chemical Manufacturing	24.8	23.8	12	1.5	2.5	17.3
326150	183	Urethane and Other Foam Product (except Polystyrene) Manufacturing		0.3	-	-	3.2	0.5
332420	234	Metal Tank (Heavy Gauge) Manufacturing	-	5.3	-	-	12.4	7.2
333611	186	Turbine and Turbine Generator Set Units Manufacturing	0.2	-	8.5	15.6	4.8	1.8
333999	286	All Other Miscellaneous General Purpose Machinery Manufacturing	-	3.2	-	3.6	-	
334413	296	Semiconductor and Related Device Manufacturing	-	3.2	5.6	3	8.5	14.2
335911	318	Battery Manufacturing	-	7	-	-	-	
336120	325	Heavy Duty Truck Manufacturing		0.4	27.5	15	12.8	22.5
541511	441	Custom Computer Programming Services	2.8	-	-	-	-	20.3
541715	446	Research and Development in the Physical, Engineering, and Life Sciences (except Nanotechnology and Biotechnology)	35	15.8	7.6	13.5	16.4	2.2
		Total Direct Impacts (\$ million)	68.9	63.3	68.2	75.7	81.1	102.2

Pacific

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## **Example Summary of Results from IMPLAN Modelling**

**Direct and Total Economic Impacts Supported by EERE 2020** Fundings (Illustrative Data)

Impact	Employment	t Labor Income Value Added (\$000) (\$000)		Output (\$000)	
Direct	210	25,706	46,1960	147,431	
Indirect	420	35,444	70,988	156,186	
Induced	375	25,283	46,952	78,622	
Total	1,005	86,434	164,137	382,238	
Total Impact Multiplier	4.8	3.4	3.6	2.6	
Per Million Funded (\$ Millions)	15.9	1.365	2.593	6.039	



## **Total Taxes** (\$000)

8,934

14,846

10,854

34,634

3.9

## 0.547



# **Results Interpretation**

## • 1,005 jobs were supported:

- 210 directly supported the funded projects
- 420 indirectly through other industries
- 375 due to household labor income expenditures
- 1 job supported resulted in 3.8 jobs supported in other industries and household consumption sectors
- 16 jobs supported per \$1 million spent

## • \$86 million in labor income was paid to the 1,005 workers

- \$1 paid to a direct worker resulted in \$2.4 in additional income in the economy
- \$1.365 million in income generated per \$1 million spent

## \$164 million contribution to the national GDP

- \$1 of direct GDP contribution generated \$2.6 in additional GDP contributions
- \$2.593 million in GDP contribution per \$1 million spent

## • \$382 million in economic output was generated by the involved industries

- \$1 of direct industry production resulted in \$1.6 in indirect and induced economic activity
- \$6.039 million worth of economic production per \$1 million spent
- Over \$34 million in tax revenues generated:
  - \$1 in direct taxes resulted in \$2.9 in additional tax revenue generated in the economy
  - \$0.547 million in tax revenue generated per \$1 million spent





## **Relevance to the Pacific Northwest**

- While this analysis is focused on national-level impacts, this approach is applicable to state and regional-level impacts analysis, including the Pacific Northwest Region
- The work can be extended to analyze regional impacts to further understand the regional contributions to the overall outcomes





# Thank you





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# **Overview of IMPLAN**

## How to Run an IMPLAN Analysis:

- Select the United States as the region of study
- Select the industries
- Input the event/activity
- Select the data year and the dollar year
- Run and Review the results
- Tip: IMPLAN provides results by year. So, use annual data to facilitate analysis

Graph and information source: https://blog.implan.com/what-is-implan





## **IMPLAN Analysis to Assess Macroeconomic Impacts**

- Our intention is to provide a holistic assessment of the EERE grants' impacts on innovation, growth, and the economy
- This limitation in the past studies can be addressed using IMPLAN
- Econometric analysis will evaluate the program's impacts on the recipients, and the IMPLAN analysis will evaluate the program's overall macroeconomic impacts on the economy