IMPLAN Methodology for Mission Innovation Analysis

Model background

Input-output models are commonly used to describe and predict the economywide impact of an economic stimulus occurring in a subset of sectors. The IMPLAN (Impact Analysis for Planning) version 3.1 input-output model was used to calculate the indirect and induced impacts of each component of the Department of Energy's (DOE's) Mission Innovation fiscal year 2017 budget request. IMPLAN is widely regarded as a reliable tool for conducting economic impact analyses and is used in studies by many federal, state, and local government agencies, as well as by the private sector. The model was created by the Minnesota IMPLAN Group (MIG) in the 1970s through a collaboration with the U.S. Forest Service and the University of Minnesota. It continues to be maintained by the MIG. Pew's research partner, ICF International Inc., obtained the latest data from IMPLAN and developed a model customized to the needs of this analysis.

Understanding the data and results

This analysis relied on the 2014 U.S. national data set, which is constructed of data from the U.S. National Income and Product Accounts and the Bureau of Economic Analysis, among a variety of other data sources. The model includes 536 industry sectors based on the North American Industry Classification System (NAICS). Each component of the DOE Mission Innovation budget request was matched to the industry sector deemed most appropriate for that activity. The process used to determine these sector counterparts is described in more detail below.

The model uses industry-specific multipliers to trace and calculate the flow of dollars from the industries that originate the effect to supplier industries. Three types of impacts are estimated in IMPLAN:

- **Direct impacts:** effects in primary industries where budget spending would be focused, such as research and development, manufacturing expenses, construction spending, and administrative oversight costs.

- **Indirect impacts:** effects in industries that supply or interact with the primary industries—for example, when renewable energy manufacturing projects require the purchase of construction-related building materials.

- **Induced impacts:** increased spending by workers who earn money due to the proposed projects, such as when researchers use their wages to purchase goods from local shops.

When new industrial activity or income is injected into an economy, it starts a ripple effect that creates a total economic impact that is much larger than the initial input. This is because the recipients of the new income spend some percentage of it and the recipients of that share, in turn, spend some of it, and so on. The *total impact* of the new activity/income is the sum of these progressively smaller rounds of spending within the economy. For the purposes of this national-level analysis, no leakage to other countries was assumed (i.e., all direct spending by DOE was assumed to occur within the U.S.). This total economic impact creates a certain level of value added to the gross domestic product (GDP), jobs, and tax revenue for federal and local governments.

The results of this analysis are reported using commonly used metrics, consistent with best practices. A summary of each metric is provided below:

- **Labor income:** includes all forms of employment income, including employee compensation (wages and benefits) and proprietor income.
- **GDP:** the difference between an industry's total output and the cost of its intermediate inputs; sometimes referred to as an industry's total value added.
- **Tax impact:** breakdown of taxes collected by the federal, state, and local governments, including corporate taxes, household income taxes, and other business taxes.

Sector determination methodology

Before using IMPLAN to model Mission Innovation, Pew and ICF reviewed the Department of Energy's fiscal 2017 budget request and determined which portions were associated with activities (e.g., a certain percentage of each request to R&D or the construction of a demonstration project). The research team examined the budget request and extracted all pertinent information relating to the activities and relative spending involved with each portion of the request. A literature review by ICF supplemented the gaps in information and provided examples of other analyses that had used IMPLAN to model similar scenarios and activities (e.g., IMPLAN analyses relating to energy efficiency and manufacturing). ICF used industry-specific NAICS codes about certain activities to link the activity to the appropriate IMPLAN sector codes. Finally, where little or no secondary information was available, the team interviewed subject matter experts within ICF to gain a better understanding of the nuanced processes of these activities.

A large portion of the budget request activities fell entirely within R&D spending. For this spending, IMPLAN Sector 456 (scientific R&D services) was used. (See Table 1.)

The IMPLAN Social Accounting Matrix (SAM) was used to estimate taxes and other payments received by governments. For the resulting tax impact analysis, marginal changes (impacts) use the same distribution as in IMPLAN's 2014 national data set.[1] While the model allows for industry-specific outputs, the model performs most effectively at the higher levels of aggregation, as applied in this analysis.

Modeling limitations

IMPLAN, along with other economic input/output models, is not designed to account for the full downstream value and spillover effects associated with R&D due to spending-related iteration constraints. As it relates to this analysis, estimating the impact of R&D dollars toward advancing new clean energy inventions through improved technology characteristics, cost, or risks is not contained in the outputs. As a result, the true value of R&D expenditures is underestimated. However, because the methodology used exists in numerous other studies, there is a strong body of comparison reports and justification that the analysis provides value to the broader discussion of the benefit of federal spending.

Majority of 2017 Mission Innovation Activities at DOE Categorized as 'Pure R&D'

Breakdown by program and budget amount

DOE offices and programs	Total investments	Pure R&D amount	R&D spending as a percentage of total investments
Cross-cutting initiatives	$215 million	$215 million	100%
Sustainable transportation	$792 million	$731 million	92%
Advanced Research Projects Agency-Energy	$350 million	$318 million	91%
Science	$1.85 billion	$1.60 billion	86%
Renewable energy	$451 million	$370 million	82%
Energy efficiency	$439 million	$313 million	71%
Electricity delivery and energy reliability	$177 million	$83 million	47%
Nuclear energy	$804 million	$362 million	45%
Fossil energy	$564 million	$216 million	38%
Other (support and infrastructure)	$212 million	$0	0%
Total	**$5.85 billion**	**$4.20 billion**	**72%**

Endnote

1   IMPLAN Group LLC, "Generation and Interpretation of IMPLAN's Tax Impact Report," accessed Nov. 11, 2016, http://support.implan.com/index.php?option=com_ content&view=article&id=419:419&catid=237:237.

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