

Decision making for Demonstration Projects Workshop: Concept Paper

Aaron Bergman and Alan Krupnick

Under the Inflation Reduction Act and the Infrastructure Investment and Jobs Act, the Department of Energy (DOE) has received billions of dollars for demonstration funding. This funding focuses on late-stage energy technologies that are ready to be deployed at scale. While there have been examples of DOE funding for demonstration projects in the past, most DOE funding has traditionally been focused on earlier-stage research and development (R&D). Because of both the scale of the money involved and the stage of technological development, demonstration project funding presents new issues for DOE as it decides how to disburse the funds and be a careful steward of taxpayer dollars.

Recent Funding Opportunity Announcements (FOAs) for demonstration projects involve two levels of review. The first is a set of scored criteria. For example, in the FOA for the Hydrogen Hubs, the criteria are (1) Technical Merit and Impact, (2) Financial and Market Viability, (3) Workplan, (4) Management Team and Partners and (5) Community Benefits Plan. In addition to this, however, there is a set of “Program Policy Factors” that can be used to select the final portfolio of projects to fund. These include considerations related to diversification, environmental justice, and domestic content.

This short paper will focus on three particular issues: metrics, risks and portfolio analysis, and community benefits. While these areas are not unique to demonstration funding, the considerations are qualitatively different as compared to earlier-stage, lower-cost R&D. In this paper and at the workshop, a number of questions that arise when considering demonstration funding will be addressed by experts for academia, finance, nongovernmental organizations, and the government. A longer paper summarizing the results of the workshop and our own research will follow a few weeks after the workshop.

The topics we discuss do not directly align with the evaluation criteria used in some FOAs. Many of the scored criteria listed above directly address the quality of the project and its risk of failure rather than the costs and benefits. The emissions benefits of the project are mentioned in the first scored criterion, however, and spillover benefits appear implicitly in some of the program policy factors. The idea of a diverse portfolio appears in a number of the program policy factors. Community benefits, on the other hand, are both directly scored as one of the main criteria and considered as part of the program policy factors.

For this paper, metrics are the criteria to judge individual projects. From an economics point of view, one wishes to maximize net benefits, so the two most prominent metrics are the costs and benefits of the projects. However, some of these benefits, particularly knowledge spillovers and network benefits, are difficult to quantify. We will discuss some of these challenges and the potential to use proxy metrics to get at these questions.

While metrics are assigned to individual projects, ultimately the goal is to develop a portfolio of projects. An essential part of developing a portfolio of projects is understanding risk and the probabilistic nature of the project’s benefits. We will discuss some aspects of risk and how one might develop a portfolio that maximizes expected benefits under some notion of risk aversion.

Finally, we will consider community benefits. In service of major Biden administration initiatives on easing energy transitions, creating jobs and improving environmental justice, DOE requires project proposers to document how they will benefit the surrounding communities (formally known as community benefits plans). These requirements will be discussed with an eye towards what guidance applicants for demonstration projects are given on how to develop these plans, and how that guidance helps DOE decisionmakers evaluate the quality of community benefits plans.

For those wanting more of an in-depth discussion, see the following sections.

Metrics

In order to compare applications for a given funding opportunity, it is important to develop metrics that capture the benefits and costs of a project. However, one must recognize from the start that not everything can be quantified with a numerical metric, and even when it is possible in theory, it may not be doable in practice. As such, identifying proxy metrics that capture these considerations is an important challenge in developing a framework for demonstration funding decisions.

In addition to metrics that directly address the costs and benefits, projects also have associated risks, and there are metrics that address the level of risk. The higher the risk of failure, the lower the expected benefits, all other things equal. The incorporation of risk into portfolio funding decisions will be the subject of the next section.

The cost metrics start with government expenditures but could include total expenditures (private and public) and any environmental damage associated with the project. On the benefit side, the main benefit is reduction in emissions. This would include greenhouse gases but also other air pollutants. Changes in emissions can be converted into dollar figures through the social cost of carbon and the social cost of other pollutants such as SO₂ and NO_x.

However, one of the motivations for demonstration projects is that there are spillover benefits from demonstrating the technology. Two things to consider are knowledge spillovers and network effects, where a user of a technology gains a benefit from others using it. These effects mean that the demonstration of the technology can lead to increased deployment. The metrics for benefits should include both those arising from the project itself and any additional deployment due to demonstration.

A final metric that is often considered is the jobs associated with projects. Jobs are a confusing metric from an economics point of view, however. For any given project, labor represents a cost, not a benefit. And it can be difficult to know when a new job is created rather than when it results from people moving from one job to another. Nonetheless, if there is under- or unemployment in a given community, there may be benefits to increasing local employment. Similarly, there may also be benefits from increased tax revenue.

Risk and Portfolio Analysis

A second layer of analysis looks at the portfolio of projects to be selected, building on the metrics for the individual projects. It is important to consider a portfolio for two reasons. The first is that the spillover benefits for a given project may be duplicative with other projects, reducing the ultimate impact. The second is that each of these projects will have an element of risk. Given this uncertainty of success, the diversification available through a portfolio is one way of maximizing the benefits subject to a level of risk tolerance.

The answer to portfolio selection may be that one should simply pick the “best” projects. Projects with high expected returns (including spillovers) and relatively low downside risks in those returns are ultimately desirable in most frameworks, although upside risks—the possibility of very high returns—shouldn’t be ignored. Selecting projects based on their overall quality along with an intuitive notion of diversification may be sufficient for these demonstration funding programs, obviating the need for overly complex analysis.

Any discussion of risk raises the question of the appropriate level of risk tolerance for the government. From a political point of view, it might be desirable to minimize any chance of failure to not allow opponents of the program to have anything to inveigh against, with the failure of Solyndra being a prime example. However, only deploying well-understood projects that are sure to succeed would lead to little, if any, spillover benefits, negating a major motivation of these programs.

There are many potential approaches to portfolio analysis. One that has been discussed at prior DOE workshops on R&D portfolio analysis is the use of expert elicitation to quantify uncertainty, allowing one to calculate an optimal R&D portfolio. One can also make use of ideas from finance, for example, modern portfolio theory, which uses variance in outcomes as a measure of risk. Other more modern approaches exist, but the additional benefits may not outweigh the added complexity.

Ultimately, in any approach, one should select a diverse set of projects. This should not just be a consideration for the projects funded in a given FOA, however. Projects in different programs can have correlated risks of failures if they involve the same technologies and similarly can have duplicative spillover benefits. As such, diversification, in theory, should apply across the entire government portfolio of investment. The broader the scope of projects included in a portfolio analysis, the better, other things equal.

Community Benefits Plans

FOAs designed to distribute funds from the IJIA require applicants to submit an initial community benefits plan (CBP) covering four main goals: community and labor engagement; investing in the American workforce; advancing diversity, equity, inclusion, and accessibility (DEIA); and contributing to the Justice40 Initiative. CBPs are scored at 20 percent of the overall technical merit review of proposals—a significant percentage, illustrating the importance and value of these plans for project evaluation. CBPs should describe prior community engagement efforts, the current state of affairs, the potential impact of the project on stakeholders, and future plans to help reach the four goals. In addition, CBPs should also describe the resources (e.g., staff, budget) dedicated to implementing the plan.

Different FOAs offer different degrees of guidance on what should be included in a robust, successful CBP. In most cases, though, it seems that there is an expectation of considerable pre-work on engagement with community and labor groups, partnership building, and DEIA strategy development—just to develop the CBP. This could pose a significant challenge—or even deterrent—to smaller applicants with less pre-award capital and capacity.

The four main goals do not speak directly to an important goal of maximizing *net* benefits of a project, taking into account its positive and negative impacts. Language that *could* relate to efficiency is contained in the Justice40 section of the FOA, which says that an assessment of the needs of communities should be made, burdens (negative impacts) characterized, benefits characterized (what

they are and where they flow) and a plan made for their tracking and quantification. The Industrial Decarbonization and Emissions Reduction Demonstrations program, introduced in the IRA, is the only FOA we reviewed prioritizing projects seeking “the greatest benefit for the greatest number of people within the area in which the eligible facility is located”—a definition of utilitarianism that does not necessarily map fully into the efficiency criterion of maximizing net benefits.

Further, enumerating (let alone quantifying) net benefits to communities and disadvantaged groups is a major challenge. Benefits are often described as job creation, which, as noted above, is very tricky to nail down, and economic development, which is also tricky and complex to measure. Economists prefer to measure social welfare, which is an even more complex metric. Additional government revenues should also be counted as a benefit, depending on how they are spent, although this is not mentioned in FOAs we reviewed. New industrial development in a small community can lead to major demands for public services, such as sewers, drinking water, new roads, and the like—what is sometimes referred to as a boomtown effect. These demands mean the revenues are not necessarily being used to increase social welfare for the residents and in transition, may mean more road congestion and other negative side effects. The main negative impacts are likely to be air pollution, additional waste streams, and changes in water use from the development. Sometimes, developers attempt to provide public and private services to a community as a way to ameliorate such impacts and to lower community opposition. How well DOE’s CBP requirements reflect these and other considerations will be discussed at the workshop.

CBPs recognize that the realization of some benefits requires investments, such as for workforce training. At least some CBPs also recognize that developers have federal, state and local regulatory obligations to meet, so “credit” should only be given to efforts that go beyond compliance.

Another major metric is equity, reflected in the Justice40 initiative embedded in the community benefits requirements. One FOA uses the language noted above—“greatest benefit for the greatest number”—which doesn’t appear to directly apply to Justice40, and may indeed conflict with it. FOAs also require emphasis on the quality of the partnerships with organizations supporting disadvantaged communities, although how to measure quality is not well defined.

The FOAs’ CBP sections also emphasize process considerations, such as where “degree of community and labor engagement” is defined (in part) as whether proposers have letters of support, partnerships, and agreements from affected communities. Engagement is also defined as ensuring that community and labor have opportunities to impact project decisions, and that developers are being transparent and accountable. There is also a temporal dimension with CBP milestones integrated with the go/no-go decisions between the different project phases (some FOAs require applicants to describe when benefits will flow to communities). These metrics will also be discussed at the workshop.