

5.3 Evaluation Methods

A growing number of studies consider how to effectively measure the effects of EBED-related activities and initiatives. Evaluation methods vary, but most of the research is focused on new approaches for economic modeling using input/output techniques and analytical approaches. Most of these approaches seek to determine the economic impact from the growth in the energy supply and energy efficiency industry in the form of job creation [35, 48, 50, 53]. Scott et al. [54] provide additional quantitative measures, such as energy saved (in Btus), cost savings in investments in building stocks, and effect on national earnings. Within this economic impact literature, research typically focuses on the effects of specific policy interventions, such as those from solar thermal electricity deployment [55], wind energy projects [51], and smart grid deployment [56]. Others have used integrated approaches with a combination of input/output and other models to determine effects on other aspects of development, such as human capital and technological development [57] and local sustainability [58]. At times the economic modeling is supplemented with case studies to further describe the context of the economic impact [46].

The literature focuses less extensively on evaluation methods other than input/output. A couple of noteworthy exceptions include those who uphold logic models as an effective way to track inputs, outputs, and outcomes of EBED efforts [59-60] and those who advocate for “development assistance criteria” to guide and evaluate EBED efforts. The criteria for evaluation within this paradigm are relevance, efficiency, impact, and sustainability [60]. Houser et al. [59] also suggest a set of “green recovery metrics” for the evaluation of large-scale federal stimulus funding; metrics include speed of implementation, employment, energy savings, reduction of oil imports, and climate change measures.

Although these evaluation tools are common in project implementation and policy intervention, the EBED discipline faces some particular challenges in the estimation of EBED effects. Most of the recent literature notes up front the significant gaps and deficiencies in measuring EBED effects, the reasons for which are numerous. One of the main reasons is that definitions for EBED, and EBED-related industries and activities, are inconsistent, which makes it difficult to aggregate relevant industry and workforce data for assessment. Additionally, assumptions, time horizons, and scenarios are inconsistent across the research [46]. Of great concern from an evaluation standpoint, many reports are not explicit about the methodological approach that they employ to measure EBED outcomes.¹⁰ Rio and Burguillo [58] also note that impact evaluations in this space are typically completed at the national level, which leaves a void for robust evaluations at the local and regional levels in EBED.

5.4 The Need for a Comprehensive Approach to Energy-Based Economic Development

Another subset of the EBED literature focuses on the need to incorporate EBED efforts into more comprehensive development initiatives or, alternatively conceived, to make EBED efforts more holistic in nature, so that they include multiple development criteria. McIntyre and Pradhan [62], for instance, state that focusing on energy advancement within an economic development plan accomplishes little unless broader issues of community mobilization, participatory community involvement, resource management, and gender disparities, among

¹⁰ The Pew Charitable Trusts [The Clean Energy Economy: Repowering Jobs, Businesses and Investments Across America](#) [61] Pew Charitable Trusts. The Clean Energy Economy: Repowering Jobs, Businesses, and Investments Across America. Washington, DC 2009, June; Retrieved from http://www.pewcenteronthestates.org/uploadedFiles/Clean_Economy_Report_Web.pdf is an example of a current report that counters this trend, describing the determinations for industry classifications, etc.

other topics, are considered. Many who contribute to this growing body of literature contend that energy issues, and their proposed solutions, are too often presented and conceived of in a fragmented manner, disconnected from other fundamental issues [25]. They assert that a more holistic approach to EBED, which seeks to address all of these issues simultaneously, will result in greater success than an EBED approach that merely isolates energy issues.

Contributors to the literature have focused on the relationship between advancements in energy supply and energy efficiency with increased levels of social sustainability. Udo and Jansson [63], for example, compared the characteristics of 132 nations, and found that high degrees of what they defined as “technological sustainability” were rarely found in concert with low measures of their definition of “social sustainability,” including evaluations of human rights, corruption levels, income equity, and life expectancy, among others. In other words, high levels of technological progress tend to be associated with high measures of human and social development, a finding that underscores the importance of energy development’s not existing in isolation from measures of social progress. Their findings led the authors to conclude that high measures of social sustainability are a “prerequisite” for energy advancement [63].

Other contributors to this topic have looked at this same issue from the other side [64-66]. These authors contend that efforts to improve energy efficiency and deploy advanced energy applications can play a critical role in improving the same social sustainability measures that Udo and Jansson reviewed in their analysis. The conclusions of this literature suggest that efforts to advance EBED would benefit from concurrent efforts to improve social sustainability indicators, because the two efforts exhibit synergy in pursuit of a comprehensive development regime.

Building from these studies, several contributions to the literature have discussed how to maximize the social impact of EBED job creation efforts. Such works discuss the importance of ensuring that programs contain measures of job quality standards, high levels of transparency, and substantial civic engagement [67-68]).

Various authors also support the following opinions, both of which consider the comprehensive nature of EBED efforts: (1) in many cases, practices do not necessarily function much differently than standard economic development; and (2) EBED may often be inserted into presently existing economic development infrastructure and does not universally require the reinvention of new programs and public investment. Recent research on economic development in Minneapolis–St. Paul, for instance, focused largely on exploring the commonalities between clean EBED and conventional economic development practices [69]. Particularly with respect to nurturing homegrown industries and attracting investment and relocation from established firms, the principles often remain the same, as energy businesses generally share many of the same needs and perspectives as other businesses. Others describe EBED as simply the injection of greater consideration to energy issues into the preexisting economic development infrastructure and framework [67].

5.5 Obstacles to Success in Energy-Based Economic Development

Some of the literature describes how, despite potential benefits of EBED initiatives, some obstacles to EBED's immediate success remain. Of primary importance, although the amount of investment in sustainable energy projects has increased nearly sixfold from 2002 to 2008 [70], inconsistent funding streams or policy mechanisms often complicate and, in some cases, can even thwart effective long-term EBED project planning [36, 71]. On-again, off-again funding makes it difficult for industry actors, community stakeholders, and other involved parties to plan

EBED projects, especially projects that take a long time to complete or require years of experience before they reach optimal performance. Consistent, predictable, and sustainable funding streams are therefore vital to the further development of this field and a successful transition toward sustained EBED practice.

Furthermore, although billions of dollars in stimulus funds have been allocated toward EBED projects, early reports indicate that the funding has, in some cases, outpaced the ability of the agencies to implement even some of their most “shovel-ready” projects. For example, a report on the ARRA weatherization program, toward which over \$5 billion were allocated in fiscal year 2009, enumerated difficulties in the project implementation process, including “state hiring freezes,... significant local budget shortfalls, and state-wide planned furloughs delayed various aspects of the program and contributed to problems with meeting spending and home weatherization targets” [72]. This again underscores the nascence of EBED infrastructure and the importance of maintaining realistic time frames for complete project implementation, particularly in the beginning stages of the field’s development.

Continuing in that vein, even with performance metrics that are easy to understand and measure, the described benefits of EBED, and established techniques for some EBED activities (e.g., weatherization), the same Department of Energy report highlights that EBED may not be successful without the coordination of all the “moving parts” involved in a given program. In the federal weatherization program example described above, coordination among multiple interested parties—including several levels of governance, outside contractors, and grant subrecipients—compounded by the aforementioned state budget difficulties, a lack of availability of trained program staff, and concurrent changes in regulatory requirements, all

proved to be unexpected complicating factors to successful EBED practice in the initial year of the program.

Although early assessments of ARRA accomplishments like this one demonstrate that funding for EBED in the United States has outpaced state and local governments' ability to successfully administer and allocate fiscal resources, one must also consider that these assessments are reporting on the early stages of project development and practice.

One should also note that, although some EBED funding existed before the global recession through both multinational development banks and local economic development agencies (through programs such as the Global Environmental Facility, the Clean Development Mechanism, and Renewable Energy and Energy Efficiency Partnership), funding behind EBED increased significantly in the wake of the economic crisis through national stimulus funds. The amount of these funds—approximately \$180 billion worldwide [70]—reiterates the world's investment-backed expectations in the potential for energy-related projects to be an area for sustained economic development and growth.

6. CONCLUSIONS AND SUGGESTIONS FOR NEXT STEPS

EBED solutions require an understanding for global circumstances, accompanied by local action and the efficient production of local energy-based resources. They also require public-private partnerships and a prominent role for policymakers, economic development practitioners, and energy users to facilitate the process of bringing new products to market, establishing appropriate infrastructure for more efficient energy use, cultivating a healthy business climate based on reliable energy supply and predictable costs, developing energy-related industry clusters, retooling workforce training to align with new skills requirements, and creating a quality of life for places that encourage sustainability as a part of community economic

development. The alignment of energy policy and planning with economic development offers decision-makers an open window to create new policies and practices to meet these emerging challenges to communities.

This paper has contributed to the EBED field by demonstrating how economic development and energy policy and planning have evolved over the last 75 years or so and how they have converged to create an avenue for new policy interventions. In our research we have shown that funding in EBED has outpaced proven practice and evaluation techniques, which has potentially ignited the use of ambiguous terminology in the field, perhaps confounding policymakers, practitioners, and other stakeholders. We have attempted to define EBED as a practice and to establish goals and suggest approaches that offer a more solid framework from which practitioners can more meaningfully develop initiatives and interventions suited to the specific needs and conditions of their communities.

The exploratory nature of this paper provides ample opportunities for other researchers and practitioners to expand on in the future. First, we encourage researchers and practitioners alike to build on this working definition and process so as to improve the performance and effectiveness of EBED projects in the medium to long term. Second, with a heavy emphasis on pre-evaluation studies, we suggest that more post-project evaluations be conducted and documented to determine actual outcomes, and compare them with potential outcome estimates. This information will provide significant value to the field by better determining the impact and thus better communicating expectations for EBED in the future. Third, because the issues of EBED are prominent in the United States and internationally, in both advanced and emerging economies, we believe there will be great value in comparing and contrasting practice and outcomes between domestic and international regions implementing EBED techniques. The

detail gained from more research and documentation for EBED will lend itself to better understanding of the EBED process and will add a more systematic result so that efforts can be implemented in a more consistent manner yet still tailored to meet distinct community and regional needs.

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