Equity Counts: Factoring Equity into Energy Decision-Making

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ABSTRACT

Our energy system causes disproportionate social, health, and economic burdens on the customers it serves, with low-income communities, communities of color, indigenous people, and rural customers often experiencing the highest costs and lowest benefits. This inequity is gaining attention as many states implement policies that factor in and seek to correct these disparate impacts. In many states, electric and gas utilities, regulators, and other decision-makers currently rely on benefit-cost analysis (BCA) to understand how investments impact customers. However, BCA results only demonstrate the average impact on customers. In collaboration with Lawrence Berkeley National Laboratory and E4TheFuture, Synapse Energy Economics created a new guidance document that describes how to use distributional equity analysis (DEA) alongside BCA results to make decisions about investments in distributed energy resources (DER) as we move to decarbonize.

The presentation will provide a comprehensive framework for using DEA to identify impacts on those customers experiencing inequities compared to other customers. We will suggest steps for defining priority populations, identifying key metrics to evaluate distributional equity, and leveraging different data resources and analytical tools. We will also describe decision-making techniques using quantitative and qualitative strategies. The forthcoming *Distributional Equity Analysis for Energy Efficiency and Other Distributed Energy Resources: A Practical Guide* serves as a companion document to the *National Standard Practice Manual for Benefit-Cost Analysis of Distributed Energy Resources*.

Introduction

The U.S. government and states around the country are setting ambitious decarbonization goals and committing to net-zero emissions by 2050 (Executive Office of the President 2021; Cohen 2023). Continued emissions from all sectors of the economy fuel the consequences of climate change such as negative health impacts, climate disasters, and economic turmoil in many communities. Building emissions specifically are a heavy contributor, with homes and other types of buildings contributing to over a third of CO_2 emissions nationally (Executive Office of the President 2021). The high levels of energy consumption from buildings not only accelerate climate change; they also pollute communities and can create or exacerbate health issues such as asthma, allergies, respiratory illnesses, and others. These impacts disproportionately fall on low-income households and communities of color who are more likely to live and work in inefficient, fossil-fuel-burning buildings, often in close proximity to other high-emitting buildings (Tan and Jung 2021). A key focus of energy policies across the country is urgently transforming the energy sector to deliver cleaner, safer, healthier energy to the built environment.

As decarbonization initiatives have grown more urgent and ambitious, interest in distributed energy resources (DER) as a solution to achieve these targets has also increased substantially. DERs “include electricity and gas resources sited close to customers that can provide all or some of their immediate power needs or can be used by the utility system to either

reduce demand or provide supply to satisfy the energy, capacity, or ancillary service needs of the grid. These include energy efficiency, demand response, distributed generation, building and transportation electrification programs, and storage" (Woolf et al. 2024). Investing in DERs has the potential to reduce utility system costs, reduce gas and electric customer bills, and shrink the environmental impacts of the energy system overall.

As decision-makers seek to implement initiatives involving DERs and other measures, it is vital that they ensure that the path toward decarbonization is an equitable one. Improving energy equity requires careful consideration and intentionality. Decision-makers must set targets, measure performance, and engage communities with equity goals in mind. This shift toward an equitable focus cannot happen without the recognition that disadvantaged communities have often historically missed out on the benefits of the energy system while disproportionately paying for its costs and shouldering its burdens.

Many jurisdictions are acknowledging the disparate energy system impacts on different populations by setting energy equity goals alongside purely environmental ones. The federal government's Justice40 initiative is a key example of the steps the United States is taking to improve equity by establishing a program directing 40 percent of the benefits of certain federal energy investments to disadvantaged communities (DOE Justice40 2024). Additionally, 27 percent of public utilities commissions (PUC) have mandates to directly consider economic equity in their major decisions or are directed to address economic equity by creating specific programs (Klee 2021).

The anticipated energy transition of decarbonizing the American economy and buildings sector presents an opportunity to incorporate equity into energy decision-making. Synapse Energy Economics (Synapse) collaborated with the Lawrence Berkeley National Laboratory and E4TheFuture to create a new distributional equity analysis (DEA) framework as a tool that decision-makers can use to factor in equity when evaluating decarbonization investments such as DERs to identify opportunities to advance equity. This new analytical framework was designed to be used alongside the more traditional benefit-cost analysis (BCA). Though there are not yet examples of a DEA being employed to evaluate new DER investments, at least one case study is underway in Illinois where the Synapse team is working with state decision-makers. While Synapse created this framework for evaluating DERs, a DEA can be used to evaluate any energy system investment.

Benefit-Cost Analysis

Commonly, decision-makers at utility companies or in government look to a BCA to evaluate energy system investments. A traditional BCA monetizes the costs and benefits of a given utility investment or program across all participating and nonparticipating customers. A BCA will tell a utility or regulating authority whether a given investment or program has net benefits and is a worthwhile investment based on the average impacts across a population (NESP 2022). A BCA does not disaggregate the costs and benefits for different populations to understand how they are distributed. For example, DERs may reduce energy costs for certain customers or emissions in certain areas of the community, while other customers may never realize those benefits or disproportionately shoulder the costs. An additional tool or type of analysis is needed to understand the distribution of those costs and benefits for different populations within a community or service area.

Energy Equity

The term “energy equity” covers a broad range of equity issues that can impact populations. Generally, these fall into the following four categories:

- Procedural: Promoting inclusive, accessible, and authentic engagement and representation when developing or implementing programs and policies
- Distributional: Promoting the equitable distribution of benefits and burdens across all segments of a community and across generations
- Recognitional: Recognizing societal structures that have led to energy inequities
- Restorative: Repairing past inequities, rectifying practices that perpetuate inequities, promoting accountability for key decision-makers

(EEP 2022; ACEEE 2023)

Addressing all of these components of equity together is important and requires a comprehensive, system-wide equity analysis (a jurisdiction or utility-system assessment that comprehensively addresses all dimensions of energy equity and all aspects of utility planning, operation, and services) (Synapse 2024). A distributional equity analysis only analyzes distributional equity impacts of potential investments. Figure 1 demonstrates the relationship between the broader system-wide equity analysis, the narrower DEA, and a BCA, which should be conducted alongside a DEA.

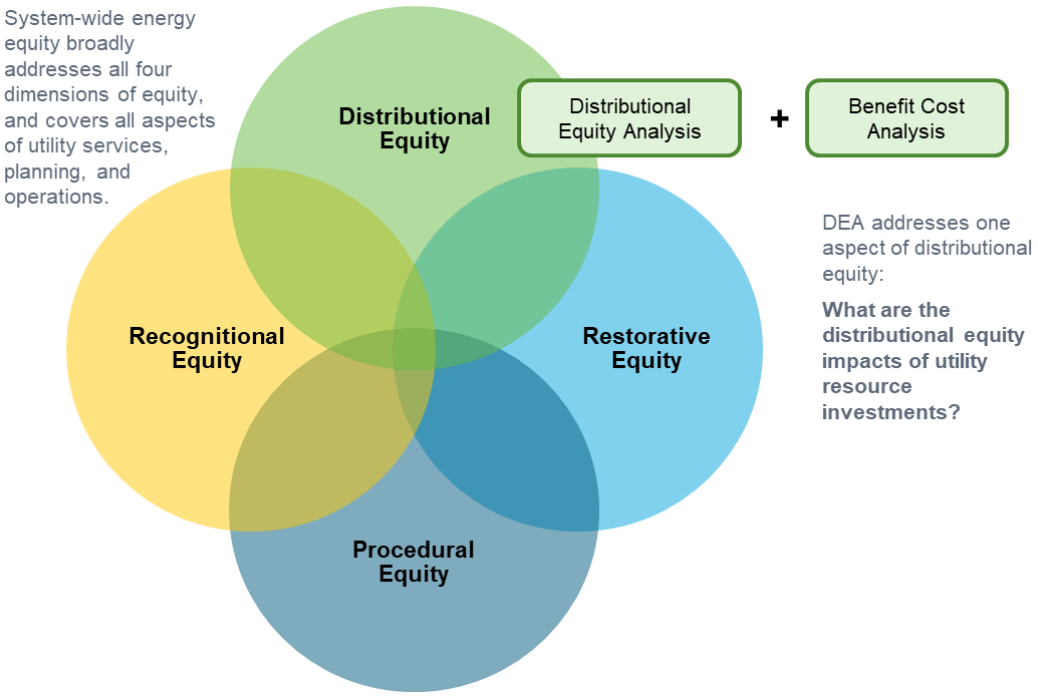

Figure 1. System-wide Equity Analysis and DEA Comparison *Source*: Synapse, 2024.

Distributional Equity Analysis

DEA is a tool for evaluating the distributional impacts of energy programs or investments on a priority population compared to all other customers. The term "priority population" generally refers to the set of electric or gas utility customers who warrant additional attention to address equity concerns, consistent with the jurisdiction's energy equity policy and with stakeholder input" (Woolf et al. 2024). By breaking out priority populations from other customers and creating metrics designed to evaluate equity, a DEA can provide insights into costs and benefits beyond a traditional BCA. Analysts can use BCA to understand benefits and burdens DERs place on average customers, while DEA will show how those benefits and burdens impact priority populations differently from average customers.

DEAs are meant to be paired with BCAs to provide stakeholders, utilities, and consumers with a complete picture of the impacts of a program. DEAs can be forward- or backwards-looking to evaluate the equity impacts of a future program or one that has already been implemented. The DEA framework can answer questions such as: (a) whether to pursue or invest in a proposed DER program; (b) whether to modify or redesign a proposed or existing DER program; and (c) how to prioritize investments across multiple DER programs (Synapse 2024).

Synapse created a framework for analysts looking to conduct a DEA, based on the following steps:

1. Establish community and stakeholder process. Community and stakeholder input is necessary in every stage of the DEA framework to make it effective and meaningful. A robust community and stakeholder process requires inclusion of representatives from a broad variety of perspectives, especially those representing priority populations.

2. Articulate the DEA context. DEA can be applied in a variety of contexts. It is useful to determine up front how the DEA will be applied and over what timeframe.

3. Identify priority populations. Defining priority populations entails using demographic and socioeconomic indicators, depending on a jurisdiction's equity goals.

4. Develop DEA metrics. DEA can use a range of metrics to assess energy inequities: e.g., energy rates, bills, and DER participation; energy burden; health and environmental impacts on priority populations; and economic development in priority populations. While BCA metrics are primarily presented in monetary terms, DEA metrics are often presented in non-monetary quantitative or qualitative terms.

5. Apply DEA metrics to priority populations. A core element of the DEA framework is to develop estimates for each of the equity metrics, for both the priority population and the rest of the customers. This exercise typically requires large amounts of data, and analytical tools are available to facilitate the collection, assessment, and presentation of this data.

6. Present and interpret DEA results. DEA metrics can be presented using a variety of values and units of measurement that are often not in monetary terms. Some utilities, regulators, and communities and stakeholders might decide to use simpler results or results that contextualize the metrics with selected benchmarks. Others might decide to use analytical techniques that aggregate all the DEA metrics into a single net score for priority populations and a single net score for other customers.

7. Make decisions using DEA and BCA results. The final stage in the decision-making process is to use the DEA results alongside the BCA results to choose between different investment options.

   (Woolf et al. 2024)

These steps are illustrated in Figure 4.

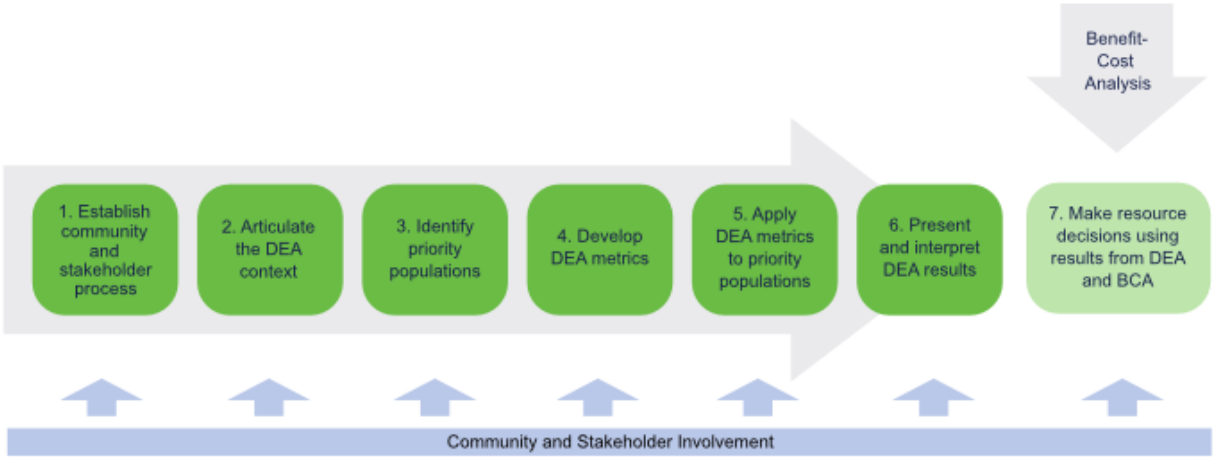

Figure 4. DEA Framework Illustration. *Source*: Woolf et al., 2024.

This framework provides guidance for jurisdictions who want to account for equity as they invest in DERs and continue to chase decarbonization goals. Jurisdictions looking to use a DEA to analyze investments will likely start from different places. Where some may have defined priority populations, others may need to start from the beginning. They will also likely have different geographic or demographic data and work with their communities to select different equity metrics that will best serve them.

A DEA can be applied to DERs in several different contexts, meaning analysts can choose to look at different types and combinations of DER investments or programs. The application of the DEA should be consistent with the application of the BCA for the DER that is evaluated. Table 1 below shows some of the applications along with examples. Often, broader applications that examine a portfolio of investments will be more useful than narrower analysis of a single DER.

Table 1. Illustrative Set of DEA Applications to Evaluate Utility DER Investments

Applications	Examples
Assess a single DER program serving priority populations	Low-income energy efficiency program, low-income community solar program, low-income microgrid program
Assess a single DER program serving all types of customers	Residential retrofit energy efficiency program, distributed generation net-billing program, distributed storage program
Compare across DER programs	*Compare same type of DERs*: one energy efficiency program vs. other energy efficiency programs, one distributed generation net-billing program versus other distributed generation net-billing programs *Compare different types of DERs*: energy efficiency versus distributed generation; distributed generation versus storage program; demand response versus storage program
Assess a portfolio including programs of the same type of DERs	Portfolio of energy efficiency programs, portfolio of multiple distributed generation programs, portfolio of multiple storage programs
Assess multiple portfolios including programs of multiple types of DERs	Portfolio including all types of DER programs (energy efficiency, demand response, distributed generation, batteries, electric vehicles)

Source: Woolf et al., 2024.

Selecting the context or application of a DEA upfront can significantly affect the choice of inputs, metrics, presentation of results, or how the results are used. Therefore, it is important to identify the context upfront.

Stakeholder And Community Engagement

Utility programs and investments are more successful when planning involves the customers and communities they will serve. To be effective, a DEA evaluating these programs and investments should also be a collaborative process with members of the community.

Many stakeholders, particularly those in priority populations such as communities of color, indigenous people, and rural and low-income communities have historically been left out

of utility and government planning processes and continue to face significant barriers to participation (LBNL 2021). A key step to incorporating equity into decision-making is to elevate voices that may have been silenced previously. Some community members may face practical issues such as language barriers and transportation limitations, which can make participating in regulatory processes more difficult. They may also lack trust in their local government or utility if programs have failed them in the past (ILLUME 2021). Stakeholder and community engagement requires an understanding of these barriers and a proactive engagement process that eliminates those obstacles to allow more community members to participate. This could mean making materials available in multiple languages, increasing opportunities to participate online, holding events in more varied locations, and various other strategies to increase accessibility.

Stakeholders and community members can help analysts and decision-makers define priority populations and identify the most impactful metrics for that community. This input will make the analysis more effective. Furthermore, people tend to buy into programs and investments more strongly when they meaningfully participate in the decision-making process (USDN 2019).

Effective engagement with stakeholders and community members requires effort and intentionality. Jurisdictions looking to conduct a DEA should work with trained facilitators and engage with local community organizations who are already active in the community and understand how to reach the population (McAdams 2024). Such a robust process led by facilitators will build relationships and empower community members to continue to participate in energy decisions in the future. Continued engagement to evaluate and re-evaluate programs in investments where decision-makers operate with transparency and are held accountable will build a strong foundation for a DEA process.

Priority Populations

Because a DEA focuses on net costs and benefits for priority populations compared to other customers, identifying the priority population is a fundamental step in the process. Exact approaches to identifying a priority population may vary from place to place, but they should always involve a robust community and stakeholder engagement process and be informed by energy equity policies.

Generally, defining the priority population begins with selecting indicators or characteristics of electric or gas utility customers who warrant additional attention to address equity concerns, consistent with the jurisdiction's energy equity policy and stakeholder input. Priority populations include customers that have suffered from, and continue to suffer from, disproportionate, systemic costs and burdens from energy extraction, generation, transmission, distribution, and consumption. For example, the U.S. Department of Energy's (DOE) Justice40 initiative uses four categories to define disadvantaged communities: fossil dependence, energy burden, environmental and climate hazards, and socio-economic vulnerabilities. Each category has multiple indicators, such as low-income, energy burden, health impacts, people with disabilities, people who are linguistically isolated, and more (DOE Justice40 Guidance). There are a vast number of possible indicators, and some may be more appropriate for certain jurisdictions and DEA applications.

Priority populations can be defined broadly or narrowly. If the definition is broader, each customer for whom an indicator applies would be included in the priority population. If it is narrower only utility customers that meet multiple indicators may be included. For example, a

customer who is a renter might not qualify as being part of the priority population, but a low-income renter might qualify (Woolf et al., 2024). Finding the right balance is key to conducting an effective DEA to ensure that the analysis properly accounts for the customers for which equity is a concern.

Some jurisdictions may already have a defined priority population, potentially using other terms like "disadvantaged community" or "energy justice community" or parameters for access to certain programs. At a minimum, these existing definitions can provide a jumping off point to determine the right priority population for a DEA. Some jurisdictions such as Illinois even have opportunities to self-designate as priority populations, an approach that expands community involvement (IPA and Elevate Energy).

DEA Metrics

The next step after identifying the priority population is to select the metrics that will be applied to these customers and to other customers. Although equity metrics may be similar to priority population indicators, or even overlap with them, equity metrics have a different purpose. Equity metrics measure the impacts of energy resources, investments, and processes rather than categorize customers.

There are many possible metrics that could apply to DERs and energy equity goals. It is helpful to start with a broad set of metrics that can be used to evaluate DERs and also address all equity dimensions. Then, that broader list of metrics can be winnowed down to metrics that are most relevant to a DEA for DERs and will provide results most useful to decision-making related to DER investments. The narrower set of DEA metrics will make the DEA easier to conduct and interpret.

Creating DEA metrics requires evaluating what impacts of DERs and aspects of equity should be considered through the analysis. As with the process of identifying priority populations, a jurisdiction's energy equity goals or other relevant policies can provide a helpful baseline. Incorporating community and stakeholder input is also crucial to creating the metrics most impactful to the community. Working directly with community members to co-develop DEA metrics together can help ensure this is accomplished. Table 2 below provides an illustrative set of DEA Metrics that can be used to evaluate a DER investment.

Table 2. Illustrative Set of DEA Metrics to Evaluate Utility DER Investments

Impact Type	Category	Subcategory	Potential DEA Metrics
Utility System	Provision of service	Reliability	Change in number and duration of outages on the utility system
		Shutoffs	Change in number of shutoffs or frequency of shutoffs
Host Customer	Non-energy impacts	Health, safety, and comfort	Change in medical costs, change in lost workdays, lost school days, maternal health impacts, % of homes at unsafe temperatures
		Reliability and resilience	Change in number and duration of outages at the customer level

Societal	Public health	Health impacts	Change in rates of hospital admissions, asthma, cancer risk
			Lost workdays
	Community	Jobs	Workforce development, job training, clean energy apprenticeships in priority populations
		Utility dollars invested	Utility funds invested in businesses and contractors located in priority populations
Rates, Bills, and Participation	Rates	Change in rate	Percent change in rates
	Bills	Change in bills	Percent change in bills
		Energy burden	Percent change in energy burden
	Participation	Participation for the DER being evaluated	Participants as percent of eligible customers

Source: Woolf et al., 2024.

Analysis

Once the priority population and DEA metrics have been established, the metrics must be applied to the priority population and other customers for the analysis.

Because this analysis is so data-intensive, there are several other components that analysts need to consider. First, it can be difficult to find clean, relevant data at the desired level of granularity. Analysts should have a plan for finding and selecting data sources for this process, including a thorough assessment of existing data sources and coordination with utilities to understand barriers they face to sharing data. Second, data privacy is essential. Any data that is used for the DEA or otherwise made public should be handled carefully so as not to present a risk of misuse. Third, analysts should ensure that the data or the methods of collecting relevant data do not disproportionately or negatively impact priority populations and that it is not biased due to historical inequities. It is likely that there are gaps in historical data related precisely to the priority population the DEA intends to consider. Analysts conducting DEAs have the potential to challenge this bias and put pressure on jurisdictions and utilities to collect more data to better understand these communities.

This process of applying the metrics to the priority populations will likely involve combining data sets from different data sources with different resolutions and formats. Much of the available data that can be used to identify priority populations comes from government entities and is at the larger, demographic level. On the other hand, much of the data used to create DEA metrics comes from utilities and is more granular, being frequently provided at the customer or household level. To achieve the most precise results, finding the most granular data is ideal. However, the results can only be as granular as the least granular data source used. Figure 2 presents an overview of how to approach this data application.

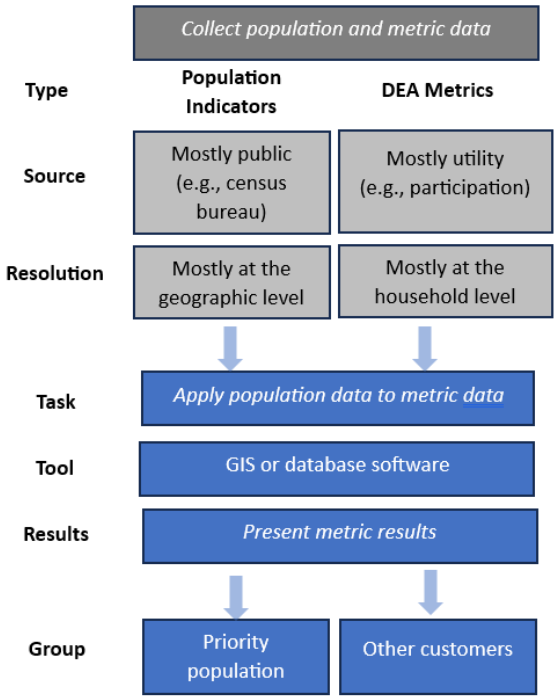

Figure 2. Data Application Process Overview. *Source*: Woolf et al., 2024.

For example, an analysis may include DER participation rates as a metric where the DEA metric data available is by address or household, but the data used to identify priority populations is by census tract. The analysis would require the street addresses of each participant to be linked to the street addresses within the census tract. The results would show what participation rates are for census tracts that have been defined as priority population communities. This result could be higher or lower than reality, depending on the proportion of priority population customers within the census tract (Woolf et al, 2024).

Present Results

As the DEA metrics are applied to priority populations, there are three different forms that the results may take, each with different formats and uses.

First, analysts can achieve simple results by applying DEA metrics to the priority population and other customers. For simple results, the analysis is concluded there, with each metric remaining in its original units. These simple, raw results do not provide additional context on the metrics or an investment's overall performance. However, they can still be useful to show how a DER investment affects the priority population and other customers for each metric singularly.

Second, benchmarked results require an additional step, which requires creating benchmarks for each metric. Benchmarks compare the performance of the utility investment to a target or a preferred outcome. Developing benchmarks should involve community and stakeholder input to determine targets against which performance should be measured.

For example, simple results may show that participation rates for the priority population were only 11 percent compared to 22 percent for other customers. Analysts may have worked with stakeholders to create a benchmark, aiming for at least 20 percent participation rates for utility customers across the board. Benchmarked results would show that the priority population did not meet the benchmark, but other customers did. Some analysts may decide to conclude their analysis after achieving simple or benchmarked results.

Third, DEA scores help analysts more easily understand overall performance, as a DEA score encompasses all metrics. Achieving DEA scores involves an additional layer of analysis, but they can be more easily compared to BCA results. This format requires developing a scoring technique to enable analysts to directly compare metrics against each other. Analysts should create a uniform scale for all metrics, a score for each DEA metric, and a weighting system across all DEA metrics to align various metrics that likely have varying units. This process is often called a multi-attribute analysis and will yield a net score that encapsulates all of the equity impacts of a DER investment (Woolf et al. 2024). A net score for a priority population and a net score for other customers will provide a direct comparison of different customer groups. The net score will be in the form of a percentage. A higher percentage score for the priority population than other customers will indicate that the priority population experiences greater equity improvements than other customers from the DEA. If both groups have positive scores, then the DER or portfolio of investments has a positive equity impact on both of them.

Analysts should note that distilling equity impacts into a single value will not present all of the nuances involved. Calculating DEA scores requires serious care, and stakeholders should be involved in the process of assigning weights to different metrics to ensure alignment with community values. This format requires the most data, greatest number of policy decisions, and greatest number of assumptions, which make the results more subjective. Calculating weighted DEA scores improperly or non-transparently creates a risk of misinterpreting results.

All three of these results formats provide helpful insights to incorporate equity into decision-making on DER investments. Each of these types of results should be based on substantial community and stakeholder input to interpret DEA results and draw actionable conclusions.

Decision-Making

A DEA is designed to be conducted alongside a BCA to fully evaluate DER investments and identify opportunities to mitigate inequities or advance equity. Utilities, policymakers, and other decision-makers have used well-established BCA methodologies to look at DER investments and programs, as well as other energy initiatives. A BCA uses monetary thresholds to evaluate costs and benefits and determine if an investment is net positive or negative. Generally, a benefit-cost ratio higher than one indicates it is a good investment, but a ratio below one indicates that it is not. A DEA helps move the analysis beyond monetary averages to understand disaggregated costs and benefits. A DEA provides insights into localized impacts and often overlooked qualitative and real benefits and costs in priority communities.

Decision-making processes must be open to DEA results for them to have an impact. Because a DEA does not have as clearly defined criteria for what types of investments are positive or negative in terms of equity, it may not compare simply with the associated BCA. It is useful to establish pass/fail criteria for the DEA to put results in clear terms that will make it easy to employ with a BCA. Any pass/fail criteria should involve community and stakeholder input to

ensure that any thresholds make sense for the community being served. Analysts should ideally establish these criteria before calculating the DEA results.

If a DER investment passes both the BCA and DEA, then it is cost-effective and has a sufficiently positive distributional equity outcome. If a DER investment or program fails both analyses, then it has neither. However, if an investment passes one but fails the other, decision-makers should engage in deeper consideration of the investment or program and its goals. Figure 3 illustrates these potential conclusions using a BCA and DEA.

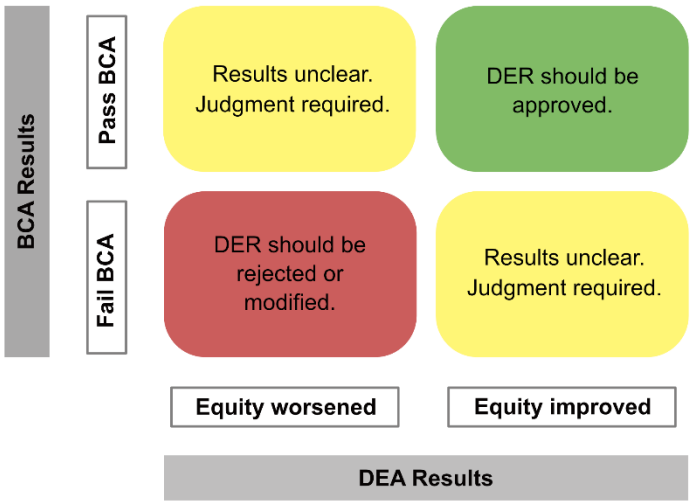

Figure 3. BCA and DEA Conclusion Matrix. *Source*: Woolf et al., 2024.

Additional evaluation of investments or programs should incorporate community or stakeholder feedback to ensure priorities are in line with community needs. For example, a DER that helps achieve a jurisdiction's equity goals, such as a low-income energy efficiency program, may pass the DEA but fail the BCA. Many states elect to implement programs like this even if they do not pass the BCA, because they have identified that the benefit to low-income customers achieves energy equity goals and potentially other state goals. Conversely, a DER could fail the DEA but pass the BCA and still be approved overall if there are other substantial benefits from the program and no negative equity impacts.

Conclusion

This framework is part of the emerging concept of distributional equity analysis. To date, there is a limited amount of literature on how to conduct these analyses for DER investments or examples of jurisdictions employing the DEA framework. This early framework provides guidance that advances the way equity is accounted for in energy decision-making that will likely be expanded and built upon over time as case studies get underway.

The DEA provides a tool to provide guidance to decision-makers, policymakers, and other leaders aiming to make equity count as communities ambitiously set out to make their buildings and communities cleaner and safer. Quantifying distributional equity impacts and

taking decision-making beyond an average assessment of customer impacts achieved through a BCA is an important early step to meaningfully addressing energy inequity as jurisdictions plan for a massive energy transition.

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