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Witness: Wesley Franks

BEFORE THE WASHINGTON
UTILITIES AND TRANSPORTATION COMMISSION

WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION, **Complainant,** **v.** **PUGET SOUND ENERGY,** **Respondent.**	**DOCKETS UE-240004, UG-240005 and UE-230810 (Consolidated)**

EXHIBIT TO TESTIMONY OF

WESLEY FRANKS

STAFF OF
WASHINGTON UTILITIES AND
TRANSPORTATION COMMISSION

Distributional Equity Analysis for Energy Efficiency and Other Distributed Energy Resources: A Practical Guide

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Office of ENERGY EFFICIENCY & RENEWABLE ENERGY

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A Practical Guide

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Disclaimer

Authors

This report was prepared by the following authors:

- Tim Woolf, Synapse Energy Economics, Inc.
- Alice Napoleon, Synapse Energy Economics, Inc.
- Danielle Goldberg, Synapse Energy Economics, Inc.
- Ellen Carlson, Synapse Energy Economics, Inc.
- Chelsea Mattioda, Synapse Energy Economics, Inc.
- Elijah Sinclair, Synapse Energy Economics, Inc.
- Camille Minns, Synapse Energy Economics, Inc.

This report was supported by the following contributing authors:

- Natalie Mims Frick, Lawrence Berkeley National Laboratory (LBNL), Principal Investigator
- Lisa Schwartz, LBNL
- Julie Michals, National Energy Screening Project (NESP™) — a project of E4TheFuture

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Preface

This guide describes an analytical framework—referred to as distributional equity analysis—that allows utilities, regulators, and stakeholders to answer one key question: *What are the distributional equity impacts of utility resource investments in the context of cost-effectiveness evaluation*? These distributional equity results can be combined with *benefit-cost analysis* results to inform decision-making regarding investments in new or existing utility resources.

Much of the energy equity work to date addresses a wide range of energy inequities that can affect all aspects of electric and gas utility planning and operations. This guide refers to such analysis as "system-wide energy equity analysis." In contrast, the distributional equity analysis explained in this guide focuses on a much narrower set of questions relating to the energy equity impacts associated with new utility distributed energy resource investments.

An important premise of the framework is that traditional benefit-cost analysis is not suited for evaluating energy inequities because it is limited to comparing impacts on all utility customers on average without considering disparate impacts on different groups. Distributional equity analysis focuses on identifying and estimating the distribution of costs and benefits *across different customer types*. This analysis can inform decision-makers of how some customers will experience costs and benefits differently from other customers.

Distributional equity analysis, or DEA, is an emerging concept; to date, literature is limited on conducting DEAs on electric or gas utilities' distributed energy resource investments. The materials provided in this guide should be viewed as early, nascent guidance useful for advancing this important topic further. Additional experience, information, and analyses over time will be important to help build upon the concepts and guidance provided in this document.

The importance of carefully and thoughtfully designing and applying a DEA cannot be overstated. Robust stakeholder input is critical at each stage of a DEA, and analytical decisions made when preparing a DEA should carefully and thoroughly account for the likely impacts on the customers and communities. As with benefit-cost analysis of utility investments, follow-up to DEA is important. Distributed energy resource programs and other utility investments should be carefully overseen and monitored over time to ensure that the programs are implemented as planned and the forecasted equity benefits are achieved in practice.

Some of the techniques described in this guide can be complex and time-consuming. To increase the accessibility and applicability of the framework, the guide identifies opportunities to streamline DEA. Analysts and decision-makers, however, should be conscientious of the implications of streamlining and the extent to which it might oversimplify, and perhaps undermine, some important elements.

Readers are encouraged to read the Executive Summary of this guide to understand the high-level concepts behind the DEA framework before reading the more complex guidance provided in the rest of the guide. Readers are also encouraged to review the extensive list of references and resources provided throughout the body of this guide for additional information on how to conduct DEA.

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Name	Affiliation
Adam Zoet	Minnesota Department of Commerce
Amanda Best	Maryland Public Service Commission
Amanda Dewey	American Council for an Energy-Efficient Economy
Ankit Jain	California Public Utilities Commission
Anne Dougherty	Illume Advising
Aubrey Newton	Northwest LECET	NW Cooperation Fund
Bethel Tarekegne	Pacific Northwest National Laboratory
Brad Banks	Michigan Public Service Commission
Brett Sproul	Maryland Public Service Commission
Brian Tyson	Puget Sound Energy
Brian Walker	U.S. Department of Energy
Briana Parker	Elevate Energy
Burçin Ünel	Institute for Policy Integrity at NYU School of Law
Cathy Reed	National Association of State Energy Officials
Cecilia Johnson-Hayman	U.S. Department of Energy
Chandra Farley	City of Atlanta
Chris Coll	New York Dept. of Public Service
Danilo Morales	Massachusetts Department of Energy Resources
David Tancabel	U.S. Environmental Protection Agency
Debra Gore-Mann	The Greenlining Institute
Divesh Gupta	Baltimore Gas & Electric Company
Dylan Voorhees	VEIC
Erin Cosgrove	Northeast Energy Efficiency Partnerships
Ezell Watson	Oregon Public Utility Commission
Gregory Ehrendreich	Midwest Energy Efficiency Alliance
Jean Su	Center for Biological Diversity
Jennifer Snyder	Washington Utilities & Transportation Commission
Jennifer Yoshimura	Pacific Northwest National Laboratory
Jeremy Peterson	Xcel Energy
John Howat	National Consumer Law Center

Name	Affiliation
Julia Friedman	Oracle
Justin Schott	Energy Equity Project
Kate Strickland	Smart Electric Power Alliance
Kelly Crandall	Colorado Public Utilities Commission
Kelsey Jones	National Association of State Energy Officials
Liz Doris	National Renewable Energy Laboratory
Logan Atkinson Burke	Alliance for Affordable Energy
Marguerite Behringer	Landis+Gyr
Michael Reiner	U.S. Department of Energy
Mohit Chhabra	Natural Resources Defense Council
Nancy Seidman	Regulatory Assistance Project
Natalia Cardona Sanchez	Vote Solar
Olivia Patterson	Opinion Dynamics
Patrick Cicero	Pennsylvania Office of Consumer Advocate
Ram Narayanamurthy	U.S. Department of Energy
Sarah Moskovitz	Illinois Citizen's Utility Board
Sonja Berdahl	National Renewable Energy Laboratory
Sneha Ayyagari	The Greenlining Institute
Steve Schiller	Lawrence Berkeley National Laboratory - Advisor
Subin DeVar	Initiative for Energy Justice
Tanya Paslawski	Elevated Energy, on behalf of the National Association of Regulatory Utility Commissioners
Troy Hutson	Puget Sound Energy
Wally Nixon	Arkansas Public Service Commission
Will Bryan	Southeast Energy Efficiency Alliance

Nomenclature or List of Acronyms

ACS	American Community Survey
AVERT	Avoided Emissions and Generation Tool
BCA	benefit-cost analysis
CA OEHHA	Office of Environmental Health Hazard Assessment
CAIDI	Customer Average Interruption Duration Index
CalEPA	California Environmental Protection Agency
CBI	Customer Benefit Indicator
CCA	Climate Commitment Act (Washington State)
CCPA	California Consumer Privacy Act
CCSC	Center for Sustainable Communities (California)
CDC	Centers for Disease Control and Prevention
CEEJH	community engagement, environmental justice, and health
CEIP	Clean Energy Implementation Plan
CEMI	Customers Experiencing Multiple Interruptions
CEMSMI	Customers Experiencing Multiple Sustained and Momentary Interruptions
CELID	Customers Experiencing Long Interruption Duration
CEJST	Climate and Economic Justice Screening Tool
CETA	Clean Energy Transformation Act
CEQ	Council on Environmental Quality
CISA	Cybersecurity Information Sharing Act
CJWG	Climate Justice Working Group (New York)
COBRA	Co-Benefits Risk Assessment Health Impacts Screening and Mapping Tool
DAC	disadvantaged communities
DEA	distributed equity analysis
DEC	Department of Environmental Conservation
DEI	diversity, equity, and inclusion
DER	distributed energy resources
DOE	U.S. Department of Energy
E3B	energy efficiency equity baseline
EAG	equity advisory group
EE	energy efficiency
EEP	energy equity project
eGRID	Emissions and Generation Resource Integrated Database
EJ	environmental justice
EJSCREEN	Environmental Justice Screening and Mapping Tool
EJI	environmental justice index
EPA	U.S. Environmental Protection Agency
ESIST	Energy Savings and Impacts Scenario Tool
EV	electric vehicle
FEMA	U.S. Federal Emergency Management Agency
GHG	greenhouse gas
GIS	geographic information system
HEAL	Healthy Environment for All
HIC	highly impacted communities
IRP	integrated resource plan

LEAD	Low-Income Energy Affordability Data
LIHEAP	Low-Income Home Energy Assistance Program
LMI	low and moderate incomes
MAA	multi-attribute analysis
MADA	multi-attribute decision analysis
MADM	multi-attribute decision-making
MAIFI	Momentary Average Interruption Frequency Index
NEI	non-energy impact
NNIP	National Neighborhood Indicators Partnership
NSPM	National Standard Practice Manual
NYPA	New York Power Authority
NYSERDA	New York State Energy Research & Development Authority
ODIN	Outage Data Initiative Nationwide
PBR	performance-based regulation
PSE	Puget Sound Energy
PV	Photovoltaic
SAIDI	System Average Interruption Duration Index
SAIFI	System Average Interruption Frequency Index
SLOPE	state and local planning for energy
SNAP	Supplemental Nutrition Assistance Program
UCLA	University of California, Los Angeles
UCT	utility cost test
TRC	total resource cost
USDN	Urban Sustainability Directors Network
UTC	Utilities and Transportation Commission (Washington State)
WA DOH	Washington State Department of Health

Executive Summary

Distributional Equity Analysis: An Emerging Framework

Distributional equity analysis (DEA) is an analytical framework that allows utilities, regulators, communities, and stakeholders to answer questions about the equity implications of utility investments and to consider those implications alongside benefit-cost analysis (BCA). Though BCA is a well-established practice, DEA is an emerging decision-making tool. Several jurisdictions in the United States have begun conducting some form of system-wide energy equity assessment, especially in the context of environmental justice, but most jurisdictions have little or no experience with conducting DEA.

This guide is a starting point in developing DEA practices and policies. It provides a framework that can be further developed. As this framework is used, input from key community members and stakeholders and access to increasing amounts of equity data will build documented knowledge and experience, leading to identification and dissemination of best practices.

Jurisdictions will likely start with different geographic or demographic data, definitions of priority populations, choices of equity metrics, and analytical tools. This document aims to provide guidance for jurisdictions wishing to account for energy equity in utility DER investment decisions, regardless of their starting point.

This DEA framework can be a powerful tool for answering one key question: *What are the distributional equity impacts of utility resource investments in the context of cost-effectiveness evaluation*? These distributional equity results can be combined with BCA results to inform decision-making regarding investments in new or existing utility resources.

As advancing energy equity becomes a more central focus for more policymakers, it will be increasingly important to apply and build upon the principles, concepts, and techniques described in this guide. Achieving energy equity goals in utility resource decision-making practices will require transparent, intentional, and comprehensive attention to all the potential impacts of those resource decisions.

Interest in Distributional Equity and Distributed Energy Resources

The burdens of the energy system do not fall equally on all electricity and gas utility customers.[1] The production, delivery, and consumption of electricity and gas can cause disproportionate social, health, and economic costs and benefits among low-income communities, communities of color, indigenous people, and rural customers, for example.

Such inequities might include excessive energy burdens,[2] limited access to distributed energy resources (DER)[3] or clean energy, inadequate infrastructure to support those resources, exposure and vulnerability to environmental and public health impacts, greater risk of reliability and resilience issues, greater risk of service shutoffs, and lack of access to economic or job benefits of the clean energy transition.

State legislators and regulators are establishing new goals and processes to promote energy equity. Such goals pursue the fair distribution of energy system benefits and burdens across all populations. Achieving this requires intentional decision-making and consideration of the technologies, policies, and procedures involved in the energy system.

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[1] The guidance document is focused on analysis of customers served by electric and gas utilities. Individuals not served by the utility may still experience impacts of DER investment decisions. This is outside the scope of this document.

[2] Energy burden refers to the percentage of a customer's income spent on energy bills.

[3] 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.

States are also increasingly motivated to address climate change challenges and improve the resilience and efficiency of our energy systems, which has led to an upwelling of interest in DERs. As the electricity and gas industries evolve and decarbonize, DERs are expected to play a sizeable role in that progress. Greater investment in DERs has the potential to reduce utility system costs, utility customer bills, and environmental impacts of energy generation.

Limits of BCA in Accounting for Equity

Regulators, utilities, and other decision-makers commonly rely on benefit cost-analysis (BCA) when considering utility investments in DERs. BCA is an essential tool for understanding whether an investment will provide net benefits for all customers on average. However, BCA does not allow for assessment of the distribution of costs and benefits across customers with different characteristics (e.g., priority populations[4] relative to all other customers). DEA can be used alongside BCA to allow for such an assessment.

Benefit-cost analysis does not typically indicate whether DER investments are equitable for priority populations relative to other utility customers.

Unlike BCA, a DEA separates customers into two distinct groups—priority populations and all other customers—to allow analysts to assess how benefits and costs may affect each group. A DEA also includes a broad set of metrics that are specifically chosen to estimate equity impacts, allowing analysts to assess additional costs and benefits not captured in a BCA. Applying the equity metrics to priority populations in a DEA will help decision-makers understand whether DER investments have the potential to deliver equitable net benefits for priority populations relative to other utility customers.

The primary purpose of this guide is to describe a DEA framework and discuss how it can be used to complement BCA results and to inform equitable utility DER investments decisions.[5] The framework can be used to answer questions such as: (a) whether to pursue or invest in a proposed DER program or continue to support an existing one; (b) whether to modify or redesign a proposed or existing DER program; and (c) how to prioritize investments across multiple DER programs. A DEA complements BCA by contributing important equity information to an overall evaluation of an investment.

Readers interested in guidance on how to conduct a BCA for DERs can refer to the *National Standard Practice Manual™ (NSPM) for Benefit-Cost Analysis of Distributed Energy Resources*. This guide is intended to serve as a companion document to the NSPM.

This guide focuses on applying DEA to DERs. In theory, the methods, concepts, and principles described herein can be applied to any type of major utility investment.

This guide focuses on applying DEA to DERs. In theory, the methods, concepts, and principles described herein can be applied to any type of major utility investment.

Overview of Distributional Equity Analysis Framework

Figure ES-1 presents the key stages in the DEA framework. A summary of each stage appears below. Some jurisdictions may choose to perform the DEA in a different order than presented below, depending upon their

[4] Priority populations are 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. These include customers who have borne and continue to bear disproportionate, systemic costs and burdens from energy extraction, generation, transmission, distribution, and consumption.

[5] The concepts in this guide apply to DER investments and programs by all types of electric and gas utilities, including vertically integrated and distribution only, as well as investor-owned, publicly owned, and cooperative utilities. While this guide uses the term "utilities" throughout, the guide also applies to DER investments by other entities that are engaged in DER programs. These entities include state energy offices, third-party DER program administrators, DER vendors and contractors, and others.

circumstances.[6] Nonetheless, each of these stages are critical for conducting a robust DEA. The remainder of this guide discusses the stages in more detail.

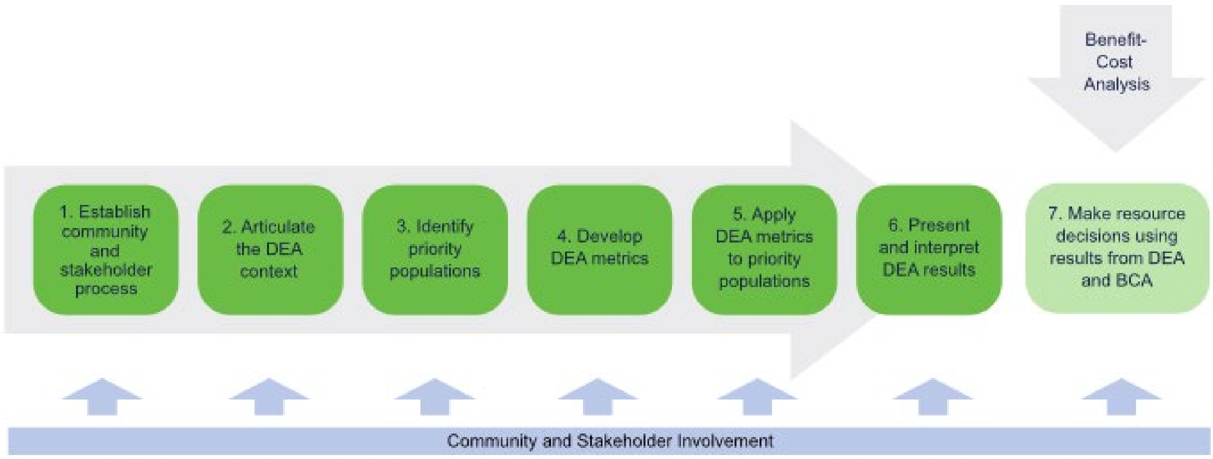

Figure ES-1. Key Stages in the Distributional Equity Analysis Framework

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.

[6] In this guide the term "jurisdictions" is used broadly to refer to any state, province, utility, municipality, or other region with a governing authority for which DER resources are planned and implemented.

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.

System-Wide Energy Equity Assessment Versus Distributional Equity Analysis

Energy inequities can affect electric and gas utility customers in complex, multidimensional aspects that often intersect and overlap. To signal this complexity, such inequities are often characterized by a systemic or structural "dimension:"

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

Comprehensively addressing energy inequities within all four of these dimensions requires a broad assessment, which this guide refers to as a system-wide energy equity assessment.[7] System-wide energy equity assessment addresses a very broad question: *How can all inequities in utility practices, services, and investments be addressed*? DEA is narrower than system-wide energy equity assessment; it addresses the question: *What are the distributional equity impacts of utility resource investments in the context of cost-effectiveness evaluation*? These DEA results can be combined with BCA results to inform decision-making regarding investments in new or existing utility resources.

> The equity impacts considered in the DEA framework are narrower than those considered in a system-wide energy equity assessment.

Figure ES-2 depicts the relationship between system-wide energy equity assessment and DEA. It shows that the DEA framework addresses a portion of distributional equity impacts but does not address issues related to the other dimensions of energy equity.[8] Further, BCA is inextricably linked with DEA for the purpose of making decisions on new utility resources, but BCA does not otherwise play a large role in understanding or addressing energy inequities.

It is important to address all dimensions of energy equity through some form of a system-wide energy equity analysis. The primary purpose of DEA is limited to addressing energy inequities that might be caused by future utility investments.

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[7] System-wide energy equity assessments are jurisdiction or utility system assessments that comprehensively address all dimensions of energy equity and all aspects of utility planning, operation, and services.

[8] DEA requires *procedural equity* concepts and practices to ensure they fully address the interests of priority populations, but the DEA framework is not designed to address or resolve procedural energy inequities.

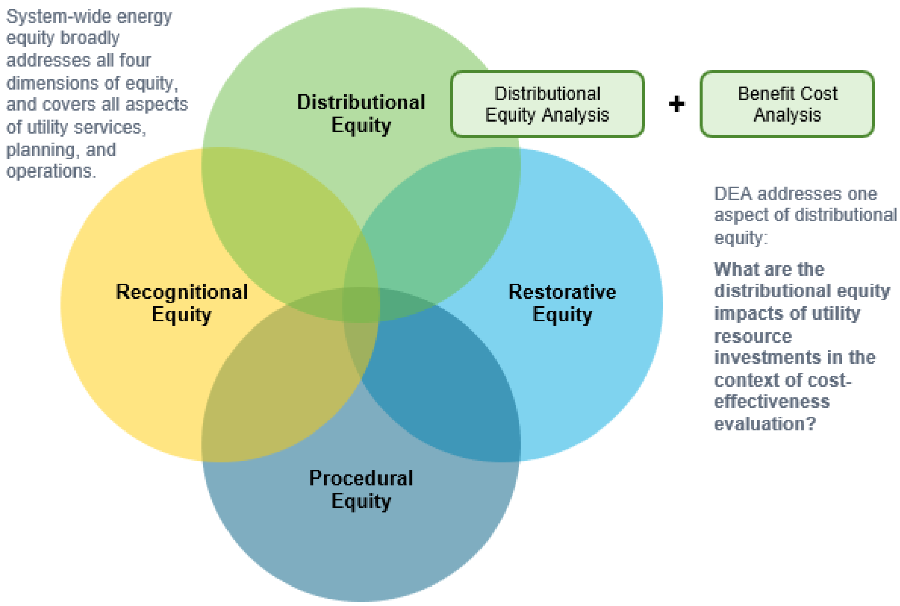

Figure ES-2. System-Wide Energy Equity Assessment and DEA

Opportunities for Streamlining Distributional Equity Analysis

Some of the techniques described in this guide can be complex and time-consuming. Several options for simplifying DEA are available to increase the accessibility and applicability of the framework. A simplified version of DEA can provide valuable information to assess the equity impacts of utility DER investments when time and resources are limited. Below are some examples of opportunities for streamlining.

- Stage 1: Establish a Robust Stakeholder Process. This stage should not be streamlined as it is a critical and central component of a DEA.
- Stage 2: Articulating the DEA Context. Start with a relatively narrow DEA application, such as assessing a portfolio of well-established energy efficiency programs where a large amount of data is readily available, instead of a broad DEA that aims to optimize multiple portfolios of different types of DERs.
- Stage 3: Identifying Priority Populations. Rely upon existing indicators, such as those created for environmental justice purposes, or those used in other jurisdictions. Use relatively few indicators that capture the most important energy equity characteristics. Skip the cumulative impact analysis.
- Stage 4: Developing Distributional Equity Metrics. Rely upon existing equity metrics, or those used in other jurisdictions. Use relatively few DEA metrics that capture the most important equity impacts. Rate impacts and DER participation rates are examples of metrics that capture very important equity implications. Minimize the use of overlapping DEA metrics.
- Stage 5: Applying DEA Metrics to Priority Populations and Other Customers. Use mapping, screening, and modeling tools that have been established in other jurisdictions.
- Stage 6: Presenting and Interpreting DEA Results. Focus on using the simple results and the benchmarked results. Skip the calculation and application of weighted DEA scores.
- Stage 7: Making Decisions Using Both BCA and DEA Results. Establish clearly defined DEA pass/fail criteria prior to conducting the DEA. Establish other conditions up front that might allow for approval of an investment when either the BCA or the DEA fails.

Streamlining the DEA process might lead to reasonable results for decision-making purposes, but it creates the risk of oversimplifying important issues or omitting important equity considerations. Jurisdictions should be careful to strike the appropriate balance between streamlining the DEA process and conducting a more comprehensive analysis. Stakeholder and community engagement is such a critical part of conducting a DEA that it should not be reduced or limited in order to streamline the DEA. Future DOE-funded research may explore how to make a DEA more accessible under policy or funding constraints.

Jurisdictions should be careful to strike the appropriate balance between streamlining the process and conducting a comprehensive analysis.

References and Resources

A detailed list of references and resources used in each chapter is provided at the end of each chapter. Chapter 8 includes a complete list of all the references and resources used in this guide.

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Introduction

Purpose of this Guide

This guide is designed for utility regulators, state energy offices, utilities, utility consumer advocates, environmental justice advocates, and other stakeholders that seek to account for the equity impacts of utility investments in energy efficiency and other distributed energy resources (DER).[9] This guide describes an analytical framework—referred to as a distributional equity analysis (DEA)—that allows utilities, regulators, and stakeholders to answer one key question: *What are the distributional equity impacts of utility resource investments in the context of cost-effectiveness evaluation*? These distributional equity results can be *combined with benefit-cost analysis* results to inform decision-making regarding investments in new or existing utility resources.

Definition: Distributed Energy Resource

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.

Increasing Interest in Energy Equity

A growing number of states are prioritizing equity in recognition of the energy system's disproportionate impacts on different types of customers or communities (LBNL and PNNL 2023). The social, health, and economic burdens of the energy system are not experienced equally across all customers. Low-income communities, communities of color, indigenous people, and rural customers often experience disproportionate impacts (IEJ 2019).

Inequities in electricity and gas utility services are potentially far-reaching and can include, for example, excessive energy burdens,[10] limited access to DERs or clean energy, inadequate infrastructure to support DERs, vulnerability to environmental impacts of greenhouse gas (GHG) and criteria air pollutant emissions, greater risk of reliability issues, greater risk of service shutoffs, and economic or job impacts of the clean energy transition (LBNL and PNNL 2023) (Carley and Konisky 2020) (LBNL 2021 Advancing Equity).

There are many definitions of energy equity—and energy justice—in use today, with examples provided below. The common theme across these definitions is that energy equity recognizes that some customers are subject to disparities in energy services and that these customers deserve to be provided with a fair allocation of energy costs and benefits. Achieving energy equity goals requires *intentional* design of energy systems, technologies, procedures, and policies to promote a fair allocation of costs and benefits.

Similarly, many terms are used to describe disadvantaged, vulnerable, or marginalized customers. These terms generally refer to those customers who have borne and continue to bear disproportionate systemic costs and burdens from energy extraction, generation, transmission, distribution, and consumption.[11] This guide uses the

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[9] This guide uses the term 'utility investment in DERs' to refer to utility investments, programs, pricing, or procurement initiatives that electricity and gas utilities undertake on behalf of their customers.

[10] Energy burden refers to the percentage of a customer's income spent on energy bills.

[11] In this guide and in this context the term "other customers" refers to all customers who are not within the priority population.

term *priority populations* to generally include 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. These indicators might include, for example, income, race, housing conditions, English language proficiency, disabilities, and exposure to environmental contaminants. (See Chapter 3 for guidance on priority populations.)

Increasing Interest in the Cost-Effectiveness of Distributed Energy Resources

This guide also responds to the upwelling of interest in DERs—defined here to include energy efficiency, demand response, distributed generation, building and transportation electrification programs, and distributed storage.[12] DERs can provide some or all of customers' immediate power needs, or be used by the utility to help satisfy the needs of the grid, or both. DERs offer the potential to reduce utility system costs, utility customer bills, and environmental impacts of electricity and gas generation. DERs are expected to play a critical role in the evolution and the decarbonization of the electricity and gas industries.

Need for a Broader Approach to Evaluating Utility Investments in DERs

Many jurisdictions use BCA to decide whether and how to invest in DERs. Interest is increasing in accounting for equity when evaluating whether to make investments in new or existing DERs. While BCA is an essential tool for understanding the advantages and disadvantages of specific investments, it typically is not sufficient for understanding energy inequities (see the section on Limits of Benefit-Cost Analysis for Assessing Energy Equity). Additional tools and techniques are needed to understand how utility investments in DERs will affect energy equity.

Ongoing initiatives and resources focus on energy equity in the broadest sense. That is, they address all types of equity across the entire utility system (see the section on System-Wide Energy Equity Assessment and Planning). A significant gap remains regarding tools and techniques to account for energy equity across priority populations when

A significant gap remains regarding tools and techniques to account for energy equity when making decisions about utility investments in distributed energy resources.

Examples: Energy Equity Definitions

The Initiative for Energy Justice: "Energy justice refers to the goal of achieving equity in both the social and economic participation in the energy system, while also remediating social, economic, and health burdens on those disproportionately harmed by the energy system. Energy justice explicitly centers the concerns of communities at the frontline of pollution and climate change ('frontline communities'), working class people, indigenous communities, and those historically disenfranchised by racial and social inequity. Energy justice aims to make energy accessible, affordable, clean, and democratically managed for all communities" (IEJ 2019).

The American Council for an Energy-Efficient Economy: "Energy equity aims to ensure that disadvantaged communities have equal access to clean energy and are not disproportionately affected by pollution. It requires the fair and just distribution of benefits in the energy system through intentional design of systems, technology, procedures and policies" (ACEEE 2023).

U.S. Department of Energy: "Energy equity recognizes that disadvantaged communities have been historically marginalized and overburdened by pollution, underinvestment in clean energy infrastructure, and lack of access to energy efficient housing and transportation" (DOE 2023).

The Partnership for Southern Equity: "Against the backdrop of global climate change, energy equity translates into the fair distribution of benefits and burdens from energy production and consumption" (PSE 2022).

Priority Populations

This guide uses the term *priority populations* to generally include 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 stakeholder input.

[12] In some cases, building and transportation electrification programs are considered energy efficiency or demand response. For example, building electrification programs promote replacement of fossil-fuel-burning equipment and appliances with high-efficiency electric measures (such as electric heat pumps for space and water heating), and therefore there is some overlap with energy efficiency programs. Transportation electrification includes vehicle-to-grid programs and managed electric vehicle (EV) charging. Because of the temporal design, managed EV charging programs are generally considered to fall under the umbrella of demand response.

making decisions about utility investments in DERs. This guide seeks to fill that gap by explaining how a DEA can be used in combination with BCA to make these decisions.

This guide focuses on applying DEA to DERs because there is an immediate need in many states for guidance on how utilities should invest in DERs in an equitable way. Nonetheless, the principles, concepts, and guidance presented here can also be used to apply DEA to other types of utility investments.

Limits of Benefit-Cost Analysis for Assessing Energy Equity

Benefit-Cost Analysis

It is useful to understand the limits of BCA for assessing energy equity because DEA is designed to overcome these limits.

In general, the purpose of BCA is to gain insight to the important advantages and disadvantages of different courses of action (US OMB 2023). A robust BCA identifies all costs and benefits and uses them to determine whether a proposed action has benefits that exceed the costs. In the electric and gas utility industries, BCA informs decisions about whether and how utilities should invest in different types of resources for generation, transmission, or distribution. For at least three decades, utilities and other stakeholders have also used BCA to assess the value of energy efficiency programs. In recent years this practice has expanded to assessing all types of DERs (NSPM 2020).

Benefit-cost analysis is typically unable to address distributional effects because the costs and benefits are aggregated across all customers rather than focusing on the relative impact for priority populations.

While BCA is an essential tool for understanding the advantages and disadvantages of specific investments, it is not sufficient for understanding energy system inequities because it is not designed to distinguish how costs and benefits might affect some customers differently than other customers.[13] BCA practices are typically unable to address distributional effects because the costs and benefits are aggregated *across all customers* rather than focusing on the relative impact for *priority populations* (US OMB 2023).

BCA practices have historically not addressed hidden disparities in the costs of DER investments as some customers might experience costs and benefits differently than others. For example, an increase in cost will have a greater impact on customers with a higher energy burden. Such disparities affect the true cost to serve disadvantaged customers and play a material role in who does and does not receive benefits from DER investments.[14]

Rate, Bill, and Participation Analyses

Rate, bill, and participation analyses may be used in conjunction with BCA to help evaluate the equity implications of DER programs. Analysts use this approach to assess: (a) the extent to which rates might increase for all customers in a rate class, (b) whether and how much bills might increase or decrease for DER program participants and non-participants, and (c) the number of customers who participate in DER programs. Taken together, this information indicates the extent to which DER investments might shift costs from participants to non-participants (NSPM 2020, Appendix A) and sheds light on equity implications.

Traditional rate, bill, and participation analyses, however, do not provide information regarding these impacts on priority populations. Thus, they do not answer questions about whether DER investments create inequities

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[13] It is possible to apply BCA to different utility customer classes, but this approach does not identify the impacts on disadvantaged populations. It is also possible to apply BCA to DER programs that are targeted to some disadvantaged populations such as low-income customers, but this does not provide information on customers who do not participate in such programs, nor does it provide information on other DER programs.

[14] While equity challenges to BCA are critically important, they cannot be easily addressed using DEA. Thus, this guidance document does not address these challenges. They would be best addressed in the context of system-wide energy equity initiatives (see the section on System-Wide Energy Equity Assessment and Distributional Equity Analysis).

between program participants and non-participants *for the priority population*. The purpose of this DEA framework is to answer this question, among others.

Distributional Equity Analysis

This guide describes an emerging analytical framework—referred to as DEA—that accounts for equity impacts in ways that are not possible or practical in conventional BCA. DEA differs from BCA in that it separates customers into different groups—priority populations and other customers—which allows practitioners to assess how costs and benefits will affect each group (US OMB 2023).

DEA is not a *replacement* for BCA. Instead, DEA *complements* BCA and uses many of the same principles, concepts, assumptions, and inputs. DEA extends beyond BCA by: (a) breaking out the population of customers into priority populations versus other customers, and (b) applying metrics specifically designed to assess energy system inequities.

Readers interested in guidance on how to conduct a BCA for DERs can refer to the *National Standard Practice Manual (NSPM) for Benefit-Cost Analysis of Distributed Energy Resources* (NSPM 2020). This guidance document is intended to serve as a companion document to NSPM.

Figure 1 presents the key stages in the DEA framework. Each stage is summarized below and discussed in more detail in the remainder of this guidance document.

Figure 1. Key Stages in Distributional Equity Analysis Framework

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. (See Chapter 1).

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. (See Chapter 2.)

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

4. Develop DEA metrics. DEA can use a range of metrics to assess energy system inequities: energy rates, bills, and DER participation; energy burden; health and environmental impacts on priority populations;

economic development in priority populations; and more. DEA metrics differ from the primary metrics used in a BCA, which are typically in monetary terms.[15] (See Chapter 4.)

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. (See Chapter 5.)

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, communities, and stakeholders might decide to use simpler results or results that contextualize the metrics with selected benchmarks. Others may 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. (See Chapter 6.)

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

In sum, DEA provides regulators, utilities, and communities and stakeholders with critical equity information by comparing the impacts of DER investments on priority populations relative to other customers. This additional information can inform decisions about: (a) whether to pursue or invest in a proposed DER program or to continue to support an existing one; (b) whether to modify or redesign a proposed or existing DER program; and (c) how to prioritize across multiple DER programs.

DEA can be used to complement BCA: BCA focuses on the costs and benefits that affect customers on average, while the DEA focuses on the equity impacts on priority populations relative to other customers. The order in which the two are conducted is not especially important—as long as the two are complete for the purposes of making decisions on utility resource investments.[16] For practical purposes it might be best to conduct the BCA before the DEA because BCA methods are generally well-established, and many of the assumptions and data from the BCA can feed into the DEA. Further, there might be some utility investments that do not pass the BCA and are not expected to have favorable equity impacts (e.g., an uneconomic fossil-fired generator in an urban setting), and thus there is no need to conduct a DEA. Aside from these practical reasons, the BCA could be conducted simultaneously with the DEA, or even after the DEA is conducted.

DEA can inform decisions about: (a) whether to implement a proposed DER program or to continue to support an existing one; (b) whether to modify or redesign a proposed or existing DER program; and (c) how to prioritize across multiple DER programs.

System-Wide Energy Equity Assessment and Planning

Energy equity encompasses many different dimensions. These dimensions typically include (among others) *distributional, procedural*, *recognitional,* and *restorative* elements (Figure 2).[17] Some of these dimensions can overlap or are interrelated. For example, to promote distributional equity, utilities can take steps to ensure stakeholders from disadvantaged communities have the means to participate in processes that inform utility investment decision-making.

Further, a broad range of electric and gas utility activities have equity implications due to disparate impacts for different populations. These include activities such as: siting of power plants, transmission lines, and pipelines;

[15] Some BCA includes additional metrics for impacts that cannot be expressed in monetary terms, e.g., reliability or resilience impacts. These tend to play a small role in the BCA relative to the monetary metrics.

[16] For this reason, the graphics in this guidance document depicting the DEA process do not include references to the BCA.

[17] "Recognitional equity" is often termed "recognition equity" in the energy equity literature. Likewise, the term used in this guide, "distributional equity," is commonly called "distribution equity" elsewhere to refer to the same concept.

infrastructure investment; customer shutoff practices; reliability metrics; exposure to environmental impacts; representation in utility decision-making; customer services; and more (LBNL Equity 2021).

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

Source: Adapted from (EEP 2022) and (ACEEE 2023). See also (Walker and Day, 2012), (Baker, DeVar and Prakash, 2019), (Ruano-Chamorro, C., Gurney, G. G., Cinner, J. E. 2022), (Young, 1990), (Fraser, 1997), and (Heffron and McCauley, 2017).

Figure 2. Dimensions of Energy Equity

Fully understanding and addressing these energy inequities and their implications requires a *system-wide energy equity* assessment and plan—a comprehensive evaluation of all the equity impacts of the utility system. System-wide energy equity analysis requires a broad assessment of all energy inequities resulting from the energy system related to the four equity dimensions above. System-wide energy equity analysis:

- Considers all dimensions of equity, all historical inequities, all types of utility practices, and all options for improving equity.
- Considers equity implications of all utility resource types: generation, transmission, distribution, and DERs.
- Assesses all utility practices and services, such as shutoff and reconnection policies, arrearage management programs, low-income programs, discounted rates, workforce development programs, actions and investments to improve reliability and resilience, and any utility practices that create or maintain inequities.

By periodically conducting and updating system-wide energy equity assessments and plans, regulators, utilities, and others can: (a) identify any existing inequities from the utility system; (b) develop recommended actions for how to address those issues; (c) monitor changes in equity over time; and (d) recommend new actions for addressing energy inequities as they become better understood over time. For example, one aspect of a system-wide energy equity assessment might include evaluating past customer shutoff practices; identifying racial disparities in those practices; assessing a wide range of strategies for eliminating those disparities; developing an action plan to implement the best strategy; and following up over time to ensure the disparities are addressed.

System -wide equity analysis can provide the foundation for DEA, for example by identifying equity goals, priority populations, equity metrics, analytical tools, data sources, and data gaps.

Where system-wide energy equity analysis has been conducted, it can provide the foundation for DEA, for example by identifying equity goals, priority populations, equity metrics, analytical tools, data sources, and data gaps.

DEA is much more focused than system-wide energy equity assessments and plans. The purpose of DEA is to provide information on equity impacts when making decisions about new investment opportunities or about continuing existing programs. This means focusing on distributional equity of future equity impacts, and on energy inequities that can be influenced by the investments or programs under consideration.

DEA is much more focused than system-wide energy equity assessments and plans.

Figure 3 depicts the relationship between system-wide energy equity assessments and DEA. System-wide energy equity assessments address a very broad question: How can inequities in utility practices, services, and investments be addressed? In contrast, DEA addresses a much narrower question: *What are the distributional equity impacts of utility resource investments in the context of cost-effectiveness evaluation?* Consequently, DEA addresses only a portion of *distributional* equity impacts. DEA requires *procedural equity* concepts and practices to ensure it fully represents the needs of customers. It is important to address all dimensions of equity, but the primary purpose of DEA is to address distributional inequities that might be caused by future utility investments.

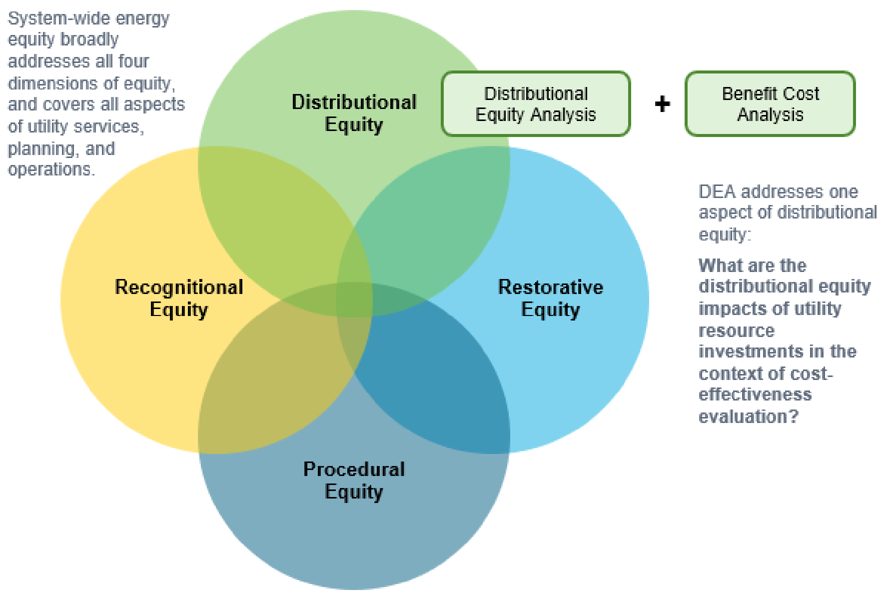

Figure 3. System-Wide Energy Equity Assessment and DEA

In the context of DEA for DERs, there is another reason why DEA should be much narrower than system-wide energy equity assessments. DERs might not help resolve many system-wide energy inequities. For example, DERs cannot resolve racial disparities in utility customer shutoff practices.[18] This DEA Guide does not address System-Wide Equity Assessments beyond this discussion.

[18] DERs might be able to help mitigate some of the disparities related to utility shutoff practices by helping some customers pay their bills more easily, but the most effective approach to addressing equity disparities such as this is to alleviate the root cause of the disparity, which did not stem from DERs.

Example of System-Wide Equity Assessment: Washington Clean Energy Implementation Plans

In 2019 Washington passed the *Clean Energy Transformation Act* (CETA), which establishes equity goals and requires the benefits from electricity investments to be distributed equitably. CETA, along with other legislation in the state, defines priority populations (referred to as "named communities"), requires utilities to establish equity metrics, requires utilities to prepare Clean Energy Implementation Plans (CEIPs), and requires a robust stakeholder process to support CEIPs. The investor-owned electric utilities have submitted CEIPs to the Washington Utilities and Transportation Commission (WA UTC). (PacifiCorp 2023), (PSE 2022), (Avista 2021)

These CEIPs are examples of system-wide energy equity assessments and plans. They are developed with input from a broad range of stakeholders representing priority populations; they address many aspects of energy equity concerns; they focus on all types of utility resources and activities; they include broad clean energy targets for 2025, 2030, and 2045, as well as interim targets; they include specific targets for coal plants, energy efficiency, demand response, and renewable energy; they include specific action plans; and they must be updated every two years and re-done every four years (WA UTC website).

The WA UTC recently ordered utilities to also conduct DEA for the purpose of assessing the equity impacts of DERs (WA UTC Avista 2022). (See Appendix A for additional information on Washington CEIPs.)

While it is preferable to conduct a system-wide energy equity analysis before conducting a DEA, it is not a prerequisite. Priority populations, equity metrics, data, and analytical tools can be developed and applied within a DEA to assess the equity implications of DER investment options. However, these equity concepts are likely to be more robust and to reflect priority population interests better if they are established in the context of system-wide energy equity. Further, DER investments can only go so far towards solving the numerous energy inequities that might exist in the communities in question. Comprehensive system-wide energy equity analysis, conducted periodically and used to monitor progress over time, is also an essential tool for improving equity for utility customers.

Relationship Between System-Wide Energy Equity Analysis, BCA, and DEA

Figure 4 shows how system-wide energy equity analysis, DEA, and BCA relate to each other in the context of DER investment decisions. The system-wide analysis identifies and addresses all energy inequities across the utility system. The DEA, combined with a BCA, addresses energy inequities related to specific new investments under consideration.

DEA is applicable to more than just utility investments in DERs. DEA is applicable to investments in generation, transmission, and distribution investments, including grid modernization technologies and storm-hardening initiatives. In sum, DEA is appropriate in any situation in which a utility would conduct BCA to determine if an investment or initiative has benefits that exceed costs.[19]

One of the main differences between system-wide analysis and DEA is the actions that each enable. For a system-wide energy equity analysis, these actions might include, for example: (a) siting a power plant in a different location to mitigate environmental justice concerns; (b) investing in renewable resources to help reduce criteria air emissions that affect priority populations; (c) promoting DERs to help enabling priority populations to acquire DERs to reduce their energy bills; (d) improving utility services to priority populations; (e) remediating a coal ash pond; (f) improving rate designs to promote customer equity, such as reducing fixed customer charges; (g) improving shutoff practices to address disparities across different types of customer; improving community resilience for priority populations; (h) improving workforce development for priority populations; and (i) training utility staff on diversity, equity, and inclusion issues.

[19] DEA also can complement other types of economic evaluation, such as least-cost, best-fit.

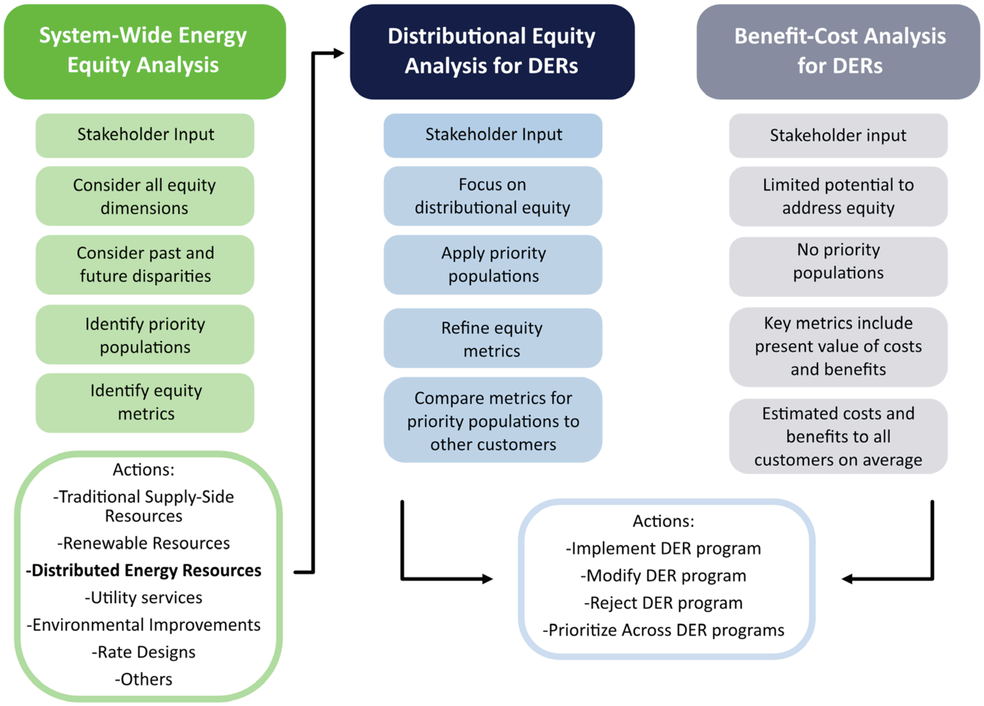

Figure 4. System-Wide Versus Distributional Equity Analysis for Utility DER Investments

DEA, in contrast, leads to actions that are limited to the specific investment being evaluated. For DERs, these actions might include, for example: (a) implementing the proposed DER program; (b) rejecting the proposed DER program; (c) modifying the proposed DER program to make it more equitable and to better serve priority populations; and (d) prioritizing across DER options to identify those that better address equity concerns.

This guide does not address system-wide energy equity analysis in additional detail. The remainder of the document addresses DEA and situations where system-wide analysis and DEA might intersect.

How to Use This Guide

What this Guide Provides

This guide provides step-by-step guidance conducting DEA for DERs. Its primary audience includes BCA practitioners conducting DEA.

The concepts in this guide apply to all types of electric and gas utilities, including vertically integrated and distribution-only, as well as investor-owned, publicly owned, and cooperative utilities. While this guide uses the term "utilities" throughout, the guide also applies to other entities engaged in DER programs. These entities include state energy offices, third-party DER program administrators, DER vendors and contractors, and others.

> This guide focuses on assessing distributional equity because BCA is not well suited for assessing the distribution of costs and benefits across different types of customers.

The guide is intended for jurisdictions that have established energy equity goals, but also is useful for other jurisdictions that want to evaluate the equity impacts of DER programs.

It focuses on assessing distributional equity because BCA is not well suited for assessing the distribution of costs and benefits across different types of customers. The guide does not provide direction for analyzing other important dimensions of equity (recognitional, procedural, and restorative) because these dimensions are not directly related to BCA.[20] Resources for understanding and assessing other dimensions of equity are provided throughout the guide.

Table 1 summarizes what this guide does, and does not, provide.

Table 1. What This Guide Does and Does Not Provide

What this guide provides	What this guide does not provide
Guidance on how to address equity impacts when making decisions about utility investments in DERs	Guidance on how to address system-wide energy equity, i.e., equity associated with all aspects of utility services
Guidance on how to address distributional energy inequities in the context of BCA	Guidance on how to address procedural, recognitional, or restorative equity dimensions
An explanation of why BCA is limited in its ability to assess energy inequities	Guidance on how to address all energy inequities related to BCA
A flexible framework for more informed assessment of energy inequities in the context of BCA	A prescriptive set of requirements that must be followed to address equity in the context of BCA
A step-by-step reference on how to conduct DEA	Specific values or assumptions that can be inputs to DEA
Guidance on how to define and identify priority populations for DEA	Specific recommendations for which customer types should be included in priority populations
Guidance on how to develop equity metrics for DEA	Specific recommendations for which equity metrics should be used for DEA
Examples of state and federal initiatives broadly addressing energy equity	Guidance regarding state and federal initiatives broadly addressing energy equity
Guidance on how to conduct DEA for DERs	Guidance on how to conduct DEA for other types of utility investments

Opportunities for Streamlining Distributional Equity Analysis

Some of the techniques described in this guide can be complex and time-consuming. To increase the accessibility and applicability of the framework there are several options for simplifying the DEA. The simplified version of the DEA still provides valuable information to assess the equity impacts of utility DER investments. Below are some examples of streamlining opportunities, organized by stage.

- Stage 2: Articulating the DEA Context. Start with a relatively narrow DEA application, such as assessing a portfolio of well-established energy efficiency programs where a large amount of data is readily available, instead of a broad DEA that aims to optimize multiple portfolios of different types of DERs.
- Stage 3: Identifying Priority Populations. Rely upon existing indicators, such as those created for environmental justice purposes, or those used in other jurisdictions. Use relatively few indicators that capture the most important energy equity characteristics. Skip the cumulative impact analysis.
- Stage 4: Developing Distributional Equity Metrics. Rely upon existing equity metrics, or those used in other jurisdictions. Use relatively few DEA metrics that capture the most important equity impacts. Rate

[20] Other equity dimensions might have implications for conducting BCA. For instance, BCA should address procedural equity by applying meaningful and inclusive stakeholder processes. (See Chapter 1.) Application of equity concepts to BCA should focus on DEA—how costs and benefits are *distributed* across different customer types.

impacts and DER participation rates are examples of metrics that capture very important equity implications. Minimize the use of overlapping DEA metrics.

- Stage 5: Applying DEA Metrics to Priority Populations and Other Customers. Utilize mapping, screening, and modeling tools that have been established in other jurisdictions.
- Stage 6: Presenting and Interpreting DEA Results. Focus on using the simple results and the benchmarked results. Skip the calculation and application of weighted DEA scores.
- Stage 7: Making Decisions Using Both BCA and DEA Results. Establish clearly defined DEA pass/fail criteria prior to conducting the DEA. Establish other conditions up front that might allow for approval of an investment when either the BCA or the DEA fails.

Streamlining the DEA process might lead to reasonable results for decision-making purposes, but it runs the risk of oversimplifying important issues or omitting important equity considerations. Jurisdictions should be careful to strike the appropriate balance between streamlining the DEA process and conducting a more comprehensive analysis.

Jurisdictions should be careful to strike the appropriate balance between streamlining the process and conducting a comprehensive analysis.

Organization of this Guide

This guide is organized as follows:

- Introduction – Describes the purpose of this guide, the limits of BCA for assessing equity impacts, the role of system-wide energy equity analysis, and an overview of DEA.
- Chapter 1 – Provides an overview of the role of community and stakeholder input in the DEA process, including input from representatives of priority populations.
- Chapter 2 – Describes the importance of articulating how the DEA will be applied and whether it will be applied prospectively or retrospectively.
- Chapter 3 – Describes how to define priority populations, including relevant indicators; how to acquire the pertinent data; and how to conduct cumulative impact analysis to determine priority populations.
- Chapter 4 – Explains development of metrics for DEA, including the role of system-wide energy equity metrics and how to refine those metrics for the purpose of DEA.
- Chapter 5 – Describes how to undertake the critical stage of applying the DEA metrics to priority populations.
- Chapter 6 – Explains how to present and interpret the results of a DEA.
- Chapter 7 – Provides guidance on how to make decisions using monetary, quantitative, and qualitative information from both the DEA and BCA.
- Chapter 8 – Provides a complete list of all the references and resources discussed in this document. Each chapter includes a list of the references and resources used in that chapter.
- Appendix A– Presents a case study of how to conduct a DEA using recent experience in Washington state.
- Appendix B– Provides details on sources and additional materials available for identifying priority populations.
- Appendix C– Provides details on sources and additional materials for establishing DEA metrics.

- Appendix D– Provides details on collecting data and establishing analytical tools, especially for the purpose of applying DEA metrics to priority populations.

The order of these chapters roughly aligns with an appropriate sequence for conducting a DEA. Readers might wish to focus on specific chapters rather than follow a strictly linear process.

Where relevant and available, the report includes examples that illustrate the concepts using actual applications. Each chapter concludes with a list of resources for further reading on the issues covered. The final section of the report is a list of all references used.

Readers interested in guidance on how to conduct a BCA for DERs can refer to the *National Standard Practice Manual (NSPM) for Benefit-Cost Analysis of Distributed Energy Resources* (NSPM 2020).[21] This manual also includes guidance on how to conduct rate, bill, and participation analyses alongside BCA (NSPM 2020, Appendix A).

Readers interested in the methods and assumptions for quantifying the impacts of DERs can refer to the *Methods, Tools, and Resources Handbook for Quantifying Distributed Energy Resource Impacts for Benefit-Cost Analysis* (NESP 2022), a companion document to the NSPM.

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[21] Note that the NSPM for DERs does not address the fact that BCA alone cannot address energy inequities. It focuses on potential energy inequities created by rate impacts but does not address priority populations or the type of energy inequities and practices discussed in this guide.

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1 Establish a Robust Community and Stakeholder Process

1.1 Overview

Robust community and stakeholder engagement is the bedrock of the DEA process. An effective community and stakeholder engagement process involves a diverse cross-section of customers in a given service area that might include urban, rural, tribal, and indigenous communities; representatives or members of priority populations; advocates (e.g., environmental justice, low-income customer consumer) and other interested or concerned parties. It should allow for transparent input and opportunities for dialog throughout the entire DEA process.

This chapter provides an overview of establishing a robust community and stakeholder engagement process as part of conducting a DEA. A companion document, *Engagement Guide for Distributional Equity Analysis* (LBNL 2024)*,* provides additional detail.

The figure below presents an overview of how community and stakeholder engagement fit into the entire process of conducting the DEA.

As used in this guide, the term "community" refers to any people with a shared identity within or across different geographic areas and includes urban, rural, tribal, and indigenous people. "Stakeholder" refers to representatives or members of priority populations, advocates (e.g., environmental justice, low-income customer, consumer) and other interested or concerned parties.

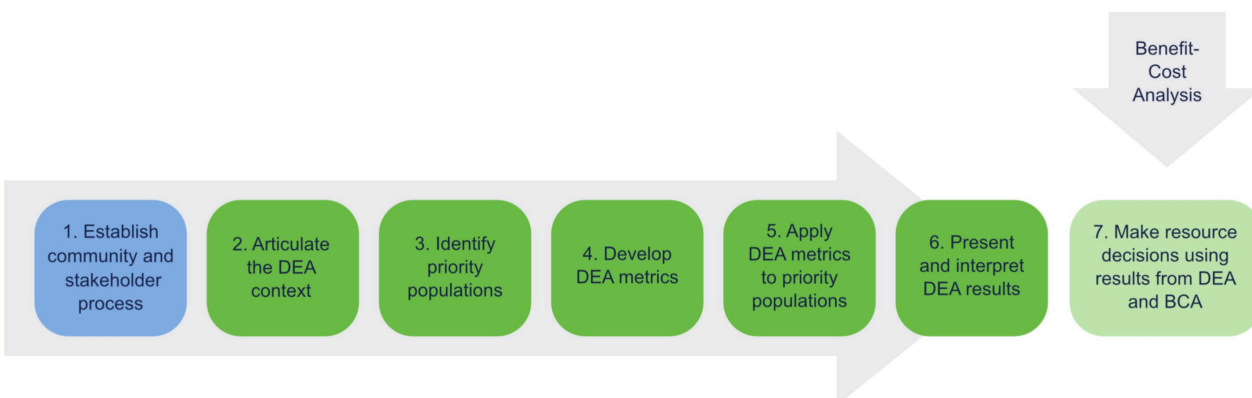

Figure 5. Overview of Community and Stakeholder Involvement Throughout DEA Process

As used in this guide, the term "community" refers to any people with a shared identity within or across different geographic areas and includes urban, rural, tribal, and indigenous people. Communities may be underrepresented in legislative and regulatory practices and hence may not currently be active stakeholders. "Stakeholder" refers to representatives or members of priority populations; advocates (for example, environmental justice, low-income customer, environmental, health, and consumer advocates) and other interested or concerned parties.

1.2 Why Community and Stakeholder Engagement Is Important

All energy resource decision-making processes, including those relying upon DEA, are most effective when supported by open, transparent, and collaborative processes that include meaningful input from communities and stakeholders who will be affected by those decisions. Community members understand the benefits and harms of DERs in their areas and are necessary voices to identify accurate and material metrics for a DEA. A DEA developed with input from priority populations may be more widely accepted and may provide a more durable foundation for future policies. Obtaining input from affected communities throughout the process can build trust and maximize positive impact of initiatives by spreading the word and obtaining buy-in up front. In addition, open collaboration with communities can help ensure that outcomes are aligned with the needs of those most impacted by them (USDN 2019).

Effective utility equity analysis requires open, transparent, and collaborative processes that includes meaningful input from communities and stakeholders representing priority populations.

Historically, communities of color, indigenous people, and rural and low-income communities have been underrepresented in legislative and regulatory practices (LBNL 2021 Advancing Equity). Further, these individuals and communities experience challenges with participating in the development of legislative policies and regulatory decisions. Challenges can include language barriers; lack of awareness of the policy process and information about specific meetings; and unfamiliarity with the terminologies, boundaries, requirements, structures, and regulatory cultures that intervenors must navigate to influence the outcome (NREL 2022) (Synapse 2020).

Many communities and stakeholders face additional barriers, including rigid schedules or limited time to engage in public input processes. For example, people working multiple jobs, lacking access to transportation or childcare, or facing inflexible work schedules might find attendance at public meetings difficult or impossible. In addition, communities and stakeholders might not trust government and utilities (ILLUME 2021) (Synapse 2023).

As a result of these barriers, a jurisdiction's equity practices, policies, and goals might not be well aligned with the lived experience of priority populations. Consequently, regulators, policymakers, and utilities need to pro-actively encourage participation from representatives of priority populations.

1.3 Participants in the Community and Stakeholder Processes

Identifying communities and stakeholders to participate is an important step in a DEA process. The organizer, for example a utility or a third party such as a community-based organization, will need to include a variety of representatives in their outreach, including:

- Urban, rural, tribal, and indigenous communities
- Priority populations
- Environmental advocates
- Low-income customer advocates and consumer advocates

In addition to community members and stakeholders, the organizer may include relevant government agencies, such as the public utility commission, state energy office, and environmental regulators in the DEA engagement process. Utility representatives should also be included in the process if they are not organizing it.

The organizer may choose to include technical experts in the community and stakeholder process as well. For example, consulting firms or academic institutions may have tools, or expertise to create tools, to support geographic or tabular analysis. Facilitators should have experience and expertise working with priority populations and energy inequities.

1.4 Characteristics of Robust Processes for Community and Stakeholder Input

There is extensive literature on strategies to empower community and stakeholder members to drive decision-making. This guide highlights only a few key points, rather than providing step-by-step guidance on creating and running a stakeholder process. Additional resources are provided at the end of this chapter.

Given the barriers that communities and stakeholders may experience to participating in a DEA process, additional effort is needed to engage and accept input. Efforts to engage communities and stakeholders, especially vulnerable populations, need to address the power imbalance that often serves as a barrier to meaningful engagement. Successful community and stakeholder engagement will support, compensate, and seek power-sharing governance to enable meaningful participation.

Equity-oriented community and stakeholder processes and practices are markedly different than utility decision-making processes seen in the United States today. Current and historical community and stakeholder input processes can disenfranchise and discourage public engagement. For example, when historically excluded communities are asked for input on an issue but do not see demonstrated responses to their needs, the process might lead to a lack of trust and an unwillingness to engage in dialog. One option to mitigate this outcome is to provide the communities with a description of how feedback will be incorporated, and if it is not, a description of the reasons why feedback cannot be included.

Effective DEA facilitators will solicit and encourage community and stakeholder input from priority population representatives throughout the process. Further, to build relationships and empower continued participation in energy decisions, facilitators will ensure priority population stakeholders are involved in evaluating, re-evaluating, and reflecting on those decisions and how successful they were. Regulators, policymakers, and utilities can facilitate input and increase priority populations' involvement by taking actions to engage them in ways that build trust, improve transparency, and increase accountability. Although not comprehensive, Table 2 describes some of these actions at a high level.

Table 2. Actions to Facilitate Input and Increase Agency of Priority Populations

Educate	Train decision-making agency staff on culturally competent and responsive communication practices
Engage	Proactively engage community members using door-to-door canvassing, educational events, and outreach through existing community groups
Partner	Partner with organizations that can drive equitable outcomes and have the community's trust
Coordinate	Coordinate efforts, for example, by working with other organizations actively seeking input on related issues to present a single engagement rather than operating competing processes, to maximize the value of communities' and stakeholders' limited available time and resources
Support	Reduce financial barriers to participation in decision-making processes by providing intervenor compensation or other financial or logistical support, such as transportation, childcare, and meals
Communicate	Address communication barriers by providing linguistically and culturally appropriate messages and materials, offering translation services during public meetings, avoiding jargon, ensuring messaging is clear, consistent, and transparent, and communicating about how stakeholder input is used
Schedule	Schedule public meetings for different times, including evenings, near public transportation, and in priority-population neighborhoods, and allow different ways to participate (e.g., in person, written, online)
Respond	Establish a clear and transparent process for responding to and adjusting plans based on the feedback received from communities and stakeholders; summarize feedback received and provide a written summary of how the feedback is or is not incorporated
Assist	Provide capacity-building and technical assistance so stakeholders can participate on equal footing and can understand and use information for their own assessments
Monitor	Work with communities to establish monitoring and accountability systems to identify unintended consequences and to make adjustments if unintended consequences are identified

Sources: (California Climate Investments 2018), (Cadmus Group, 2018), (ILLUME 2021), (IEJ 2019) (Synapse 2021), (Synapse, RAP and CAP 2020).

Conducting community and stakeholder outreach and engagement in a way that builds trust and relationships—for example, by implementing the actions in Table 2—takes time and effort. Funding and human resources must be allocated to these efforts to be successful.

Following is a case study on using equity principles in stakeholder engagement in New York.

Example: Stakeholder Engagement in New York

Background: New York's *Climate Leadership and Community Protection Act* (Climate Act) required that the Department of Environmental Conservation (DEC), in cooperation with the New York State Energy Research & Development Authority (NYSERDA) and the New York Power Authority (NYPA), (1) create a set of criteria to identify disadvantaged communities (DAC), and (2) issue a report identifying both the barriers these communities face in accessing energy resources and opportunities to increase access and community ownership. To accomplish this, NYSERDA enlisted support from ILLUME Advising LLC. (ILLUME) to engage with these communities to gather accurate and actionable information.

ILLUME worked with New York's Climate Justice Working Group (CJWG) to create a set of criteria to identify DACs in New York State. These criteria will guide New York State's Climate Act funding, which broadly aims to reduce the impacts and inequities of climate change through programs and projects to reduce air pollution and GHG emissions, create economic development opportunities, and enable targeted clean energy and energy efficiency investments. ILLUME also conducted community-based research to understand the barriers communities face when addressing climate inequities. This included two major stakeholder engagement efforts: (1) co-creating the DAC criteria, and (2) conducting a series of community-centered listening sessions to understand barriers to clean energy adoption.

Co-creating DAC criteria with Environmental Justice Advocates. ILLUME worked with the CJWG, which included Environmental Justice (EJ) advocates representing New York regions and New York State agency staff, to define DACs. This multi-year process began with listening and learning from EJ advocates about what the term "disadvantaged communities" means to them and their communities. ILLUME then operationalized those descriptions into a set of potential criteria and worked with the CJWG to refine the DAC criteria which would, in turn, guide Climate Act funding.

Community-centered barriers identification: NYSERDA, DEC, NYPA, and ILLUME held eight focus groups with individual community members, community organizations, and community leaders (e.g., business owners). ILLUME worked with study advisors to identify focus group participants and discussion topic areas. The insights from the 65 focus group participants helped crystallize the barriers disadvantaged communities face.

To incorporate existing insights into this study, ILLUME held working group sessions with State Agency staff and reviewed prior research on relevant barriers. ILLUME also held two public hearings—attended by 97 individuals—and solicited community comments through public notice and the Climate Act website. Through these three community-centered engagement efforts, ILLUME identified physical, financial, informational, and program design barriers communities face when trying to access clean energy investments.

Recommendations for engaging communities and stakeholders: This study was grounded in a robust set of community engagement efforts. ILLUME provided recommendations to New York State agencies for how they can continue to engage stakeholders as Climate Act funding rolls out:

(1) New York agencies should ensure processes are inclusive by co-designing programs with communities. Agencies should compensate community organizations to assist with outreach and recruit community partners to further expand collaboration.

(2) New York agencies can address emerging issues by facilitating support among community members during emergencies. By actively engaging with community members, particularly landlords in DACs, State agencies can identify and address barriers quickly.

(3) New York agencies can build trust by engaging in a cycle of continuous engagement with community members—one that starts at program design and continues through program improvement and iteration. By demonstrating that stakeholders' insights are heard and incorporated, agencies can build meaningful and lasting relationships with the communities they serve.

Source: (ILLUME NY 2021)

1.5 Key Junctures for Community and Stakeholder Engagement

Community and stakeholder input from priority populations should directly inform and influence all aspects of a DEA, including assumptions, scope, methodology, and use in decision-making. Including community-based organizations that represent the views of the populations being considered can help define priority populations. Likewise, as described below, the people that DER programs are meant to serve can co-create metrics and decision-making applications.

During some key points in a DEA process, community and stakeholder input will be particularly important.

Concept: Co-Creation of Metrics

Equity-driven decision-making incorporates the input of the people that DER programs are meant to serve throughout the program planning, development, and implementation process. One idea for democratizing energy decision-making is for energy regulators and community stakeholders to co-create the metrics that will be used to develop programs and to assess their performance. Working closely with community stakeholders builds links with the community, which allows for two-way learning and begins to bridge social and equity gaps. (National Committee for Responsive Philanthropy 2014)

Chapter 4 provides more information on the development of metrics.

Table 3 outlines key moments in a DEA process to seek input. The table also shows the stage, action, and section of this guide that readers can consult for further information. The table may not show all points at which community and stakeholder input will be useful or needed.

Table 3. Key Moments in DEA Process for Community and Stakeholder Input

Stage	Action	Guidance Section
Identify priority population	Consider whether and how to enable communities to self-designate as a priority population	3.2
	Choose the set of indicators for the priority population	3.4
	Determine the scope of the priority population	3.6
Develop DEA metrics	Develop a full set of system-wide energy equity metrics	4.2
	Winnow down system-wide energy equity metrics to a set that is more appropriate for DEA	4.3
Apply DEA metrics to priority populations	Incorporate community and stakeholder input on data collection and analytical tools	5.2
	Review and critique data input to the DEA, i.e., ground-truthing	5.3, 5.4
	Protect data privacy and encourage equitable data practices	5.4
Present and interpret DEA results	Develop benchmarks for metrics	6.3
	Determine importance weights for each metric	6.4
Make decisions with BCA and DEA	Define or clarify DEA pass/fail criteria	7.4
	Draw conclusions from both the BCA and DEA results	7.5

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2 Articulate the DEA Context

2.1 Overview

The DEA framework can be applied in a variety of different DER contexts. It is useful to determine up front what questions and scope the analysis should address with the DEA. This will help with the preparation, presentation, and interpretation of analysis results.

Figure 6 shows how articulating the DEA context fits into a DEA process. The bottom section of the figure presents the steps discussed in this chapter.

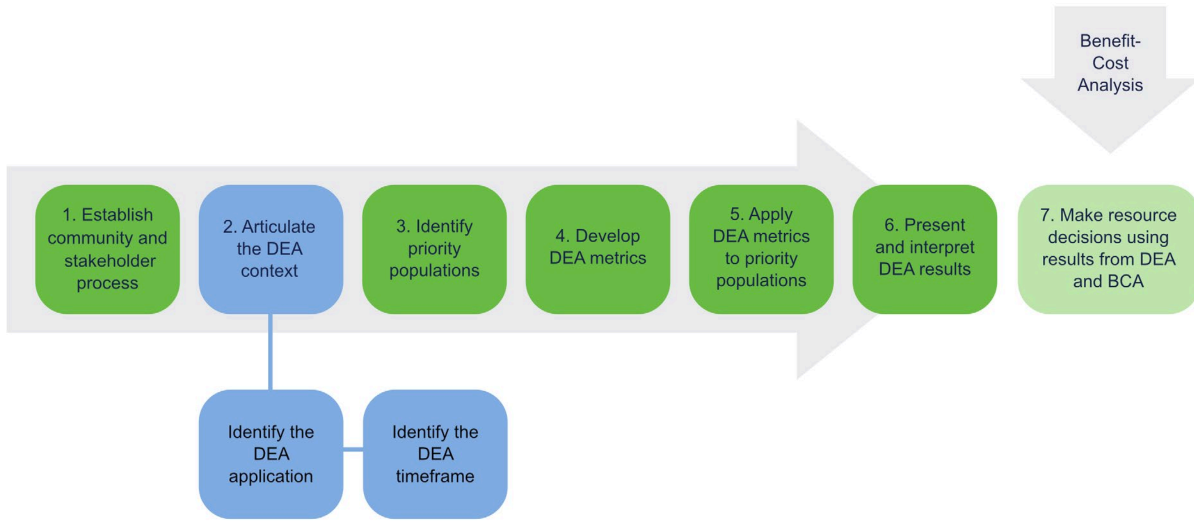

Figure 6. Steps for Articulating the DEA Context

Key terms for this chapter:

- “DEA application” refers to the type of DERs and program scope that are the focus of the DEA.
- “DER portfolio” refers to multiple programs or investments of DERs that may be deployed or managed together.
- “Prospective DEA” refers to a DEA applied before a program or portfolio has been implemented, in the planning, program design, or investment decision stage.
- “Retrospective DEA” refers to a DEA applied after a program or portfolio has been implemented.

2.2 Identify the DEA Application

Determining the DEA application is an important foundation for the DEA process. What decision will the results of the DEA inform? Is the analysis designed to assess the equity of a single DER program, or help decision-makers choose a preferred portfolio made up of multiple programs? Is the DEA examining a DER that has already been implemented or examining whether a planned DER will serve customers equitably?

Table 4 presents several of the most likely applications of DEA for DERs, with examples. In general, the DEA application should be consistent with the BCA application of the DER being evaluated. For example, if a BCA is applied to a portfolio of distributed generation programs, the DEA should be applied to the same portfolio of programs.

The DEA process described in this guide is designed to be flexible to accommodate a range of scenarios. Still, a clear objective is useful for addressing the key decisions and assumptions discussed throughout the document.

Table 4. Potential DEA Applications

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 vs. other distributed generation net-billing programs • *Compare different types of DERs*: energy efficiency vs. distributed generation, distributed generation vs. storage program, demand response vs. 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
Asses multiple portfolios including programs of multiple types of DERs	Portfolio including all types of DER programs (energy efficiency, demand response, distributed generation, batteries, EVs)

Determining the application lays the groundwork for the DEA in several ways. First, the application might affect the scope of the DEA, which might affect the choice of metrics. Second, the application might affect the choice of how to present, interpret, and use the results. Third, the application might affect whether and how to compare the DEA results with the BCA results. For example:

- *Assess a single DER program serving the priority population*. This application would be useful for assessing how well a DER program designed to serve a priority population achieves that goal. One of the most important DEA metrics in this case would be DER program participation, because it indicates how extensively it will serve the priority population and promote equity. For this application, it might not be necessary to use the results of the BCA in combination with the DEA if the jurisdiction has decided that the program should be implemented regardless of the BCA results, as is currently the case in many states for low-income energy efficiency programs.

- *Assess a single DER program serving all types of customers*. This application might be of limited use because assessing a single DER program cannot capture the equity implications of other, related DER programs. For example, assessing the equity impacts of a residential retrofit energy efficiency program cannot account for the equity implications of other residential energy efficiency programs, including those designed to serve priority populations. Nonetheless, this application might be useful in a situation where a utility is offering only a single DER program of a certain type, e.g., a distributed generation net-billing program. In this situation, utilities, regulators, and stakeholders might be most interested in focusing on the rate impacts and participation rate of the program, because the main concern with such programs is their potential to shift costs from participants to non-participants. Estimating rate impacts is the best way to examine the potential for cost-shifting, and estimating participation rates helps to indicate how the cost-shifting is distributed across customer types.

- *Compare across DER programs*. This application might be particularly useful for identifying which DER programs are most effective at addressing equity goals at the lowest cost. In this instance, it might be especially important to consider the results of both the BCA and the DEA. This application might also be useful for prioritizing or optimizing across those DER programs on the basis of equity.

- *Assess a portfolio including programs of the same type of DERs*. This application might be especially useful because assessing a complete portfolio of the same type of DER programs allows for a more holistic assessment of the equity impacts of all the programs combined. This avoids the problem mentioned above, where looking at a single DER program ignores the equity implications of related DER programs.
- *Optimize a portfolio including programs of multiple types of DERs*. This application would be useful for a utility or jurisdiction seeking to prioritize and optimize across all types of DER programs. In this instance, more attention to DER program participation can help ensure that the benefits of all DER programs reach as many customers as possible in priority populations.

The last three applications—comparing across DER programs, assessing a portfolio for a particular type of DER, and optimizing a portfolio of multiple DER types—are likely to be the most useful, and therefore most common, application of DEA for DERs. Each application is useful in different scenarios and should be selected based on the goals for the analysis.

2.3 Determine the DEA Timeframe

The timeframe of the DEA analysis affects what data is available to analyze, what metrics are reasonable to include, and what conclusions and decisions a jurisdiction can make. A DEA could be useful at many points, including initial planning and program design, investment decision-making, interim program tracking, or historical annual reports. Each of these points during a DER's lifecycle can be divided into one of two categories:

- A *retrospective* DEA is an analysis that takes place after a program has been implemented. In this case, data and metrics will ideally be sourced from actual, historical program data.
- A *prospective* DEA is an analysis that takes place before a program has been implemented. In this case, data and metrics will involve more assumptions and will be based on forecasted estimates or proxy data.

In this way DEA is similar to BCA, which can be assessed retrospectively or prospectively. Retrospective BCA uses actual data, while prospective BCA uses projections. However, BCA has a long implementation history that leads to many data advantages with both retrospective and prospective analyses. For example, many utilities have decades of experience tracking participation, savings, costs, and benefits for their ratepayer-funded energy efficiency programs. This data can be directly used to conduct BCA for past programs or create reasonable estimates for future programs. While there is never certainty that a utility will achieve the results shown in prospective BCA, the estimates are typically based on experience.

Conversely, most jurisdictions have little or no history of conducting DEA. Accordingly, regardless of the DEA timeframe, it might be advantageous to review how historical data can inform DEA inputs or align with DEA results, based on definitions of priority populations and the selected equity metrics (see Chapters 3 and 4). Specifically, for retrospective DEA, historical data could be used to calculate the results for each metric. For prospective analysis, historical data could inform reasonable projections, or supply important baseline data. Furthermore, for jurisdictions without a history of conducting DEA or without sufficient historical data, utilities and other analysts should begin tracking or collecting data to inform future DEA. All assumptions and data sources used for retrospective or prospective DEA should be well documented.

It is important that DER programs be monitored and evaluated over time to ensure that the assumptions used in a DEA are as accurate as possible.

It is important that DER programs be monitored and evaluated over time to ensure that the assumptions used in a DEA are as accurate as possible. It is common practice to hire independent evaluation, measurement, and verification experts to review utility energy efficiency programs, including low-income programs. These verification techniques should be expanded to other types of DER programs and should be used to inform future DEA, including both retrospective and prospective DEA.

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3 Identify Priority Populations

3.1 Overview

Presenting results separately for priority populations relative to other customers is a core element of DEA. The identification of priority populations is important for ensuring that the DEA properly accounts for those customers for which equity is a concern. Ideally, each jurisdiction will determine its own priority populations to reflect its equity goals.

Figure 7 presents an overview of how identifying priority projects fits into the DEA process. The bottom section of the figure presents the steps discussed in this chapter. Section 3.7 provides additional sources of information that can help define priority populations.

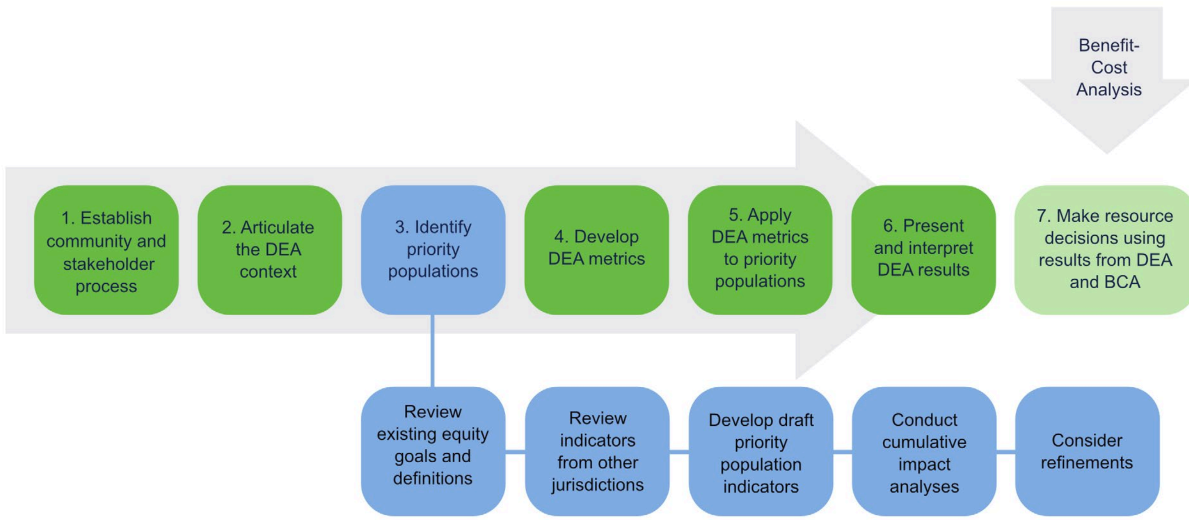

Figure 7. Steps for Identifying Priority Populations

The following steps can be used to identify priority populations:

1. Review any existing goals and definitions of priority populations already in use in the jurisdiction for environmental justice, energy justice, weatherization assistance programs, system-wide energy equity analysis, or other initiatives addressing disadvantaged communities.

2. Review indicators used by other jurisdictions to identify priority populations (see Table 5 for an illustrative list of such indicators).[22]

3. Draft priority population indicators for the priority populations based on input from stakeholders, data availability, existing energy equity policies, and indicators in use in the jurisdiction and in other jurisdictions.

4. Conduct cumulative impact analysis to identify the most highly impacted communities within the jurisdiction. This can be done with methods and tools from other jurisdictions or with new methods and tools to better reflect the jurisdiction's conditions and needs.

[22] Jurisdictions might want to give extra weight to the characteristics used to define priority populations for the Justice40 initiative, to promote consistency with state and federal equity efforts.

5. Consider refinements to priority populations for the purpose of conducting DEA. Key considerations include the number of customers who benefit from actions to improve equity and any incremental costs from those actions that fall on all the other customers.

Key term for this chapter:

- The term "priority population" refers to a set of electric or gas utility customers who typically experience disparities or inequities relative to other customers. Priority populations are those customers who have have borne and continue to bear disproportionate systemic costs and burdens from energy extraction, generation, transmission, distribution, and consumption. Many similar terms can represent this concept: disadvantaged, overburdened, marginalized, underserved, vulnerable, environmental justice communities, frontline communities, and more. This guide uses the term "priority population" to capture all these concepts and to describe the set of customers that will be analyzed separately from the other customers in a DEA.

This guide does not offer prescriptive recommendations for how to define priority populations. Instead, it describes factors to consider when defining priority populations and provides examples of how jurisdictions have defined such populations to date. Each jurisdiction can define priority populations in a way that meets its own equity objectives. The analysis does not have to include all the actions described in this chapter. For example, some DEA exercises might not include cumulative impact analysis due to lack of time and resources. Stakeholder input should be used to help guide decisions on which actions to take or to skip to avoid taking shortcuts that might undermine the trust of certain communities or certain equity goals.

3.2 Review Existing Equity Goals and Priority Populations

Identification of priority populations should be driven by the jurisdiction's equity goals. Equity goals can be established by legislation, executive action, or regulatory initiative. Legislation might set forth goals, or it might identify parameters for a goal and call on regulators to set a more precise goal. In the absence of equity policies or regulations, utilities and stakeholders can propose equity goals.

Equity goals often involve one or more dimensions of equity: distributional, procedural, recognitional, and restorative. Distributional equity goals may identify priority populations, which is directly relevant for this part of conducting a DEA.

Many states have defined equity and corresponding priority populations, but others are still in the process of setting specific goals, defining relevant terms, and identifying priority populations. Some states have more explicit targets and accountability protocols, while others position equity as more of a qualitative or non-binding goal, which may result in lower impact unless strengthened through future interventions or program design (LBNL and PNNL 2023).

In jurisdictions that have already defined priority populations for environmental justice or energy justice purposes, utilities, regulators, and stakeholders might want to review and refine these definitions to ensure that they meet the needs and goals of DEA.

3.3 Review Priority Population Indicators from Other Jurisdictions

A common definition for priority populations is those who are eligible for certain programs that provide benefits to low-income customers, the elderly, or other specific groups. Examples include participants in the Low-Income Home Energy Assistance Program; the Supplemental Nutrition Assistance Program; the Women, Infants, & Children Nutrition Program; the Weatherization Assistance Program; Medicaid; and energy assistance programs. In general, these priority population definitions are useful for conducting DEA.

Priority Population Indicators

Identifying priority populations inherently requires the use of population indicators. These are the customer traits that show which populations are likely to experience some form of inequitable impact. Analysts have used many indicators for this purpose to date. The following sections describe the most frequently used indicators and categories of indicators. The list is not exhaustive.

The descriptions are primarily based on work by the Energy Equity Project (EEP 2022), California Governor's Office of Planning and Research (CA GOPR 2018), and U.S. Council on Environmental Quality, which hosts the Environmental Justice Screening Tool (CEQ website).

The analysis might include other indicators that are especially relevant or important for addressing energy inequities. Further, to encourage consistency with federal initiatives, some analyses might define priority populations consistent with the U.S. Office of Management and Budget's Interim Guidance for Justice40 or agency interpretations of the Interim Guidance (DOE Justice40 website).

Existing Inequities, Institutionalized Racism, or Exclusion

This category of indicators captures customers facing disadvantage or discrimination who "often have lower socioeconomic status, which result in fewer resources for preparing [for], coping [with] and recovering from climate impacts" (CA GOPR 2018, p.6-7). Most jurisdictions with equity goals, policies, or actions identify elements of this category in their definitions of priority populations. For example, every state reviewed in this study considered income and most considered race. Typical indicators include the following:

- *Income*. Includes people with low and low-to-moderate incomes (LMI) relative to the federal poverty level, area median income, or other measures of financial means; might also be defined by eligibility for financial incentives (such as rate assistance or tax benefits) (EEP 2022).
- *Race and Ethnicity*. Includes race or people that identify as non-white and/or list their ethnicity as Hispanic or Latino (EPA 2022); in some cases, these populations also include Muslims and immigrants (EEP 2022).
- *English Language Proficiency*. Refers to people who are not proficient in the English language (CEQ website).
- *Resident of Tribal Lands*. Refers to residents of federally designated tribal lands (CEQ website).
- *Other Household Indicators*. Includes a variety of indicators of people living in the customer's household, such as elderly, youth, people with disabilities, and single parents (EEP 2022).
- *Workforce and Employment*. Includes communities with high unemployment rates, individuals who are unemployed, or individuals who are legacy energy workers (e.g., coal miners).
- *Housing*. Includes communities that have experienced historical underinvestment or redlining[23] or that have high housing costs, a lack of green space, a lack of indoor plumbing, or lead paint (CEQ website); could also include mobile homes and manufactured housing. Some states have different ways of accounting for housing inequities—for example, Connecticut considers housing age in its definition of vulnerable communities, which presumably is meant to be a proxy for poor housing conditions that might create housing inequities (CT DEEP website).
- *Gender and Sexual Orientation*: Includes lesbian, gay, bi-sexual, trans, and queer (LGBTQ+) people (EEP 2022).

[23] The term "redlining" refers to the practice of isolating some neighborhoods based on race, income, or other factors in a way that limits the services or opportunities provided to those neighborhoods. More information on redlining is available from (NCRC 2022).

Population Health

Certain indicators put individuals at a higher risk of health problems from pollution or the impacts of climate change. These individuals include older adults, young children, pregnant women, and people with chronic health conditions or mental illness (CA GOPR 2018). States often identify this category in their definitions of priority populations. Most definitions of priority populations consider that health and other conditions might worsen the impact of environmental exposures.

- *Health Impacts*. Includes communities that have high levels of asthma, diabetes, heart disease, or low life expectancy (CEQ website).

Poor Environmental Conditions, Access to Services, or Living Conditions

Certain populations are at higher risk under a changing climate. These include “those who are uninsured or underinsured or lack access to health care or child care, lack access to transportation, live in areas with poor air quality, live on upper floors of tall buildings, live in areas with lots of impervious surfaces and little tree cover, and lack life-supporting resources such as adequate housing, ways to cool living space, are food insecure or lack adequate medications, or are tenants or renters. Populations at higher risk also include those living in ‘land islands’ that have limited access to resources and services due to conditions of geographic isolation” (CA GOPR 2018, p.6-7). States often identify this category in their definitions of priority populations. Many definitions of priority populations reviewed for this report consider that health and other conditions might worsen the impact of environmental exposures.

- *Climate Change Impacts*. Includes communities expected to experience increased rates of agriculture loss, building loss, population loss, flooding, or wildfires as result of climate change (CEQ website).

- *High Levels of Pollution*. Includes communities that have at least one abandoned mine or are in proximity to hazardous waste facilities, superfund sites, or risk management plan facilities (CEQ website). Other sources of pollution could be included, such as exposure to diesel particulate matter, nitrogen oxides emissions, and wastewater discharges.

Summary of Priority Population Indicators in Use

Table 5 summarizes indicators that several states use to define their own priority populations. For additional information, the National Association of State Energy Officials maintains a list of resources describing how states define priority populations (NASEO website).

Table 5. Priority Population Indicators Used by Some Jurisdictions to Date

	Existing Inequities, Institutionalized Racism, or Exclusion								Health & Environment		
State	Income	Race / Ethnicity	English Language Proficiency	Residents of Tribal Lands	Workforce & Employment	Housing	Gender & Sexual Orientation	Other Household Characteristics	Health Impacts	Climate Change Impacts	High Levels of Pollution
AR	Y	Y	N	N	N	N	N	N	N	N	N
AZ	Y	Y	Y	N	N	N	N	Y	N	N	N
CA	Y	Y	Y	Y	Y	Y	P	P	Y	Y	Y
CO	Y	Y	Y	P	Y	Y	Y	Y	Y	Y	Y
CT	Y	Y	N	P	N	Y	N	N	N	Y	N
DE	Y	N	N	N	Y	Y	N	N	N	N	N
GA	Y	Y	N	N	N	N	N	N	N	N	N
HI	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
IL	Y	Y	P	Y	Y	N	Y	Y	Y	N	Y
MA	Y	Y	Y	P	N	N	N	N	Y	N	Y
MA	Y	Y	Y	P	N	Y	N	N	Y	N	N
MD	Y	Y	N	N	N	N	N	N	Y	P	Y
ME	Y	Y	Y	N	N	N	N	N	N	Y	Y
MI	Y	Y	N	N	N	N	N	N	N	N	N
MN	Y	Y	Y	Y	N	N	N	N	P	N	Y
NJ	Y	Y	Y	P	N	N	N	N	N	N	N
NM	Y	Y	Y	Y	Y	P	Y	Y	Y	P	Y
NV	Y	Y	N	N	N	N	N	N	Y	N	Y
NY	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y
OR	Y	Y	Y	Y	P	P	Y	Y	Y	Y	Y
PA	Y	Y	N	N	N	N	N	N	N	N	N
RI	Y	Y	Y	Y	N	N	Y	Y	N	N	N
TX	Y	Y	N	N	N	N	N	N	N	N	N
VA	Y	Y	Y	Y	N	N	N	N	Y	N	Y
VT	Y	Y	N	N	N	N	N	P	P	P	P
WA	Y	Y	Y	Y	Y	Y	P	P	Y	Y	Y

N= No, Y= Yes, P= Potentially. Other household indicators include age, single parent, and disabilities.

The DOE established indicators to define disadvantaged communities (i.e., priority populations) as part of the Biden Administration's Justice40 initiative. In addition to federally recognized populations, it groups the indicators into four categories: fossil dependence, energy burden, environmental and climate hazards, and socioeconomic vulnerabilities. Table 6 presents the full list of indicators used by DOE for this purpose.

Table 6. DOE Justice40 Priority Population Indicators

Federally Recognized Populations	Fossil Dependence	Energy Burden	Environmental & Climate Hazards	Socioeconomic Vulnerabilities	
Tribes	Coal employment	Energy burden	Cancer risk	>30-minute commute	Less high-school education
	Fossil energy employment	Non-grid connected heating fuel	Climate hazards: loss of life	Disabled population	Uninsured
		Outage duration	Diesel particulates	Food desert	Mobile home
		Outage events	Particulate matter	Homelessness	No vehicle
		Transportation costs	National Priorities List proximity	Housing costs	Access to parks
			Traffic proximity	Incomplete plumbing	Population 65 and older
			Treatment, storage, disposal facility proximity	Internet access	Renters
			Water discharge	Job access	Single parent
			Risk management program facility proximity	Linguistic isolation	Unemployed
			Lead paint	Low income	

Source: (US DOE Justice40 Guidance).

The CEQ Environmental Justice Screening Tool defines environmental justice populations by using several population indicators *plus* an indication of income, defined as at or above the 65th percentile of the federal poverty level.[24] While this DEA guide presents income indicators and other population indicators separately, jurisdictions can choose to combine multiple indicators when defining priority populations. (See Section 3.5 on cumulative impact analysis for more discussion of this topic.)

Jurisdictions can also allow community representatives to *self-designate* their community as a priority population. An example of the process in Illinois is described below.

Self-Designation of Priority Populations - Example

Communities in Illinois can apply for designation as an environmental justice community if they are not identified as environmental justice communities using the standardized framework developed through the state's Long-Term Renewable Resources Procurement Plan. The application for designation can include qualitative factors such as lack of infrastructure, historical events like fires, severe weather events, and economic conditions like local business closings or widespread mortgage foreclosures. The application can also include quantitative factors, such as reports based on citizen science or analysis of data from a database. Materials to guide communities through the self-designation process are available in English and Spanish (IPA and Elevate website).

3.4 Develop Draft Priority Population Indicators

Developing draft priority population indicators is a collaborative process that might use a range of resources and examples. Many jurisdictions have developed equity goals and definitions of "priority populations." That

[24] The CEQ Environmental Justice Screening Tool does not use race/ethnicity as a criterion for identifying disadvantaged communities, but the most recent version provides data on race/ethnicity for informational purposes.

foundation may provide a starting point to draft indicators for priority populations. Some organizations and jurisdictions already have example priority population indicators that may be incorporated.

Analyses can consider recent research findings on energy justice impacts in their definitions and indicators of priority populations. New findings on different populations' experience of energy equity impacts are likely to come to light over time and can be used to refine indicators over time.

Input on priority population indicators should be solicited from the stakeholders, including individuals and organizations that represent likely priority populations. To bolster that process, jurisdictions may want to consider opportunities to enable communities to self-identify as priority populations.

Analysts should check data availability for potential indicators. If data is not available, analysts should consider collecting data to better inform definitions and indicators going forward.

3.5 Conduct Cumulative Impact Analysis to Account for Multiple Indicators

Customers in a priority population do not necessarily face the same equity concerns. For example, some customers might face a high energy burden, while other customers might face inequitable environmental impacts. Further, not all customers within a priority population are subject to the same number, magnitude, or type of equity concerns. For example, some customers experience higher energy burdens than others, while some customers face a high energy burden *and* inequitable environmental impacts. Still other customers might experience high energy burdens and *multiple* inequitable environmental impacts (such as air emissions from a nearby fossil-fired power plant and close proximity to a hazardous waste facility). Environmental justice initiatives have addressed this concept by conducting *cumulative impact analysis* on populations.

The U.S. Environmental Protection Agency defines cumulative impacts as the "totality of exposures to combinations of chemical and non-chemical stressors and their effects on health, well-being, and quality of life outcomes" (EPA 2022, p.4). These impacts might include exposures to multiple stressors over a person's lifetime. Chemical stressors might include waste, pesticide use, or emissions; non-chemical stressors include race and income. Cumulative impacts can be considered at an individual, community, or population level (EPA 2022). Other federal agencies, such as the Centers for Disease Control and Prevention (CDC) and the Council on Environmental Quality, define cumulative impacts similarly.

The U.S. Environmental Protection Agency defines cumulative impacts as the "totality of exposures to combinations of chemical and non-chemical stressors and their effects on health, well-being, and quality of life outcomes."

Cumulative impact analysis creates a score for a population or geographic community that reflects the extent of economic and environmental stressors exposure. The populations or communities that score highest on a cumulative impact analysis represent people facing the greatest combination of identified stressors.

States including Washington, California, Colorado, and New York have undertaken cumulative impacts analysis to determine priority populations in line with their distributional equity goals (WA DOH), (CA OEHHA website), (NY CJWG), (CO DPHE). These states also developed mapping tools to illustrate the location of their priority populations (see Chapter 4).

Cumulative Impact Analysis: US DOE

As a part of the Biden Administration's Justice40 initiative, DOE conducted a cumulative impact analysis to identify the geographic areas (census tracts) that would be considered disadvantaged communities. DOE's working definition of priority populations considers 36 quantitative indicators that indicate burden on a census-tract level (see Table 6).

To conduct its cumulative impacts analysis, DOE identifies the percentile rank of each census tract for each of the 36 burden indicators. These are then added together into a single score for each census tract, with a maximum score of 36. The highest scoring 20 percent of census tracts are considered priority populations (US DOE Justice40 Guidance).

To aid the federal agencies tasked with achieving Justice40's 40 percent benefits goal, the DOE maintains a mapping tool called the Disadvantaged Communities Reporter to illustrate the priority populations identified in its analysis (DOE DCR website).

Cumulative Impact Analysis: California

The California Environmental Protection Agency (CalEPA) and its Office of Environmental Health Hazard Assessment (CA OEHHA) developed CalEnviroScreen, an online mapping tool that identifies the extent to which communities in the state are vulnerable to pollution. The tool applies a cumulative impact analysis to calculate a score that reflects the total burden of a community. The score is based on 21 indicators of environmental and socioeconomic stress that can be categorized within each of four components: exposures, environmental effects, sensitive populations, and socioeconomic factors. The score accounts for both environmental stress and socioeconomic factors, as displayed in Figure 8.

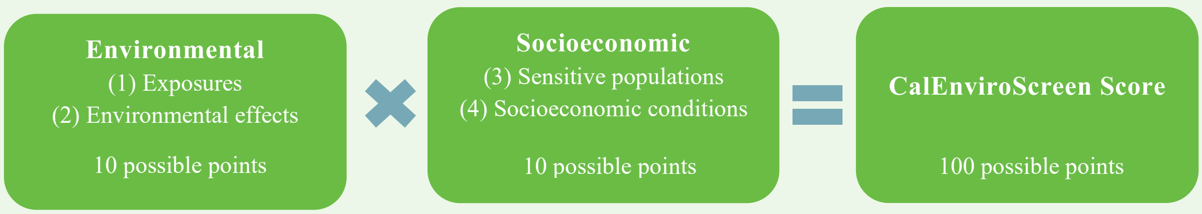

Figure 8. Formula for Calculating CalEnviroScreen Score

The tool uses the following steps to select indicators, calculate rankings, and produce scores for each geographic unit:

1. Identify the 21 indicators for each of the four components.
2. Find sources of data for the 21 indicators of environmental stress.
3. Select and develop the indicators, assigning a value for each geographic unit.
4. Assign a percentile for each indicator for each geographic unit, based on the rank-order of the value.
5. Derive scores for environmental conditions and socioeconomic factors.
6. Derive the overall score by combining the component scores.
7. Generate maps to visualize overall results.

Each of the 21 indicators are reviewed for relevance, importance, representativeness, actionability, and data availability and accuracy at the census tract level (CA OEHHA website).

CalEnviroScreen originated in response to input from a statewide environmental justice working group, which identified the need for a tool to assess cumulative burdens and vulnerabilities in California. Subsequent versions updated the tool with currently available data and incorporated improvements and recommend-dations from residents, stakeholders, and government partners. For the most recent (fourth) version, OEHHA sought public review and input on the draft CalEnviroScreen 4.0 report and mapping tool by convening a webinar and six workshops and taking written comments. CA OEHHA updated the tool and made changes based on public input (CA OEHHA and CEPA 2021).

CalEnviroScreen does not include race within the score; however, CA OEHHA and CalEPA published analysis on how the tool results correlate with race.

3.6 Consider Refinements to Scope of Priority Population

The scope of the priority populations has important implications for all customers. Defining the scope might require making a trade-off between: (a) the number of customers who benefit from actions to improve equity, and (b) any incremental costs from those actions that fall on all the other customers.

Defining the scope of priority populations might require making a trade-off between (a) the number of customers who benefit from decisions to improve equity, and (b) any incremental costs from those decisions that fall on other customers.

On one hand, a broad scope for priority populations that includes customers experiencing many different types of equity concerns could encourage equity initiatives that ultimately reach more customers and address more energy inequities. On the other hand, too broad a scope might lead to affordability concerns for customers, such as moderate-income customers or small businesses, who are not in priority populations but are nonetheless struggling with high energy burdens.

Striking the right balance in this trade-off is an important aspect of identifying priority populations. The jurisdiction's equity and affordability goals can guide this effort, along with input from stakeholders, including representatives of the priority populations (see Chapter 1).

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4 Develop Distributional Equity Analysis Metrics

4.1 Overview

Developing metrics is a core element of DEA, because metrics help determine what aspects of equity will be considered in the analysis. This stage considers a broad list of metrics used for system-wide energy equity analysis and narrows them down to a subset that is appropriate for DEA.

Figure 9 presents an overview of how the metrics development stage fits into the DEA process. The bottom section of the figure presents the steps discussed in this chapter.

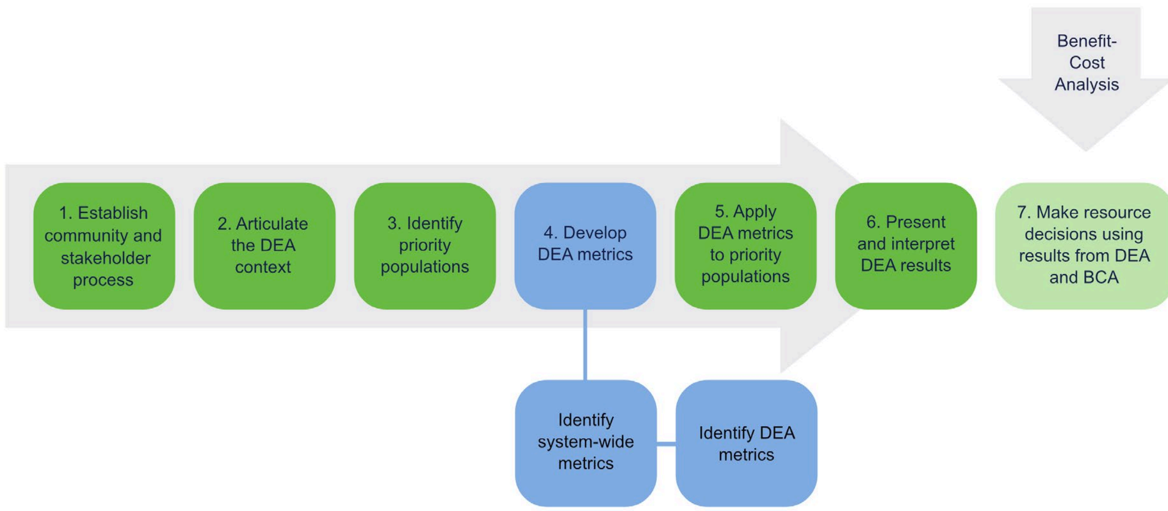

Figure 9. Steps for Developing DEA Metrics

Key terms for this chapter:

- The term "system-wide energy equity metric" refers to a broad range of metrics that can be used to address the full range of energy inequities.
- The term "DEA metric" refers to a narrower subset of metrics used to determine if costs and benefits of a utility program or investment are equitably distributed between priority populations and other customers.

The following steps can be used to develop DEA metrics:

1. *Identify system-wide energy equity metrics.* There are many sources for identifying system-wide energy equity metrics. See Appendix C for system-wide energy equity metrics based on a survey of these sources.
2. *Identify DEA metrics.* Winnow down system-wide energy equity metrics to a set of metrics that are relevant for DEA by checking whether the metrics are distributional, not unduly overlapping, tied to equity goals, and relevant to the DERs being evaluated.

DEA metrics will vary across jurisdictions based on equity goals, priority equity issues, and input from stakeholders, including priority populations.

In developing DEA metrics, it is critical to consider time, complexity, and administrative burden. Using many metrics increases the complexity of DEA, because analysts need to calculate each metric for both the priority populations and all other customers (see Section 5.2). Using many DEA metrics also can make it more difficult to interpret DEA results, especially if some metrics overlap.

Equity metrics might be similar to priority population indicators described in Chapter 3, but their purposes are different: Priority population indicators serve to identify populations, while equity metrics serve to measure impacts of utility conditions and practices. Sometimes, data works for both purposes. For example, energy burden can help both define a priority population and measure how a utility investment might increase or reduce energy burden. Figure 10 presents an illustrative selection of indicators for defining priority populations, metrics for measuring program impacts, and areas of overlap between the two.

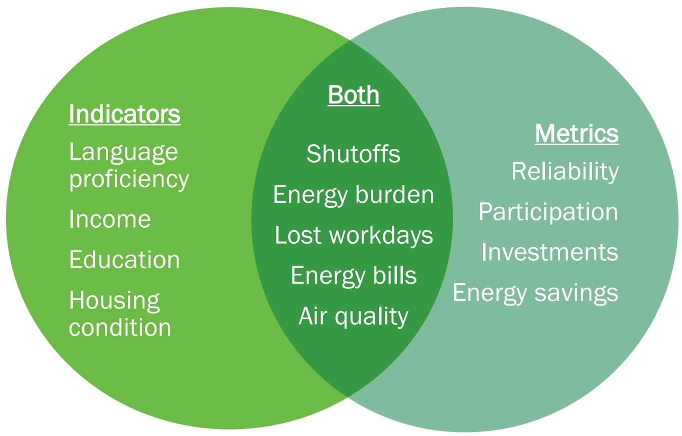

Figure 10. Illustrative Selection of Indicators, Metrics, and Overlap

4.2 Identify System-Wide Energy Equity Metrics

System-Wide Energy Equity Metrics

In recent years, many initiatives have identified *system-wide* energy equity metrics to address all equity dimensions: recognitional, procedural, distributional, and restorative—e.g., (EEP 2022), (PNNL 2022), (PNNL 2021), (CELICA 2018) (see the Introduction). System-wide energy equity metrics may address any type of equity concern that arises on a utility system, regardless of what created the inequity or how it might be resolved by utility actions. Consequently, a long list of potential system-wide energy equity metrics is now available for consideration and use. See Appendix C for examples of the types of system-wide energy equity metrics proposed to date.

Many useful metrics are available for broad, system-wide energy equity assessments. When conducting a DEA, however, it is necessary to develop a narrower list of metrics.

For DEA, it is necessary to develop a narrower list of equity metrics that are relevant to the utility investment being considered in the analysis. Caution must be used when selecting metrics because there might be overlap between some system-wide metrics, which can result in over-counting impacts if they were applied in a DEA. Similarly, thoughtful interpretation of the results is necessary. (See Section 4.3 for discussion of how to refine metrics for DEA.)

Before developing DEA metrics, it may be useful to start with the full range of system-wide metrics—if such system-wide metrics are available—for broad assessments of all energy inequities applicable to a utility or jurisdiction. Table 7 summarizes common system-wide energy equity metric categories and subcategories used by several jurisdictions.[25] (See Appendix C for additional information about system-wide energy equity metrics.)

Table 7. System-Wide Equity Metric Categories and Subcategories Used by Some Jurisdictions

Category	Subcategory	CT	CA	HI	MA	IL	WA
Access	DER program participation	✓	✓	✓	✓		✓
	DER participation rate		✓	✓		✓	✓
Economy	Clean energy jobs	✓	✓				✓
	Small business contracts		✓				
	Workforce development	✓			✓		✓
	Funding and investment	✓	✓	✓	✓	✓	✓
Energy	Energy savings, peak load savings	✓	✓	✓	✓	✓	✓
Affordability	Energy bills		✓	✓		✓	✓
	Energy burden		✓	✓		✓	✓
	Financial hardship			✓			✓
Health	Health and safety abatement		✓				✓
Environment	GHG emissions				✓	✓	✓
Reliability and resilience	Community resilience		✓			✓	✓
Procedural equity and transparency	Data reporting and transparency		✓				
	Supplier or staff diversity	✓				✓	✓
	Customer service					✓	

Sources: (CT DEEP website), (2022-2024 Conservation & Load Management Plan), (California Energy Commission 2018), (Illinois Commerce Commission 2021), (Hawaii PUC 2021), (Hawaii Energy Triennial Plan), (Massachusetts PAs and EEAC 2021), (Avista 2021), (PacifiCorp 2023, CEIP, p. 32), (PSE 2022).

Several states have developed equity metrics, and several states have conducted system-wide equity analyses that include multiple equity metrics. However, few, if any, states have gone through the process recommended here to identify the key metrics that should be used for DEA.

Equity metrics can be in the form of quantitative data—including monetized data—or qualitative data. Not all aspects of equity can be consistently quantified (PNNL 2022). For example, restorative justice metrics might be limited or hard to define and might be best addressed using a set of values or questions, rather than using quantitative metrics (EEP 2022).

[25] Each of these categories and subcategories can include many types and variations of metrics. For example, the metric subcategory for "DER program participation" can include a metric on the number of customers who participate, a metric on the portion of eligible customers who participate, metrics on participation by customer class, metrics on participation by different types of DERs, and more.

Example: Equity Measures Identified by the Energy Equity Project

The Energy Equity Project (EEP) Report assesses 148 potential energy equity metrics at the census tract level and nationally. The authors assessed each metric to identify data status or priority data gaps, quantitative and qualitative data, and best practices. EEP groups these metrics by the four dimensions of energy equity (recognitional, procedural, distributional, and restorative), and 12 sub-dimensions (EEP 2022) (Figure 1).

Regarding distributional equity metrics, the EEP report groups these into three categories: energy affordability, household benefits, and community benefits. The report presents 19 distributional equity metrics, including, for example, energy burden of the priority populations; disparity in DER program savings between priority populations and other customers; improved indoor air quality for priority populations; quality of new jobs created by utility programs that go to priority populations; and climate resilience benefits for priority populations (EEP 2022) (p. 123). Note that while these are referred to as distributional equity metrics, that does not mean that they all need to be used for DEA metrics; it might still be appropriate to narrow them down for the purpose of conducting DEA.

4.3 Identify DEA Metrics

Guidelines for Developing DEA Metrics from System-Wide Energy Equity Metrics

DEA metrics can be developed by starting with a comprehensive list of system-wide energy equity metrics and winnowing them down to a set that is more appropriate for DEA for DERs. Table 8 presents guidelines for assessing whether metrics are appropriate for DEA.

Table 8. Guidelines for Developing DEA Metrics

Guidelines	Description
Distributional	Equity metrics for a DEA should focus on distributional equity impacts. Broad, system-wide energy equity metrics may cover many dimensions of equity (distributional, procedural, recognitional, restorative). DEA is not designed to address all these dimensions.
Discrete	Many metrics might overlap or measure the same impact in different ways. DEA metrics should minimize overlap with each other to avoid double-counting of the same or similar impacts, where possible.
Tied to equity goals	DEA metrics should capture the costs and benefits relevant to a jurisdiction's equity goals.
DER impact	When applying a DEA to DERs, focus on metrics where utility DER investments, or the investments that they defer or avoid, are likely to have an impact.

Source: These guidelines for DEA metrics were developed for this guide.

The guidelines in Table 8 are in addition to generic guidelines for any type of performance metric (specific to equity or not). For example, metrics should be clearly defined: that is, the description of the methodology for quantifying performance metrics, including data definitions and formulas, should leave little ambiguity regarding what data to use, units of measurement, frequency of measurement, and methods used to analyze and report the metrics. Also, wherever possible, metrics should be consistent with national or regional standards and definitions. Performance metrics—both qualitative and quantitative—should be easy for stakeholders to understand and communicate with others. Readily interpreted metrics generally provide stakeholders with a better understanding of metrics and how they change, while metrics that require complex modeling or calculations might be difficult for stakeholders to understand or calculate.

In addition, all metrics should provide a basis for comparison, such as having applicable baselines, relative to past performance or other utility performance, to assess progress towards targets. Metrics can be normalized where reasonable to remove the influence of other factors like weather. Further, they should lend themselves to evaluation and verification wherever possible. Straightforward data collection and analysis techniques improve transparency, enabling regulators and other stakeholders to determine the data's accuracy more easily.

Ideally, performance metrics in general should focus on areas that are sufficiently objective and have minimal exogenous influences (such as macroeconomic shifts), although it may be desirable to include factors with some external influence if they are consistent with the jurisdiction's equity goals. Likewise, all performance metrics and underlying data, whether equity-related or otherwise, should be available, obtainable, and updatable without substantial difficulty if possible. However, data on energy equity might not be currently available, in which case utilities and regulators should establish a process for determining whether and how such data should be collected (e.g., to protect against privacy or data security concerns), (Sandia 2021), (RAP 2017), (Synapse, 2015).

Participation in DER Programs

In general, DER programs that are designed and implemented well will provide significant benefits to participating customers. Energy bill savings is one of the most important benefits of participation, but there are additional benefits of participation such as health and safety benefits, increased comfort, reduced operational and maintenance costs, improved productivity, improved reliability, and more (NSPM 2020). Therefore, identifying the extent to which priority populations participate in DER programs can be an important indication of the benefits experienced by those customers. If DER program participation is used as a DEA metric, it is important to recognize that it might overlap with other DEA metrics, such as energy savings, bill reductions, or reduced energy burden.

However, participation in a DER program by a priority population customer does not guarantee that the customer will experience all the benefits expected from the program. In many cases, there might be structural, institutional, or procedural issues that prevent participation, e.g., customers who live in master-metered, multi-family buildings might not experience the benefits of bill reductions from DERs because those flow to the landlord and not the tenant. As another example, priority population customers might experience disproportionate costs for bringing their building up to code or ensuring electrification readiness, and these costs can reduce or eliminate the savings on energy bills.

Participation in a DER program by a priority population customer does not guarantee that the customer will experience all the benefits expected from the program.

For this reason, it might be preferable to use DEA metrics that reflect the actual impact on DER program participants (e.g., participant energy savings, participant bill savings, improvements in indoor air quality, participant safety benefits). These metrics more directly indicate the actual benefits of participating customers relative to a simpler program participation metric. For example, if a priority population customer lives in a master-metered, multi-family housing unit, and the landlord does not pass the energy bill savings on to that customer in some way, then the bill savings from the DER program should not be attributed to the priority population customer. Therefore, it would be more accurate to use these more direct DEA metrics, in addition to or instead of using program participation as a DEA metric.

Further, it is important that DER programs be monitored and evaluated over time to ensure that the program participants actually experience the benefits assumed in the BCA and the DEA. It is common practice to hire independent evaluation, measurement, and verification experts to review utility energy efficiency programs, including low-income programs. These verification techniques should be expanded to other types of DER programs and should focus especially on the impacts on priority population customers.

GHG Emissions

GHG emissions require special attention when determining DEA metrics. On the one hand, many entities have established goals of decarbonizing the electric and gas sectors in a way that is equitable across all customers. On the other hand, assessing the distributional effects of GHG emissions is challenging, for two main reasons:

First, there is the issue of double-counting GHG emissions in a BCA and in a DEA. The most direct way to assess the GHG impacts of utility DER investments, as well as other utility investments, is to include the full value of GHG emissions in the BCA. This will indicate the extent to which DERs can reduce GHG emissions relative to other utility investments, such as investments in fossil-fueled generators. But this says nothing about the implications of GHG emissions for priority populations.

Second, a DEA metric could be defined to help address the question of how priority populations are affected by climate change. For example, the DEA could include a metric that captures the GHG-driven, weather-related impacts on priority populations. This metric is sometimes included in system-wide energy equity analysis. This metric is a more direct indication of how GHG emissions are likely to affect the utility's customers, and it is possible to identify those priority populations that are more likely to be at risk of GHG-driven, weather-related events due to their geographic location. However, it is very difficult, if not impossible, to isolate the extent to which a utility investment in DERs would change GHG-driven, weather-related impacts of GHG emissions on either priority populations or other customers. Thus, this is not a useful metric for DEA.

Equity impacts of GHG emissions can be accounted for by using a system-wide energy equity assessment combined with a BCA.

Equity impacts of GHG emissions can be accounted for by using a system-wide energy equity assessment combined with a BCA.

- The system-wide energy equity assessment could include multiple GHG metrics such as GHG emissions and GHG-driven, weather-related impacts. The results of this system-wide assessment would indicate the potential extent of the problems caused by GHG emissions for priority populations, without requiring a connection between how a DER could affect those specific problems.
- The BCA could include robust estimates of the monetary values of the GHG emissions from power plants (and avoided by DERs), accounting for both the cost of compliance with GHG regulations and the remaining impacts of those emissions. The BCA could also include a monetary adder to the cost of GHG emissions, perhaps in the form of a proxy multiplier, to reflect the fact that those emissions have a greater burden on priority populations.

Together, these actions will allow utilities, regulators, and other stakeholders to account for equity implications of GHG emissions when assessing utility DER investments without having to estimate the specific impacts of climate change on specific populations as a result of those investments.

Criteria Air Pollutant Emissions

Criteria air pollutant emissions also require special attention when determining DEA metrics. On one hand, criteria air pollutants lead to important public health impacts that are a very important issue for energy equity and environmental justice initiatives. On the other hand, assessing the distributional effects of criteria air pollutant emissions is challenging for two main reasons:

First, there is the issue of double-counting criteria air pollutant emissions in a BCA and in a DEA. The most direct way to assess the criteria air pollutant impacts of utility DER investments, as well as other utility investments, is to include the full value monetary value of those emissions in the BCA. This will indicate the extent to which DERs can reduce those emissions relative to other utility investments, such as investments in fossil-fueled generators. This, however, says nothing about the implications of criteria air pollutant emissions for priority populations. It is possible to use air emission dispersion modeling to estimate how criteria air pollutant emissions from fossil-fueled generators might affect certain geographic areas, including areas where priority populations live. It is, however, very challenging to estimate how a particular DER or set of DERs would likely affect the operation of the specific power plant that creates the emissions that affect the priority populations.

Second, a DEA metric could be defined to help address the question of how priority populations are affected by criteria air pollutant emissions. For example, the DEA could include metrics specifically related to the public health impacts of those emissions, such as changes in the air quality in priority population regions based on air quality monitoring data, changes in the rate of hospital admissions for asthma, or changes in the rate of reported cancers or other health impacts related to criteria air pollutants. However, as noted above, it is very challenging to estimate how a particular DER or set of DERs would likely affect the operation of the specific power plant that creates the emissions that affect the health impacts on the priority populations. Further, there are often multiple sources of criteria air pollutant emissions that could affect all the health impacts, regardless of anything that an electric or gas utility might do. Therefore, these types of metrics might need to be screened out because they do not fit the "DER Impact" guideline in Table 8.

One way to account for the equity impacts of criteria air pollutant health impacts is by using a system-wide energy equity assessment combined with a BCA.

- The system-wide energy equity assessment could include multiple equity metrics such as criteria air pollutant emissions from power plants, the criteria air pollutant emissions that affect priority populations based on dispersion modeling, changes in air quality readings in geographic regions that include priority populations, changes in rates of asthma, cancers, or other health impacts associated with criteria air emissions. The results of this system-wide assessment would indicate the potential extent of the problems caused by pollutant air emissions for priority populations without requiring a connection between how a DER could affect those specific problems.
- The BCA could include robust estimates of the monetary values of the criteria air pollutant emissions from power plants (and avoided by DERs), accounting for both the cost of compliance with criteria air pollutant regulations and the remaining public health impacts of those pollutants. The BCA could also include a monetary adder to the cost of those health impacts, perhaps in the form of a proxy multiplier, to reflect the fact that those pollutants have a greater burden on priority populations.

Some jurisdictions might have already established equity metrics (as indicated in Appendix C) and might be able to skip that step during the initial DEA process. Further, in some cases, analysis might entail developing DEA metrics without first establishing system-wide metrics. In this case, it would still be useful to apply the guidelines described above to ensure that the DEA metrics are designed well and are suitable for DEA. In any case, jurisdictions should plan to periodically review existing metrics and modify them as needed to incorporate new or refined data (e.g., every three years).

Scope of the DEA Metrics Relative to the Scope of the BCA

DEA metrics might be more appropriate to include if the BCA test does not incorporate costs and benefits related to that metric. For example, if a jurisdiction uses a BCA that does not account for public health impacts (e.g., a Utility Cost Test or a Total Resource Cost Test), it may nonetheless choose to include the public health impacts of energy investments on priority populations in its DEA. This would be appropriate if a jurisdiction has clearly articulated that improving the public health of priority populations is an equity goal.

4.4 Example: Applying the Guidelines for Developing DEA Metrics from System-Wide Metrics

Table 9 presents an illustrative list of metrics that could be used for a DEA. These metrics were winnowed down from the list of system-wide energy equity metrics in Appendix C using the guidelines described above.

Table 9. Illustrative Set of DEA Metrics for DERs

Impact Type	Category	Subcategory	Potential DEA Metrics
Utility System	Provision of service	Reliability	Change in number and duration of outages on the utility system [a]
		Shutoffs	Change in number of shutoffs or frequency of shutoffs
Host Customer	Non-energy impacts (NEI)	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 [b]
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: These DEA metrics were developed by starting with the long list of broad, system-wide energy equity metrics presented in Appendix C, and winnowing them down using the guidelines presented above.

[a] *Specific metrics include System Average Interruption Duration Index (SAIDI), System Average Interruption Frequency Index (SAIFI), Customer Average Interruption Duration Index (CAIDI), and Momentary Average Interruption Frequency Index (MAIFI).*

[b] *Specific metrics include Customers Experiencing Multiple Interruptions (CEMI), Customers Experiencing Long Interruption Duration (CELID), and Customers Experiencing Multiple Sustained and Momentary Interruptions (CEMSMI).*

The metrics presented in Table 9 are not the only metrics that might be appropriate for a DEA in a particular jurisdiction. For example, analysis might include a subset of the metrics presented in Table 9, or a broader set of metrics depending upon equity goals and the time and resources available to conduct the analysis. The steps below provide an example rationale for winnowing down system-wide metrics to create the DEA metrics in Table 9. These steps incorporate the guidelines presented in Table 8.

1. Establish equity metrics. This step used the system-wide energy equity metrics presented in Appendix C.

2. Identify distributional equity metrics. Address system-wide energy equity metrics that are poorly suited to a DEA, such as:

    - *Metrics measuring whether utility personnel receive DEI training*. Such requirements will not directly address distributional equity.

    - *Metrics measuring utility diversity*. Metrics measuring the diversity of the utility's employees, contractors, and its suppliers might directly affect procedural or restorative equity, but they do not directly affect distributional equity.

3. Check for DER impact. Examples of system-wide energy equity metrics that might be poorly suited to a DEA include:

   - *Stakeholder access to intervenor funds*. Utility investments in DERs will not affect stakeholder access to intervenor funds.

   - *The magnitude of fixed charges on customer bills*. While the implementation of DERs can help *mitigate* inequities caused by high fixed charges, they do not directly address the *cause* of the high fixed charges. The cause of high fixed charges should be addressed through rate design in rate cases.

4. Check for overlap with DEA metrics. Examples of system-wide energy equity metrics that might be poorly suited to a DEA include:

   - *Energy saved or generated by DERs*. This energy impact can overlap with reduction in energy bills associated with DERs in the program. Reduction in bills is probably more useful than energy impacts because it more directly addresses customer energy burdens.

   - *Criteria air pollutant emissions*. Air emission impacts are a precursor to public health impacts. Public health impacts resulting from air emissions can provide a *direct* indicator of equity concerns for priority populations. Criteria air pollutant emissions provide an *indirect* indicator of equity because air emissions might be dispersed across tens or hundreds of miles to different populations. Therefore, public health impacts could be used as a DEA metric *instead* of criteria air pollutant emissions.

5. Check for overlap with BCA impacts. Examples of system-wide energy equity metrics that might be poorly suited to a DEA include:

   - *GHG emission impacts*. Many jurisdictions now include the monetary value of GHG emissions in BCA.[26] In such cases, there is a risk of double-counting GHG emissions between the BCA and the DEA. Nonetheless, stakeholders might be interested in how the weather-related impacts of GHG emissions (e.g., wildfires, flooding, extreme heat, damage from hurricanes) affect priority populations differently than other customers. It might be appropriate to include GHG-driven, weather-related impacts as a DEA metric, as long as those impacts are not somehow added to the results of the BCA. To do so would result in double-counting. Further, there are other challenges associated with this metric, as described in Step 6 below.

6. Apply standard guidelines for developing utility performance metrics. Examples of equity metrics that might be poorly suited to a DEA include:

   - *Poorly defined or difficult to measure metrics*. For example, GHG-driven, weather-related impacts of GHG emissions could be useful as a DEA metric, but these impacts might be very difficult to measure in the context of a DEA for DERs. While DERs can clearly help reduce GHG emissions, it would be extremely difficult to isolate the extent to which a utility investment in DERs would change GHG-driven, weather-related impacts of GHG emissions on either priority populations or other customers.

   - *Metrics that are not easily comparable or do not have useful baselines*. For example, a metric that measures the total number of participants in a DER program is not as useful as one that measures

[26] It is important to distinguish between: (a) the costs of compliance with GHG requirements and (b) the environmental impacts of GHG emissions, which are also known as environmental externalities. See (NSPM 2020) and (NESP 2022) for a discussion of how to make this important distinction. The discussion here is referring to the environmental impacts of GHG emissions.

the percentage of eligible customers who participate in the program. The latter metric provides much more context for understanding participation.

- *Metrics requiring complex calculations or using data that is not publicly available*. For example, estimating how DERs create jobs in priority populations might not be feasible or might require overly complex analysis and assumptions that undermine confidence in the results. While estimating *total* job impacts of DERs is feasible and can produce reasonable results, identifying exactly *who gets those jobs and where they live* is difficult. Instead, other metrics could be established that are easier to apply to priority populations, such as workforce development, job training, or clean energy apprenticeships.

- *Metrics that measure areas that are not sufficiently objective and free from external influence*. For example, energy burden reflects energy bills and income. Income is affected by a large number of exogenous variables, including international supply chains and macroeconomic policy.

7. Check for consistency with equity goals. After establishing a draft set of DEA metrics, consider whether the set of DEA metrics as a whole addresses key aspects of the jurisdiction's equity goals. For example:

   - If a jurisdiction has a statutory requirement that 40 percent of benefits go to the most disadvantaged groups, then choose metrics to help measure that goal.

   - If a jurisdiction emphasizes affordability but not indoor air pollution, it might choose metrics for energy burden and exclude metrics related to indoor air pollution.

4.5 References and Resources

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5 Apply DEA Metrics to Priority Populations and Other Customers

5.1 Overview

DEA requires developing estimates for each of the DEA metrics, for both the priority population and the other customers. Chapter 3 discusses how to identify priority populations, and Chapter 4 discusses how to identify DEA metrics. This chapter describes how to apply the metric data to priority populations and other customers.

Figure 11 below presents an overview of how this stage fits into the entire process of conducting the DEA. The bottom section of the figure presents the steps discussed in this chapter.

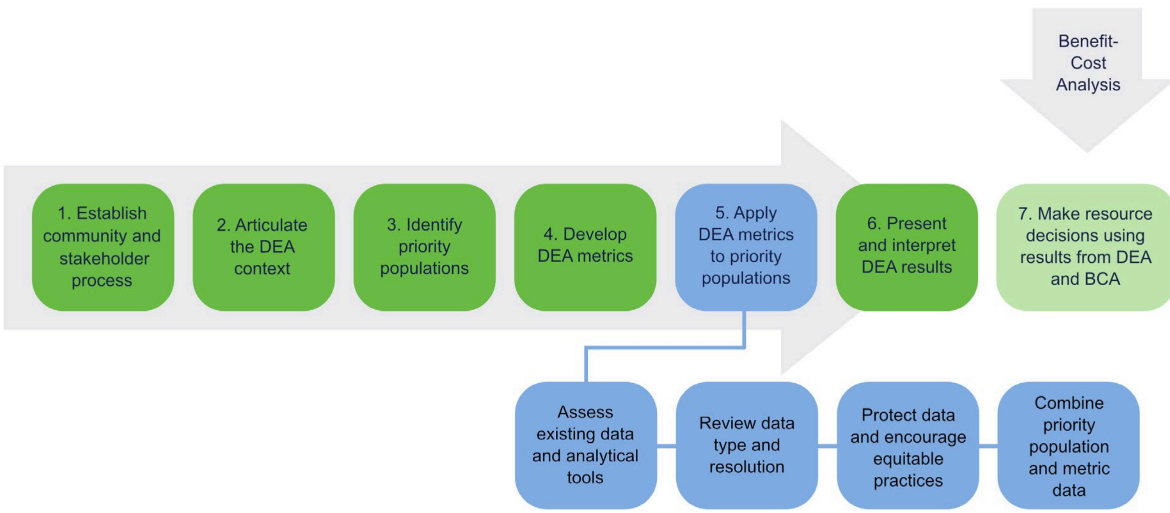

Figure 11. Steps for Collecting Data and Developing Analytical Tools

Key terms for this chapter:

- "Analytical tool" broadly refers to the variety of tools, interfaces, or models that might be used for data analysis or presentation for a DEA.
- "Resolution" refers to the specificity or granularity of the data.
- "Household level" data refers to data associated with a utility account, such as an address, customer information, enrollment data, or billing data.
- "Geographic level" data refers to data associated with a defined geographic area, such as a county, zip code, or census tract.

The following steps can be used to apply the DEA metrics to priority populations and other customers.

1. Assess existing data and analytical tools. Jurisdictions may have access to a wide range of data and analytical tools or may need to collect their own data or develop their own analytical tools in order to proceed with the DEA.
2. Review data type and resolution. Data used in a DEA is generally available at the household level or geographic level. The data type and resolution of the metric and priority population datasets will impact the results of the DEA.

3. Protect data privacy and encourage equitable data practices. Collecting certain sensitive data at the household level can raise customer privacy concerns. Analysts can take actions to protect customer privacy while still ensuring a robust analysis.

4. Combine priority population and metric data. This is the final, crucial step of this stage in the DEA process. After carefully considering data type, resolution, and sources of uncertainty, analysts calculate results for each metric for both population groups: priority populations and other customers.

These steps do not need to be taken in this order. Some steps, such as protecting customer privacy, should be applied throughout this stage of the DEA work.

Appendix D provides more detail and in-depth examples about preparing data and analytical tools.

5.2 Assess Existing Data and Tools

Existing Data

Conducting a DEA requires data identifying priority populations, which is largely demographic and socioeconomic, and metric data measuring impacts on those populations, which is largely based on information available from utilities. This data might be available in many different forms and at different levels of granularity. More discussion of data sources can be found in Appendix D.

Priority population data may be obtained from sources such as:

- U.S. Census Bureau
- American Community Survey
- State or federal programs such as the Supplemental Nutrition Assistance Program (SNAP) or Low-Income Home Energy Assistance Program (LIHEAP)
- Community surveys
- Opt-in questions for program participants
- Records of customers who are medically dependent on electricity or customers who receive energy assistance

Data regarding the impacts of DER programs on priority populations and other customers may be obtained from sources such as:

- Utility billing data, customer account data and addresses, grid infrastructure performance data, DER installations, geographic data
- Government-collected health or environmental data. For example, utility emissions rates might be reported to state environmental agencies, or state agencies might have other relevant environmental or health data available (see Appendix C and Appendix D).

Those who are starting the DEA process for the first time may find it helpful to ask a few questions to help determine their data needs:

- What sources of public data are available?
- What data is currently collected but not published by an organization or utility that could be helpful for a DEA? What data can be purchased or requested for a DEA?

- When was the data last updated?
- How accurately does existing data measure current conditions? Does the data need to be calibrated or adjusted to apply to current conditions? For example, monetary data collected in a previous year may need to be adjusted for inflation.
- What data collection opportunities are available? What resources are available to collect additional data?

Generally, analysts should prioritize using known or recorded data, then move to data from which they can make reasonable estimates. In some cases, if reasonable estimates cannot be calculated, or if the data is not sufficiently accurate for a DEA, it might be best to forego it and start tracking or collecting that data instead. Furthermore, some datasets might require significant scrubbing or corrections to confirm the data and ensure it is in usable formats. More information on data preparation and presentation can be found in Appendix D.

Analytical Tools

Analytical tools are available to facilitate the collection, assessment, and presentation of this data. Table 10 below defines the types of analytical tools that could be relevant in a DEA. This guide uses the term "analytical tool" to broadly refer to the variety of tools, interfaces, or models suitable for data analysis or presentation for a DEA. Examples and further discussion of analytical tools can be found in Appendix D.

Table 10 provides a summary of the types of analytical tools that are useful for DEA. Appendix D provides additional details on the information in this table.

Table 10. Categories of Analytical Tools Relevant to DEA

Tool	Description
Mapping tool	An interactive data visualization platform that displays geographic data.
EJ screening tool	A type of mapping tool that combines environmental, health, socioeconomic, and/or demographic information—overlaid in an interactive mapping format—to assist policymakers, researchers, and communities with decision-making in pursuit of environmental justice (Urban Institute, 2022)
Dashboard	A platform that consolidates information in a central location and presents the data in a transparent and meaningful way. Dashboards are commonly used for utility performance data. A designated website—hosted either by the utility or the commission—provides a useful forum for displaying performance information, ideally through both interactive graphs and downloadable data (Synapse, 2015) (Matheus et al. 2020).
Modeling tool	A software program that creates a dynamic representation or simulation to determine possible impacts of certain factors or decisions based on selected inputs and parameters. Decision-makers use modeling tools for planning and decision-making in setting targets on a range of scales (EPA 2022).

Source: Adapted from (Urban Institute, 2022), (Synapse, 2015), (Matheus et al. 2020), and (EPA 2022).

Utilities, regulators, and stakeholders might want to use existing analytical tools as a data source, input, or output. However, most of the mapping tools and dashboards discussed in this guide do not have the functionality to conduct a DEA on their own. Analysts may utilize a variety of tools or models throughout the DEA process. Alternatively, analysis may entail developing custom tools and models to conduct a DEA. No matter the type of analytical tool or how it will be used in a DEA, analysts should evaluate the tool's accessibility and transparency (See Appendix D). Whether an analyst uses an analytical tool as an input or output of a DEA, it may be helpful to ask a few questions to determine how they will use analytical tools:

- What information or analysis is already available in an existing tool?
- Does the analytical tool act as an input or output for the DEA?
- Who is expected to use or view the analytical tools? Who is the tool designed for?

- How transparent and accessible is the tool, or tool outputs, to the public? How accessible is it to a non-technical audience?
- Does the tool or platform align with standards or requirements for data sharing or publication in the jurisdiction?

5.3 Review Data Type and Resolution

Data Resolution

Both population data and metric data can be collected and presented at varying scales. This guide uses the term "household level" to refer to data associated with a utility account, such as an address, customer information, enrollment data, or billing data. In some situations, analysts could map the data using mapping tools, for example to show the locations of addresses on a map.

In contrast, this guide uses the term "geographic level" to refer to data associated with a defined geographic area, such as a county, zip code, census tract, or census block group. Many types of socioeconomic and demographic data relate to a geographic level; that is, the data represents the characteristics of an area, or it represents an aggregation of data points within an area. Accordingly, geographic-level data might obscure the impact on individual households or businesses. The smaller the geographical area, the better the resolution of the impacts to priority populations.

Household-Level Versus Geographic-Level Data

Geographic analysis approaches, such as GIS models, can be used to combine geographic and non-geographic data, for example to assign demographic data to individual program participants or service areas based on geographic boundaries such as census tracts. Combining these data types requires care. For more information on data types and spatial analysis, see Appendix D.

Household, account, and address are not necessarily synonymous or interchangeable. One account could have multiple households, or one address could have multiple accounts. For example, multifamily apartment complexes might be associated with a single utility account and address but serve multiple households.

Ideally, all data resources for a DEA would be reported and defined at the household level. However, this is unlikely to be the case for many types of priority population and metrics data. Once the priority population is established, the resolution of the data for defining the priority population will usually determine the resolution of the results of the DEA. In other words, even if a jurisdiction has household-level metric data, if the priority population is defined at the census tract, that household-level metric would be aggregated or otherwise summarized at the census-tract level.

Thus, the metrics data must have at least some shared attributes with the priority population data for it to be applied to the correct customer group. For example, if the priority population is identified by census tract, the equity metrics should have some locational information that can be applied to census tracts, such as street addresses. The larger the geographic area, the larger the uncertainty that specific metrics reach priority population customers; thus, high resolution data provides the best chance of capturing the true distributional impacts to priority population customers. See Appendix D for more information on data resolution.

This potential for higher uncertainty due to low data resolution and interoperability is perhaps one of the greatest challenges of preparing a DEA. Analysts can address it in several ways. Each of these options should take advantage of information and input from stakeholders representing priority populations.

- Analysts should first seek to find as much data as possible at the household level. If utilities do not have this data already, they might be able to begin collecting it for future DEA.
- While data privacy and security are important concerns that should be considered (see Section 5.4), it is important to distinguish between those datasets where these concerns matter and those where they do

not. Data privacy and security concerns should not be used as a barrier for collecting or disaggregating data without first thoroughly documenting and justifying those concerns.

- Lower-resolution data could be supplemented by other higher-resolution data. Household-level data might be available from programs serving priority populations, such as the LIHEAP programs. In addition, some customers might be able to self-identify as being eligible for priority population based on surveys by trusted organizations serving priority populations.
- Local community organizations and representatives can help provide guidance on the extent to which specific geographic zones might contain priority populations. For example, they might be able to advise DEA analysts on whether certain geographic zones include a high, medium, or low proportion of customers with characteristics consistent with priority population indicators.

DEA analysts can decide whether reasonable assumptions can be made about how to distribute the metric results among the priority populations and the other customers included within the area. They might also decide whether the distributional equity impacts to each population will be too greatly obscured to even use the metric in question.

Analysts should account for how data type, resolution, and uncertainty will impact the results of the DEA. For some jurisdictions starting the DEA process for the first time, it might be helpful to ask a few questions to help evaluate their data limitations:

- How granular is the data? Are all the data at the same resolution, or different resolutions?
- Are the datasets interoperable?
- What sources of error are present in the data?
- How many assumptions need to be made to estimate the metrics for the priority populations? How reasonable are those assumptions?

5.4 Protect Data Privacy and Encourage Equitable Data Practices

Utility Data Transparency and Privacy

Utilities collect large volumes of customer data, such as bill payment status, household energy usage, and program participation. It is less common for utilities to collect data on race, income, or addresses (A. Drehobl 2021). The collection and analysis of sensitive data such as race, income, education, and health status can help identify disproportionate impacts on vulnerable populations and design interventions to mitigate such impacts. However, the use of sensitive data also raises concerns about privacy, security, and potential misuse that need to be addressed through proper safeguards and regulations. Accordingly, analysts conducting a DEA must take care to protect data privacy.

The data collected by utilities, often through smart meters and smart appliances, includes information on energy consumption patterns, household demographics, and equipment details (McDaniel and McLaughlin, 2009). To collect this data, utilities also use methods such as customer surveys, billing systems, public records, and energy audits (Alsharif et al., 2018). Billing systems, for example, provide information on energy usage and charges, while customer surveys collect demographic information and feedback on services. From these various methods, sensitive data collected can include names, addresses, social security numbers, and financial information, as well as health data, energy usage data, and other types of personal information. Some researchers have argued that high-resolution energy usage information, such as that provided by smart meters, can be used to reconstruct intimate details of a consumer's daily life, and that existing protections for such information might be inadequate (Quinn, 2009). It is important for utilities and other related entities to protect this sensitive data and follow strict data privacy regulations to ensure that customer information is not misused or shared without their consent (Lee et al., 2019).

This protection also extends to third parties. Utilities might share data with third-party organizations such as government, energy service providers, and researchers for various purposes such as research, planning, and policymaking. For example, some jurisdictions may wish to hire an outside or third-party analyst to facilitate or conduct a DEA. As sharing data can also pose privacy risks to consumers, energy utilities and other entities are subject to federal regulations such as the *Privacy Act of 1974* (U.S. DOJ 2022) and the *Cybersecurity Information Sharing Act* (CISA 2015). Some states have laws on data collection and sharing, such as *California's Consumer Privacy Act* (CA DOJ 2023). Regulations like these ensure that data sharing is done in a transparent and secure manner. Analysts should carefully review relevant privacy laws in their jurisdiction when managing data for a DEA.

In collecting and sharing data, data aggregation and masking techniques can be used to protect personal identifiers and prevent re-identification of individuals in publicly available datasets. Data aggregation involves combining data at a higher geographic or other characteristic level. This protects individual customer data while allowing for higher-level utilization of that information. Masked data has been stripped of personal identifiers, such as name, address, social security number, and telephone number. The entity managing the data, such as a utility, can identify a specific customer with a number or code that the utility does not share publicly. Developing strategies for data-masking and aggregation requires a careful balance between data transparency and privacy concerns. By using a combination of aggregation techniques, statistical methods, and careful data analysis, it is possible to provide useful information for a DEA while protecting sensitive personal information.

Equitable Data Practices

Analysts conducting DEA have an important responsibility to ensure that data collection and sharing does not disproportionately and negatively impact certain groups—namely priority populations (Véliz and Grunewald, 2018). In a DEA, equity is a priority—not only as a marker of the distribution of benefits and burdens—but also as a fundamental factor throughout the process of conducting the analysis.

One method of prioritizing equity in this process is to involve the priority populations the DEA seeks to serve by working with locally embedded institutions and organizations. Individuals and communities themselves can take a more active role in the collection, use, and dissemination of data and information, especially their own. This can be through environmental justice advisory councils, public workshops, collaborative partnerships, or even co-creation of a mapping tool with community groups (ERI 2021). See Chapter 1 for more discussion on stakeholder engagement and co-creation.

Table 11 presents principles for promoting data equity. These principles can guide jurisdictions in preparing data for a DEA through all steps of the data lifecycle: planning, collection, access, analysis, and reporting and dissemination (CDC Foundation, 2022). See Appendix D for further resources on data equity.

Table 11. Principles of Data Equity

1	Recognize and define systemic, social, and economic factors that affect individual household outcomes and communities' ability to thrive.
2	Use equity-mindedness as the guide for language and action in a continual process of learning, disaggregating data, and questioning assumptions about relevance and effectiveness.
3	Proactively include participants from the communities of interest in research and program design to allow for cultural modifications to standard data collection tools, analysis, and sharing.
4	Collaborate with agencies and the community to generate a shared data development agenda ensuring a plan for data completeness, access, and prioritized use to answer high-interest questions.
5	Facilitate data sovereignty by paving the way for communities to govern the collection, ownership, dissemination, and application of their own data.

Source: Adapted from (CDC Foundation, 2022).

5.5 Combine Priority Population and Metric Data

Preparing a DEA requires combining the information from two distinct datasets, priority population data and equity metrics data, to allow calculating the impacts of each DEA metric on the priority populations. As described above, these datasets typically come from different sources and are in different formats, creating opportunities and challenges when using them in a single analysis.

Figure 12 illustrates differences in the source and resolution of data for priority populations and DEA metrics, and the process for combining the datasets.

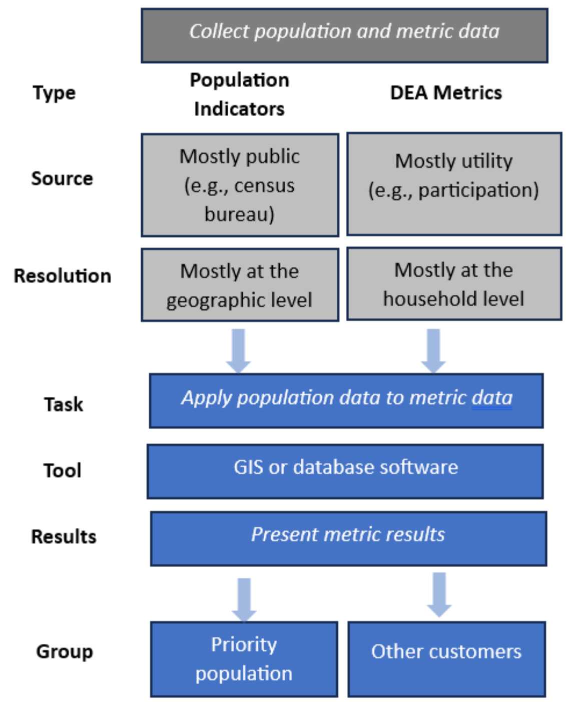

Figure 12. Process for Calculating DEA Metrics for Priority Populations and Other Customers

Once the priority population and metric data has been collected and reviewed, analysts can begin the key task of combining the population and metric data to calculate results. As defined previously, the two broad data types in a DEA are household-level and geographic-level data. Thus, it is likely that priority population indicators and DEA metric data will need to be combined in one of four ways, described below from most simple to most complicated, and summarized in Table 12.

Case 1. Both datasets are at the household level. In this case, the results provide a high level of resolution and the greatest precision. There is less uncertainty in the accuracy of the results, and more specific conclusions are possible. Since both datasets contain household data, the analysis could most likely take place entirely in a spreadsheet. Working with household-level data requires special consideration to issues of confidentiality and privacy.

Case 2. Both datasets are at the geographic level. In this case, a modeling tool such as GIS can help align the two datasets. Ideally, both geographic areas are at the same resolution, i.e., both are reportable by census tract, by census block group, or by census block (see Appendix D). Having datasets at different resolutions will require assumptions about the distribution of impacts across populations. The analysis should use the highest level of resolution available for both datasets. The results will have some uncertainty and a loss of precision since specific impacts cannot be identified at the household level. The primary challenge with this case is the resolution and interoperability of geographic data.

Case 3. Priority population data is at the geographic level and metric data is at the household level (the most common situation). If equity metrics data is available by address, it may be plotted geographically, and the datasets can be merged using GIS. The analysis should use the geographic data for the priority population that provides the highest level of resolution (e.g., census tract or block group rather than county). The results will have some uncertainty and loss of precision since analysts cannot identify whether specific households experiencing impacts are members of the priority population. The primary challenge with this case is data resolution and uncertainty.

Case 4. Priority population is at the household level and metric data is at the geographic level. In this case, the usefulness of the analysis will vary and the conclusions that can be drawn will depend on the specific metric. For example, some metrics might be consistent across every household within a certain geographic area, including:

- access to the same public EV charging infrastructure
- outdoor air quality, depending upon the type of air emissions, the dispersion of air emissions, and the characteristics of the geographic region
- equal risk of climate-change-related events

In these instances, metrics can be mapped to specific households within the priority population. However, in some instances, metrics are originally household-specific but are reported at an aggregated geographic level for privacy or other reasons. An example of less granular, geographic-level data sourced from aggregated household-specific metrics are as follows:

- Census tract A experiences three shutoffs per year: data identifying individual utility customers experiencing shutoffs is aggregated and reported annually at the census tract level.
- Census tract A had a 5 percent increase in asthma-related hospital visits: data identifying the number of individual asthma-related hospital visits each year is aggregated at the census tract level to calculate a metric showing the percent increase.

It might not be feasible to disaggregate these types of metrics to the household level. Analysts should exercise caution in making assumptions that distribute geographic-level metrics to particular households. A potential solution is to calculate an average per-household metric by dividing the number of customers within the geographic boundary. However, this adds a new source of uncertainty because it requires the analyst to make assumptions about how metric impacts are distributed across households. While the resolution of the results can be at the household level, the results in this case are less precise and have greater uncertainty.

Table 12. Considerations and Examples of Data Format Combinations

Case	Priority Population Data Format	DEA Metric Data Format	Considerations	Examples and Conclusions
1	Household level	Household level	Specific metrics can be mapped to specific customers at a high resolution.	DEA metric: Customer shutoffs for non-payment DEA metric data: By address Priority population data: By address Resolution: Household level. This is ideal. Analysis: Link the customer shutoff addresses directly to the priority population addresses. Conclusion: All priority population customers experience a decrease in shutoffs equal to "X." Precision: High, because the resolution is at the household level, which is the most detailed level.
2	Geographic level	Geographic level	Metrics can be mapped to geographic areas, such as census tracts, but not for individual customers. Users should exercise caution if geographic scales differ between the priority population and the metrics datasets.	DEA metric: Reliability DEA metric data: By electricity circuit Priority population data: By census tract Resolution: Electricity-circuit level Analysis: Link the street addresses for each circuit to the census tracts. Conclusion: Census tracts identified as priority populations experienced a reliability change equal to "X." The reliability impact for an individual priority population household will depend upon the proportion of priority population customers within the census tract and the distribution of reliability incidents within that census tract. Precision: Medium.
3	Geographic-level	Household-level	Metrics can be mapped to geographic areas, such as census tracts, but not for individual customers.	DEA metric: DER participation rates DEA metric data: By address Priority population data: By census tract Resolution: Census tract Analysis: Link the street address for each participant to the street addresses within the census tract. Conclusion: Census tracts defined as priority population communities have a participation rate for this DER program equal to "X" percent of all eligible customers in that census tract. This number might be higher or lower depending upon the proportion of priority population customers within the census tract. Precision: Medium.
4	Household level	Geographic level	Metrics that are consistent across the reported geographic area (e.g., access to infrastructure, tailpipe emissions) can be mapped to specific customers. Users should exercise caution and account for uncertainty if a metric is household-specific (e.g., power outages), but is reported at a geographic level.	DEA metric: Reliability DEA metric data: By zip code Priority population data: By household Resolution: By household Analysis: Link the street address for each household to the street addresses within the zip code. Conclusion: On average, priority population households experience "X" reliability outages. This number is an average of zip code-level outage incidents; an individual household might experience outages that are different from this. Precision: Low, because the metric is not identified at the household level and could therefore have a large variation within a single zip code.

In each of these four cases, the process of combining datasets culminates in two results for each metric: one for the priority population, and one for other customers. These two outputs are the simple results of the study and are discussed more in the following chapter.

Illustrative DEA Example: Apply Equity Metrics to Priority Populations and Other Customers

This illustration is based on Case 3 above, where the priority population information is available by census tract (at the geographic level) while the metric data is available from the utility (at the household level). This example illustrates how the analyst could calculate energy efficiency program participation; a similar approach could be used for the remaining metrics.

- First, the analyst uses a GIS-based modeling tool to indicate all the census tracts within the utility service territory that qualify as priority populations.
- Second, the analyst uses a GIS-based modeling tool to locate addresses of participating customers within census tracts in the utility service territory.
- Third, the analyst calculates a participation rate for each census tract based on the percentage of customers in that census tract participating in the energy efficiency program.

The census-tract-level participation rates are aggregated by priority population tracts and other tracts. This gives a result that represents the percent participation of utility customers in census tracts identified as priority populations. The analyst notes the uncertainty in the results of determining whether individual households that meet the priority population criteria participate in the energy efficiency program.

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6 Present and Interpret DEA Results

6.1 Overview

DEA metrics can be presented using a variety of values and units of measurement that are often not in monetary terms. Consequently, presenting and interpreting the DEA results requires clearly articulating the results for each metric and putting these metrics in context using benchmarks. Analysts can take an additional step and use multi-attribute analysis (MAA) techniques to create weighted scores for the DEA results, which allows for aggregating the results across all the metrics and creating a net DEA score for priority populations and for other customers. Section 6.5 presents an example that walks through each of these steps.

Figure 13 presents an overview of how this stage fits into the entire process of conducting the DEA. The bottom section of the figure presents the steps discussed in this chapter.

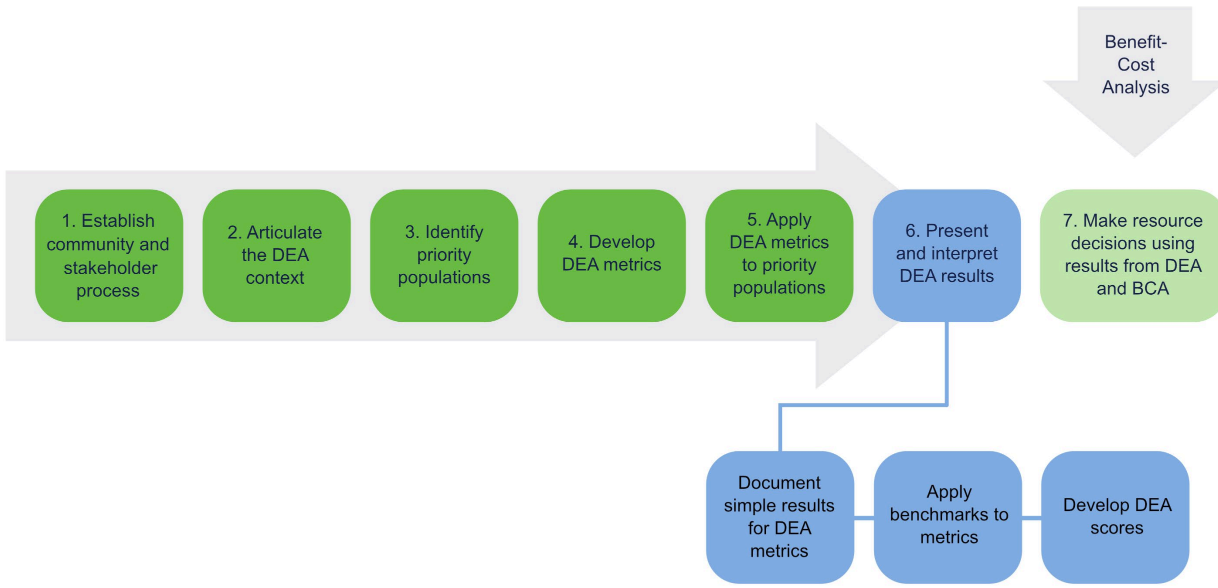

Figure 13. Steps for Preparing the DEA

Key terms for this chapter:

- "Simple results" are the unadjusted results for each metric, presented separately for priority populations and other customers.
- "Benchmarked results" are simple results for each metric presented alongside metric-specific benchmarks that provide additional context for assessing equity.
- "Multi-attribute analysis" is a decision-making technique useful for choosing between alternatives based on results presented with multiple and incongruous metrics, such as weighting metrics by importance. MAA frameworks help decision-makers find the preferred option using scores and weights for each metric.
- "Unweighted DEA scores" are the percent change between the metric result and its benchmark, framing each metric based on its result relative to a benchmark.

- "Weighted DEA scores" result from applying MAA techniques to benchmarked metrics to allow for comparison and aggregation across different metrics.

The following steps can be used to present and interpret DEA results:

1. Document simple results for DEA metrics. The unadjusted results for each metric and customer group provide a transparent way to consider each metric in isolation.

2. Apply benchmarks to DEA metrics. Benchmarks based on identified goals for each metric provide additional data points when considered with the simple results to determine if the intervention had equitable or inequitable outcomes. Benchmarks also form the basis for developing DEA scores.

3. Develop DEA scores using MAA and benchmarks for each DEA metric. MAA can be used to normalize the simple results to a common scale such that the metric results can be aggregated and analyzed together. This step includes four sub-steps: (a) remove duplicate metrics, (b) calculate unweighted DEA scores, (c) assign importance weights to metrics, and (d) calculate weighted DEA scores.

The final section of this chapter includes an example that applies each step described herein to an illustrative energy efficiency portfolio.

Table 13 presents the advantages and limitations of the three options for presenting the DEA results. In many cases, analysis can show all three types of results to obviate the limitations associated with each. In other cases, decision-makers may have enough information from the simple results or the benchmarked results to draw conclusions about equity, thereby avoiding the need to calculate weighted DEA scores. If weighted DEA scores are calculated, it would nonetheless be useful and transparent to also report simple results and benchmarked results.

Table 13. Applicability of DEA Results

Results type	Description	Advantages	Limitations
Simple results (Section 6.2)	Includes unadjusted results for each DEA metric separately for priority population and other customers.	This format is simple, transparent, and does not require policy-based assumptions.	Results for different metrics cannot be compared to each other or aggregated for populations. It may be difficult to draw conclusions about the total equity impact.
Benchmarked results (Section 6.3)	Includes simple results for each metric alongside metric-specific benchmarks.	This format provides additional context for the simple results, allowing analysts to draw equity conclusions for each DEA metric in isolation.	The benchmarks may be interpreted as goals which impact the objectivity of the results. Results for different metrics cannot be compared to each other or aggregated for populations.
Weighted DEA scores (Section 6.4)	Applies MAA techniques, including importance weights, to benchmarked metrics to calculate DEA scores. Weighted scores for each DEA metric can be aggregated to present net scores for priority population and other customers.	This format allows for comparison across different metrics. It also allows for net DEA scores to be calculated for each population. This format provides the most context for overarching conclusions.	This format requires the most policy decisions and assumptions, which can significantly impact the objectivity of the results. If not applied properly and transparently, it can result in misinterpretation of the DEA results.

6.2 Document Simple Results for DEA Metrics

When documenting "simple results," the DEA results are displayed using the measurement units that correspond with the individual metric (e.g., the DER program participation rate appears in terms of percentage of eligible customers who participate in the program). In many cases, the units will be inconsistent across metrics.

This guide uses the term "simple results" to convey that the results have not been compared to benchmarks and have not been converted into any kind of score. Documenting simple results in an unadjusted format can provide valuable insight. The unadjusted results present straightforward data that might be sufficient for decision-making depending on the application of the DEA. For example, the DEA stakeholders might have previously determined that a program must have greater participation rates for the priority population than other customers to achieve their equity goals, creating a go/no-go threshold. If the participation rates for the priority population are lower than the other customers, the stakeholders might choose not to proceed with the rest of the analysis.

DEA metrics might have overlapping definitions or represent duplicative impacts. For example, stakeholders might have chosen both the change in bills and the change in energy burden as key equity metrics. These two metrics are both driven by the change in bills (energy burden is calculated as customer energy bills divided by customer income), which means they are both capturing the change in bills. When displayed as simple results, any overlap between metrics is relatively unimportant because the metrics are not being added together, and it may be useful to consider multiple DEA metrics for one DER program. For example, energy bills are a useful metric for understanding energy cost savings, regardless of the characteristics of the participant or program type; while energy burden is a useful metric that shows the effects of energy cost savings in a way that particularly matters for low-income customers. Nonetheless, analysts will want to articulate any overlap in DEA metrics like this when documenting the simple results, because to ignore the overlap might result in overstatement of the variable affected by the DER (in the example here this would mean overemphasis of the DER participant bill savings).

When displayed as simple results, any overlap between metrics is relatively unimportant. Nonetheless, analysts will want to articulate any overlap in DEA metrics when presenting the simple results to avoid overstating some impacts.

The simple results are more likely to provide valuable insight for simple DER applications rather than complex DER applications. In a complex DER application, such as comparing across DERs or DER portfolios, there could be numerous metrics and DER alternatives—each with results for the priority population and other customers. In these situations, unless the equity goals are clearly defined, decision-makers might need to move on to a more comprehensive analysis.

6.3 Apply Benchmarks to DEA Metrics

After documenting simple results, it can be helpful to provide additional context for each metric. Benchmarks can be used to draw more informed conclusions from the DEA than simple results. Benchmarks are a set of policy standards or goals by which success can be measured. Benchmarks come in many forms and can range from floors below which an outcome cannot go, to target objectives, to aspirational goals, and to caps above which an outcome cannot go. Benchmarks compare the performance of a program, portfolio, or investment to an ideal outcome, modeled simulation, or standard (DOE 2023 Benchmarking).

Benchmarks can be presented alongside the simple results to provide context. These reference points can help communities and stakeholders understand and interpret the results, even if the metrics are unfamiliar or are in different measurement units.

Examples of benchmarks that might be useful for evaluating DERs include:

- Targets for DER program participation rates for priority populations
- Caps or targets for reasonable or acceptable rate impacts
- Targets for reducing the energy burden on priority populations
- Targets or caps for the number of shutoffs for priority populations
- Targets for reducing public health impacts of electricity or gas production, transmission, distribution, or consumption
- Targets for reliability improvements

Benchmarks can be presented alongside the simple results to provide context. These reference points can help communities and stakeholders understand and interpret the results.

Ideally, benchmarks will predate this step in the analysis. In some cases, communities and stakeholders may need to establish them during this step. To propose and establish benchmarks, communities and stakeholders may use goals articulated in relevant statutes, commission orders, or other government agency directives. Benchmarks can also be based on national policies such as the Biden Administration's Justice40 initiative. In some cases, the community and stakeholders might select goals that are more ambitious than criteria that would cause the DEA to fail. Additionally, metric benchmarks do not have to be the same for both populations. For example, if communities and stakeholders determine a proposed DER has to serve both customer groups at least as well as a historical DER, each customer group could have a distinct benchmark for each metric.

To ensure transparency, analysts may present the sources or rationale for each benchmark applied to each metric. Given the variety of DEA metrics, both in scope and units of measurement, interpreting the results of benchmarking requires thoughtfulness. In some cases, exceeding a benchmark might be a desirable outcome (e.g., the DER participation benchmark was to serve at least 5,000 program participants but the program actually served 6,000 participants). In other cases, exceeding a benchmark might be an undesirable outcome (e.g., the rate impact benchmark was a cap on rate increases of 2 percent or less but the program increased rates by 2.5 percent). The DEA analyst should clearly note whether exceeding the benchmark is a good or a bad outcome to support proper interpretation of the results and avoid drawing incorrect conclusions.

In some instances, presenting the simple results alongside the benchmarks might be a reasonable final step in the DEA. For example, if a DER program exceeds all the benchmarks for all metrics, these results might be sufficient for decision-making. Other situations might require additional analysis. For example, if one metric is projected to have a desirable equity impact while another would have an undesirable equity impact, it will be difficult to determine whether equity is improved or worsened overall. In these situations, analysts can prepare and present the results in a way that normalizes the metrics using DEA scores, thus allowing for an assessment of how *all the metrics combined* affect equity.

6.4 Develop DEA Scores Based on Benchmarks Using Multi-Attribute Analysis

After documenting simple results and applying benchmarks, some jurisdictions might wish to evaluate the net equity implication for each population. One option is to conduct a MAA—a decision-making technique useful for choosing between alternatives based on results presented with multiple and incongruous metrics. Metrics used to evaluate equity could use different scales, represent different perspectives, or be both quantitative and qualitative. For example, one DER program might reduce energy burden by 5 percent for participants and provide 100 people with resiliency during an outage, while another DER program might reduce energy burden by 20 percent for participants but not provide any resiliency benefits. These results are not easily comparable because one alternative succeeds in one metric (resiliency benefits) while the other alternative succeeds in a different metric (energy burden). These criteria are in different measurement units, have different baselines, and serve different functions. MAA frameworks help decision-makers find the preferred option using scores and weights for each metric. Numerous MAA frameworks are available for this purpose; this guidance document suggests an approach that maximizes transparency and simplicity.

MAA translates metrics using different measurement units (such as monetary units or percentages) to one uniform scale. This guidance document suggests an approach where the uniform scale represents a percent deviation from the benchmark for each metric. This deviates from a traditional MAA approach in which the simple results are normalized on a scale of 0 to 1, where 0 represents the minimum impact and 1 represents the maximum impact. The choice of maximum and minimum values significantly affects the DEA scores and can lead to misinterpretation of the results or even manipulation of the analysis.

MAA is a decision-making technique useful for choosing between alternatives based on results presented with multiple and incongruous metrics.

This alternate approach using benchmarks is recommended because maximum and minimum potential impacts are difficult to establish for many DEA metrics in their simple form. Using benchmarks puts the metric in context against equity goals, makes it easier to interpret the results, and if appropriately documented provides a scale that is transparent and easy to understand.

MAA techniques enable a quantitative comparison of DEA metrics that are not in monetary terms or even in the same measurement units.[27] The scores indicate the performance of each metric relative to the benchmarks established in prior steps, allowing for numerical comparisons across metrics.

The MAA recommended in this guidance document includes the following steps: remove duplicative metrics, calculate unweighted DEA scores, assign importance weights to metrics, and calculate weighted DEA scores. These steps are described in detail below.

Remove Overlapping DEA Metrics

Chapter 4 provides guidance on how to develop DEA metrics by starting with a broad range of system-wide energy equity metrics and narrowing them to those that are most relevant and appropriate for DEA. One of the criteria for narrowing down the metrics is to remove metrics that are duplicative or overlapping. An analysis might, nonetheless, include some metrics for the DEA that overlap. For example, analysis results might present both the impact on bills and the impact on energy burden for priority populations—even though a change in customer energy costs will affect both energy bills and energy burden. Both metrics can offer value because they put the same impact into different contexts.

When presenting the simple or benchmarked DEA results there is little concern about overlap as long as it is recognized and accounted for when interpreting the results. The simple DEA and benchmarked DEA results are not added together, so any overlapping effects are also not added together. This reduces the risk of overstating the implications of overlapping metrics.

In contrast, overlap between metrics matters when conducting MAA because it combines all the DEA metrics into a single score. If multiple metrics are used to capture what is essentially the same effect, there is a risk of double-counting or giving undue weight to that one effect. For example, if an MAA includes a DEA metric for customer bills and a separate DEA metric for customer energy burden, then the impact of increased or decreased customer costs would be accounted for twice in the MAA, which would overstate this impact in the DEA score.

It is appropriate to *consider* overlapping metric results together, acknowledging that they overlap, but it is not appropriate to *add* them together in any kind of a scoring system.

This step of removing overlapping DEA metrics requires careful consideration. In general, metrics that are sensitive to the same variable can be pared down to a single metric. Consider three potential metrics for a DEA: energy rates, non-participant bills, and non-participant energy burden. The non-participant energy bills calculation is energy rates multiplied by customer energy consumption. The non-participant energy burden

[27] MAA is also commonly referred to as multi-attribute decision-making (MADM) or multi-attribute decision analysis (MADA). This guide uses the term "multi-attribute analysis" to generally refer to this type of analysis where multiple metrics that are presented using different terms are scored and weighted to allow for ready comparison.

calculation is energy bills over customer income. Since non-participant energy consumption and customer income will not be affected by the DER being evaluated, the only variable changing among the three metrics is rates. Including these three metrics in a DEA would inadvertently count the impact of rates three times. Decision-makers could include any one of these three metrics within its DEA and have results that fully indicate the rate impact. In general, it is best to use the metric closest to the variable that changes, which in this case is energy rates.

This removal of overlapping metrics from the MAA scoring is not to suggest that the metrics removed, e.g., energy burden, are not of interest. This removal is required to prevent double-counting of impacts in the DEA scores. Anyone interested in the implications of the removed metrics can review the simple or benchmark results. In sum, it is appropriate to consider overlapping metric results together, acknowledging that they overlap, but it is not appropriate to add them together in any kind of a scoring system.

In some cases, determining how metrics overlap and which ones to use might not be straightforward and thus might require a judgement call, which may merit stakeholder input.

Calculate Unweighted DEA Scores

Unweighted DEA scores are presented as the percent change between the metric result and its benchmark. Reframing each metric based on its result relative to a benchmark allows decision-makers to answer two simple questions for each metric: (1) did a population surpass, achieve, or fall short of the metric, and (2) by how much? Calculating and presenting the metrics in these terms provides more information to help interpret the metric results. The unweighted DEA scores do not account for importance weightings, discussed in the next section.

As mentioned previously, benchmarks can represent either upper or lower thresholds or targets for success. With that clarification, the unweighted DEA scores calculation will entail one the following simple equations:

- For benchmarks where exceeding the value is a <u>desirable</u> outcome:

  $$Unweighted\ DEA\ score\ (\%) = (metric\ value - benchmark\ value)/benchmark\ value$$

- For benchmarks where exceeding the value is an <u>undesirable</u> outcome:

  $$Unweighted\ DEA\ score\ (\%) = (benchmark\ value - metric\ value)/benchmark\ value$$

The two examples in Figure 14 and Figure 15 show the unweighted DEA scores for two metrics: participation rates and reduced emergency room visits. The first example, Figure 14, translates the simple results for participation rates into unweighted DEA scores. The utility selected a goal of 20 percent participation to serve as its benchmark. For this metric, scoring higher than the benchmark is a desirable outcome. The priority population is projected to have a participation rate of 11 percent, and the other customers are projected to have a participation rate of 22 percent. Applying the formulas above, the priority population results fall short of the benchmark, resulting in a deviation of negative 45 percent. In contrast, the results for other customers exceed the benchmark, resulting in a deviation of +10 percent.

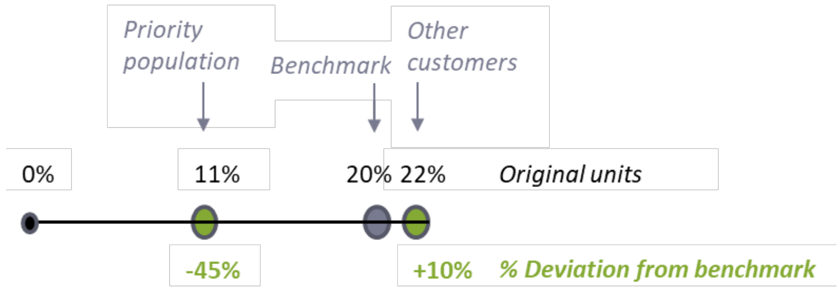

Figure 14. Unweighted DEA Score: Participation Example

The second example, Figure 15, performs the same calculation for change in asthma-related emergency room visits. The utility selected a goal of -2 percent change in emergency room visits as its benchmark. For this metric, a value that is more negative (meaning a larger reduction in ER visits) than the benchmark reflects a better score, while a value that is closer to zero or is positive falls short of the goal. In this example, the priority population has a change in ER visits of -6 percent, and the other customers have a change in ER visits of -4 percent. Applying the formula above, the priority population experiences a greater reduction in emergency room visits than the benchmark, exceeding the benchmark by 200 percent. The other customers exceed the benchmark by 100 percent. These examples emphasize the importance of carefully considering the direction of units and the implied meanings of different benchmarks.

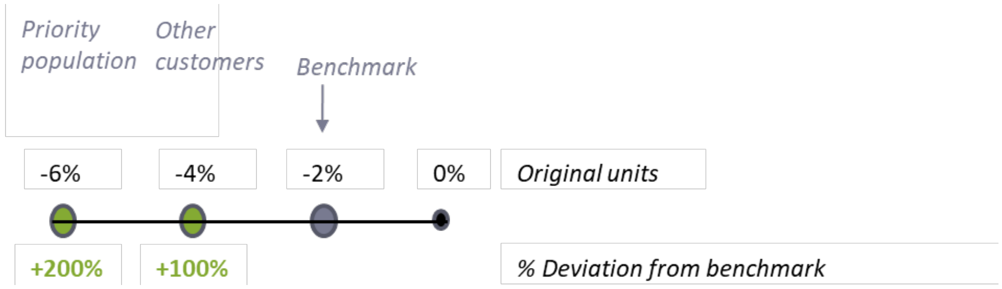

Figure 15. Unweighted DEA Score: Reduced ER Visits Example

Once the analyst calculates an unweighted DEA score for each metric and each population, they can present the results on a single chart with a uniform axis (e.g., percent deviation from benchmark). Values that are positive indicate the metric has exceeded the benchmark. Values that are negative indicate the metric has fallen short of the benchmark. Metrics that fall at zero percent have met the benchmark exactly.

Assign Importance Weights to DEA Metrics

Finally, decision-makers assign weights to each metric within the analysis. The metric weights signify the *relative* importance of each metric in the DEA. The weights assigned to each metric are put into percentage terms and sum to 100 percent. As one example, a DEA analysis might use four metrics, with one having a weight of 40 percent and the other three a weight of 20 percent each, for a total of 100 percent. If regulators, stakeholders, and the utility deem it appropriate, an analyst might choose to skip this step and apply equal weights to all metrics.

The choice of how much weight to apply to each metric is a policy decision and will have significant implications for the results of the DEA. This choice will ideally reflect the equity policy goals of the jurisdiction and will have meaningful input from stakeholders representing the priority population (see Chapter 1).

There are many possible approaches to determining metric weights. Several examples appear below:

- Stakeholders reach consensus on metric weights based on group discussion.
- Each stakeholder provides metric weights based on that party's perspective and interests, and the results are merged by taking an average.
- Each stakeholder provides metric weights based on that party's perspective, and the analyst creates sensitivities based on different permutations of weights.
- Regulators establish weights. By soliciting and accounting for input from stakeholders, transparency is increased and weights are established fairly.

Regardless of how weights are established, transparently reporting the selected weights and providing sufficient justification for them is essential. Similar to setting benchmarks, the results of the DEA are highly sensitive to the choice of these weights. Consequently, the analysis might include conducting sensitivity analysis using different weights to test how different assumptions affect the results.

Calculate Weighted DEA Scores

Once weights are established, the analyst multiplies the percent deviations developed during the prior step by the weights assigned to each metric to create the weighted DEA scores. The metric-specific weighted DEA scores can be summed for each population (Figure 16). This process takes a weighted average of the unweighted DEA score (the percent change from the benchmarks) based on each metric's importance. Accordingly, the results will emphasize benchmark deviations from more important metrics and place less emphasis on benchmark deviations from less important metrics. The resulting scores can be compared across populations or DERs.

Figure 16 shows a weighted DEA score calculation. The net DEA score is calculated for two metrics for a priority population. Each metric has an unweighted DEA score, calculated in the previous step, and a weight. The analyst calculates a metric-specific DEA score for each impact by multiplying the two values together. A net score is calculated by summing the metric-specific scores.

Metric examples	Unweighted DEA score		Importance weight		Weighted DEA score	Implication
Metric 1	+50%	X	40%	=	+20%	Equity improved
					+	
Metric 2	-20%	X	60%	=	-12%	Equity worsened
					=	
			Net score		+8%	Net improvement

Figure 16. Sample Calculation of Weighted and Net DEA Scores

The weighted DEA scores can be displayed for each population in the format shown in Figure 17. Values above the x-axis indicate the metric exceeds the benchmark while values below the x-axis indicate the metric falls short of the benchmark. Figure 17 builds off the example above, which calculates a net DEA score of 8 percent for the priority population. The stacked bar chart shows that Metric 1 promotes equity for the priority population, while Metric 2 detracts from equity. A second stacked bar chart is included for other customers (example calculations not shown). In this example, metrics for the other customers exceed their benchmarks, and the net score is 15 percent. In this example, all customers experience net positive equity impacts, but other customers experience greater positive impacts than the priority population. For information on how to interpret DEA results, see Chapter 7.

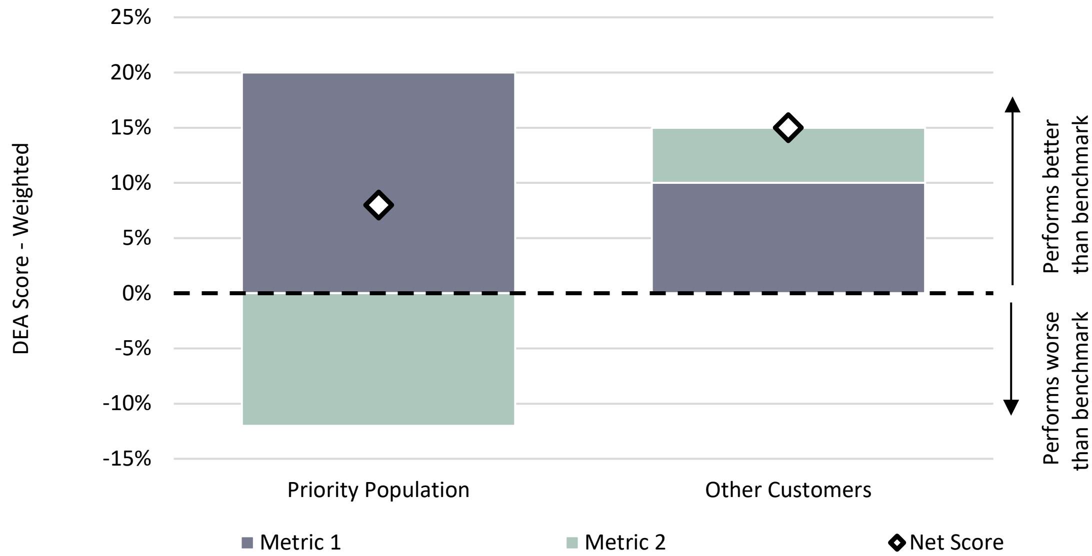

Figure 17. Sample Presentation of Weighted and Net DEA Scores

The key to a successful DEA is transparency. The DEA proposed in this guidance document is simplistic in its calculations but requires thoughtful and potentially complex analysis and decision-making. Data sources and rationales should be provided wherever appropriate.

6.5 Example: Presenting and Interpreting DEA Results

This section applies each step outlined above to an illustrative, tangible example. This example will examine whether a hypothetical utility's planned electric energy efficiency portfolio will serve a priority population equitably, compared to other customers.

In this example, the utility is conducting the analysis and has followed the guidance from the prior chapters. Accordingly, it is actively engaged in a DEA stakeholder process (Chapter 1). The stakeholders refined the scope (see the Introduction) to assess the equity implications of a portfolio of electric energy efficiency programs serving residential customers. The analysis includes all energy efficiency programs in aggregate targeted at residential customers, including multifamily programs that are targeted at residential customers but are delivered through commercial customers (building owners and operators).

Next, the stakeholders defined the priority population (Chapter 3), identified an appropriate set of equity metrics (Chapter 4), and applied the DEA metrics to the priority population and other customers (Chapter 5). The key metrics selected through the stakeholder process include the following:

- DER program participation
- change in electric rates
- change in DER participant bills
- change in DER participant energy burden
- change in non-participant bills
- change in non-participant energy burden
- change in frequency of asthma emergency room visits
- change in frequency of shutoffs
- change in customer reliability

Document Simple Results

The simple results for the residential energy efficiency portfolio are documented for the priority population and for other customers. The data sources for each metric are included in Table 14 to maximize transparency.

Table 14. Simple Results for Example

Metric	Unit	Priority Population	Other Customers	Data Source
Participation	% of eligible population	11%	22%	Utility 2024 Energy Efficiency Plan.
Rates	% change	0.9%	0.9%	Utility rate and bill impact analysis from 2024 Energy Efficiency Plan.
Participant bills	% change	-5.6%	-1.5%	Utility rate and bill impact analysis from 2024 Energy Efficiency Plan.
Participant energy burden	% change	-2%	-0.5%	Utility rate and bill impact analysis from 2024 Energy Efficiency Plan.
Non-participant bills	% change	1.4%	1.4%	Utility rate and bill impact analysis from 2024 Energy Efficiency Plan.
Non-participant energy burden	% change	1.4%	1.4%	Utility rate and bill impact analysis from 2024 Energy Efficiency Plan.
Frequency of asthma ER visits	% change	-3%	-2%	Local hospitalization reporting from 2023.
Frequency of shutoffs	# change	-12	-3	Utility shutoff data from 2023. Data not publicly available by population.
Customer reliability (CEMI)	% change	-2%	-4%	Utility reliability data from 2023. Data not publicly available by population.

This information might lead to the following conclusions regarding equity:

- The energy efficiency participation rate for priority populations is expected to be lower than for the other customers.
- This energy efficiency portfolio is expected to increase rates for all customers by 0.9 percent.
- Participating customers will experience reduced bills and reduced energy burden.
- This energy efficiency portfolio will help reduce ER visits due to reduced criteria pollutants. The percent reduction for the priority population is greater than the percent reduction for other customers.
- This energy efficiency portfolio will help reduce customer shutoffs for the priority population due to lower electricity bills and thus increased ability to pay those bills.
- This energy efficiency portfolio improves reliability (reduced CEMI scores represent improvement), but priority customers see less of an improvement.

In order to weigh these competing results, the stakeholders recommend continuing through the DEA process.

Apply Benchmarks to DEA Metrics

The stakeholders discussed the various goals and potential outcomes of the programs. What minimum participation should the program achieve? What is a reasonable target for rate impacts? How effectively have similar programs reduced emergency room visits? How much could the program reduce the frequency of customer shutoffs? Will participants have more reliable power in their homes?

The table below presents benchmarks chosen by the stakeholders for the energy efficiency portfolio alongside the simple results for the priority populations and the other customers. The table also includes a column to clarify whether exceeding the benchmark is a desirable or undesirable outcome. This example shows the same benchmarks for the priority population and other customers. It is also possible to develop different benchmarks for priority population customers than for other customers.

Table 15. Benchmarked Results for Example

Metric	Unit	Priority population	Other Customers	Benchmark	Good to Exceed Benchmark?	Source of Benchmark
Participation	% of eligible population	11%	22%	20%	Yes	Established by stakeholders in preparing energy efficiency plan
Rates	% change	0.9%	0.9%	0.5%	No	Established by commission in approving energy efficiency plan
Participant bills	% change	-5.6%	-1.5%	-2%	Yes (abs)*	Established by stakeholders in preparing energy efficiency plan
Participant energy burden	% change	-2%	-0.5%	-2%	Yes (abs)	Established by stakeholders in DEA process
Non-participant bills	% change	1.4%	1.4%	1%	No	Established by stakeholders in preparing energy efficiency plan
Non-participant energy burden	% change	1.4%	1.4%	1%	No	Established by stakeholders in DEA process
Frequency of asthma ER visits	% change	-3%	-2%	-1%	Yes (abs)	Established by stakeholders in DEA process
Frequency of shutoffs	# change	-12	-3	-5	Yes	Established by stakeholders in DEA process
Customer reliability (CEMI)	% change	-2%	-4%	-3%	Yes (abs)	Established by commission in reliability docket

**(abs) is an abbreviation for absolute value, indicating that the magnitude of the benchmark should either be exceeded or not exceeded provided the +/- signs of the result and the benchmark are in the same direction. For example, with a benchmark reduction in energy burden of -2 percent, if the result is -2.2 percent, then the benchmark has been exceeded, but if the result is +2.2 percent, then the benchmark has not been exceeded.*

Once again, the results vary across metrics. In some cases, both the results for the priority population and for other customers outperform the benchmark (e.g., the asthma ER visits metric). In other cases, only one of the customer groups exceeds the benchmark (e.g., participation). Alternatively, the results for both customer groups could fall short of the benchmark (none in the example above).

These results provide context for the simple results presented earlier. For example, they indicate that program participation by priority population customers is well below the benchmark for participation, indicating this is a significant problem with this energy efficiency portfolio. As another example, they indicate participant bill reductions exceed the benchmark for the priority population, but not for other customers.

Develop DEA Scores Based on Benchmarks

Remove Duplicative Metrics

The following table articulates which metrics to include in the MAA scoring calculations and the rationale behind the decision.

Table 16. Rationale for Removing Duplicative Metrics for Example

Metric	Include in DEA Scores?	Rationale
Participation (% of eligible population)	Yes	While participation could impact the results for the other metrics (i.e., a larger program will have bigger impacts), participation conveys unique information about the reach of the program. Assessing DER program participation is very important for DEA because customers participating in DER programs will experience the most benefits of those programs.
Rates (% change)	Yes	Rates are an important measure of program impacts across all customers.
Participant bills (% change)	Yes	Participant bills relay important information about a large portion of the benefits from program participation.
Participant energy burden (% change)	No	Participant energy burden equals participant energy bills divided by income. Thus, this metric and participant bills capture the same information about the change in energy expenses. Since income is heavily influenced by external factors, energy burden provides a less direct measure of the program's impact (See Chapter 4).
Non-participant bills (% change)	No	Non-participant bills follow the same pattern as rates, making this metric duplicative.
Non-participant energy burden (% change)	No	Consistent with the reasons listed above, this metric is duplicative with rates.
Frequency of asthma ER visits (% change)	Yes	No overlap with other metrics. This metric is an important indicator of the public health impacts of DERs.
Frequency of shutoffs avoided (# change)	Yes	No overlap with other metrics.
Customer reliability (% change in CEMI)	Yes	No overlap with other metrics.

The metrics for the MAA are narrowed down to participation, rates, participant bills, frequency of asthma ER visits, frequency of shutoffs avoided, and customer reliability.

Calculate Unweighted DEA Scores

The following table and figure present unweighted DEA scores. Values above the x-axis show metrics that exceed the benchmark while values below the x-axis show metrics that fall short of the benchmark. The results are broken out into the target population and the other customers.

Table 17. Unweighted DEA Scores for Example

Metric	Unweighted	
	Priority Population	Other Customers
Participation	-45%	10%
Rates	-80%	-80%
Participant bills	180%	-25%
Asthma ER visits	200%	100%
Shutoffs	140%	-40%
Customer reliability	-33%	33%

This figure displays the variability of results. In some cases, both the target population and the other customers exceed the benchmark (asthma ER visits). In other cases, the results for both populations fall short of the benchmark (rates). For still other metrics, there is a split (customer reliability). Additionally, this figure displays the magnitude of the percent deviation from the benchmark.

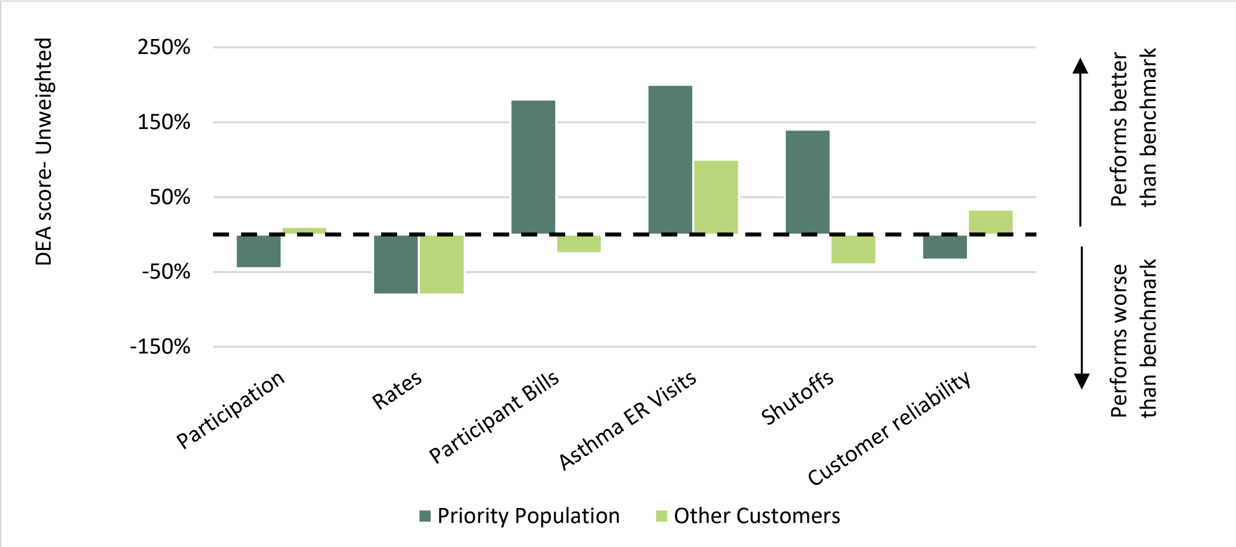

Figure 18. Unweighted DEA Scores for Example

Assign Importance Weights to Metrics

The following table shows the importance weights assigned by the stakeholders along with the rationale for the weights. In this case, each stakeholder provided a weight for each metric, and the analyst took an average value.

Table 18. Importance Weights for Example

Metric	Weight	Rationale
Participation	30%	The stakeholders determined the importance weights. Each participant organization (seven total) weighed the final six metrics based on its unique perspective. The analysis included the average of each organization's importance score.
Rates	20%	
Participant bills	10%	
Asthma ER visits	20%	
Shutoffs	10%	
Customer reliability	10%	

Calculate Weighted DEA Scores

The following table and figure combine the unweighted DEA scores with weights for importance to calculate the weighted DEA scores for priority population and other customers. Values that are positive signify metrics that exceed their benchmarks, negative values represent metrics that fall short of their benchmarks. The net score sums all the metrics together to calculate a single DEA score, displayed on the figure below as a white diamond.

Table 19. Weighted DEA Score Results for Example

Metric	Weighted	
	Priority Population	Other Customers
Participation	-14%	3%
Rates	-16%	-16%
Participant bills	18%	-3%
Asthma ER visits	40%	20%
Shutoffs	14%	-4%
Customer reliability	-3%	3%
Net score	**39%**	**4%**

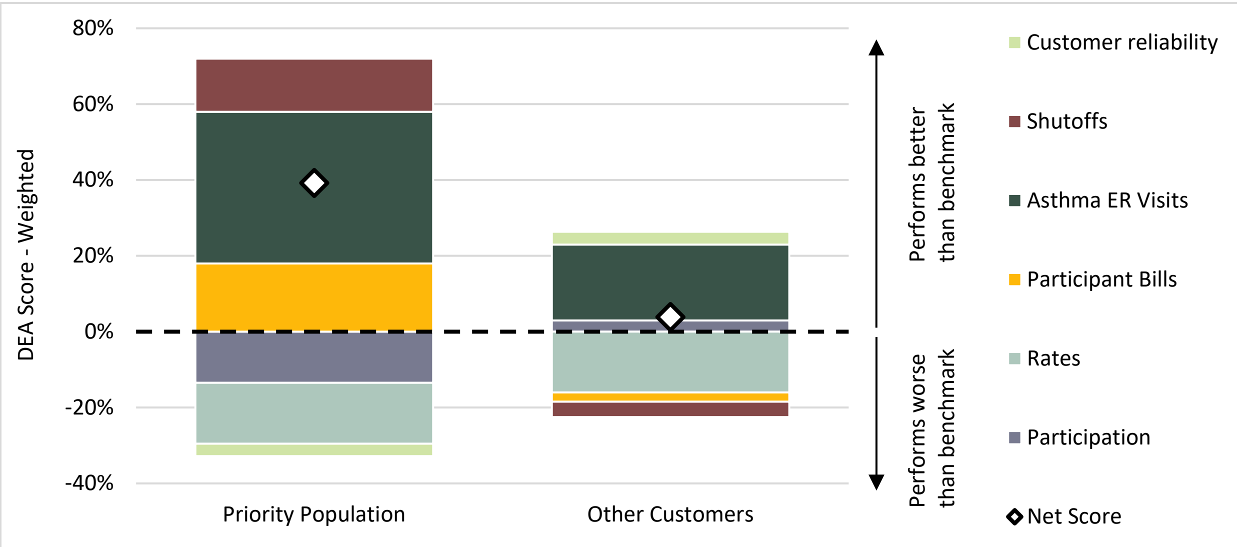

Figure 19. Weighted DEA Scores for Example

Combining the data using this approach presents a broader view of how a DEA might impact different populations. In this example that looks at an energy efficiency portfolio's impact on priority populations and other customers, both populations have metrics that exceed their benchmarks and fall short of their benchmarks. For both populations, the net DEA scores (displayed as the white diamond) are positive. However, the priority population (net score of 39 percent) experiences more equity improvements than the other customers (net score of 4 percent).

The highlights from the DEA score results indicate that:

- The net DEA score for the priority population is greater than the net DEA score for the other customers.
- The net DEA scores for both groups are positive.

See Chapter 7 for drawing conclusions from both the BCA and DEA.

6.6 References and Resources

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7 Make Decisions Using Both BCA and DEA Results

7.1 Overview

The final stage in conducting a DEA is using both the results of the BCA and the DEA for making decisions about utility investments in DERs. This requires first presenting the BCA results, then presenting the DEA results—either simple results, benchmarked results, or MAA scores—and then interpreting what those results imply about costs, benefits, and equity impacts.

DEA can be conducted before, during, or after the BCA, but there are practical reasons why it might be best to conduct the BCA before the DEA (see the introductory section on Distributional Equity Analysis). Since both the BCA and the DEA will be used to inform decisions on utility investments, they should both be conducted at the same application level, e.g., a single program, a comparison of DER programs, a DER portfolio, optimization of multiple DER portfolios (see Section 2.2).

Figure 20 below presents an overview of how this stage fits into the entire process of conducting the DEA. The bottom section of the figure presents the steps discussed in this chapter.

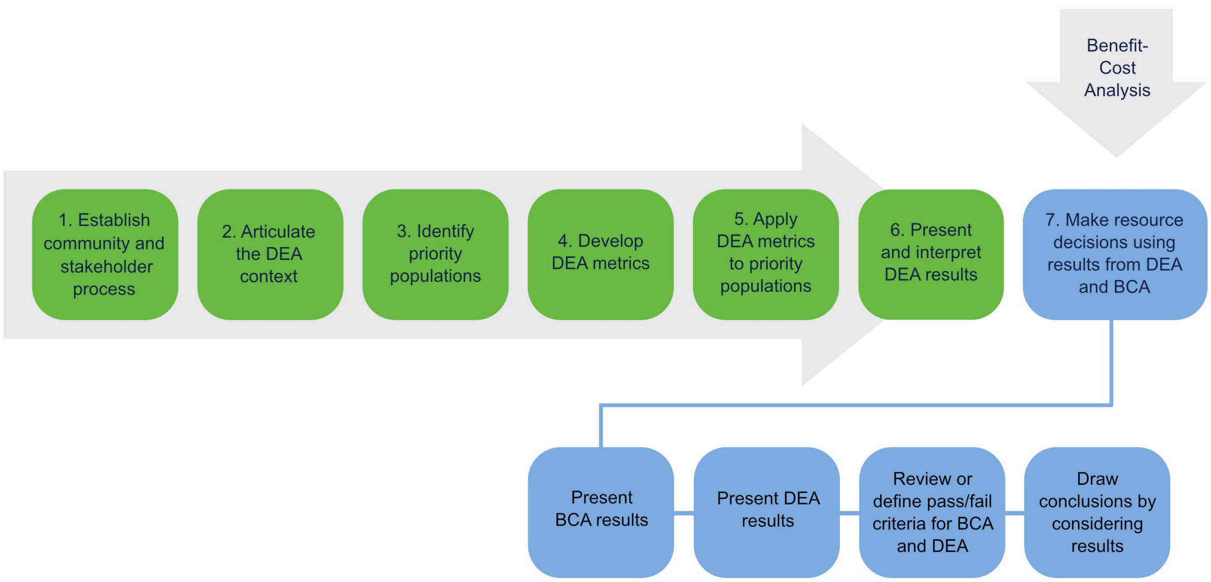

Figure 20. Steps for Making Resource Decisions Using DEA and BCA

Key terms for this chapter:

- "Net benefits" are equal to the difference between the cumulative present value of benefits and the cumulative present value of costs.
- "Benefit-cost ratios" are equal to the ratio of the cumulative present value of benefits to the cumulative present value of costs.
- "Non-monetary impacts" are impacts of a BCA that are difficult to monetize but may be considered alongside BCA results.

The following steps can be used to make decisions using both BCA and DEA results:

1. Present BCA results, usually in terms of net benefits and benefit-cost ratios.[28]
2. Present DEA results, as simple results, benchmarked results, and/or MAA scores.
3. Review or define pass/fail criteria for the BCA and DEA before presenting the final results.
4. Draw conclusions by considering the BCA and DEA results together and then interpreting what those results imply about costs, benefits, and equity impacts to inform investment decisions.

The final section of this chapter includes an example that illustrates the application of each step.

7.2 Present BCA Results

BCA can be conducted using different tests, each of which represents a different perspective. The most common BCA tests include the utility cost test, the total resource cost test, the societal cost test, the participant cost test, the ratepayer impact test, or a jurisdiction-specific test (NSPM 2020).[29] Often, jurisdictions have specific guidelines in place that dictate which tests should be applied to DERs. It is useful to articulate the choice of BCA test when presenting BCA results because the choice has bearing on the scope of the BCA and therefore the relationship between the BCA and the DEA.

BCA results are typically presented in terms of the cumulative present value of costs and the cumulative present value of benefits. These are typically put into two straightforward metrics: net benefits and benefit-cost ratios.

Net Benefits

Net benefits are equal to the difference between the cumulative present value of benefits and the cumulative present value of costs. If a DER's net benefits are greater than zero, its benefits exceed its costs and it is considered cost-effective.

One advantage of the net benefits metric is that it indicates the magnitude of the benefits to be gained by the efficiency resource, in a way that the benefit-cost ratio cannot. However, this advantage is a limitation when comparing DERs across different utilities and jurisdictions. A large utility would naturally expect to have higher net benefits than a small utility for a comparable DER program (NSPM 2020, Appendix D).

Benefit-Cost Ratios

Benefit-cost ratios are equal to the ratio of the cumulative present value of benefits to the cumulative present value of costs. If a DER's benefit-cost ratio exceeds 1.0, its benefits exceed its costs, and it is considered cost-effective.

The benefit-cost ratio metric can be useful for comparing DERs with each other because it normalizes the results for DERs of different sizes. This metric is also useful for comparing DERs across utilities and jurisdictions of different sizes, again because it normalizes the results for any differences in size. The benefit-cost ratio metric provides important information that is not provided by a net benefits metric, by indicating the relative effectiveness of the money spent on the resource, i.e., how many dollars of benefits are received per dollar spent (NSPM 2020, Appendix D).

Non-Monetary Impacts

Some impacts of a BCA may be difficult to monetize and therefore difficult to include in a benefit-cost ratio or in the net benefits. For example, a jurisdiction might try to capture macroeconomic impacts by using increased job-years instead of the dollar value of increased gross state product. In these instances, the analyst would

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[28] Readers interested in guidance on how to conduct a BCA for DERs can refer to the National Standard Practice Manual (NSPM) for Benefit-Cost Analysis of Distributed Energy Resources (NSPM 2020).

[29] For some jurisdictions, a jurisdiction-specific test may be consistent with one of the traditional cost tests.

include the results of the non-monetary impacts alongside the results of the BCA and factor them into the final conclusions in the BCA.

7.3 Present DEA Results

Simple Results

The simple results present the values for each DEA metric in its original measurement unit, separately for priority population customers and other customers (Section 7.2). This format allows for a simple, transparent comparison of equity impacts for the priority population and other customers.

Benchmarked Results

Benchmarks provide valuable context when presented alongside the simple results. The benchmarks can be compared to the metric values for each population group, presenting a measuring stick by which to judge success. This way, in addition to being able to compare how a priority population performs compared to other customers for each metric, jurisdictions can view how both populations compare to the benchmark. Effective benchmarks reflect a jurisdiction's energy and equity goals and are informed using stakeholder input, including stakeholders representing priority populations (see Section 6.3).

While benchmarked results are helpful for interpreting the implications of each DEA metric *on its own*, they do not allow for comparison *across metrics;* nor do they allow for assessing the impacts of *all DEA metrics combined.* DEA scores can help address these limitations to benchmarked results.

DEA Scores

DEA scores can be calculated for each metric and population as a percentage change from the benchmark. The scores are designed to indicate whether a population has performed better or worse than the benchmark for a particular metric and quantify the magnitude of the difference.

Unweighted DEA scores refer to a percent deviation from a benchmark. Weighted DEA scores multiply that percent deviation by a metric-specific importance weight set by the stakeholders.

The weighted DEA scores can be added together to determine a net score, which indicates the net effect that all the DEA metrics combined will have on customer equity (see Section 6.4).

Once the findings and conclusions of the DEA are clear, the DEA and BCA can be viewed together to determine whether and how to proceed with the DER being evaluated.

7.4 Define or Clarify DEA Pass/Fail Criteria

Before drawing conclusions using the DEA, it is helpful to define or clarify the criteria that will be used to determine whether a DER investment will improve or worsen equity. That is, to define the pass/fail criteria for the DEA.

The pass/fail criteria for BCA are clear. If the net benefits are positive and the benefit-cost ratio exceeds 1.0, then the investment is considered cost-effective and passes the BCA. If not, it fails.

In contrast, the pass/fail criteria for DEA are not inherently obvious or clear. DEA requires that regulators, policymakers, and utilities, along with stakeholders, define what constitutes an equitable outcome. Stakeholders are guided through some of these questions in this document, such as:

- Which customers require equity considerations?
- Which metrics should be used to measure distributional equity?
- How much weight should be given to each metric?

Depending on the results of the analysis, stakeholders may need to discuss additional questions such as:

- What considerations are needed when DEA improves equity for some metrics but worsens equity for other metrics?
- Do both customer groups need positive DEA scores, or just the priority population?

Stakeholders might find it useful to outline specific pass/fail criteria for DEA. For example, stakeholders could determine that for a DER to pass a DEA, the priority population must have a net DEA score greater than or equal to the other customers, or the DEA score for all metrics for the priority population must be positive, or that one particular metric must exceed its benchmark in addition to a positive net score. Each jurisdiction can develop its own DEA metric pass/fail criteria, based on its equity goals and input from stakeholders.

7.5 Draw Conclusions from Both the BCA and the DEA

BCA Results Are Ill-Suited for Multi-Attribute Analysis

Utilities, regulators, and stakeholders might be tempted to combine BCA results with DEA results using MAA techniques (see Section 6.4), particularly in scenarios where there are many metrics and multiple DERs under consideration. After all, the bottom line of a BCA, whether in terms of net benefits or benefit-cost ratios, is just another metric with measurement units that are incongruous with the other metrics of the DEA.

BCA results, however, are ill-suited to using MAA techniques. One of the key elements of MAA is that all metrics must be put on a consistent, normalized scoring system. This requires establishing a benchmark for each metric. These benchmarks have a large impact on the resulting scores for each of the metrics and must be based on logical, meaningful targets (see Section 6.4).

It is much more difficult to create such benchmarks for BCA metrics. The two BCA metrics that could be used for this purpose are the net benefits and the benefit-cost ratio. One could choose a relatively random value for this purpose, such as a benefit-cost ratio of 3.0 or net benefits of $100 million. The problem with this approach is that the choice of benchmark will have dramatic impacts on the resulting BCA score; thus, the choice must be rooted in some logical outcome or policy goal.

In the absence of a clearly defined, transparent benchmark, there is a high risk that the results of a combined BCA and DEA score will be misinterpreted, manipulated, or both. Accordingly, if analysts apply MAA techniques to BCA metrics, it is critical to apply caution, transparency, and robust input from all stakeholders. Without any one of these conditions, they should not be used at all.

Draw Conclusions from Both the BCA and the DEA

Without relying on MAA, BCA and DEA can be considered together for the purpose of making DER investment decisions. In some cases, this might require professional judgment to draw conclusions on cost-effectiveness and equity. The jurisdiction's equity policy goals will guide these conclusions, which will ideally be informed by meaningful input from stakeholders—especially those representing priority populations.

Figure 21 below presents four alternative combinations of outcomes for BCA and DEA results. A DER could pass both the BCA and the DEA, it could fail both the BCA and the DEA, or it could pass one and fail the other. Considering the results in these terms can help expedite drawing conclusions from the results. In a situation where a DER passes both the BCA and the DEA, it will likely be approved. In a situation where a DER fails both the BCA and the DEA, it will likely be rejected or modified.

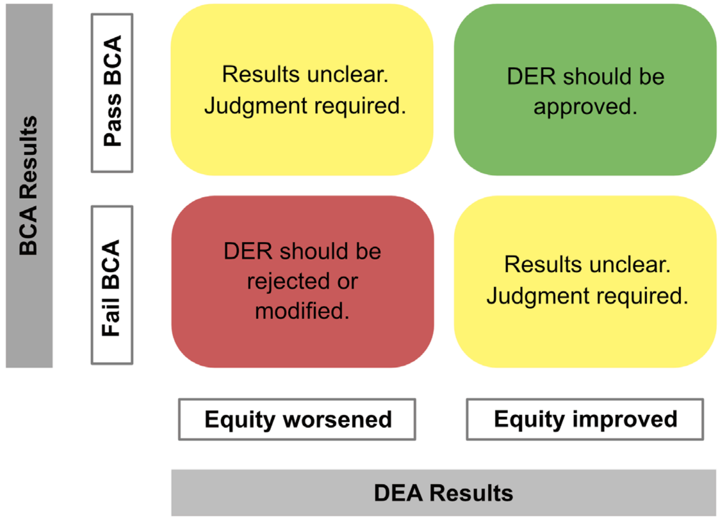

Figure 21. Conclusions Matrix for the BCA and DEA

Otherwise, if the BCA and DEA show conflicting results, professional judgement guided by policy goals might be needed. For example, there might be some situations where high equity benefits outweigh poor BCA results, or high BCA results outweigh poor equity results. In these cases, stakeholders, and ultimately decision-makers, need to prioritize the economic results of the BCA relative to the equity results of the DEA.

For many DER programs, the BCA and DEA results will be conflicting.

For many DER programs, the BCA and DEA results will be conflicting. And in many cases, a DER program targeted to priority populations passes the BCA, but is less economic than similar DER programs that are not targeted to priority populations or do not offer the same level of equity improvements. In these cases, it is especially important to present all the BCA and DEA results as transparently as possible, and to incorporate stakeholder input to help strike the balance between the BCA results and the DEA results.

7.6 Example: Making Decisions Using Both BCA and DEA Results

This section applies each step outlined in this chapter to a tangible example. This section builds upon the example in Section 6.5 to draw conclusions as to whether a hypothetical utility's planned electric energy efficiency portfolio will serve a priority population equitably, compared to other customers.

Review or Define Pass/Fail Criteria

The utility first states the criteria for passing the BCA. The utility follows guidance provided previously by a commission that all DERs must be cost-effective as defined by the societal cost test.

The utility sought guidance from stakeholders regarding pass/fail criteria for the DEA. In order to facilitate decision-making with the DEA scores, the stakeholders define their criteria for an equitable program to include the following:

1. The priority population has to be served at least as well as the other customers with regard to the net metric impacts.
2. For both populations, the net metric impacts should be positive.
3. Rate impacts cannot exceed a cap of 2 percent rate increase.

4. Participation rates must be at least as high for the priority population as the other customers.

The utility presents the results of the BCA and DEA such that the criteria outlined above can be examined and serve as the basis for decision-making.

Present BCA Results

The sample utility performed a BCA on its planned energy efficiency portfolio. The utility requires the energy efficiency portfolio to be cost-effective as defined by the societal cost test. The results of the plan are as follows:

- Cumulative present value of societal costs: $16 million
- Cumulative present value of societal benefits: $26 million
- Cumulative present value of net benefits: $10 million
- Benefit-cost ratio: 2.25
- Increased jobs: 400 job-years
- Summary: The portfolio is cost-effective with net benefits of $10 million and a benefit-cost ratio of 1.6. PASS.

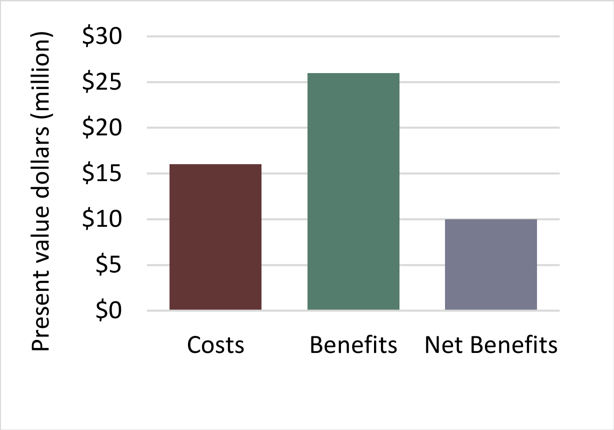

Figure 22. BCA Results

Present DEA Results

Simple Results (from Section 6.5)

The highlights from the simple results indicate that:

- The energy efficiency participation rate is expected to be lower than for the other customers.
- This energy efficiency portfolio is expected to increase rates by 0.9 percent.

Benchmarked Results (from Section 6.5)

The highlights from the benchmarked results indicate that:

- Program participation by priority population customers is well below the benchmark for participation, indicating a significant concern with this energy efficiency portfolio.
- The rate impacts exceed the benchmark of 0.5 percent. However, they are still below the pass/fail DEA criteria set by the stakeholders, which required rate impacts below 2 percent. This shows there might be opportunities to reduce rate impacts, but the metric will not on its own cause the DEA to fail.

DEA score results (from Section 6.5)

The highlights from the DEA score results indicate that:

- The net DEA score for the priority population is greater than the net DEA score for the other customers.
- The net DEA scores for both groups are positive.

Error! Reference source not found. can be used to determine whether the energy efficiency portfolio meets the practitioner's definition of equitable, as defined by the four pass/fail criteria:

1. The net score is greater for the priority population than for the other customers. PASS.

2. The weighted average of the metrics is greater than zero. PASS.

3. The rate impacts are lower than the caps set by the stakeholders. PASS.

4. Participation rates are better for the priority population than the other customers. FAIL.

The portfolio does not pass the four requirements of an equitable program. The utility could have learned of the participation rate shortcoming without developing MAA scores; however, the MAA provides valuable insight that can be used to optimize future versions of the plan.

Draw Conclusions from Both the BCA and the DEA

This step reviews the criteria for the BCA and the DEA together to draw conclusions about whether the illustrative DER should be implemented. Both results are displayed side by side below.

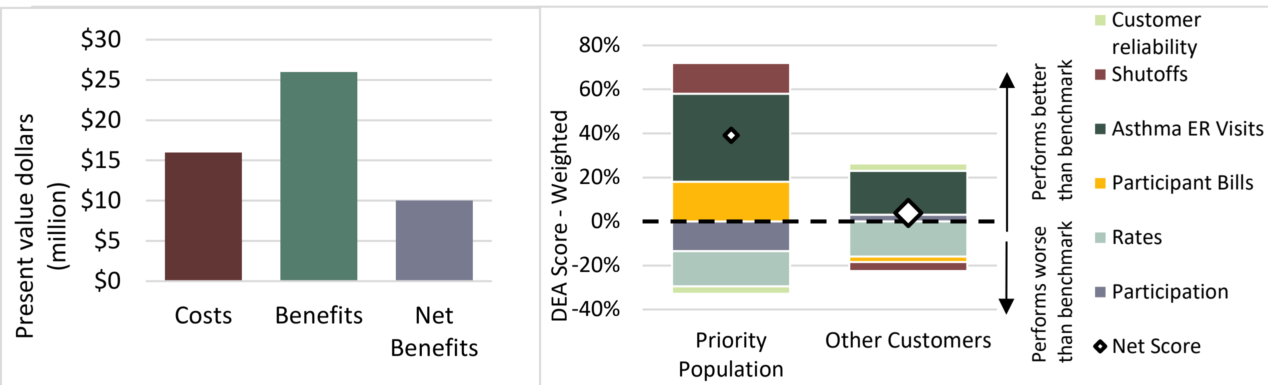

Figure 23. BCA Results and DEA Results

BCA Results

The portfolio is cost-effective with net benefits of $10 million and a benefit-cost ratio of 1.6. PASS.

DEA Criteria and Results

1. The net score is greater for the priority population than for the other customers. PASS.

2. The weighted average of the metrics is greater than zero. PASS.

3. The rate impacts are lower than the caps set by the stakeholders. PASS.

4. Participation rates are better for the priority population than the other customers. FAIL.

Conclusion

The energy efficiency portfolio is cost-effective but fails an important equity criterion because the priority population participation rates are too low. One or more of the programs in the portfolio should be modified to increase participation of priority population customers.

Based on these results, the stakeholders direct the utility to modify the energy efficiency portfolio to pass the fourth criteria. The DEA revealed other areas for improvement as well, such as customer reliability for the priority population, and participant bills and avoided shutoffs for the other customers.

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Appendix A. Case Study: Washington State

A.1 Background

In recent years, the state of Washington passed legislation advancing equity and environmental objectives. In 2021, Washington passed the *Healthy Environment for All* (HEAL) act, its first coordinated statewide environmental justice law. The HEAL act required state departments to operationalize environmental justice practices within their work and created the Environmental Justice Council to advise the departments. The law sets a goal for 40 percent of grants and expenditures that create environmental benefits to go toward creating environmental benefits for overburdened communities and vulnerable populations (HEAL 2021).

Also passed in 2021, the *Climate Commitment Act* (CCA) created a cap-and-invest program, whereby a minimum of 35 percent of auction-generated revenue will be used for projects that provide direct benefits to vulnerable populations and overburdened communities (CCA 2021).

Washington passed the *Clean Energy Transformation Act* (CETA) in 2019, establishing a statewide goal of GHG-free electricity by 2045. Under CETA, every four years starting in 2022, each investor-owned utility must file a clean energy implementation plan (CEIP) for meeting the state targets.[30] CETA requires the benefits from utility investments in electricity supply to be distributed equitably and to reduce burdens to affected populations. In pursuit of this, CETA directed the Department of Health to create a Cumulative Impact Analysis mapping tool to identify "highly impacted communities" (HIC) in the state. CETA also required these utilities to develop a distributional equity analysis in their CEIPs (CETA 2019).

The Washington Utilities and Transportation Commission (UTC) adopted rules addressing the CETA CEIPs and Integrated Resource Plans (IRPs) in December 2020 (General Order R-601). The rules set a timeline for IRPs to be filed in early 2021 to inform the CEIPs, and drafts to be filed in August 2021.

In recent rate cases, the UTC required Washington's investor-owned utilities (PacifiCorp, Puget Sound Energy—or PSE—and Avista) to conduct distributional equity analyses going forward.[31] A 2022 Order from an Avista rate case established a Commission-led collaborative process to create methods and standards for DEA in which Avista would be required to participate, as would any investor-owned utilities in the state. In a separate 2022 Order from a PSE rate case, the UTC ordered PSE to develop and participate in a pilot DEA for its proposed DERs.

Washington provides a useful case study on how states are addressing energy inequities, establishing priority populations, developing equity metrics, conducting system-wide energy equity analysis, and preparing for DEA. This appendix examines available information related to those experiences.

No real-world DEA example exists yet. The WA Case Study and example (see Section A.7) examine real data from PSE's 2022 energy efficiency portfolio and apply the methodology within this document to that DER for the first time. In addition, LBNL is working with Puget Sound Energy to pilot the DEA framework on two community solar programs.

A.2 Clean Energy Implementation Plans

The Washington UTC required utility companies to submit CEIPs, which are essentially four-year roadmaps for compliance with CETA. WAC 480-100-640 provides that the CEIPs must include a plan to reach the

[30] Utilities must pursue all cost-effective, reliable, and feasible conservation and efficiency resources to reduce or manage electric load; they must also use renewable electricity and non-emitting electric generation, or use alternative compliance options including RECs, compliance payments, and energy transformation projects.

[31] UTC uses the term Distributional Equity Analysis, however that analysis may differ from the methodology described in this guide.

mandatory clean electricity targets set by CETA. This includes interim targets to meet those standards; specific targets for energy efficiency, demand response, and renewable energy; and specific actions the utility will take over four years to meet the targets. In addition, each CEIP must identify highly impacted communities (HIC) using a cumulative impact analysis and vulnerable populations based on adverse socioeconomic and sensitivity factors developed in collaboration with stakeholders and include customer benefit indicators.

The CEIPs combine a system-wide energy equity analysis with a planning process that builds on the 10-year clean energy action plan developed as part of each utility's IRP process. The IRPs must analyze non-energy cost and benefits and how they accrue to the utility system, customers, participants, vulnerable populations, HICs, or the general public. CEIPs build upon this analysis to consider how economic, health, and environmental burdens and benefits are distributed to vulnerable populations and HICs for a specific set of actions (Avista 2021), (PacifiCorp 2023), (PSE 2022).

In general, the CEIPs are much broader than DEA for DERs. Table 20 compares Washington's CEIPs to DEA as described in this guide. CEIPs cover a wider range of utility actions and equity dimensions, and thus include a wider range of metrics for analysis.

Table 20. Clean Energy Implementation Plans v. Distributional Equity Analysis

Characteristic	Clean Energy Implementation Plans	Distributional Equity Analysis
Scope	Broad: system-wide energy equity	Narrow: equity of DER investments
Purpose	Monitor changes to equity over time	Determines whether a DER improves or worsens equity
Resources at issue	All utility investments and practices	Utility investments in DERs
Reporting frequency	Fixed, every 5 years in sync with utility IRPs, with biennial updates	As needed, when evaluating an investment or initiative (aligns with timeline for conducting a BCA)
Equity dimensions	Structural, procedural, distributional, and restorative	Distributional
Priority populations	HICs and vulnerable populations	HICs and vulnerable populations
Metrics	Broadly defined for all dimensions of equity	Narrowly defined for distributional equity
Specific actions	Broad recommendations on types of resources to pursue over 5 years	Investment decisions on specific, relevant DERs

In late 2021 and early 2022, Washington's three investor-owned electric utilities (PacifiCorp, Avista, and PSE) filed their CEIPs. At the time of this report, the UTC had approved Avista's and PSE's CEIPs, with some conditions. The UTC required Avista to expand its clean energy targets and add a Customer Benefit Indicator (CBI) condition to ensure an equitable distribution of customer benefits from the transition to clean energy (WA UTC Docket 210628).

The UTC required PSE to make the following modifications (Docket No. UE-210795):

- Nearly double its community solar target
- Significantly increase its demand response target and expand its demand response service offerings
- Ensure that at least 30 percent of benefits within distributed clean energy programs flow to HICs
- Expand its criteria to identify HICs
- Set up a pilot program to engage directly with HICs to develop programs and resources that will benefit them
- Change the way it measures customer benefits and burdens of its programs

- Fully account for the social cost of GHGs and the value of energy storage in its planning models

A.3 Stakeholder Process

The UTC identified meaningful and inclusive public participation as an important element of the CEIP process. WAC 480-100-655 requires utilities to create a Public Participation Plan that describes how the utility will collaborate with stakeholders to develop the CEIP, including a schedule of public participation activities and tools to share information and gather feedback. Participation plans must include specifics on timing, methods, and language for seeking and considering input; identification of barriers to public participation; and plans to provide data and effective participant education. WAC 480-100-655 requires utilities to demonstrate and document how they considered input from their advisory group members and the public in the development of the CEIPs, including an external Equity Advisory Group (EAG).

The CEIP process involves extensive stakeholder engagement from utility customers (including HICs and vulnerable populations), the EAG, and other advisory groups. Each utility convened its own EAG to advise the utility on energy inequities and assist with customer engagement. Beginning in late 2020, PSE worked with external stakeholders and the UTC to develop a framework for the group and identify potential members. PSE convened an initial EAG to serve until March 2022. That inaugural group put together a diverse group of people, especially heads of community organizations, with experience in environmental justice, public health, tribes, frontline communities, vulnerable populations, or social and economic development issues. The EAG was instrumental in creating a plan to equitably deliver the benefits of the CEIP and engage a diverse group of stakeholders throughout its process.

After the utility files the final CEIP, there are additional rounds of stakeholder comments and public hearings, which include a variety of intervenors. In the CEIPs, utilities describe stakeholder input and feedback they received and how they incorporated it, or an explanation of why stakeholder input on a specific area was not incorporated.

PSE, Avista, and PacifiCorp each engaged community members and solicited stakeholder input on its CEIP through a variety of channels. For example, PSE hosted the following while developing its CEIP:

- 10 EAG meetings
- 16 meetings with other previously established PSE advisory groups, including the Low-Income Advisory Group, IRP Stakeholders, and Conservation Resource Advisory Group
- "Go-to-you" meetings with community-based organizations
- A multi-lingual session
- An online survey, which received 921 residential survey responses and 194 business survey responses

A.4 Priority Populations

CETA explicitly requires utilities to assess potential impacts on two communities: HICs and vulnerable populations (CETA 2019). Collectively these two groups are referred to as "named communities."

> **HICs:** Highly impacted communities are either census tracts situated in "Indian Country" as defined in statute, or census tracts that score at least a nine out of ten on the cumulative impact analysis presented in the Washington Health Disparities Map (WA DOH).
>
> **Vulnerable populations:** Vulnerable populations are generally population groups that are more likely to be at a higher risk for poor health outcomes and environmental harms based on socioeconomic and sensitivity factors. Utilities identify vulnerable populations in their service territory with consultation from advisory groups and participation from the public. The utilities break out the vulnerable populations into three categories: high, medium, and low.

Each utility was tasked with independently identifying vulnerable populations in its service territory, and thus there are different definitions and approaches across the three CEIPs. For example, Figure 24 lists the population groups included in PacifiCorp's definition of vulnerable populations. PacifiCorp identified vulnerable populations with help from its Equity Advisory Group and public participation.

PacifiCorp sought input from its stakeholders—primarily the EAG—for the designation of vulnerable populations. The list of 22 vulnerable populations includes:

1. People with lower education attainment
2. Adults 65 years old and above
3. Young children
4. People with a hearing impairment
5. People with a disability
6. People with medical equipment at home
7. Diverse supplier business owners
8. Energy burdened
9. Asset Limited, Income Constrained, Employed (ALICE)
10. Low-income migrants
11. Low income
12. Immigration status (outside of US citizen)
13. People who speak limited English
14. Renters
15. Multi-generational households
16. Multi-family households
17. People experiencing homelessness
18. People living in rural areas
19. People living in different land statuses (such as land trust vs. fee patent that have different regulatory requirements)
20. Agricultural and/or farm workers
21. Gas-heated homes
22. Single parents

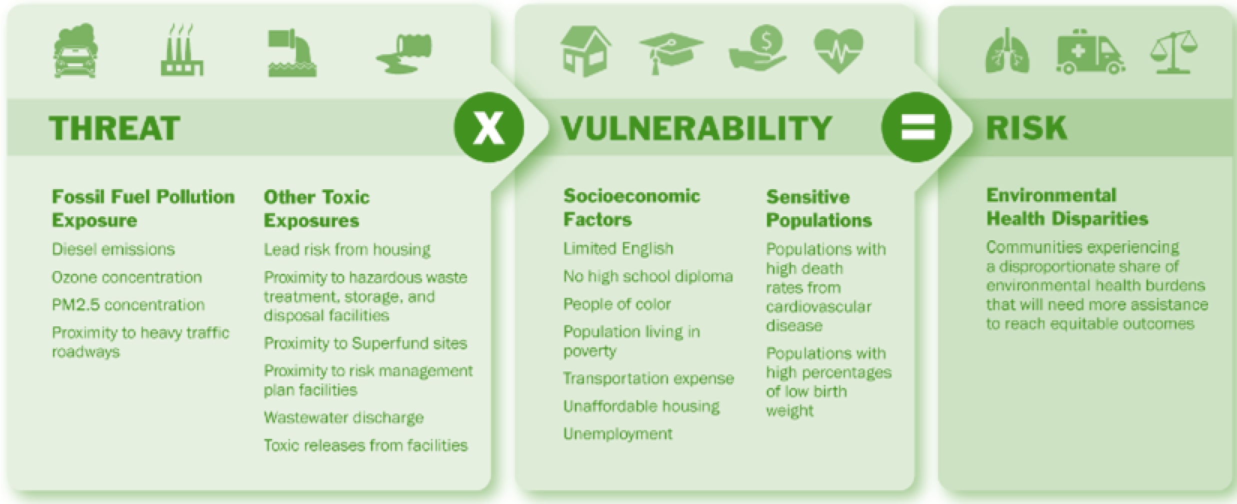
Source: (PacifiCorp 2023, CEIP).

Figure 24. PacifiCorp's Vulnerable Population Indicators

In comparison, PSE's definition of vulnerable populations accounts for socioeconomic factors (unemployment, housing costs, access to nutritious food), sensitivity factors (low birth weight, hospitalization rates) as well as racial and ethnic minorities, low-income communities, and other disproportionately impacted populations. PSE developed a list of primary attributes, and then the EAG expanded upon that list to include factors from its collective experience and sessions with PSE (PSE 2021). PSE collected and analyzed data related to these factors, primarily at the census-block level, to identify the vulnerable populations in its service area (discussed more in Section A.6) (PSE 2021).

PSE sought and integrated data on the factors listed in 2021 PSE CEIP from various sources to identify vulnerable populations at the census-block group level. PSE aggregated its individual customer data to this scale and characterized neighborhoods across its previously identified factors. For each vulnerable population indicator, PSE found the value for each census tract, and then rescaled all the values on a 1–5 scale to aggregate the indicators into a single score. PSE then used this single score to rank census-block groups as high-, medium-, or low-vulnerability populations (PSE 2021). PSE acknowledged that a geographic assessment has limitations because it may ignore the distribution of characteristics across a population within a geographic area. PSE says it will continue to explore other ways to determine customer groups (Docket No. UE-210795).

Unlike the process for identifying vulnerable populations, HICs are identified by the WA DOH across the entire state and thus have consistent criteria in each utility CEIP. CETA directed the DOH to identify HICs using cumulative impact analysis (CETA 2019). The Washington Environmental Health Disparities Map groups 19 different indicators into four themes as shown in Figure 25: "threats" (environmental exposures and environmental effects) and "vulnerabilities" (sensitive populations and socioeconomic factors). Communities ranked in the top 10 percent, i.e., with an overall risk score of 9 or 10, are designed as "highly impacted" (WA DOH).



Source: (Washington DOH, "Washington Environmental Health Disparities Map.")

Figure 25. Highly Impacted Communities Cumulative Impact Analysis Indicators

A.5 Equity Metrics

In accordance with WAC 480-100-610(4)(c), each CEIP must propose customer benefit indicators (CBI) that ensure that all customers are benefiting from the transition to clean energy through the following:

- The equitable distribution of energy and non-energy impacts and reductions of burdens to vulnerable populations and highly impacted communities
- Long-term and short-term public health and environmental benefits and reduction of costs and risks
- Energy security and resiliency

A CBI is an "attribute" of utility resources or investments associated with customer benefits or customer burdens. Each CBI can include multiple equity metrics. Table 21 summarizes the CBI categories as defined by CETA. In the CEIPs, CBIs play a key role in utility resource and program evaluation and investment decisions. For each of the CETA benefit categories in Table 21, utilities must present specific CBIs. WAC 480-100-655 also requires utilities to get public input to prioritize what CBIs address. The utilities must provide the CBI value for each specific action in their CEIPs (or designate the CBI as non-applicable) to establish the amount of customer benefit provided by the specific proposed actions (WAC 480-100-655).

Table 21. CEIP Customer Benefit Indicator Categories

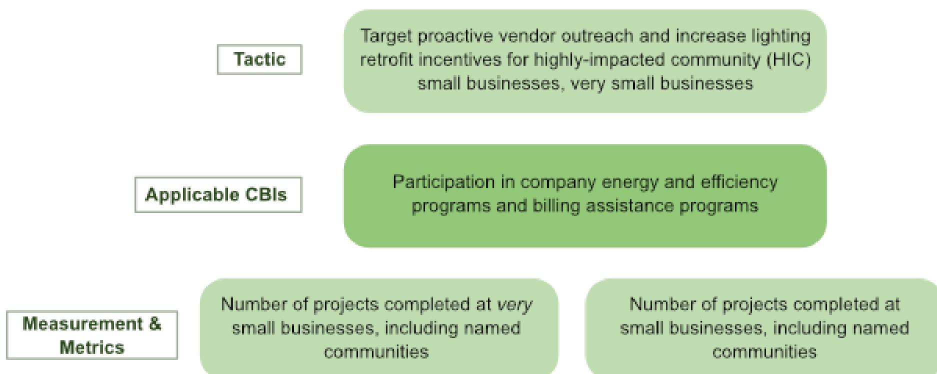
Who?	**Benefit category**
Highly impacted communities and vulnerable populations	Energy benefits
	Non-energy benefits
	Reduction of burdens
All customers (including HIC and vulnerable populations)	Public health benefits
	Environmental benefits
	Cost reduction
	Risk reduction
	Energy security benefits
	Resiliency benefits

Source: (CETA 2019)

Each utility develops its own CBIs and metrics with the requirement of having at least one CBI in each benefit category displayed in Table 21. The list of CBIs must include, at a minimum, one or more indicators associated with energy benefits, non-energy benefits, reduction of burdens, public health, environment, reduction in cost, reduction in risk, energy security, and resiliency (CETA 2019). CBIs are applied to resources in the CEIP to guide decision-making for energy efficiency, demand response, and renewable energy (both utility-scale resources and DERs).

PacifiCorp developed its list of CBIs based on continuous stakeholder input. It identified challenges and barriers facing named communities and matched those to CETA benefit categories. PacifiCorp prioritized the benefit categories it could impact and proposed draft CBIs based on that list. PacifiCorp relied on data from public surveys and input from its EAG to weigh the benefit categories, with the highest-scoring CBIs becoming the initial set included in the CEIP (PacifiCorp 2023).

PacifiCorp created quantifiable metrics for its CBIs by using internal and external data, stakeholder feedback, and EAG input to refine and validate its proposed metrics. It aimed for metrics that are reliable, repeatable, and representative of the communities and goals of the CBIs. Through stakeholder meetings with subject matter experts, PacifiCorp brainstormed tangible actions the company could take to impact each CBI. PacifiCorp then engaged in "action-to-CBI" mapping to relate each action type to a tactic, applicable CBIs, and metrics for those CBIs. This process culminated in actionable items and clear ways to measure those actions. Figure 26 shows an example of Pacificorp's "action-to-CBI" mapping.



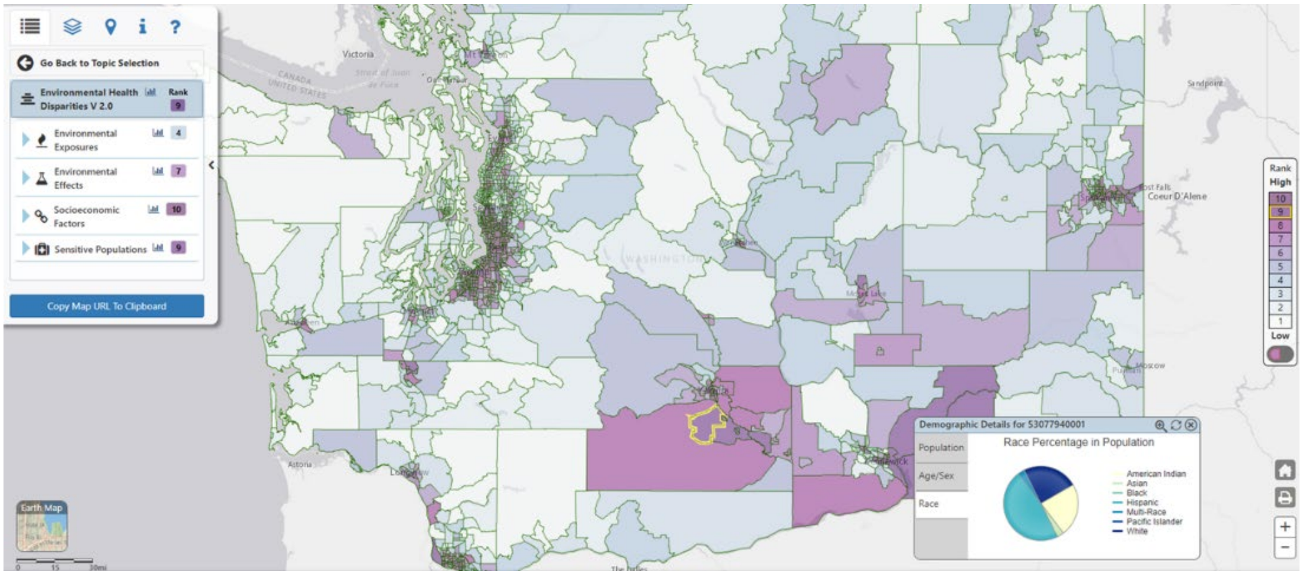
Source: (PacifiCorp 2023, CEIP).

Figure 26. Example of PacifiCorp's "action to customer benefit indicators" Mapping

A.6 Data and Analytical Tools

Utility companies in Washington relied on the WA DOH's state-level mapping tools to understand and identify HICs in their respective service areas. The WA DOH has developed eight mapping tools related to environmental justice issues, and CETA specifically required the WA DOH to develop a cumulative impact analysis to identify HICs (WA DOH).

The WA DOH, Department of Commerce, University of Washington's Department of Environmental and Occupational Health Sciences, Front and Centered, Washington State Department of Ecology, and Puget Sound Clean Air Agency collaborated for several years to create the Washington Health Tracking Network Map that went live in 2019. This includes the Environmental Health Disparities map shown in Figure 27, which the utilities use to identify highly impacted communities in their service territories (WA DOH).



Source: Washington DOH.

Figure 27. Washington Environmental Health Disparities Map

Beyond the map used to identify HICs, PSE relied on various data sources to identify vulnerable populations including the following (PSE 2021):

- National-level data sources like the National Historic Geographic Information System, University of Michigan and 2019 American Community Survey Data
- State-level data sources, such as Department of Health and Tree Equity Score datasets
- Utility data from PSE's Customer Information System
- Purchased market research data (related to income)

Some of these resources provide customer-level information, while others provide census-block group or census-tract-level data. PSE aggregated customer-level data to the census-block scale to characterize neighborhoods in its service area across the vulnerable population factors it developed with its EAG. Each factor received a 1–5 frequency score within a given block group. With that standardized scale, PSE was able to run analysis to identify any patterns that could show which census-block groups have higher concentrations of vulnerable populations and what factors have high frequencies among the population (PSE 2021).

PSE plans to use other tools and data sources to further develop and track its metrics for CBIs. To develop a baseline for cost and burden reduction metrics, it may use DOE's Low-Income Energy Affordability Data (LEAD) tool alongside its internal data to measure the affordability of clean energy for PSE customers compared to all customers. To establish baseline data on the affordability of clean energy, another component of the burden reduction metric, PSE will likely purchase household income data and use it with American Community Survey data to compare bill reduction and affordability of clean energy by census tract. American Community Survey data does not include income data for individual households, which is an important facet of understanding and measuring energy affordability (PSE 2021).

For GHG reductions metrics, PSE expects to use EPA's AVERT model to get data on GHG reductions based on avoided conventional energy production and compare it to the estimated amount of energy the clean energy programs saved or generated over the course of the program year. PSE already reports its own GHG emissions data under EPA and Washington state regulations (PSE 2021).

PSE expects to use the EPA's COBRA tool to forecast the reduction in impact to community health, based on avoided emissions for new clean resources. PSE relied on various types of data and analytical tools to develop its vulnerable population factors (discussed in A.3). This includes the WA Commerce Utility Energy Program Assistance Survey Tool to compare its service area to statewide proportions of populations experiencing high energy burdens (PSE 2021).

To define which communities specifically experienced a high energy burden, PacifiCorp reported using its own survey data as well as census data and other data tools, such as DOE's LEAD tool to estimate and cross-reference customers' energy burden (PacifiCorp 2023).

A.7 Illustrative BCA and DEA for PSE

Overview

This section offers an example of decision-making based on BCA and DEA applied to a real DER. It applies the methodology within this document to PSE's 2022 energy efficiency portfolio (EE portfolio). The EE portfolio was well suited to this analysis because of its existing, available data. First, the EE portfolio has a readily available BCA. Second, PSE applied the CBI metrics included in its CEIP to its 2022 EE portfolio, where appropriate. Lastly, PSE back-calculated some CBIs for its 2020 EE portfolio, creating usable benchmark data.

This example is meant to be illustrative and does not reflect an official DEA for PSE. The example relates only to PSE, not the other utilities in Washington. The example uses a combination of data collected by PSE, simplified assumptions where data gaps existed, and streamlined decisions. Each choice was made to highlight the DEA framework. All sources, decision shortcuts, or data assumptions are clearly noted within this section. Because of the data gaps and the corresponding assumptions, this illustration should not be used to evaluate the actual equity implications of PSE's EE portfolio.

> Because of the data gaps, and the corresponding assumptions made, this illustration should not be used to evaluate the actual equity implications of PSE's energy efficiency portfolio.

This section first presents PSE's BCA results for its 2022 EE portfolio. This section does not incorporate any methodology or assumptions beyond PSE's cost-effectiveness modeling, but rather it presents the key elements of the BCA that are useful to display alongside the DEA.

Next, this section presents a simplified methodology for conducting a DEA to determine whether the EE portfolio improves or worsens energy equity.

Benefit-Cost Analysis

It is important to present the results of the BCA in clear and useful terms for decision-making purposes. Consistent with the guidance in the Introduction, the key metrics to present include the benefit-cost ratios, the net benefits, and the present value of the total costs and total benefits. Washington uses two cost-effectiveness tests: the total resource cost (TRC) test as the primary test and the utility cost test (UCT) as the secondary test (NSPM 2022). Since both tests are relevant for decision-making, BCA results are shown for the 2022 electric EE portfolio in both perspectives.

The results in Table 22 show the EE portfolio is robustly cost-effective. The portfolio has a TRC ratio of 1.99 and a UCT ratio of 2.29. Accordingly, the net benefits are also positive. TRC net benefits are $112 million, and UCT net benefits are $110 million. Table 22 also displays the total costs and total benefits for full transparency.

Table 22. BCA Results for PSE's 2022 Electric Energy Efficiency Portfolio

Metric	TRC	UCT
Total benefits (million PV$)	$226	$194
Total costs (million PV$)	$114	$85
Net benefits (million PV$)	$112	$110
Benefit-Cost Ratio	1.99	2.29

Distributional Equity Analysis

Identify Priority Populations

The CEIPs identify priority populations using two terms with distinct definitions: HICs and vulnerable populations. For simplicity the example defines priority populations as HICs-only.

As stated in Section A.4, HICs are identified as either census tracts situated in "Indian Country" as defined in statute, or census tracts that score at least a nine out of ten on the cumulative impact analysis presented in the Washington Health Disparities Map (WA DOH).

Identify Distributional Equity Metrics

In its CEIP, PSE proposed 11 CBIs with associated metrics spanning the CETA benefit categories. For each CBI, PSE presented baseline data for 2020 (or explained data gaps) and described the expected burdens to be reduced.

PSE developed its CBIs with input from stakeholders including the Equity Advisory Group, Low-Income Advisory Group, Conservation Resource Advisory Group, and community-based organizations that serve vulnerable populations. In June 2023, The Washington UTC approved the CBIs with the following modifications:

- Remove one of the climate change CBIs that multiplied GHG emissions reductions by the social cost of carbon.
- Replace proposed cost reduction CBI of reduced median electric bills with the number of customers with high energy burdens (greater than 6 percent), and the average excess energy burden.
- Add energy security CBI metrics relating to arrearages and disconnections for non-payment.

Table 23 summarizes PSE's approved CBIs and metrics, color-coded to align with the CETA benefit categories in Table 21 (metrics applicable to HICs-only displayed in green, metrics applicable to all customers displayed in grey).

Table 23. PSE's CBIs and Metrics

CBI Category	Customer Benefit Indicator	Metric
Energy benefits, non-energy benefits, burden reduction	Improved participation in clean energy programs from highly impacted communities and vulnerable populations	Number and percentage of participation in energy efficiency, demand response, and distributed resource programs or services by PSE customers within highly impacted communities and vulnerable populations
Non-energy benefits	Increase in quality and quantity of clean energy jobs	Number of jobs created by PSE programs for residents of highly impacted vulnerable populations
		Number of local workers in jobs for programs
		Number of part-time and full-time jobs by project
		Range of wages paid to workers
		Additional benefits offered
		Demographics of workers
Non-energy benefits	Improved home comfort	Dollars in net present values (NPV) in non-energy benefits for EE programs
Reduction of burdens	Increase in culturally and linguistically accessible program communications for named communities	Outreach material available in non-English languages
		Outreach material available in English language
		Outreach material impressions in non-English languages
		Outreach material impressions in English language
Environmental benefits	Reduced GHG	PSE-owned electric operations metric tons of annual carbon-dioxide-equivalent emissions
		PSE contracted electric supply metric tons of annual carbon-dioxide-equivalent emissions
Public health benefits	Improved outdoor air quality	Regulated pollutant emissions (sulfur dioxide, nitrogen oxides, and fine particulate matter)
Public health benefits	Improved community health	The occurrence of health factors like hospital admittance and work loss days
Resiliency benefits	Decreased frequency and duration of outages	Number of outages, total hours of outages, and total backup load served during outages using System Average Interruption Duration Index (SAIDI) and System Average Interruption Frequency Index (SAIFI)
		Peak demand through demand response programs
Risk reduction and energy security benefits	Improved access to reliable, clean energy	Number of customers who have access to emergency power
Reduction of burdens	Decreased number of households with a high energy burden (>=6%)	Number and percent of households
		Average excess burden per household
Energy security benefits	Decreased residential arrearages and disconnections for nonpayment	Number and percentage of residential electric disconnections for nonpayment by month, measured by location and demographic information (zip code/census tract, known low-income customers, vulnerable populations, highly impacted communities, and for all customers in total)
		Residential arrearages
		The number of customers with past-due balances (arrearages)
		The amounts of arrearages that are past due 30+ days, 60+ days, and 90+ days, as compared to total arrearages
Energy benefits, non-energy benefits, burden reduction	Improved participation in clean energy programs from highly impacted communities and vulnerable populations	Number of residential appliance and equipment rebates provided to customers residing in Named Communities
		Number of residential rebates provided to customers residing in rental units

For the illustrative DEA, the metrics were narrowed down using the criteria outlined in Section 3.4. PSE's CEIPs encompass system-wide energy equity impacts, rather than energy-efficiency-specific impacts; accordingly, not every metric applies to energy efficiency or is appropriate for a DEA. For this illustrative case study, only the following metrics for HICs and other customers are applied to the DEA:

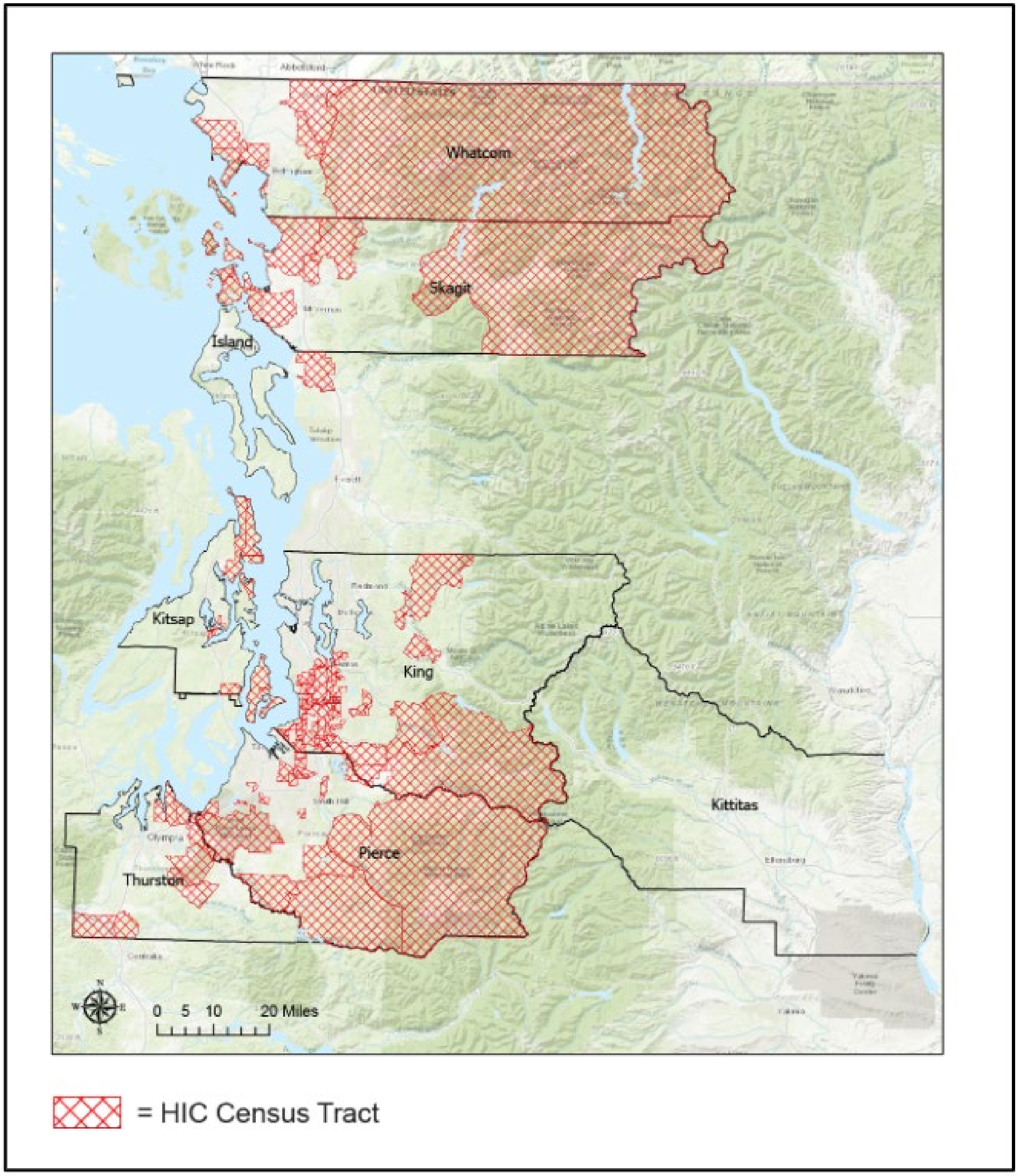
- Participation in EE programs, where participation is defined as the percentage of eligible customers who participate in the program in the relevant year
- Avoided illness from the reduction of outdoor air pollution, estimated by PSE in dollar values
- Health and safety benefits to the EE program participant due to home retrofit improvements, estimated by PSE in dollar values
- Change in number of households with a high energy burden, where a high energy burden is defined as having energy costs that are equal to or greater than 6 percent of household expenses

The DEA metrics selected are directly attributable to the DER in question. For example, the two reliability metrics, SAIDI and SAIFI, indicate the duration and frequency of electrical outages. Energy efficiency can contribute to improved reliability by lowering electric load and generally improving the equipment that interacts with the electric grid (LBNL 2022 Reliability). Nonetheless, other factors might lead to improved or worsened reliability, and PSE was not able to isolate *the extent to which its EE programs will affect reliability*. For this reason, this illustrative DEA excludes those two reliability metrics.

Collect Data and Establish Analytical Tools

PSE combined geographic- and household-level data to apply equity metrics to HIC and other customers. Washington's DOH analysis supplied PSE with the mapped boundaries of HICs, constituting geographic-level data. Meanwhile, PSE had energy efficiency data by account number, or household-level data.

PSE applied mapping tools to display where HICs exist within its service territory. The map below of the HICs in PSE's electric service area (Figure 28) shows that 27 percent of PSE customers are located in HICs.



Source: (PSE 2021).

Figure 28. Highly Impacted Communities Census Tracts in PSE Electric Service Area

Using the boundary information, PSE binned each of its customers as an HIC or non-HIC customer based on their addresses. PSE calculated its CBI metrics for each group based on account-level data.

Apply Metrics to Priority Populations with Other Customers

Table 24 and Table 25 display metrics data for the HICs and the other customers. Table 24 presents the raw data, calculated values, and sources. This table displays the data that will ultimately be used for the metrics, but not necessarily the final format of the metrics. This table is included here because it shows the steps taken to convert the PSE data into metrics better suited for a DEA, where applicable. All calculated values are indicated in grey. For example, Row 3 shows a participation rate for each group, which is calculated as the number of participants divided by the total number of PSE customers. Participation rates are more indicative of program reach than the total number of participants.

Table 24. Raw Metric Data

Metrics	Sector	HIC	Other Customers	Source	Link
Participation (annual)	All	44,469	87,438	Communication with PSE	
Total customers	All	294,002	792,326	Communication with PSE	
Participation rate (annual) (%)	All	15%	11%	Calculated	
Avoided illness from pollution non-energy impacts (NEI) ($)	Residential	$175	$548	CBI report card	CBI Report (Filing UE - 210795)
	Commercial	$464	$1,062	CBI report card	See above
	Total	$640	$1,610	Calculated	
Health and safety NEIs ($)	Residential	$255,235	$795,153	CBI report card	See above
	Commercial	$0	$0	CBI report card	See above
	Total	$255,235	$795,153	Calculated	
Number of households with a high energy burden (>=6%)	Residential	50,369	154,413	CBI report card	See above
Change in number of households with a high energy burden (>=6%)	Residential	-5,000	-3,000	Illustrative assumption[32]	

Table 25 presents the simple results for the HICs and other customers. The simple results show the following:

- Participation rates are higher for HICs than other customers.
- Both avoided illness benefits and health and safety benefits are lower for HICs than other customers.
- HICs experienced a greater decrease in the number of energy burdened homes than other customers.

[32] PSE did not calculate the change in number of homes with high energy burden resulting from the 2022 portfolio. The number above is illustrative.

Table 25. Simple Results

Metrics	Portfolio Performance	
	HIC	Other Customers
Participation Rates (%)	15%	11%
Avoided illness from pollution NEIs ($)	$640	$1,610
Health and safety NEIs ($)	$255,235	$795,153
Change in number of households with a high energy burden (>=6%)	-5,000	-3,000

While the simple results provide some information on how the EE portfolio impacted each customer group, it is difficult to draw meaningful conclusions from this set of metrics without benchmarks. As stated above, only 27 percent of PSE's territory is HICs; thus, comparing avoided illness reported in dollar values across populations, for instance, is challenging without a frame of reference.

Benchmarking

This guidance document recommends including benchmarks in the analysis to provide useful context and ultimately develop DEA scores (see Chapter 5). The stakeholders play an important role in developing benchmarks or reviewing benchmarks developed by the utility. This example uses values from the 2020 portfolio as benchmarks. This choice of benchmarks effectively checks whether the new 2022 plan is at least as effective in each metric category as the 2020 plan for each customer group.[33]

Unlike in the example in the main body of the guidance document, the example shown in Table 26 uses distinct benchmarks for HICs and other customers for each metric, showing how the DEA framework can be adapted for different equity definitions and metrics. The stakeholders should determine whether one benchmark applies sufficiently to both customer groups, or whether group-specific benchmarks (such as those below) are needed.

Table 26. Benchmarked Results

Metrics	Portfolio Performance		Benchmarks			
	HICs	Other Customers	HICs	Other Customers	Good to exceed?	Benchmark source
Participation rates (%)	15%	11%	7%	8%	Yes	Illustrative assumption[34]
Avoided illness from pollution ($)	$640	$1,610	$525	$1,694	Yes	2021 CEIP, Table 3-12
Health and safety ($)	$255,235	$795,153	$275,339	$421,567	Yes	2021 CEIP, Table 3-12
Change in number of households with a high energy burden	-5,000	-3,000	-4,000	-4,000	Yes	Illustrative assumption[35]

[33] This choice is not meant to imply using a prior year's equity metric results is the optimal benchmark to define success. There are better ways to develop benchmarks, either as part of the DER program design or as part of the DEA process with input from stakeholders, including those representing priority populations.

[34] PSE calculated the percent of participants in 2020 that qualified as HICs, but not the participation rate of HICs and other customers. In the absence of a calculated value, the number above is assumed.

[35] PSE did not calculate the change in number of homes with high energy burden resulting from the 2020 portfolio. The number above is illustrative.

DEA Scores

Unweighted DEA Scores

The unweighted DEA scores present the percent change between the simple results and benchmarks. Figure 29 reports values for the HICs and other customers for each equity metric. Values that are above the x-axis mean the population performed better with the 2022 EE portfolio than the 2020 EE portfolio. Values below the x-axis mean the population performed worse.

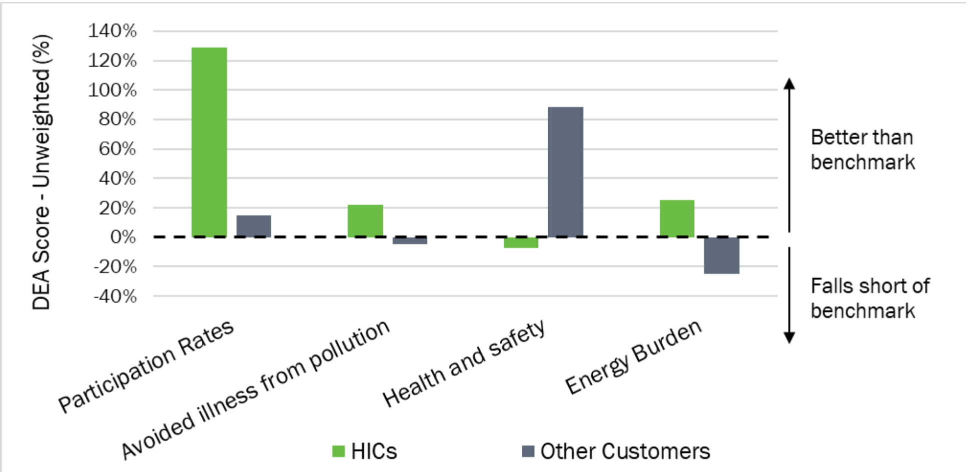


Figure 29. Unweighted DEA Scores

The unweighted DEA scores provide more information than the simple results. The following conclusions can be drawn from Figure 29 that could not be drawn from the simple results:

- Participation rates in 2022 exceeded participation rates in 2020 for both customer groups. The increased participation was much greater for HICs.
- The next two metrics, illness from pollution and health and safety, showed opposite results. The 2022 EE portfolio avoided more illness from pollution for HICs than in 2020 but avoided marginally less illness from pollution for other customers. Meanwhile, HICs experienced slightly fewer health and safety benefits compared to 2020, while the other customers saw significantly increased benefits.
- HICs experienced a greater decrease in high-energy-burdened homes in 2022 compared to 2020. Meanwhile, other customers had a smaller decrease in high-energy-burdened homes than in 2020.

The unweighted DEA scores lend insight at the metric level but it is challenging to draw meaningful conclusions regarding all the metrics combined.

Weighted DEA Scores

The final step of the DEA framework is to present a net DEA score that combines individual metric scores with the importance weights assigned by the stakeholders. For this example, each of the metrics receives equal weight for simplicity. Since there are four metrics, each is assigned a weight of 25 percent.

Table 27. Importance Weights Assigned in Example

Metrics	Importance Weight
Participation Rates	25%
Avoided illness from pollution	25%
Health and safety	25%
Energy burden	25%

Figure 30 merges the unweighted, metric-level DEA scores with the importance weights to develop weighted DEA scores. The weighted score for each metric sums to a net score.

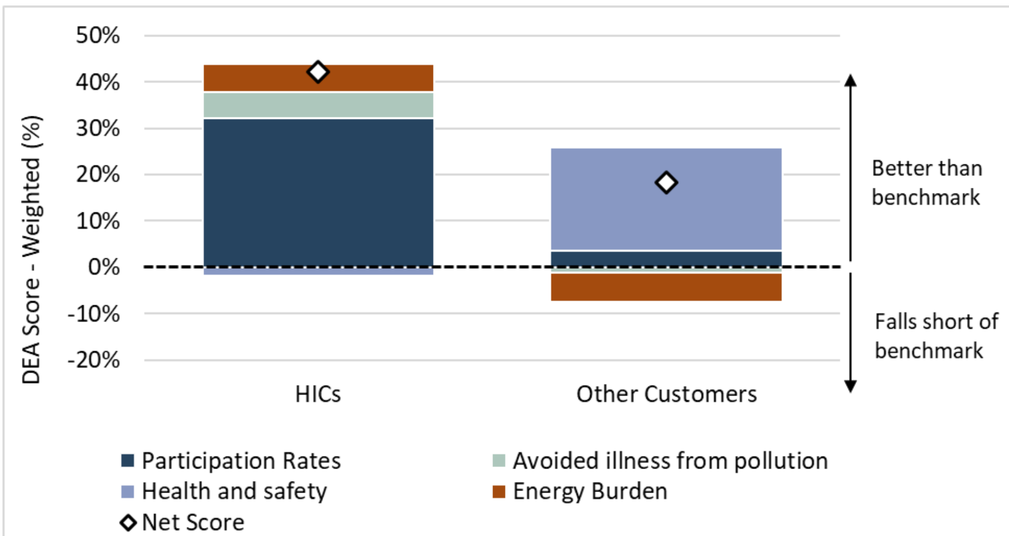


Figure 30. Weighted DEA Scores

The weighted DEA scores integrate the results from each metric and its importance weight to allow for comparison between populations. The following conclusions can be drawn from Figure 30 that could not be drawn from Figure 29:

- The net scores indicate that, in total, the 2022 EE portfolio improved equity more for the HICs than the other customers (compared to the 2020 EE portfolio).
- The net scores also indicate that both customer groups experience net positive equity impacts.
- Improved participation was the most significant equity metric for the HICs.
- Health and safety benefits were the most significant improvement for the other customers.

Draw Conclusions from the BCA and the DEA

Figure 31 below is a useful reference tool when making decisions based on a BCA and a DEA (see Chapter 7). The figure presents four alternatives based on whether the DER passes or fails the BCA and passes or fails the DEA. The figure indicates that, if the DER passes both the BCA and DEA, it should be approved. If the DER fails both the BCA and DEA, it should be rejected (or modified). If it has mixed results from the two analyses, judgement is required to move forward.

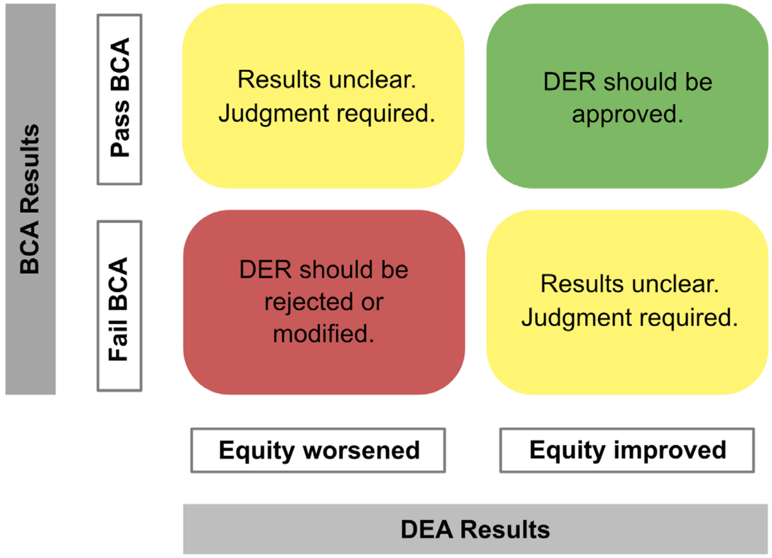


Figure 31. Conclusions Matrix for the BCA and DEA

As described in Table 22, PSE's EE portfolio passed the BCA.

The DEA results are less straightforward. As noted above, the goal of this DEA is to determine whether the EE portfolio improves or worsens equity. The choice of benchmarking assumptions, where benchmarks are based on the equity metric results from the 2020 EE portfolio, essentially narrows the scope of this question to whether (a) the 2022 EE portfolio improves or worsens equity relative to the 2020 EE portfolio, and (b) the HICs would be served at least as well as the other customers.

Referencing Figure 30 both net scores for the HICs and the other customers were decisively positive, indicating equity was improved relative to the 2020 EE portfolio. Additionally, the net score for the HICs exceeded the net score for the other customers, passing the criteria that HIC were served at least as well as the other customers. The EE portfolio passes the DEA.

According to Figure 31, the EE portfolio should be approved. Nonetheless, decision-makers will need to consider whether improvements could be made to improve equity for all customers. For example, there may be possible improvements to program implementation practices so that the EE programs increase the health and safety benefits to participating customers. Specific actions could include adding initiatives to pair weatherization upgrades with improved ventilation, or addressing structural concerns by patching up roofs, or repairing broken windows. Safety can be improved, for example, by installing smoke or carbon dioxide alarms in households that do not already have them.

Despite the apparent simplicity of Figure 31, utilities, regulators, and stakeholders will ideally always think critically and broadly about what the results of the DEA mean before approving or rejecting a DER. In many cases, equity improvements or modifications to the DER design might prove to be more equitable or more cost-effective than simply accepting or rejecting a DER.

A.8 Resources

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Appendix B. Sources for Priority Population Indicators

B.1 Introduction

Chapter 3 provides a summary of how to define priority populations and describes several indicators that can be used. This appendix provides some of the publicly available data sources that contain information on these indicators.

In addition, the White House Environmental Justice Advisory Council issued recommendations that included a list of data sources and data gaps for information on priority population indicators (White House EJ Advisory Council).

B.2 Existing Inequities, Institutionalized Racism, or Exclusion

This category captures those customers facing disadvantage or discrimination, who "often have lower socioeconomic status, which result in fewer resources for preparing, coping and recovering from climate impacts" (CA GOPR 2018, p.6-7). Most jurisdictions with equity goals, policies, or actions identify elements of this category in their definitions of priority populations. For example, every state reviewed in this study considered income and most considered race. Typical indicators include the following:

Income

Definition: Includes people with low income and low-to-moderate income (LMI) relative to the federal poverty level, area median income, or other measures of cost burden. Might also be defined by ability to benefit from financial incentives (such as rate assistance or tax benefits) (EEP 2022).

Primary Data Source: (US Census Bureau website, American Community Survey).

Race and Ethnicity

Definition: Includes race or people that identify as non-white and/or list their ethnicity as Hispanic or Latino (U.S. Environmental Protection Agency 2022). In some cases, these populations also include Muslims and immigrants (EEP 2022).

Primary Data Source: (US Census Bureau website, American Community Survey).

English Language Proficiency

Definition: Refers to people who are not proficient in the English language (CEQ 2023 Methodology).

Primary Data Source: (US Census Bureau website, American Community Survey).

Tribal Lands

Definition: Refers to federally designated tribal lands (CEQ 2023 Methodology).

Primary Data Source: (US DOI website, Land Area Representation Dataset).

Other Household Indicators

Definition: Includes a variety of indicators of people living in the customer's household, such as elderly, youth, people with disabilities, and single parents (EEP 2022).

Primary Data Sources:

- Elderly: (US Census Bureau website, American Community Survey)

- Youth: (US Census Bureau website, American Community Survey)
- People with disabilities: (US Centers for Disease Control and Prevention website, Disability and Health Data System)
- Single parents: (US Census Bureau website, American Community Survey)

Workforce and Employment

Definition: Includes communities with high unemployment rates, individuals who are unemployed, or individuals who are legacy energy workers (e.g., coal miners).

Primary Data Sources:

- Unemployment: (US Census Bureau website, American Community Survey)
- Legacy Energy Workers: DOE's Energy Community Tax Credit Bonus map and data, which shows communities historically reliant on fossil fuel extraction, processing and transport, and facing above-threshold unemployment (US DOE/NETL Energy Community website 2023). Other data varies by definition and state. One example is the energy communities map created by Charles River Associates, which maps geographic locations that have "historical ties to traditional fossil fuel industries" (CRA 2022).

Housing

Definition: Includes communities that have experienced historical underinvestment or redlining,[36] have high housing costs, a lack of green space, a lack of indoor plumbing, or lead paint (CEQ 2023 Methodology). This could also include mobile homes and manufactured housing. Some states have different ways of accounting for housing inequities. For example, Connecticut considers housing age in its definition of vulnerable communities, which presumably is meant as a proxy for poor housing conditions that might create housing inequities (CT DEEP website).

Primary Data Sources:

- Historical Underinvestment: (UM ISR website, Dataset of formerly redlined areas)
- Housing Cost: (HUD OPDR website, Comprehensive Housing Affordability Strategy dataset)
- Lack of green space: (MRLC website, NLCD 2019 Percent Developed Imperviousness)
- Lack of Indoor Plumbing: (HUD OPDR website, Comprehensive Housing Affordability Strategy dataset)
- Lead Paint: (US Census Bureau website, American Community Survey)

Gender and Sexual Orientation

Definition: Includes lesbian, gay, bi-sexual, trans, and queer (LGBTQ+) people (EEP 2022).

Primary Data Source: Some data might be available from the US Census Bureau website, American Community Survey.

[36] The term "redlining" refers to the practice of isolating some neighborhoods based on race, income, or other factors in a way that limits the services or opportunities provided to those neighborhoods. More information on redlining is available from (NCRC 2022).

B.3 Population Health

Certain indicators put individuals at a higher risk of health problems from pollution or the impacts of climate change. These individuals include older adults, young children, pregnant women, and people with chronic health conditions or mental illness (CA GOPR 2018, p.6-7). This category is often identified by states in their definitions of priority populations. Most definitions of priority populations consider that health and other conditions might worsen the impact of environmental exposures.

Health Impacts

Definition: Includes communities that have high levels of asthma, diabetes, heart disease, or low life expectancy (CEQ 2023 Methodology).

Primary Data Sources:

- (CDC Local Data website)
- (CDC ALEEP website)

B.4 Poor Environmental Conditions, Access to Services, or Living Conditions

Certain populations are at higher risk under a changing climate. These include "those who are uninsured or underinsured or lack access to health care or child care, lack access to transportation, live in areas with poor air quality, live on upper floors of tall buildings, live in areas with lots of impervious surfaces and little tree cover, and lack life-supporting resources such as adequate housing, ways to cool living space, are food insecure or lack adequate medications, or are tenants or renters. Populations at higher risk also include those living in 'land islands' that have limited access to resources and services due to conditions of geographic isolation" (CA GOPR 2018, p.6-7). States often identify this category in their definitions of priority populations. Many definitions of priority populations reviewed in this study consider that health and other conditions might worsen the impact of environmental exposures.

Climate Change Impacts

Definition: Includes communities expected to experience increased rates of agriculture loss, building loss, population loss, flooding, or wildfires as result of climate change (CEQ 2023 Methodology).

Primary Data Sources:

- (CEQ Social Vulnerability Index website)
- (FEMA website, the National Risk Index)
- (The First Street Foundation, Climate Risk Data)

High Levels of Pollution

Definition: Includes communities that have at least one abandoned mine or are in proximity to hazardous waste facilities, superfund sites, or risk management plan facilities (CEQ 2023 Methodology). Other sources of pollution could be included, such as exposure to diesel particulate matter, nitrogen oxides emissions, and wastewater discharges.

Primary Data Sources:

- (CEQ Environmental Justice Index website)
- (CEQ Social Vulnerability Index website)

B.5 References and Resources

The White House Environmental Justice Advisory Council (White House EJ Advisory Council). 2021. *Justice40 Climate and Economic Justice Screening Tool & Executive Order 12898 Revisions: Interim Final Recommendations.* May. https://www.epa.gov/sites/default/files/2021-05/documents/whejac_interim_final_recommendations_0.pdf

Appendix C. Equity Metrics

C.1 Illustrative System-Wide Equity Metrics

Table 28 through Table 31 list potential metrics to assess system-wide energy equity by type of impact, category, and subcategory. This list was compiled by reviewing several studies of equity metrics (including (PNNL 2022); (PNNL 2021); (Initiative for Energy Justice 2021), (EEP 2022), (DOE 2023), and (CELICA 2018), and by surveying a portion of U.S. states, including Connecticut, California, Hawaii, Massachusetts, Illinois, and Washington.

While this list of metrics is broad, it is not exhaustive. Rather, it is intended to provide a summary of the range of potential metrics to measure energy equity impacts across the entire utility system.

As described above in Section 4.3, system-wide energy equity metrics need to be refined for the purpose of conducting DEA. Table 9 in Section 4.4 presents an illustrative list of DEA metrics that was developed by refining the full list of metrics in Table 28 through Table 31. These tables include a column indicating which of the system-wide energy equity metrics were chosen for inclusion in Table 9. Section 4.4 provides examples of the rationale used for selecting the system-wide metrics to use for DEA metrics.

Table 28. System-Wide Equity Metrics: Utility System Impacts

Category	Subcategory	Potential Metrics	DEA Metric
Procedural or recognition equity	Outreach, accessibility, and engagement	Increase in outreach material available in non-English language(s)	-
		Participation in workgroups, surveys, or focus groups	-
		Numeric representation of community satisfaction surveys	-
		Qualitative data collection: Oral accounts of community experiences	-
		Rate of customer service callbacks	-
	Transparency and data access	Presence of reporting or disclosure requirements	-
		Reporting and transparency of utility data on equity impacts, e.g., outages in disadvantaged communities or disconnections for priority populations.	-
		Energy consumption disclosure or benchmarking	-
	Other	Presence of Diversity, Equity, and Inclusion training and reporting requirements	-
		Socioeconomic diversity of utility staff or program administrators	-
	Public intervenor access	Access to public intervenor funds: % program budget for intervenor funds	-
		Ease of access to intervenor trainings and information	-
Provision of service	Reliability and resilience	Change in number and duration of outages on the utility system, e.g., CEMI, SAIDI, SAIFI, CAIDI, MAIFI	✓
		% of customers or load served by critical feeders or substations	-
	Utility service shutoffs	Change in number of shutoffs, frequency of shutoffs	✓
		Shutoff costs	-
		Number and duration of disconnections disproportionately impacting priority populations	-
		% of customers protected by disconnection moratoria	-
		Presence or duration of disconnection moratoria or suspensions during extreme circumstances	-
	Utility complaints rate	Frequency and severity of complaints	-
Financial hardship	Financial hardship program participation	Percent of eligible customers participating in financial assistance programs	-
	Financial hardship program costs	Financial assistance provided	-

Key: A checkmark in the rightmost column indicates whether the metric might be suitable for a DEA metric based on application of the guidelines in Section 4.3.

Table 29. System-Wide Equity Metrics: Host Customer Impacts

Category	Subcategory	Potential Metrics	DEA Metric
Non-energy impacts	Health, safety, and comfort	Physical health: rates of respiratory distress, change in medical costs, change in lost workdays	✓
		Indoor air quality	-
		% customers denied access to DER programs or measures due to home health and safety issues	-
		% of homes at unsafe temperatures	-
		Number and percent change in health and safety measures received by customers, or funding provided for healthy homes measures	-
		Change in thermal, noise, lighting impacts	-
	Reliability and resilience	Change in number and duration of outages at the customer-level: CEMI, CEMSMI, CELID	✓
		% of customers or critical services with backup generation	-
	Other	Costs or net benefits of reduced consumption of fuels	-
		% of appliances converted to efficient models	-
		% change in asset values, building values, equipment lifetime, maintenance costs	-

Key: A checkmark in the rightmost column indicates whether the metric might be suitable for a DEA metric based on application of the guidelines in Section 3.4.

Table 30. System-Wide Equity Metrics: Societal Impacts

Category	Subcategory	Potential Metrics	DEA Metric
Public Health	Health impacts	Physical health: change in rates of hospital admissions, asthma, cancer risk	✓
		Lead paint indicator: % of housing units built before 1960	-
		Proximity to toxic facilities	-
		Lost workdays	✓
	Impacts of GHG-related events	Expected annual loss of life (fatalities and injuries) from GHG-driven, weather-related impacts	-
Environment	Criteria air emissions	Criteria pollutant emissions	-
		Vehicle emissions: Diesel particulate matter level	-
		Local air quality: Weighted average days exceeding healthy levels	-
	GHG emissions	Emissions of GHGs	-
	Other environmental impacts	Solid waste, land, water impacts	-
		Impacts of GHG-related events	-
		Heat exposure, heat wave risk	-
Community	Jobs	Jobs created	-
		Change in quality of jobs (wages, benefits)	-
		Supplier or local contractor diversity	-
		Workforce development, clean energy apprenticeships	✓
	Economy fossil fuel dependence	Coal or fossil energy employment: % of total civilian jobs	-
	Energy independence and accessibility	% electricity generation from renewables	-
		Amount and increase in transit electrification	-
		% of community energy from non-emitting sources	-
		Electrification rates: % of households without electricity	-
	Resilience	% of critical services without power in an outage	-
		% of customers or community served by microgrid or customers with islandable resources or distributed storage	-
	Utility dollars invested in the community	Utility funds invested in businesses and contractors in priority populations	✓

Key: A checkmark in the rightmost column indicates whether the metric might be suitable for a DEA metric based on application of the guidelines in Section 4.3.

Table 31. System-Wide Equity Metrics: Rate, Bill, and Participation Impacts

Category	Subcategory	Potential Metrics	DEA Metric
Rates	Change in rate	Absolute change in rate	-
		% change in rate	✓
	Rate structure or type	Amount of fixed charges on utility bill	-
		Rate disparities between residential and other customer classes	-
		% customers applying and participating in rate incentives for DER adoption	-
Bills	Energy consumption	Amount of energy saved or generated from DERs	-
		Energy use intensity: household energy consumption per square foot	-
	Change in bills	Absolute change in bills	-
		% change in bills	✓
	Energy burden	Energy burden	-
		% change in energy burden	✓
		Transportation energy burden	-
		Housing energy burden	-
		Number of customers with excess burden	-
Participation	Participation *for the DER being evaluated*	Number of participants	-
		Participation as a percent of eligible customers	✓
		% efficiency potential or solar potential achieved	-
	Barriers to participation	Presence of auto-enrollment or opt-out program structure	-

Key: A checkmark in the rightmost column indicates whether the metric might be suitable for a DEA metric based on application of the guidelines in Section 4.3.

C.2 Descriptions of Illustrative DEA Metrics

This section provides brief descriptions of each of the equity metrics that were selected as DEA metrics, as indicated in the three tables above, including definitions, formulas, and data sources for calculating the metrics.

Utility System DEA Metrics

Reliability and Resilience

Reliability metrics measure utility system or grid performance during outages under relatively normal conditions (Sandia 2017). Inequities in reliability of the utility system include longer durations of service interruptions than system averages during severe weather events or more frequent interruptions than system averages (PNNL 2022). For example, during the blackouts in February 2021 in Texas, areas with a high share of minority population were more than four times as likely to experience a blackout than predominantly white areas (LBNL 2022 Reliability). DERs can improve reliability by reducing load on the system, which can improve system reliability during peak demand events.

Table 32. Example Metrics: Reliability and Resilience

Metric	Definition	Formula
System Average Interruption Duration Index (SAIDI)	Duration of sustained (non-momentary) interruptions, per year, the average customer experienced	$\frac{Total\ minutes\ of\ customer\ interruptions}{Total\ number\ of\ customers\ served}$
System Average Interruption Frequency Index (SAIFI)	Number of sustained interruptions, per year, the average customer experienced	$\frac{Total\ number\ of\ customer\ interruptions}{Total\ number\ of\ customers\ served}$
Customer Average Interruption Duration Index (CAIDI)	Average number of minutes it takes to restore non-momentary electric interruptions	$\frac{Total\ minutes\ of\ customer\ interruptions}{Total\ number\ of\ interruptions}$
Momentary Average Interruption Frequency Index (MAIFI)	Number of momentary customer interruptions, per year, the average customer experienced	$\frac{Total\ number\ of\ momentary\ interruptions}{Total\ number\ of\ customers}$

Source: (Synapse, 2015) and (Sandia 2021).

These indexes measure the duration or frequency of outages over a period of time. These metrics are used at a national level by the Federal Energy Regulatory Commission and in many states to monitor and enforce the reliability performance of utilities and have standardized definitions and calculation methodologies. These metrics are designed to provide system-level measurement of total duration and frequency of interruptions averaged over all utility customers. However, these metrics only reflect the availability of power to customers, and do not reflect the actual impact or reliability experienced by each customer (LBNL 2022 Reliability).

These metrics require data on the duration and frequency of customer interruptions or sustained outages and the total number of customers on the system. The U.S. Energy Information Administration (EIA) Form 861 provides reliability data for utilities in the country through variations in SAIDI, SAIFI, CAIDI. Utilities can use outage management systems or advanced metering infrastructure (AMI) to track system performance and reliability using equipment monitoring and GIS data. For example, Nevada requires utilities to evaluate locational benefits and costs in their distributed resource plans. Interruptions or outages might or might not exclude outages from major storms or events (LBNL 2022 Reliability). However, to use this metric, it is useful to define a "sustained outage" and "major event" and standardize frequency of measurement. Generally, a sustained outage is a loss of power that lasts over five minutes, while a momentary interruption is one that lasts less than five minutes (LBNL 2022 Reliability).

Utility Service Shutoffs

Vulnerability to utility service shutoffs, e.g., disconnection due to bill non-payment, is a persistent inequity of the electricity infrastructure system. DERs can lower customer utility bills, thus reducing the risk of nonpayment or arrearages, and thus reducing shutoff rates.

Table 33. Example Metrics: Utility Service Shutoffs

Metric	Definition	Formula
Frequency of shutoffs	Total number of disconnections over a period of time.	$\frac{Total\ customer\ disconnections\ in\ a\ period\ of\ time}{Total\ number\ of\ customers\ served}$
Trend in shutoffs	Percent change in the frequency of shutoffs.	$\frac{Total\ customer\ disconnections\ in\ a\ period\ of\ time}{Total\ number\ of\ customers\ served}$

Shutoffs can be measured as the total number of shutoffs or as a frequency (number over a period of time). The number of shutoffs lasting longer than 30 days is a frequently used baseline or threshold for identifying severe shutoffs. Utilities will ideally provide the data for calculating shutoff metrics. Either the utility collects customer demographic data alongside shutoff information, or it estimates shutoffs based on an average within geographic boundaries. Data on shutoffs is not mandated in many states, and often is only required for investor-owned utilities (Ryan, 2021).

Data examples:

- Michigan Public Service Commission requires investor-owned utilities to file monthly reports on disconnections and arrearages in docket U-20757. This data is presented in a publicly accessible online dashboard (MPSC, Utility Customer Data).
- A report from the National Bureau of Economic Research analyzes zip code data on electricity shutoffs to document correlation with extreme economic distress in Illinois (NBER 2021). The study found that utility customers in Black and Hispanic zip codes were roughly four times as likely to be disconnected for non-payment.

Host Customer DEA Metrics

Many of the energy-related impacts of DERs on host customers are already accounted for in the BCA; the rate, bill, and participant impact analysis; or are measured at the societal or utility system level. Non-energy impact (NEI) is a broad term for a wide range of impacts (positive or negative) participants experience that are not directly associated with energy production, transmission, distribution, or use. NEIs can be more difficult to quantify than direct energy impacts, but there are sources and methods for determining NEI values. The presence, direction, and magnitude of these impacts will depend on many factors, including the type of DER, the specific DER technology, and the type of host customer. There are many methods to estimate host customer non-energy impacts, and the uncertainty/accuracy of these methods will vary by method selected.

Reliability and Resilience

Most reliability benefits accrue to the utility system. Some reliability benefits, however, might accrue to the host customer or other customers. An example of this would be when a micro-grid or a combination of distributed generation and distributed storage allows the host or hosts to continue to have power during a power outage (Grid Strategies 2018). The utility system receives a benefit of reduced costs to restore service, but customers also benefit. Traditional system-level reliability metrics (such as SAIDI or SAIFI) do not necessarily capture the differences of the actual interruptions experienced by customers (LBNL 2022 Reliability). Metrics such as numbers of customers experiencing multiple interruptions and customers experiencing lengthy interruptions (represented by the indexes in Table 34 below) aim to measure reliability experienced by the most impacted customers, as opposed to utility-centric performance. Value of lost load (VOLL) is traditionally measured through customer interruption cost surveys, separately for residential, commercial, and industrial customers (LBNL 2022 Reliability).

Table 34. Example Metrics: Host Customer Reliability and Resilience

Metric	Definition	Formula
Customers Experiencing Multiple Interruptions (CEMI)	Total customers experiencing more than N sustained outages.	$\frac{Total\ number\ of\ customers\ experiencing\ more\ than\ N\ interupptions}{Total\ number\ of\ customers\ served}$
Customers Experiencing Lengthy Interruptions Index (CELID)	Total customers experiencing one or more interruptions of N hours or more.	$\frac{Total\ number\ of\ customers\ experiencing\ interupptions\ longer\ than\ N\ hours}{Total\ number\ of\ customers\ served}$
Value of lost load (VOLL)	The monetary impact on customers of power outages.	VOLL is often measured using customer surveys or using tools that rely upon customer surveys

As with SAIDI or SAIFI, calculating CEMI and CELID requires data on the duration and frequency of customer interruptions or sustained outages and the total number of customers on the system. In contrast, VOLL is traditionally measured through customer interruption cost surveys, separately for residential, commercial, and industrial customers (LBNL 2022 Reliability).

Health, Safety, and Comfort

Energy production and consumption can result in a variety of pollutants that can impact health, including air emissions, solid waste, and liquid emissions. At a household level, DERs might impact indoor air quality or temperature.

There is a substantial body of literature on quantifying NEIs of DERs and the challenges of quantifying these impacts (E4The Future, 2016). Estimating health, safety, and comfort impacts requires data not typically collected by utilities. Many public data sources exist for estimating these impacts. Some jurisdictions have conducted in-depth analysis of health and safety impacts that could be applied as a proxy to other jurisdictions (E4The Future, 2016) (LBNL Non Energy Impacts 2020). Some health and safety impacts might be difficult to measure without sufficient data, such as indoor comfort level as measured in customer surveys (NEEP 2017).

Table 35. Example Metrics: Host Customer Health, Safety, and Comfort

Metric	Definition	Formula
Lost workdays	Lost work or school days experienced by households due to health impacts.	$\frac{Decrease\ in\ annual\ lost\ work\ days}{Household}$
Change in medical costs	Change in respiratory or indoor air quality medical costs.	$\frac{Annual\ medical\ costs}{Household}$
Percent of homes at unsafe temperatures	Percent change in the number of households unable to use heating or cooling equipment or forgoing comfortable temperatures.	$\frac{Homes\ kept\ at\ unsafe\ temperatures}{All\ customers}$

Example: Inflection Temperatures and the Energy Equity Gap

A group of researchers took utility billing records and hourly energy consumption and weather data to estimate the "inflection temperature": the temperature at which households in Arizona turn on their cooling systems (Cong et al., 2022). The report defined the *energy equity gap* as the difference in inflection temperatures between low- and high-income groups.

Societal DEA Metrics

Public Health Impacts

While there are many potential health impacts from energy resources, the primary impacts are caused by air emissions including nitrogen oxides, sulfur dioxide, particulate matter (e.g., $PM_{2.5}$), ozone, carbon monoxide, volatile organic compounds, mercury, and lead. These emissions have several implications for public health, including non-fatal heart attacks, respiratory or cardiovascular hospital admissions, upper and lower respiratory symptoms, asthma, and asthma-related hospital visits. DERs affect public health impacts primarily by *avoiding* emissions from power plants, but also by producing emissions from, for example, fossil-fired generators used for distributed generation purposes.

Table 36. Example DEA Metrics: Societal Public Health Impacts

Metric	Definition	Formula
Lost workdays	Lost work or school days experienced by households due to health impacts.	$\frac{\textit{Decrease in annual lost work days}}{\textit{Customer population}}$
Hospital admissions	Increase or decrease hospital admissions for respiratory or temperature-related concerns.	$\frac{\textit{Number of hospital admissions}}{\textit{Customer population}}$

When conducting a DEA, it is important to avoid double-counting household health and safety impacts and societal public health impacts. Measurements of public health at the societal level include cancer rates, childhood asthma, hospital admissions, or other health metrics that can be measured at the community level (for example, the percent change in asthma-related emergency room visits for priority populations versus other customers). There are various tools and sources of public data to measure societal health impacts, including EPA's COBRA screening tool (EPA COBRA, 2023) or estimates of health benefits per kilowatt-hour (EPA, 2019).

Job Impacts

Job impacts (jobs created that are associated with investment in DERs) is a metric used to measure macroeconomic development. Jobs are affected by DERs directly (jobs associated with constructing, installing, and operating DERs) or indirectly (additional jobs associated with supply chains for the direct impacts) (NESP, 2022).

Metric	Definition	Formula/Source
Jobs created	Change in jobs created by the DER program.	The change in jobs can be estimated using macroeconomic models such as IMPLAN and REMI.
Workforce development	Clean energy apprenticeships & trainings.	This information should be available from the utility.

Job impacts are estimated using macroeconomic models. It is important to avoid double-counting different macroeconomic impacts. The dollar value of macroeconomic impacts should not be simply added to other dollar values in a BCA, because there is too much overlap between macroeconomic impacts and utility system impacts.

Community Investment

These metrics are proxies for economic development.

Metric	Definition	Formula/Source
Utility funding invested in community	Amount of utility dollars spent on DERs that flow to priority populations.	*This information should be available from the utility.*
Local business contracts	Amount of utility dollars spent on contractors that are based in priority populations.	*This information should be available from the utility.*

Rates, Bills and Participation DEA Metrics

Bill Impacts

Average annual or monthly bills are commonly reported as affordability or program data and are a key metric in a variety of regulated utility proceedings. Bill impacts can be expressed in dollars per year, dollars per month, per capita, by customer class, by income group, or other dimensions. For a DEA, bill impacts are measured as the percent change in host customer and non-host customer bills, for both the priority population and other customers.

Metric	Definition	Formula
Monetary change in bills	Dollar value change in monthly or annual utility bills for participants versus nonparticipants.	$(Future\ bill\ \$) - (Current\ bill\ \$)$
Percent change in bills	Percent change in monthly or annual utility bills for participants versus nonparticipants.	$\frac{Change\ in\ bill\ \$}{Current\ bill\ \$}$

Energy Burden

Energy burden combines bill information with income, to calculate the percent ratio of household income spent on energy expenses. In the context of DEA, this is measured as the percent change in energy burden for host and non-host customers, for priority populations and other customers. Energy burden is a key equity metric that captures how affordable energy is for households. Low-income households spend up to three times as much of their income on energy bills compared to non-low-income households (ACEEE, 2020).

A ratio of 6 percent or greater is often considered the threshold for a "high" energy burden; above 10 percent is considered a "severe" energy burden (ACEEE, 2020). Analyzing energy burden in relation to this threshold can be a way to assess energy affordability: if a household's burden exceeds this threshold, their energy costs are considered unaffordable (Empower Dataworks, 2020).

Metric	Definition	Formula
Percent change in energy burden	Percent change in energy burden for participants versus nonparticipants.	$\frac{Annual\ Household\ Energy\ Costs}{Annual\ Household\ Income}$

Calculating energy burden requires data on annual energy bill and gross income for a group of customers or entire service territory. This can come from Census or American Community Survey data, from utility customer surveys, or utility billing data.

- The Low-Income Energy Affordability Data (LEAD) Tool, created by DOE, is a national map of energy burdens across the United States by state, county, census tract, or city (DOE 2020).

Rate Impacts

As with bill impacts, rate impacts are a key metric in a variety of regulated utility proceedings. For a DEA, rate impacts are measured as the percent or unit ($/kWh) change in rates for priority populations and other customers. DERs might create rate impacts through changes in utility system costs and changes in sales as a result of DER resources (NSPM 2020).

Metric	Definition	Formula
Monetary change in rates	Dollar value change in monthly or annual utility rates for participants versus nonparticipants.	$Future\ rate\ \$/kWh - Current\ rate\ \$/kWh$
Percent change in rates	Percent change in monthly or annual utility rates for participants versus nonparticipants.	$\frac{Change\ in\ rate}{Current\ rate}$

Data for calculating rate impacts can typically be obtained from the relevant utility.

- Public data on utility rates: NREL manages a public Utility Rate Database of rates for over 3,000 EIA-recognized utility companies (NREL Utility Rate Database). Users can look up rates by zip code utility name.

Participation Rate

The participation rate refers to participation in the DER program under consideration. For DEA, this is measured as the percent change in participation in utility programs for priority populations versus other customers. Participation is a crucial DEA metric, as it captures many of the benefits associated with participating in a DER program.

Metric	Definition	Formula
Participation rate	Percent of eligible population participating in the DER program under consideration.	$\frac{Total\ program\ participants}{Total\ eligible\ customers}$

Utility DER program data and records are the data inputs for this metric. However, a key issue relating to data collection is identifying which participants in a program are priority populations. This issue applies to all the DEA metrics and is not unique to participation metrics.

Participation Rates Indicate Equity in PV Adoption

A study by Sunter et al. (2019) showed the disparity in energy access (i.e., clean and efficient energy technology access) where solar photovoltaic (PV) adoption aggregated at the census tract level for majority black census tracts was 20% behind majority white census tracts in having existing installations. The study also found that the disparity persisted even after increases in income and homeownership were considered (PNNL 2022).

Appendix D. Prepare Data and Establish Analytical Tools

D.1 The Purpose of Data and Analytical Tools

Overview

The core element of a DEA is to develop estimates for each of the DEA metrics, for both the priority population and the rest of the customers. This requires a lot of data, including (a) data identifying priority populations, which is largely demographic and socioeconomic, and (b) metric data measuring impacts on those populations. Thoughtful collection, preparation, and analysis of data are essential to conducting a DEA.

The next sections will outline some of these tools and data as applicable to DEA, with a focus on data analysis concepts and analytical tools, specifically web-based mapping tools and dashboards. The primary discussions of data sources for priority population characteristics and metrics are found in Chapter 3 and Chapter 4, respectively.

Types of Data

The sources, forms, and types of data relevant to a DEA are typically economic, social survey, energy, and geographic. Figure 32 shows the most common data for identifying priority populations and for assessing impacts of DER programs.

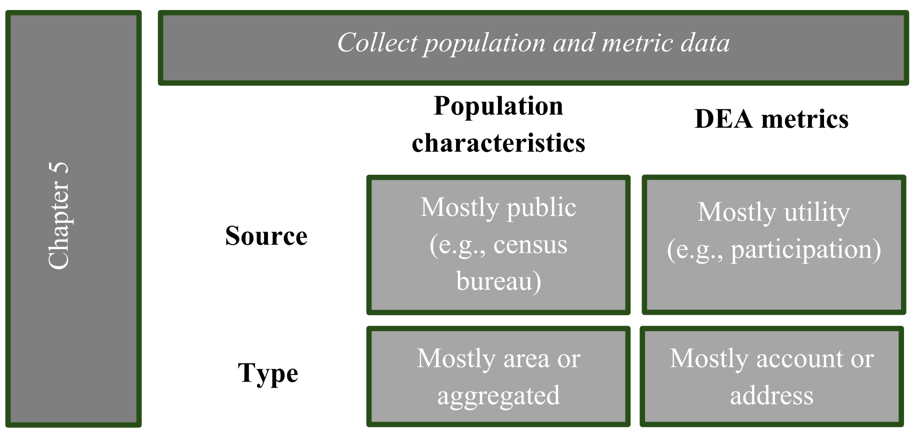


Figure 32. Typical Data Types for Identifying Priority Populations and for DEA Metrics

First, data for identifying priority populations is primarily socioeconomic and demographic. National agencies such as the U.S. Census Bureau collect, store, and provide the public with access to much of the socioeconomic and demographic data that jurisdictions will want to use for this purpose. This data can also be collected by state and local government agencies or other entities through community surveys, opt-in participation questions, or other data collection efforts. For certain types of data, utilities might have relevant data in existing customer information databases, for example regarding customers who are medically dependent on electricity or customers who receive energy assistance. Utilities can begin collecting certain types of data that they do not currently have. Specific indicators and data sources regarding priority populations are discussed in Chapter 3.

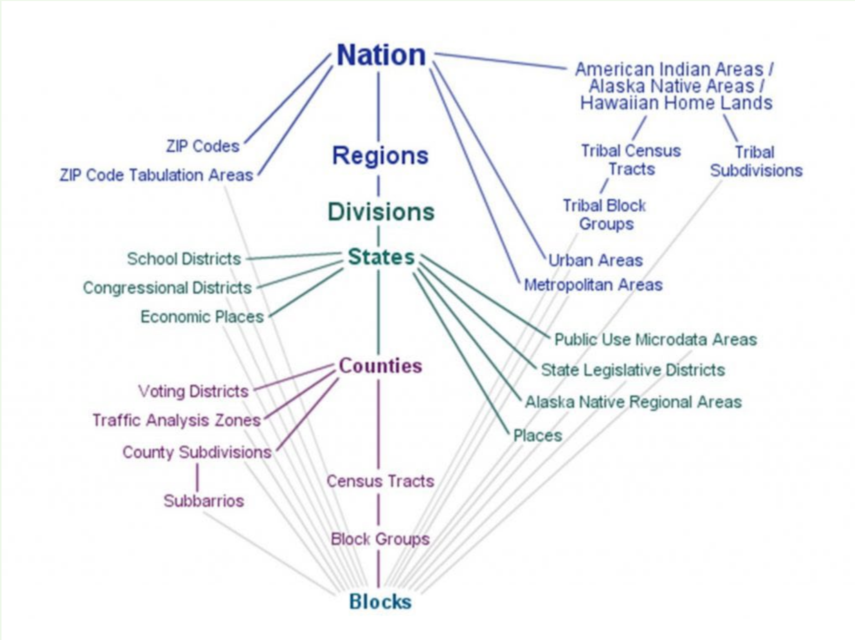
Second, a DEA requires data regarding the impacts of DER programs on priority populations and other customers. Utilities collect data that might be useful for tracking DER program impacts across a wide range of services and activities: billing data, customer account data and addresses, grid infrastructure performance data, DER installations, geographic data, and more. Web-based tools and dashboards are increasingly used by utilities or program administrators to collect or publish program or grid information. Much of this data is associated with individual accounts or addresses.

Considerations for Combining Datasets

When working with different geographic datasets, or geographic and non-geographic datasets, it is crucial to consider *resolution* and *interoperability*. *Resolution* refers to the specificity or granularity of the data, where higher resolution means smaller areas of measure or narrower categories. Resolution is crucial for determining distributional impacts and patterns. The more granular the data, the more reliable the modeling results will likely be. *Interoperability* refers to the ability of different datasets or systems to align and work together.

The figure below shows the relationships between legal, administrative, and statistical boundaries maintained by the Census Bureau, a primary source of publicly available data in the United States. How about "nation" or "country" instead?). Counties, census tracts, and census block groups are easily comparable as they have standard boundaries nationwide, as defined by the Census Bureau. Census blocks are divisions of census block groups, which are divisions of census tracts, and so on.

Data reported at the census block level offers greater specificity—i.e., higher resolution—than data aggregated at the tract or block-group level. However, data are often not publicly available at the census block level to protect privacy. Thus, tracts or block groups are typically the smallest geographic units used for standard analysis. Both census tracts and zip codes are geographic areas commonly used to report data, but their boundaries rarely align. As shown in the figure below, there is no consistent relationship between census tracts and zip codes. One census tract might overlap with parts of multiple zip codes. Thus, a dataset reported at the census-tract level might have poor interoperability with a dataset reported at the zip code level. Chapter 6 provides more detail on linking geographic and non-geographic data.



Source: (US Census Bureau website, American Community Survey).

Analysts might be able to use non-utility outcome data to calculate metrics, such as government-collected health or environmental data. For example, utility emissions rates might be reported to state environmental agencies, or state agencies might have other relevant environmental or health data available (see Appendix C).

Both population data and metric data can be collected and presented at varying scales. This guide uses the term "household level" to refer to data associated with a utility account, such as an address, customer information, enrollment data, or billing data.[37] Much of the data described above is presented in text-based or tabular form, such as a spreadsheet or database. In other situations, the data could be mapped using mapping tools, for example to show the locations of addresses on a map.

In contrast, this guide uses the term "geographic level" to refer to data associated with a defined geographic area, such as a county, zip code, census tract, or census block group. Many types of socioeconomic and demographic data are presented at a geographic level; that is, they represent the characteristics of an area, or they represent an aggregation of data points within an area. Accordingly, geographic-level data might obscure the impact on individual households or businesses. The smaller the geographical area, the better the resolution of the impacts to priority populations. Geographic analysis approaches, such as GIS models, can be used to combine geographic and non-geographic data, although combining data types requires care. (See text box.)

Shape and Scale of Geographic Data

The boundaries, granularity, and unit of geography affect the results of geographic analysis. Jurisdictions must carefully consider how the shape and size of geographic boundaries affect the results of a DEA.

Larger geographic areas can obscure finer patterns. For example, election results at a state level might obscure trends at a county level that show differences between urban areas and rural areas. Furthermore, how point data are aggregated into zones—the specific shape and scale of a geographic boundary--will affect the results, as happens when voting districts are gerrymandered.

Broader categories along other dimensions can have similar masking effects. For example, temporal resolution is important for seeing variability over time: average temperature over a whole year obscures the variation that would be visible if the data was reported on a monthly, daily, or hourly basis.

Types of Analytical Tools

Analytical tools are available to facilitate the collection, assessment, and presentation of this data. Table 37 below defines the types of analytical tools that could be relevant in a DEA. The rise of these tools follows the general trend of increased usage of data dashboards and other information management and visualization tools for policymaking (Matheus et al. 2020), (Fusi et al., 2022). This guide uses the term "analytical tool" to broadly refer to the variety of tools, interfaces, or models that might be used for data analysis or presentation for a DEA.

In this guide, a **mapping tool** refers to a broad category of interactive online maps. This includes government-published tools like DOE's Low-income Energy Affordability Data (LEAD) tool (DOE 2020) or CDC's National Environmental Public Health Tracking Network tool (CDC PHT Tool), local tools from research organizations like UCLA's Energy Atlas (UCLA 2020), or utility-published maps like Eversource's Outage Map (Eversource 2023).

Dashboards often include charts, graphs, and even maps. As with mapping tools, there are a variety of applications for dashboards. Examples of dashboards include New Jersey's County Solar PV Dashboard (NJDEP 2023), Atlanta's Energy Benchmarking Map, Michigan Public Service Commission's dashboard on Utility Customer Data (MPSC, Utility Customer Data). (See the text box on Atlanta's Energy Benchmarking Map below.)

Finally, **modeling tools** can be used to generate and/or analyze data for a DEA. For example, models such as EPA's Avoided Emissions and Generation Tool (AVERT) can be used to model avoided emissions impacts from renewable energy, or EVs (US EPA, 2023) Geographic Information System (GIS) based modeling tools can combine geographic and non-geographic data and are the underlying foundation of many mapping tools.

[37] Note that household, account, and address are not synonymous or interchangeable. One account could have multiple households, or one address could have multiple accounts. For example, multifamily apartment complexes might be associated with a single utility account and address but serve multiple households.

Economic models such as IMPLAN can generate projections of employment, although such models often lack the necessary granularity to allow consideration of whether priority populations specifically will see increased employment as a result of program investments. (An in-depth discussion of the modeling and collection of health, economic, or environmental data is beyond the scope of this document.)

Table 37. Categories of Analytical Tools Relevant to DEA

Tool	Description
Mapping tool	An interactive data visualization platform that displays geographic data.
EJ screening tool	A type of mapping tool that combines environmental, health, socioeconomic, and/or demographic information, overlaid in an interactive mapping format, to assist policymakers, researchers, and communities with decision-making in pursuit of environmental justice. (Urban Institute, 2022)
Dashboard	A platform that consolidates information in a central location and presents the data in a transparent and meaningful way. Dashboards are commonly used for utility performance data. A designated website—hosted either by the utility or the commission—provides a useful forum for displaying performance information, ideally through both interactive graphs and downloadable data. (Synapse, 2015) (Matheus et al. 2020)
Modeling tool	A software program that creates a dynamic representation or simulation to determine possible impacts of certain factors or decisions based on selected inputs and parameters. Decision-makers use modeling tools for planning and decision-making in setting targets on a range of scales. (EPA 2022)

Source: Adapted from (Urban Institute, 2022), (Synapse, 2015), (Matheus et al. 2020), and (EPA 2022).

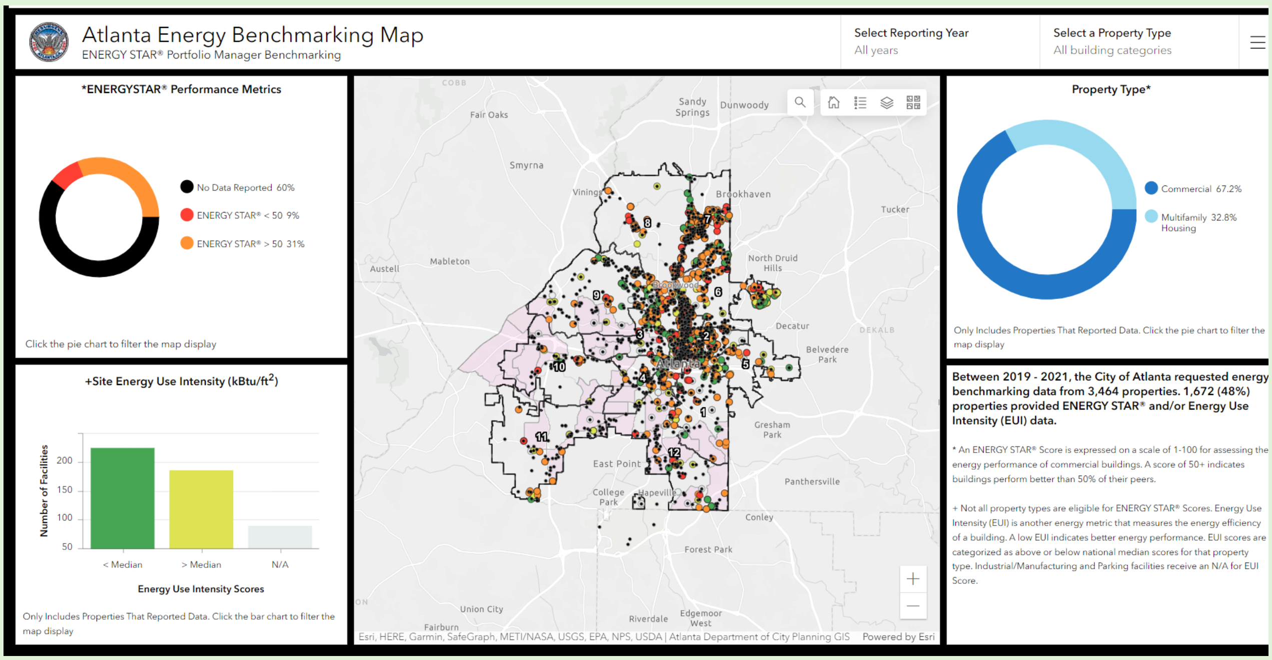
Atlanta's Energy Benchmarking Map

The City of Atlanta's 2015 Commercial Buildings Energy Efficiency Ordinance requires owners of all covered properties over 25,000 gross square feet to annually submit data on their energy and water consumption data in ENERGY STAR Portfolio Manager. Administered by the U.S. EPA, Portfolio Manager is an industry-standard tool for measuring and tracking energy performance in commercial buildings.

With the data reported through ENERGY STAR Portfolio Manager from 2019–2021, Atlanta created a dashboard that shows energy, water, and GHG emissions of buildings. The benchmarked data is used to create an ENERGY STAR score, based on a scale of 1–100 where a higher score represents a better energy performance.

With this data, the City created the Atlanta Energy Benchmarking Map dashboard. The dashboard shows the locations of commercial and multifamily buildings that reported ENERGY STAR scores (high and low) and those that have not reported. It also shows the geographic distribution of facilities with Energy Use Intensity (EUI) (the amount of energy used per square foot annually) that is higher and lower than the median. Stakeholders can use the data in this dashboard to compare performance and participation rates among city council districts, including those containing disadvantaged communities.

For example, the data generally shows that buildings with a higher ENERGY STAR score have a lower EUI. The data also shows low levels of reporting (proportionately) in disadvantaged communities.



D.2 Socioeconomic Data and Tools

Overview

Socioeconomic and demographic data include income, age, unemployment rate, race, ethnicity, and other variables that jurisdictions might want to use to identify priority populations in a DEA. An increasing number of jurisdictions across the United States are developing mapping tools that combine geographic and socioeconomic data for the purpose of identifying priority populations or for other environmental justice analysis. These mapping tools can be used to gather standard demographic data such as income and race but can also be used to map energy equity metrics, such as energy burden, environmental impacts, and health impacts, to priority populations. Many of these tools perform screening functions, such as identifying EJ communities or identifying specific vulnerabilities or burdens. Other tools provide descriptive or contextual information rather than explicitly designating EJ communities (Urban Institute, 2022).

Mapping tools might already be incorporated in a jurisdiction's equity or environmental justice policies. The analysis might entail using existing mapping tools as a data source in a DEA, or it might involve creating a mapping tool for the purpose of conducting a DEA. Alternatively, jurisdictions might wish to utilize other publicly available data sources, such as data from the U.S. Census Bureau. Furthermore, they might want to collect their own data if there is not available data sufficient for a DEA. Note that while mapping tools can be an input or output of a DEA, the types of mapping tools discussed in this guide do not have the functionality to conduct a DEA.

The following subsections provide an overview of some of the prominent mapping tools at the national and state level that are used to identify priority populations. This is not an exhaustive list of all mapping tools or datasets that exist or might be relevant to DEA.

National-Level Data and Tools

The federal government collects and publishes a large amount of robust data at the national level. The Justice40 initiative has increased attention to developing public map tools identifying disadvantaged communities nationwide. Some jurisdictions might use national EJ screening tools to identify their priority populations.

Table 38 summarizes national-level, public data sources, maps, and other tools that might be relevant to DEA. The four columns to the right describe the main data categories included in the resource. This table is not an exhaustive list of all tools available and is intended to simply demonstrate the types of resources available at a national level. The following section discusses a few frequently referenced national mapping tools that could be used by any jurisdiction to define or identify priority populations geographically, if their definition of priority population aligns with these tools.

Table 38. National-Level Analytical Tools

Tool	Author	Resource type	Environ-mental Justice	Energy	Health, Environment, Climate	Socio-demographic
EJSCREEN	EPA	Mapping tool	x		x	x
Electric Vehicle Charging Justice40 Map	DOT	Mapping tool	x	x		
Geospatial Energy Mapper	DOE, Argonne National Labs	Mapping tool		x		
Energy Justice Mapping Tool - Disadvantaged Communities Reporter	DOE	Mapping tool	x	x		
CEJST	CEQ	Mapping tool	x		x	x
Low-Income Energy Affordability Data (LEAD) Tool	DOE	Mapping tool	x	x		x
CDC National Environmental Public Health Tracking Network	CDC	Mapping tool	x		x	x
CDC Social Vulnerability Index	CDC	Mapping tool			x	x
Environmental Justice Index (EJI) Explorer	CDC	Mapping tool	x		x	x
Energy Equity Project interactive map	Energy Equity Project: University of Michigan	Mapping tool	x	x	x	x
Climate Alliance Mapping Project	CAMP	Mapping tool	x	x		
Mapping US Energy Communities	Resources for the Future	Mapping tool	x	x	x	x
Census: American Community Survey	US Census Bureau	Data				x
Residential Energy Consumption Survey	EIA	Data		x		x
Housing and Transportation Affordability Index	Center for Neighborhood Technology	Mapping tool	x	x		
National Risk Index	FEMA	Mapping tool				
Annual Electric Power Industry Report, Form 861	EIA	Data		x		
Utility Rate Database	NREL	Data		x		
State and Local Planning for Energy (SLOPE) tool	NREL		x	x		
Interactive Energy Efficiency Equity Baseline (E3B) Map	Urban Energy Justice Lab, U Michigan	Mapping tool	x	x		
Outage Data Initiative Nationwide	ORNL and DOE	Mapping tool		x		
Avoided Emissions and Generation Tool (AVERT)	EPA	Modeling tool		x	x	
CO-Benefits Risk Assessment Health Impacts Screening and Mapping Tool (COBRA)	EPA	Modeling tool			x	
Energy Savings and Impacts Scenario Tool (ESIST)	EPA	Modeling tool	x	x	x	x
Emissions & Generation Resource Integrated Database (eGRID)	EPA	Modeling tool		x	x	

Environmental Justice Screening and Mapping Tool (EJSCREEN)

Developed by the U.S. Environmental Protection Agency (EPA), the Environmental Justice Screening and Mapping Tool (EJSCREEN) was first released in 2013. The online tool combines environmental and demographic socioeconomic data at a census-block-group scale from the U.S. Census Bureau's American Community Survey (ACS) and EPA's Overview of Indicators (EPA 2023 Overview of Indicators). EJSCREEN maps 13 environmental indicators and seven socioeconomic indicators, plus EJ and supplemental indexes, for a user-defined geographic area. The EJ indexes combine each environmental indicator in isolation with a demographic index measuring the low-income population and people of color (EPA 2023 Indexes). EJSCREEN allows users to generate standard reports for a selected area and compare them to state and national results. EPA refers to EJSCREEN as a "pre-decisional screening tool," not intended to definitively designate EJ communities but to supplement local knowledge and other data sources and support various research, program, and policy efforts.

EJSCREEN has three key drawbacks. First, the tool broadly addresses people of color, but does not further disaggregate race as an indicator, which is a prominent, historical indicator of inequity (Urban Institute, 2022). Second, the tool utilizes national-level data such as demographic and environmental estimates at the block-group level which can have uncertainty, especially when analyzing more granular areas (ELI 2022). Third, because EJSCREEN uses screening level proxies as environmental indicators, this tool might lack relevant environmental data or health impact data for all situations (EPA 2023 Limitations and Caveats). For example, EJSCREEN does not have consistent drinking water data or facility registration for all states.

Justice40: Climate and Economic Justice Screening Tool (CEJST)

The Climate and Economic Justice Screening Tool (CEJST) was developed by the White House Council of Environmental Quality (CEQ) to help federal agencies identify disadvantaged communities to benefit from the Justice40 Initiative[38] (CEQ 2022 About). CEJST uses census data to classify "overburdened and underserved" census tracts as disadvantaged communities (CEQ 2023 Methodology). CEJST identifies disadvantaged communities based on thresholds for burden indicators, which includes categories such as climate change, energy, health, housing, legacy pollution, transportation, water and wastewater, and workforce development.

Like EJSCREEN, CEJST is publicly available online. Users can download data from the tool, which includes data at the census-tract level as well as for federally recognized tribal lands and other U.S. territories. Additionally, recent improvements of this tool in 2023 address previous criticisms such as the absence of race as an indicator and the inability for the tool to discern communities who have a single burden from communities with many (Urban Institute, 2022). The tool now includes information on race and ethnicity for each tract, which have been historical indicators of inequity. However, this demographic data is provided for informational purposes only and does not integrate into the tool's methodology for identifying disadvantaged communities. Furthermore, the tool now includes directions that address the prioritization of communities that experience more burdens (Council of Energy 2023) (CEQ 2023 Methodology). CEJST also has a ground-truthing mechanism for soliciting public input, which can include suggesting a new data source, providing feedback, or reporting missing or erroneous data.

Energy Burden: Low-income Energy Affordability Data (LEAD) Tool

The U.S. Department of Energy developed the Low-Income Energy Affordability Data (LEAD) Tool using public microdata from the U.S. Census 2020 ACS. While not an explicit environmental justice screening tool, LEAD is an example of a tool displaying data that could be used by jurisdictions to identify areas with high energy burdens. DOE developed the LEAD tool to provide stakeholders with data that improves their understanding of low-income housing and energy characteristics so they can make informed decisions and improvements regarding energy strategies and programs (DOE 2020). LEAD allows users to examine average annual energy costs and average annual energy burden across a variety of dimensions, including income, rent

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[38] Justice40 Initiative, createdunder the Biden administration, aims to provide 40 percent of the overall benefits of certain federal investments to disadvantaged communities that are marginalized, underserved, and overburdened by pollution (The White House 2022).

or own, building age, heating fuel type, and building type. The map displays data at the state, county, census tract, or city level.

LEAD combines a map with auto-generated charts for easy comprehension and provides additional information and considerations for tribal lands, such as distinguishing tribal lands from state and federal lands as well as including their specific housing counts. However, because LEAD uses ACS data, it only includes data on expenses associated with a household's primary heat source when calculating energy burdens; it does not include expenditures from supplemental or secondary heating sources. A recently released version of the tool allows comparisons of energy burdens by race and education level. Figure 33 shows a snapshot of average energy burden for households earning up to 200 percent of the federal poverty level by county in several southern states using the LEAD tool.

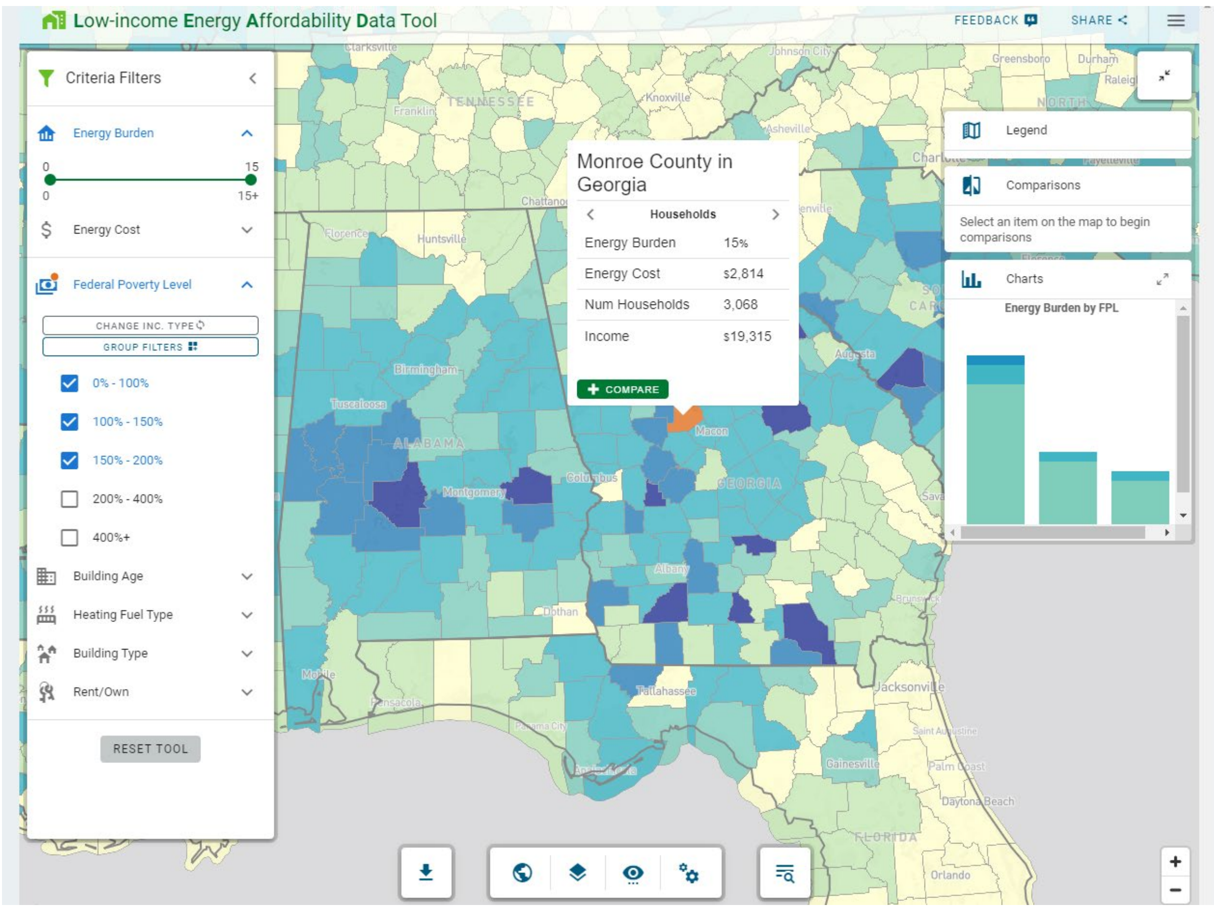


Figure 33. LEAD Map of Southeastern States, Average Energy Burden by County

State-Level Data and Tools

While national data and tools can provide publicly available, robust, and consistent data, not every indicator or impact is relevant or consistent for all communities across the country. For example, environmental impacts affecting rural areas will vary widely by region or industry: mining industries have different impacts than agricultural industries. State- and local-level data can be more tailored to a region or jurisdiction than national data.

Many states responded to the need for robust local data for environmental justice analysis by creating their own mapping tools. At least 22 states have developed or are developing maps or mapping tools to support energy or environmental justice initiatives. A handful of states, such as Oregon (Oregon State Legislature 2022) have legislation mandating or proposing a statewide EJ mapping tool.

One benefit of state-level tools is coordination between different agencies and organizations to share jurisdiction-specific data. For example, characteristics of sensitive populations in Michigan's MiEJScreen were prepared by the Michigan Department of Health and Human Services using statewide inpatient and outpatient data (Urban Institute, 2022). Jurisdiction-level data can also come from third-party sources such as research or community organizations. For example, Maryland's MD EJScreen uses data on food accessibility sourced from the Johns Hopkins Center for a Livable Future (Urban Institute, 2022).

In addition to greater local coordination and context, a benefit of state-level mapping tools is that there can be greater opportunity to engage local community groups and perspectives. Whether for a public platform or internal state agency use, community engagement is a crucial step to creating an EJ mapping tool (ERI, 2021).

In addition to greater local coordination and context, a benefit of state-level mapping tools is that there can be greater opportunity to engage local community groups and perspectives. Whether for a public platform or internal state agency use, community engagement is a crucial step to creating an EJ mapping tool (ERI 2021). Maryland's MD EJScreen is an example of how jurisdictions can incorporate community engagement and participation in the creation of these maps. The MD EJScreen tool was developed by the Center for Community Engagement, Environmental Justice, and Health (CEEJH). Throughout the tool creation process, CEEJH worked to get feedback from local community activists, planning organizations, and environmental justice coalitions (Urban Institute, 2022).

Community input is crucial even after a mapping tool has been developed and published. In Virginia, Mapping for Environmental Justice's EJ Demo Map includes qualitative data on community perspectives and experiences that are incorporated into the published map as pop-up windows. Some tools incorporate ground-truthing practices, such as allowing communities to self-identify as EJ communities. For example, Illinois' Environmental Justice Communities map for the Illinois Solar for All program includes a self-designation process where communities not identified in the tool can apply to be designated as an EJ Community.

CalEnviroScreen

California's CalEnviroScreen is one of the leading EJ mapping tools. Many other states have followed California's example and created their own EJ mapping tools. Some (such as Michigan's MiEJScreen) have acknowledged that they adapted their tool from CalEnviroScreen (Urban Institute, 2022).

CalEnviroScreen was developed by the California Environmental Protection Agency (CalEPA) and the Office of Environmental Health Hazard Assessment (CA OEHHA) in 2013. CalEnviroScreen is explicitly intended to inform agency actions. The tool identifies communities that face multiple burdens of pollution and socioeconomic disadvantage, based on aggregated scores for "Pollution Burden" and "Population Characteristics" (Urban Institute, 2022).

Even in the current version (4.0), CalEnviroScreen does not treat race and ethnicity as a variable. However, CA OEHHA conducted an analysis of race and ethnicity profiles and found patterns that are largely the same as those seen with CalEnviroScreen (CA OEHHA). California is "constrained by a ballot initiative that eliminated affirmative action in state funding," which can explain why race and ethnicity are not explicitly addressed in the tool. The tool has been effectively used to funnel money toward communities of color (Grist). Had race been explicitly included in the tool, decisions based on it might have been challenged on legal grounds.

Public Data Accuracy and Error

National-level data, such as the US Census Bureau American Community Survey, is nationally available and well suited to inform a wide variety of social analyses. However, national-level data might not always be consistent. Almost all EJ screening tools, or similar analyses, use demographic data from the US Census Bureau. The benefit is that this data is standardized, detailed, and comparable across the country. However, the downside is that smaller areas, rural areas, or historically marginalized areas can face data quality issues such as undercounting, under sampling, and higher margins of error (Urban Institute, 2022) (Urban Institute, 2019).

The Census routinely counts certain populations (such as children, renters, and racial minorities) less accurately than others, called the "differential undercount" (Green and Gilman, 2018). Undercounting and data marginalization have real consequences for policymaking because population counts impact federal and state resource allocation or apportionment for political representation.

There can be a bias towards urban areas because of a lack of data or lack of statistical significance of analyses using sparse data for rural or tribal communities. The ACS less frequently updates its estimates for geographies with populations less than 65,000 (Urban Institute, 2022). Also, indicators chosen to measure burden can be biased towards urban areas. For example, proximity to traffic is a common indicator of pollution burden that predominantly affects urban areas more than rural.

Furthermore, public data are often aggregated, i.e., collected at one scale, such as an individual household, and then reported at a higher level, such as a census tract or county. Aggregation is important for protecting privacy, as discussed in Section 4.3. However, aggregation can also lead to the "ecological fallacy": the assumption that a characteristic calculation for a group in aggregate can be applied to an individual member of that group (Manson 2017). This ecological fallacy can apply to both geographic and non-geographic data. For example, not every household located in a county earns the median income of that county.

D.3 Utility Customer Data Regarding Metrics

Overview

This section gives an overview of utility data, utility data collection, and dashboard tools for sharing and analyzing utility data. Data specific to metrics are discussed in Chapter 3.

Utility Data Collection, Reporting, and Dashboards

Energy utilities and related entities collect data to improve their services and operations, such as load forecasting, analyzing energy consumption patterns, and identifying opportunities for energy efficiency. Most utilities collect data related to customer address, household energy usage, and bill payment status, such as arrearages, service quality, and participation in income-qualified programs (ACEEE 2021). Utilities collect data for various reasons, such as for performance tracking metrics, hosting capacity maps, or efficiency program data.

Few utilities track data relating to race, language, tenure, energy burden, workforce diversity or diversity of leadership (ACEEE 2021). If demographic data or other data required for a DEA is not linked to utility data, utilities, regulators, and stakeholders can explore strategies to collect that data. This could include customer self-reporting in order to participate in a DER program, having evaluation contractors solicit this information from customers after participation in a DER program, or collaborating with Community Action Program agencies or similar groups representing priority populations to identify geographic areas or individuals.

Not all utility data is publicly available; many utilities are not required to collect or report certain types of data, especially data that is useful to assessing equity.[39] Some jurisdictions are working to improve transparency broadly and have dashboards or central data reporting platforms.

- As a part of performance-based regulation (PBR) proceeding and requirements in Hawaii, Hawaiian Electric reports a portfolio of scorecards and metrics on its website across a variety of areas including service reliability, affordability, and renewable energy (Hawaiian Electric, 2023).
- In Connecticut, energy efficiency program administrators are required to report program spending, energy savings, and emissions on a statewide "Energy Efficiency Dashboard" (Connecticut Statewide Energy Efficiency Dashboard 2023).
- In Michigan, the Public Service Commission requires investor-owned utilities to file monthly reports on customer disconnections and arrearages, which is presented in an online dashboard (MPSC, Utility Customer Data).
- Some states are in the process of considering reporting requirements or dashboards. For example, in Xcel Energy Minnesota's PBR proceeding, Xcel was recently required to investigate a public web-based dashboard or other means of utility data transparency (Minnesota PUC, 2021).

In addition to dashboards for reporting traditional program data, some utilities publish geographic data. Publicly available geographic data tends to be utility outage maps, reliability data, and hosting capacity maps. Geographic utility data can be helpful for DEA to identify priority populations and geographically track impacts and outcomes to locations, even if it is not published in a public mapping tool.

- As a part of Efficiency Vermont's 2021–2023 Triennial Plan, the utility reports Quantifiable Performance Indicators for Geographic Equity by county and utility (Efficiency Vermont, 2022). However, county- or utility-level reporting is generally not granular enough for a DEA.
- Pepco DC has a performance tracking metric reporting CEMI-3 by ward.
- New York utilities publish a hosting capacity map estimating the amount of DERs that can be accommodated without impacting power quality or requiring infrastructure upgrades (Joint Utilities, 2023).
- Washington state publishes an online Electric Utility Outage Dashboard map, as part of the pilot Outage Data Initiative Nationwide (ODIN) program (WA DOC, 2023). Utilities "opt-in" to share outage data to help improve responses to outages. Similarly, Eversource Energy publishes a map of customer outages across its service territory in Massachusetts, Connecticut, and New Hampshire (Eversource 2023).
- Washington Utilities and Transportation Commission publishes an online map of customer arrearages by zip code (WA UTC).

In general, information presented in dashboards relates to typical utility services, such as energy efficiency, emissions, renewable energy, program costs, and customer affordability. These dashboards typically only disaggregate metrics or program outcome data by utility or customer class (residential, commercial, etc.). Some, such as Michigan's arrearage data dashboard, disaggregate residential data by low-income and non-low income categories (MPSC, Utility Customer Data). A small but growing number of utilities or jurisdictions include contextual map data on customer demographics or energy burden. Pacific Power's Distribution System

[39] In many instances utilities are restricted in what kind of personal data they can collect. Such restrictions might have served to remove the possibility of utilities using demographic or socioeconomic data in a discriminatory way. However, these restrictions have likely impeded the ability of jurisdictions and utilities to track and address equity impacts of energy systems. See Chapter 5 for more information on data privacy.

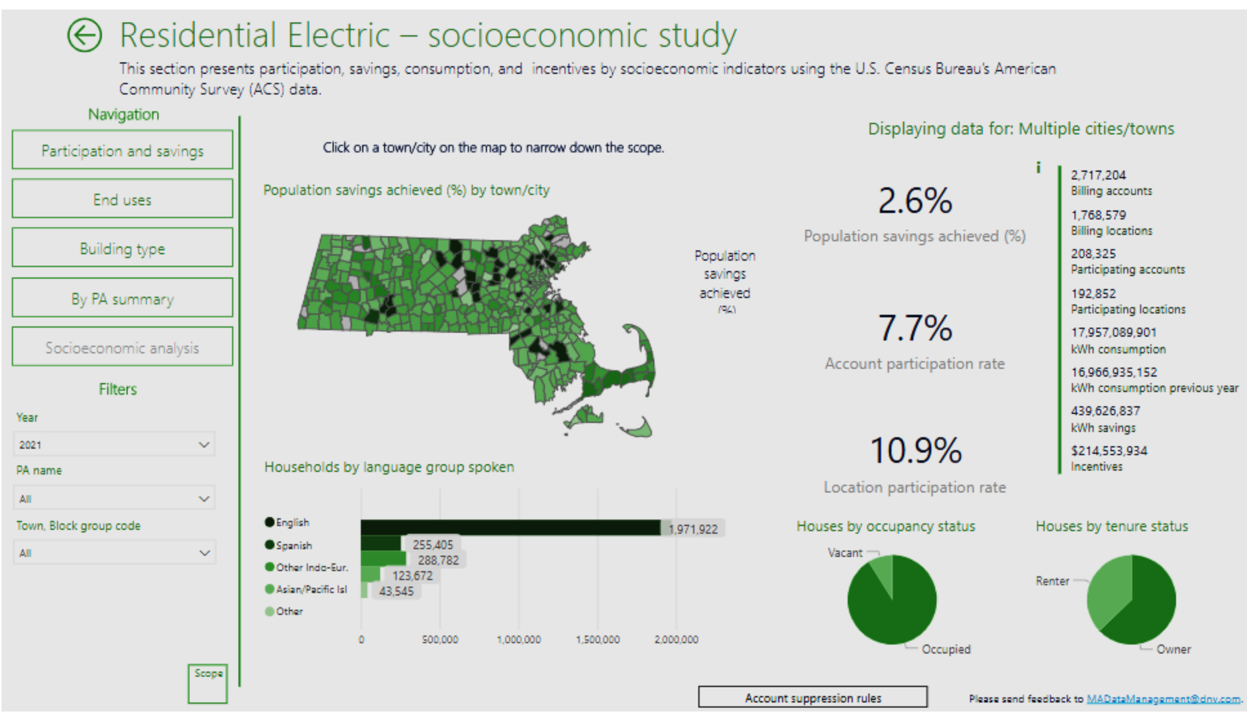
Planning map includes energy burden data from the LEAD tool (PacifiCorp 2023). Xcel Energy Minnesota maps demographic data from the US Census Bureau in its service quality map (Xcel Energy, 2023).

Publicly available utility dashboards and maps can help reduce information asymmetry, improve transparency and accountability, and increase accessibility to utility data. When utility performance statistics or relevant customer data are only provided in filings across various dockets and reporting timelines, as opposed to a central location, it is more difficult and time-consuming for stakeholders and regulators to gain a holistic understanding of utility performance or programs across multiple dimensions (Synapse, 2015).

Massachusetts Mass Save Customer Profile Dashboard

The Massachusetts Mass Save Customer Profile Dashboard ("Mass Save Dashboard") is a web-based platform that displays energy efficiency program data for the state's energy efficiency programs, organized under Mass Save. The platform publishes the annual statewide analyses of the residential and commercial and industrial (C&I) programs administered by the state's electric and gas utilities (Mass Save, 2023). Using program billing and tracking data, the platform displays metrics including customer energy savings, energy usage, and program participation across all utilities. The Mass Save Dashboard publishes metrics for historical and current years to show trends over time. The metrics can be disaggregated by fuel (electric or gas), utility, program, and municipality.

In addition, the Mass Save Dashboard contains a socioeconomic analysis section that displays program metrics in conjunction with socioeconomic indicator data from the American Community Survey. In 2019 and 2020, Mass Save did a residential nonparticipant analysis to characterize which customers were not participating in the Mass Save programming across the state and the barriers they face to participation (Navigant, ILLUME and Cadeo, 2020). As a result, the Mass Save utilities now track energy efficiency program participation with finer granularity and a focus on underserved customers identified in the nonparticipant study. The socioeconomic analysis section of the Mass Save Dashboards allows users to view program results by EJ and non-EJ community, by municipality, and by utility. Users can filter the data to view metrics for areas disaggregated by income level, English language proficiency, and proportion of renters.



Source: (Mass Save, 2023)

Figure 34. Mass Save Customer Profile Dashboard, Residential Electric Socioeconomic Study Page

EJ communities in Massachusetts are defined at the block-group level; however the Mass Save Dashboard reports metrics only at the municipality or utility level to protect privacy. Furthermore, the platform has account suppression rules for displaying aggregated data. The platform will hide data when the number of individual datapoints is less than a threshold of 100 accounts for residential participants.

D.4 Preparing Data and Analytical Tools for DEA

Principles of Data Preparation and Presentation

Overall, underlying data in a DEA should accurately reflect the current state of the populations, communities, or geographies displayed and account for local context (Urban Institute, 2022). Data (and analytical tools) should be chosen based on their relevance to local, state, or regional communities (NWF, 2020). Data should be sufficiently disaggregated by demographic information, geographic information, or other variables that enable insights on disparities in access and impacts of programs and policies (Schwabish et al., 2022). However, when using or collecting disaggregated demographic data, it is important to protect privacy so as not to increase vulnerability for members of priority populations (White House OSTP, 2022). Jurisdictions must carefully choose the appropriate granularity, based on available data and objectives.

Generally, analysts should prioritize using known or recorded data, then move to data from which they can make reasonable estimates. In some cases, if reasonable estimates cannot be calculated, or if the data is not sufficiently accurate or precise for a DEA, it might be best to forego it and start tracking or collecting that data instead. Furthermore, some datasets might require significant scrubbing or corrections to confirm the data and ensure that it is in usable formats.

It is important to follow these best practices across the data lifecycle to ensure accurate, transparent, and robust analysis. Table 39 presents general principles of data preparation and presentation. Jurisdictions should consider and address these principles when planning, collecting, storing, analyzing, and publishing data for a DEA.

Table 39. Principles of Preparation and Presentation of Data and Analytical Tools for DEA

Accessible	Data should be presented in a publicly accessible manner (i.e., it can be accessed by a diverse audience, including members of priority populations), such as on a designated website, and should include a means for downloading the underlying data.
Contextualized	Performance targets, historical data, benchmarks or thresholds, peer performance, and explanations of any major events that impacted performance or outcomes should be included in the data presentation.
Clear and concise	Data should be presented in graphs that are clear and easily interpreted. An explanation of how a metric is calculated should also be included. Highly technical terms should be adequately defined or avoided.
Comprehensive	The data-sharing platform should provide data and graphs for all aspects of utility or program performance and/or outcomes that the jurisdiction wishes to monitor.
Up to date	The data and graphs should be updated frequently. Many metrics might warrant quarterly updates, while others should be updated at least on an annual basis. For example, some data sources, like the US Census American Community Survey, are updated annually. Analytical tools should thus update as frequently as possible if using this data.
Interoperable	Data being linked should be comparable. Data being compared should be based on similar aggregation units, categories, and temporalities. For example, both zip codes and census tracts are geographic areas for which data is often reported, but they rarely have the same boundaries. A census tract might overlap multiple zip codes and vice versa, and thus have poor interoperability.
Locally relevant	Data utilized for a DEA should be relevant to the jurisdiction, geography, and population.
Appropriately granular	Data should be granular or disaggregated enough to enable analysis of disparate impacts. For geographic data, this means finding the smallest unit of geography (for example, census tract or block group rather than county level). Or, for non-geographic data, this means data that is disaggregated enough by race or income groups (for example) to support sufficient analysis.
Aggregated	Data granularity for accurate analysis should be balanced with sufficient aggregation to protect privacy. Masking, aggregation, or other relevant privacy-protecting strategies should be employed when presenting or publishing data.

Source: Adapted from (Synapse, 2015), and (Manson 2017).

Massachusetts: Mass Save Customer Profile Dashboard

The Mass Save Customer Profile Dashboard offers an example demonstrating the data principles in Table 40.

Accessible: The Mass Save dashboard is publicly available online. Users can download data from the dashboard. A User Guide and other materials accompany the dashboard.

Contextualized: Energy savings, program expenditures, and total benefits are shown relative to projections from the 3-year plan. The dashboard includes historical data from past program years.

Clear and concise: Graphs are simple and easily interpreted. Calculations for metrics and explanation of metric variations are provided.

Comprehensive: The dashboard covers all utilities in the state, both gas and electric, for residential and commercial Mass Save programs.

Up to date: Data are regularly updated, at least annually.

Interoperable: Data are reported by utility, municipality, and program, in alignment with other data sources/reporting in Massachusetts. Data can be downloaded in spreadsheet format.

Locally relevant: The dashboard uses the Massachusetts-specific definition of EJ communities. The socioeconomic analysis disaggregates metrics by customer indicators previously identified through a statewide nonparticipant study.

Appropriately granular: The dashboard reports at the municipal level, as opposed to counties, zip codes, or census tracts because that is how other Massachusetts government programs are organized, such as the Green Communities program. Users can view detailed breakdowns by building type, end uses, program, and utility. The socioeconomic analysis allows users to filter by different income brackets, renter populations, and share of population with limited English proficiency.

Aggregated: Individual datapoints are aggregated into block groups, utilities, and municipalities for ease of data comparison. Data suppression rules are in place to mask individual account information and to protect customer privacy.

Equitable Data Practices

It is the important responsibility of utilities and other entities conducting a DEA to ensure that data collection and sharing does not disproportionately and negatively impact certain groups, namely priority populations (Véliz and Grunewald, 2018). In a DEA, equity must be prioritized—not only as a marker of the distribution of benefits and burdens, but as a fundamental factor throughout the process of conducting the analysis as well.

One method of prioritizing equity in this process is to involve the very priority populations the DEA seeks to serve by working with locally embedded institutions and organizations. Individuals and communities themselves can take a more active role in the collection, use, and dissemination of data and information, especially their own (see Chapter 1). This can be through environmental justice advisory councils, public workshops, collaborative partnerships, or even co-creation of the mapping tool with community groups (ERI 2021).

Table 40 presents principles for promoting data equity. These principles, in conjunction with the data principles listed in Table 39, can guide jurisdictions in preparing data for a DEA through all steps of the data life cycle: planning, collection, access, analysis, and reporting and dissemination (CDC Foundation, 2022).

Table 40. Principles of Data Equity

1	Recognize and define systemic, social, and economic factors that affect individual household outcomes and communities' ability to thrive.
2	Use equity-mindedness as the guide for language and action in a continual process of learning, disaggregating data and questioning assumptions about relevance and effectiveness.
3	Proactively include participants from the communities of interest in research and program design to allow for cultural modifications to standard data collection tools, analysis, and sharing.
4	Collaborate with agencies and the community to generate a shared data development agenda ensuring a plan for data completeness, access, and prioritized use to answer high-interest questions.
5	Facilitate data sovereignty by paving the way for communities to govern the collection, ownership, dissemination, and application of their own data.

Source: Adapted from (CDC Foundation, 2022).

Resources on Data Equity

The following are examples of and recommendations from successful collaboration programs between the federal government and local communities involving equitable data (Schwabish et al., 2022). The Urban Institute is one of many organizations engaging in and advocating for this work and for more equity in data, in general.

- Do No Harm Guide –Offers practical ways to collect, analyze, share, and communicate data more equitably and inclusively (Urban Institute, 2022)
- Principles for Advancing Equitable Data Practice Brief – Introduces the Belmont Report's principles and provides related practices and resources to help data experts at all levels integrate the principles into their work and move toward more equitable data practices (Urban Institute June 2020)
- Spatial Equity Data Tool – Enables nontechnical audiences to easily assess the racial, economic, and geographic disparities present in user-uploaded data to identify if resources are equitably distributed and the datasets used in decision-making are representative (Urban Institute, 2021)
- The National Neighborhood Indicators Partnership (NNIP, 2023)–Coordinated by the Urban Institute, the NNIP is a notable learning network of independent partner organizations in more than 30 cities across the nation utilizing their expertise and data to build a shared understanding of community issues and develop solutions together. Networks and organizations like these serve as valuable resources in the process of conducting an equitable DEA.

D.5 References and Resources

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Glossary

Term	Definition
benefit-cost analysis (BCA)	A systematic approach for comparing the benefits and costs of alternative options to determine whether the benefits exceed the costs over the lifetime of the program or project under consideration.
bill impact analysis	An assessment that indicates the extent to which customer bills are affected for customers who participate in DER programs and those who do not.
census tract	Statistical subdivisions of a county or equivalent entity that are updated by local participants prior to each decennial census. The U.S. Census Bureau delineates tracts to provide a stable set of geographic units for the presentation of statistical data.
clean energy	Clean or renewable energy comes from natural sources or processes that are constantly replenished, such as solar or wind energy.
cost shifting	A situation in which some utility customers might be undercharged or overcharged for their energy usage, generally in a recurring way. Rates might increase for all customers when some customers participate in DER programs to cover the costs of participation, meaning some populations might bear an undue cost-shifting burden.
criteria air pollutants	Particulate matter, photochemical oxidants (including ozone), carbon monoxides, sulfur oxides, nitrogen oxides, and lead. The EPA specifically sets standards for these pollutants as part of the Clean Air Act.
cumulative impact	The effects of the totality of exposures to combinations of chemical and non-chemical stressors on health, well-being, and quality-of-life outcomes.
cumulative impacts analysis	A comprehensive assessment that evaluates the combined effects of multiple activities, projects, or policies on the environment, human health, and social factors.
demand response	Programs that reduce or shift electricity or gas usage during peak periods in response to time-based rates or other forms of financial incentives. Demand response programs are used by some electric system planners and operators as resource options for balancing supply and demand.
diversity, equity, and inclusion (DEI)	Diversity refers to people's race, gender, religion, sexual orientation, ethnicity nationality, socioeconomic status, language, (dis)ability, age, religious commitment or political perspective. Equity promotes justice, impartiality, and fairness within the procedure, processes, and distribution of resources by institutions or systems. Inclusion ensures people of all diverse backgrounds are welcome and have an opportunity to provide input.
DER program or investment	Any electric or gas utility initiative intended to promote the deployment of distributed energy resources (DERs) such as solar photovoltaics, energy storage, demand response, and energy efficiency measures.

distributed energy resources (DER)	Electricity and gas resources sited close to customers that can provide all or some of their immediate power needs and/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.
distributed generation	Electric generation interconnected to the distribution grid and operating at the distribution level, generally near a load, though sometimes stand-alone. Distributed generation includes distributed solar photovoltaic (PV/DPV) technology, combined heat and power, district heating and cooling, small wind, and biomass and biogas facilities associated with landfills and agricultural operations.
distribution	The delivery of electricity to end users via lower voltage power lines over shorter distances, after it is transferred from higher-voltage transmission lines.
distributional equity	A form of equity concerned with promoting equitable distribution of benefits and burdens across all segments of a community and across generations.
distributional equity analysis (DEA)	An analytical framework that can be used to evaluate the distributional impacts of energy efficiency and other DER programs on different customer groups, particularly priority populations. DEA involves analyzing the costs, benefits, and burdens of DER programs across different customer groups to identify any disparities or inequities in program outcomes.
energy equity	Energy equity aims to ensure that disadvantaged communities have equal access to clean energy and are not disproportionately affected by pollution.
energy burden	The percentage of household income spent on energy bills.
energy efficiency	Resources that include technologies, services, measures, or programs that reduce energy consumption by host customers and that are funded by, promoted, or otherwise supported on behalf of all electricity and gas utility customers.
environmental justice	The fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.
energy security	Uninterrupted, affordable access to basic home energy services without disconnection notices, involuntary disconnection of service, foregoing other necessities to retain service, and/or maintaining unhealthy indoor temperature.
energy usage intensity (EUI)	The amount of energy used per square foot annually. It is calculated by dividing the total energy consumed by the building in one year by the total gross floor area.
equity	The principle encompassing justice, impartiality, and fairness within the procedure, processes, and distribution of resources by institutions or systems.
generation	The production of electricity or equipment used to produce electricity. Electricity might be generated through power plants or by DERs (see above) and might be provided to the grid.
greenhouse gas (GHG) emissions	Gases that trap heat in the atmosphere (including carbon dioxide, methane, nitrous oxide, and fluorinated gases) emitted from human activities, primarily burning fossil

	fuels for electricity generation, transportation, industrial processes, commercial and residential heating, and agriculture.
host customer	The owner or occupant of the site at which DERs are installed and/or operated behind the customer's meter. In some cases, these are program participants, e.g., participants in a demand response or energy efficiency program. In other cases, where there is no program, e.g., EV owners, 'customer' refers to these consumers being a customer of a utility.
incremental impacts	The additional costs or benefits associated with a proposed project or policy compared to a baseline scenario without the project or policy.
interoperability	The ability of different datasets or systems to align and work together.
jurisdiction	Any state, province, utility, municipality, or other region with a governing authority for which DER resources are planned and implemented.
Justice40	A Biden Administration initiative establishing the goal that 40 percent of the overall benefits of certain federal investments in climate and clean energy flow to disadvantaged communities.
low income	Characteristic of earning less than the relevant jurisdiction's threshold for income (which might be defined based on the federal poverty level, area median income, state median income, or other measure of cost burden).
metrics	Measures used in research to assess the effectiveness of programs, interventions, or policies. Metrics might be quantitative or qualitative and are used to track progress, identify areas that need improvement, and evaluate outcomes.
microgrid	A group of interconnected loads and DERs within clearly defined electrical boundaries. A microgrid can act as a single controllable entity with respect to the grid and can connect or disconnect from the grid to operate as either grid-connected or an "island."
non-energy impact (NEI)	Impact of DERs other than direct energy and demand impacts. While these impacts can be non-energy benefits and related costs, most are considered benefits (non-energy benefits, or NEBs). Examples include reduced emissions, comfort and productivity improvements, local macroeconomic development, and reduced risk of utility service disruptions or price spikes.
priority populations	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. These include customers who have borne and continue to bear disproportionate, systemic costs and burdens from energy extraction, generation, transmission, distribution, and consumption.
procedural equity	A form of equity concerned with promoting inclusive, accessible, authentic engagement and representation when developing and implementing programs.
public intervenor	A party (person or organization) that does not have a direct interest in the outcome of the lawsuit but has an interest that might be affected by the outcome of the litigation and is granted standing by the court for the entire litigation or for a narrow issue.
rate class	A group of utility customers who receive utility service under similar or the same pricing terms. Utilities apportion costs differently among different rate classes,

	generally broken into residential, commercial, and industrial based on similarities in use.
rate impact analysis	An assessment of the extent to which investing in a resource will impact customer rates.
recognitional equity	A form of equity concerned with recognizing the historical cultural and institutional dynamics and structures that have led to energy inequities.
resilience	The ability to prepare for and adapt to changing conditions and withstand and recover rapidly from disruptions.
resolution	Specificity or granularity of the data.
restorative equity	A form of equity concerned with addressing reparations for past inequities, rectifying practices that perpetuate inequities, and promoting accountability for key decision-makers.
rate, bill, and participation analyses	Analyses that provide information about the extent to which rates and bills might change for DER host customers relative to non-host customers and provide information about how many customers are host customers versus non-host customers.
stakeholder	A person, group of people, or organization with an interest in an organization or entity's decision-making. Stakeholders generally include customers, suppliers, government representatives, and other local community members. Stakeholders might also include people who work at the utility such as employees, owners, or investors.
system-wide energy equity metrics	Measures that are used for broad assessments of all energy inequities applicable to a utility or jurisdiction, not just those relevant to the BCA or DEA of a utility investment.
transmission	The segments of the electric grid between power plants and distribution lines. Electricity is generally transported on the transmission system over long distances via higher voltage power lines.
utility system	All elements of the electricity or gas system necessary to deliver services to the utility's customers. For electric utilities, this includes generation, transmission, distribution, and utility operations. For gas utilities, this includes transportation, delivery, fuel, and utility operations. This term refers to any type of utility ownership or management, including investor-owned utilities, publicly owned utilities, municipal utility systems, cooperatives, etc.

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