Distributional Equity Analysis for Energy Efficiency and Other Distributed Energy Resources

National Association of State Utility Consumer Advocates: Mid-Year Meeting
Lawrence Berkeley National Laboratory Training Session

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Agenda

- Background
- Overview of energy equity
- Priority populations
- Equity metrics
- Analytical tools and data
- Conducting a Distributional Equity Analysis (DEA)
- Using the results of DEA and Benefit-Cost Analysis (BCA)

Please ask questions at any time

Note that the materials presented here should be considered "draft" because the Advisory Committee for this project has not reviewed the draft report or this slide deck.

The National Energy Screening Project

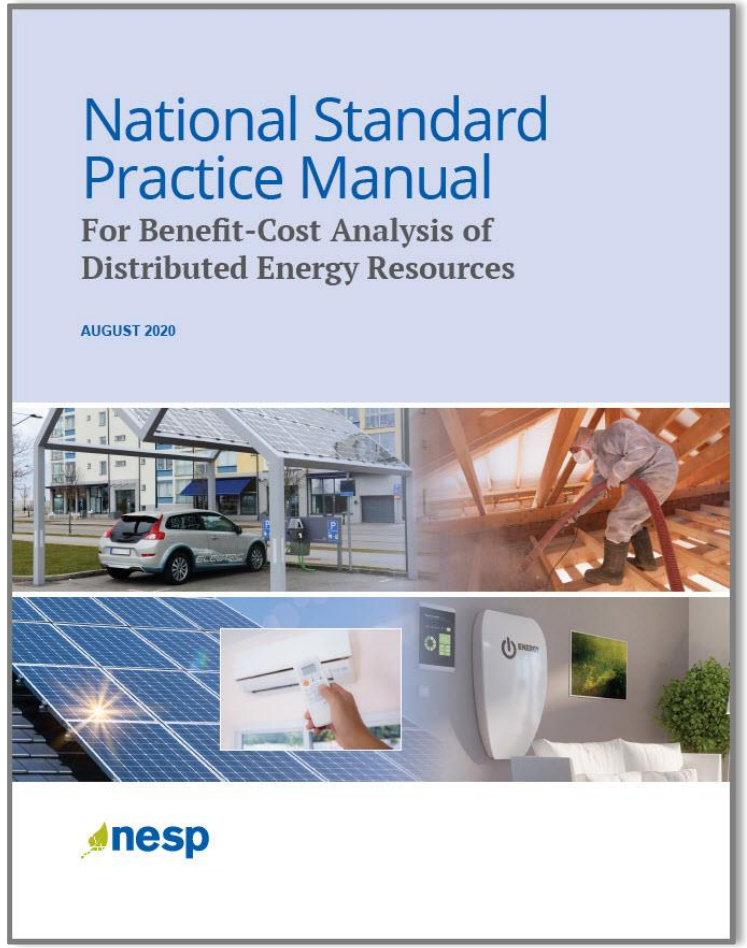
A stakeholder organization that works to improve cost-effectiveness screening practices for distributed energy resources (DERs)

- Managed by E4TheFuture

Key products to date:

- National Standard Practice Manual for Benefit-Cost Analysis of Distributed Energy Resources Link
- Methods, Tools, and Resources:
  A Handbook for Quantifying DER Impacts for Benefit-Cost Analysis Link
- Database of Screening Practices Link

These products resulted in many requests for guidance on how to account for equity in BCA.
Simultaneously, Berkeley Lab planned to pursue similar work.



Distributional Equity Analysis Guidance Document: Background

Funded by

- US DOE, through Lawrence Berkeley National Laboratory
- E4TheFuture

Prepared by

- Lawrence Berkeley National Laboratory
- E4TheFuture
- Synapse Energy Economics

Overseen by an Advisory Committee made up of experts in energy equity and in energy resource planning and assessment.

Status

- Advisory Committee will review the complete draft report soon.
- Berkeley Lab will publish the final report following review and approval by DOE.

Additional information

- https://emp.lbl.gov/publications/distributional-equity-analysis

DEA Guidance Document: Advisory Committee

Name	Affiliation	Name	Affiliation
Adam Zoet	Minnesota Department of Commerce	Jennifer Yoshimora	Pacific Northwest National Laboratory
Amanda Best	Maryland Public Service Commission	Jennifer Snyder	Washington Utilities and Transportation Commission
Amanda Dewey	American Council for an Energy-Efficient Economy	Jeremy Peterson	Excel Energy
Ankit Jain	California Public Utilities Commission	John Howat	National Consumer Law Center
Anne Dougherty	Illume Advising	Justin Schott	Energy Equity Project
Aubrey Newton	Northwest LECET | NW Cooperation Fund	Kate Strickland	Smart Electric Power Alliance
Bethel Tarekegne	Pacific Northwest National Laboratory	Kelly Crandall	Colorado Public Utilities Commission
Brad Banks	Michigan Public Service Commission	Kelsey Jones	National Association of State Energy Officials
Brian Tyson	Puget Sound Energy	Logan Atkinson Burke	Alliance for Affordable Energy
Briana Parker	Elevate Energy	Liz Doris	US Dept of Energy, Office of Economic Impact and Diversity
Burcin Unel	Institute for Policy Integrity	Marguerite Behringer	Landis & Gyr
Cassandra Kubes	US Environmental Protection Agency	Mary Sprayregen	Oracle
Chandra Farley	City of Atlanta	Mohit Chhabra	Natural Resources Defense Council
Chris Coll	NY State Energy Research and Development Authority	Natalia Cardona Sanchez	Vote Solar
Danielle Sass-Byrnett	National Association of Regulatory Utility Commissioners	Nancy Seidman	Regulatory Assistance Project
Danilo Morales	Massachusetts Department of Energy Resources	Patrick Cicero	Pennsylvania Office of Consumer Advocate
Debra Gore-Mann	Greenlining Institute	Sarah Moskovitz	Illinois Citizen's Utility Board
Divesh Gupta	Baltimore Gas and Electric	Sonja Berdahl	National Renewable Energy Laboratory
Dylan Voorhees	Vermont Energy Investment Corporation	Steve Schiller	Consultant
Elaine Prause	Regulatory Assistance Project	Subin DeVar	Initiative for Energy Justice
Erin Cosgrove	Northeast Energy Efficiency Partnership	Theresa Schmidt	Consumers Energy
Ezell Watson	Oregon Public Utility Commission	Wally Nixon	Arkansas Public Service Commission
Gregory Ehrendreich	Midwest Energy Efficiency Alliance	Will Bryan	Southeast Energy Efficiency Alliance
Jean Su	Center for Biological Diversity		

DEA Guidance Document: Impetus

Increasing interest in DERs

- Including energy efficiency (EE), demand response (DR), distributed generation (DG), distributed storage, and managed charging for electric vehicles

Increasing interest in benefit-cost analysis of DERs and clean energy resources

- To achieve energy and climate goals at the lowest cost

Increasing interest in energy equity

- White House Justice40 initiative
- Many states have established energy equity objectives and requirements.

Lack of methods and techniques to account for equity when conducting BCA

- Many stakeholders are asking for technical assistance on this topic.

DEA Guidance Document: Overview

Executive Summary

1. **Introduction**
2. **Stakeholder Input**
3. **Priority Populations**
4. **Distributional Equity Metrics**
5. **Analytical Tools and Data Needs**
6. **Conduct the Distributional Equity Analysis**
7. **Using DEA and BCA for Decision-Making**
8. **Case Study – Washington State**

Appendices

Overview:

- A practical how-to guide on conducting DEAs in combination with BCAs to inform decision-making for utility DER investments.
- Priority audience includes utilities, public utility commissions, state energy offices, utility consumer advocates, equity advocates, consultants, and others.
- Builds on existing equity initiatives and research.

Many Definitions of Energy Equity

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.” (U.S. 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 2023)

Several Dimensions of Equity

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

BCA is Not Well Suited for Addressing Equity Impacts

BCA is not designed to address equity between customers because it measures impacts *on average* across customers.

- Costs – typically recovered across all customers or all customers within a class
- Benefits – typically a blend of avoided costs experienced by all customers

BCA cannot distinguish impacts on specific customers of interest.

- Except for programs designed to serve specific customers (e.g., low-income programs)

BCA focuses mostly on monetary results.

- But many equity metrics cannot be put into monetary terms

BCA does not, and should not, account for rate, bill, or participation impacts.

- The Rate Impact Measure (RIM) Test combines BCA results with rate impact results.
- That makes it difficult to understand either result.
- Instead, rate, bill, and participation impacts should be analyzed separately from BCAs.

DEA Can Be Used in Combination with BCA to Address Equity

DEA can be conducted alongside BCA.

- To provide additional information on equity
- DEA uses many of the same inputs, methods, and assumptions as BCA.

Key differences between DEA and BCA

- DEA separates customers into priority populations and other customers.
  - To indicate how the costs and benefits are distributed across different customers
- DEA includes metrics to provide energy equity data

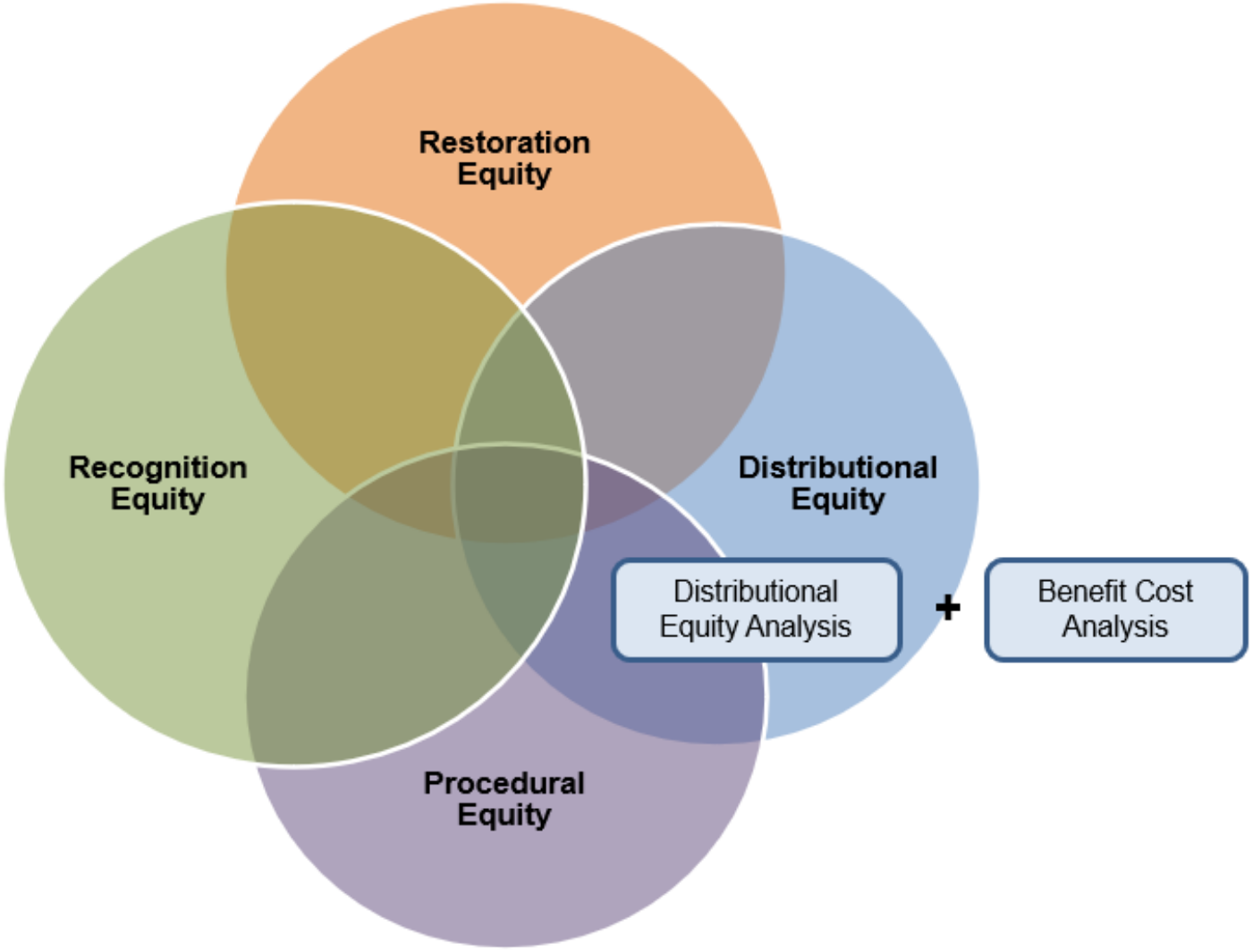
Together the two analyses can inform decisions about whether and to what extent utilities should invest in DERs.

Summary of Differences Between BCA and DEA

	Benefit-Cost Analyses	Distributional Equity Analyses
Purpose	To identify which DER programs utilities should invest in	a) To identify how DER programs impact priority populations b) To identify which DER programs utilities should invest in
Costs and Benefits	Costs and benefits across all customers on average	a) Costs and benefits for priority populations b) Costs and benefits for other customers
Impacts Analyzed	• Utility system impacts • Participant impacts • Societal impacts	Depends on choice of DEA metrics
Metrics	• Costs (PV$) • Benefits (PV$) • Net present value (NPV) • Benefit-cost ratio (BCR)	Examples: • Rates ($/kWh) • Bills ($/month) • Participation rates (% of eligible customers) • Energy burden (% of income spent on energy bills) • Reliability impacts (% change in CEMI*) • Service shutoffs (% change) • Health impacts (ER visits for asthma) • Environmental impacts (PM 2.5 emissions)

*Customers Experiencing Multiple Interruptions

Systemwide Equity Assessment Compared with DEA



Systemwide equity assessment

Broadly addresses how to eliminate inequities in all utility services, practices, and investments.

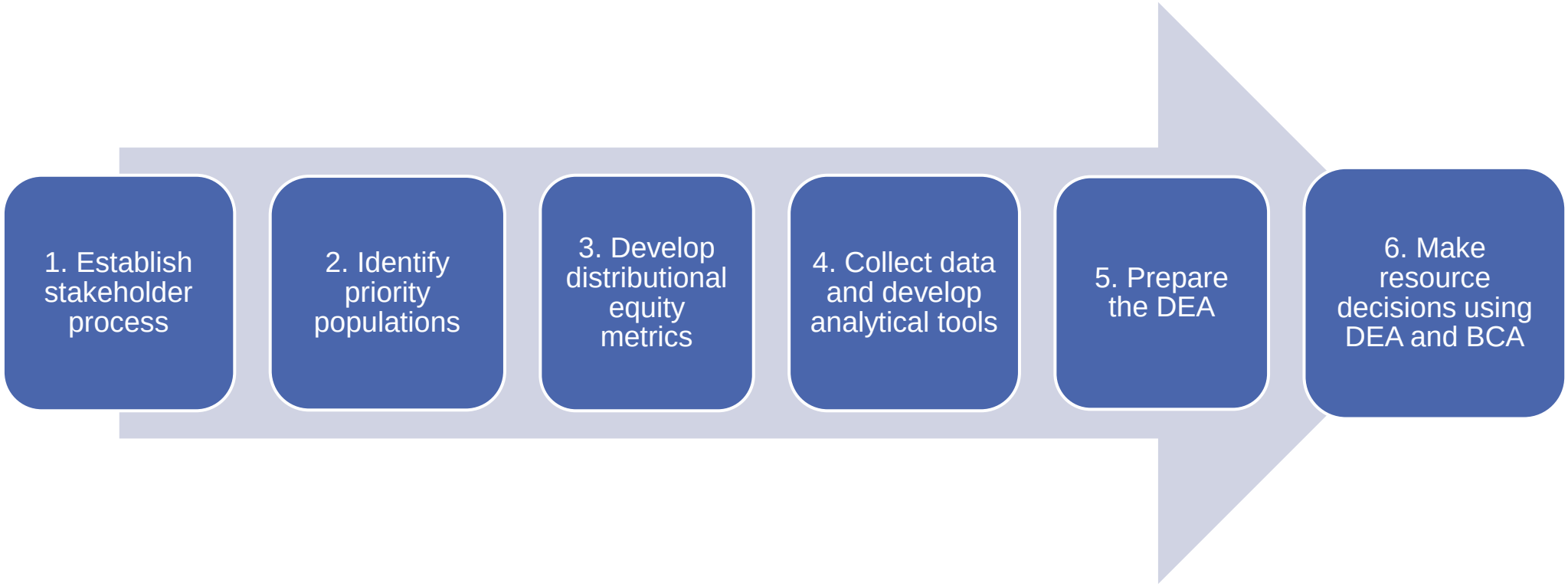
Encompasses all four dimensions of equity.

DEA

Address only distributional equity, and only one aspect of that.

Address just one question: Which new resources should utilities invest in?

Key Steps to Conducting a DEA



Stakeholder Process

A robust stakeholder process is critical to support DEA.

Stakeholders should include representatives from the priority population.

- These representatives often face barriers to participation in PUC processes.
- The barriers should be recognized and addressed.

Stakeholder input should be solicited and utilized in all stages of the DEA.

- Defining priority populations
- Establishing equity metrics
- Applying metrics to priority populations
- Applying data, maps, and other tools
- Interpreting the DEA results
- Deciding on what to do with BCA and DEA results

Identify Priority Populations

Many terms are used to represent the concept of priority populations.

- Disadvantaged, overburdened, marginalized, underserved, vulnerable, environmental justice communities, frontline communities, highly impacted communities, target populations.

The scope of the priority populations should be determined based on the state's equity policy goals and stakeholder input.

In some cases, actions to improve equity might require increased costs, which might be borne by the non-priority customers.

Therefore, determining the scope of the priority population might require tradeoff between:

- The number of customers who might benefit from actions to improve equity
- The number of customers who might have to pay for those actions

Priority Population Indicators: Examples

Existing inequities, institutionalized racism, or exclusion

- Income, race, ethnicity, English language proficiency, tribal lands, other household indicators, workforce and employment, housing costs and conditions, gender

Population health

- Health impacts, including communities that have high levels of asthma, diabetes, heart disease, low life expectancy

Poor environmental conditions or access to services

- Climate change impacts, including communities expected to experience increased rates of agriculture loss, building loss, population loss, flooding, or wildfires from climate change
- High levels of pollution, including communities that are in proximity to hazardous waste facilities, superfund sites, or abandoned mines or exposed to diesel particulate matter, NOx emissions, and wastewater discharges

Priority Population Indicators: State Examples

	Existing inequities, institutionalized racism, or exclusion								Health & Environment		
State	Income	Race / Ethnicity	English Language Proficiency	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

Y = yes
N = no
P = potentially

Priority Population Indicators: US DOE and Justice40

Fossil Dependence	Energy Burden	Environmental & Climate Hazards	Socio-Economic Vulnerabilities	
Coal employment	Energy burden	Cancer risk	>30-minute commute	< HS education
Fossil energy employment	Non-grid connected heating fuel	Climate hazards loss of life	Disabled population	Linguistic isolation
	Outage duration	Diesel particulates	Food desert	Low-income
	Outage events	Homes built before 1960	Homelessness	Mobile home
	Transportation costs	National Priorities List proximity	Housing costs	No vehicle
		Traffic proximity	Incomplete plumbing	Access to parks
		Treatment, storage, disposal facility proximity	Internet access	Population 65 and older
		Water discharge	Job access	Renters
			< HS education	Single parent
			Linguistic isolation	Unemployed
			Low-income	Uninsured

Key Steps in Identifying Priority Populations

1. Review any existing state definitions already in use (e.g., for environmental justice)
2. Review existing state energy equity goals
3. Review indicators that other jurisdictions have used for priority populations
4. Solicit input from stakeholder representatives
5. Choose a set of indicators based on the previous four steps
6. Conduct “cumulative impact analyses” to identify the most highly impacted customers
7. Consider refinements for the purpose of conducting the DEA
    1. Is the scope too narrow? Are any key customer types excluded?
    2. Is the scope too broad? Will it impose undue burdens on non-priority populations?

Establish DEA Metrics

Metrics are an essential element of DEA because they determine which aspects of equity will be evaluated.

There are many, many metrics that can be used for systemwide equity assessments.

But these need to be winnowed down for distributional equity analysis.

- Some metrics overlap with each other.
- Some metrics overlap with results of the BCA.
- Some metrics might not be relevant for distributional equity.
- Some metrics might not be affected by the DER investment under consideration.
- Too many metrics might complicate the DEA and make the results hard to interpret.

Systemwide Energy Equity Metrics: State Examples

Category	Subcategory	CT	CA	HI	MA	IL	WA
Access	DER program participation	✓	✓	✓	✓		✓
	DER saturation		✓	✓		✓	✓
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		✓			✓	✓

Guidelines for Developing DEA Metrics

The following criteria can be used to select DEA metrics from systemwide equity metrics.

Criteria	Description
Distributional	Equity metrics for a DEA should focus on distributional equity impacts. Broad, systemwide equity metrics tend to cover many dimensions of equity (institutional, procedural, distributional, restorative). DEA is not capable or 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	Metrics should capture the costs and benefits relevant to a jurisdiction's policy goals.
DER impact	When applying a DEA to DERs, metrics should focus on those where utility DER investments, or the investments that they defer or avoid, are likely to have an impact.

DEA Metrics: Examples

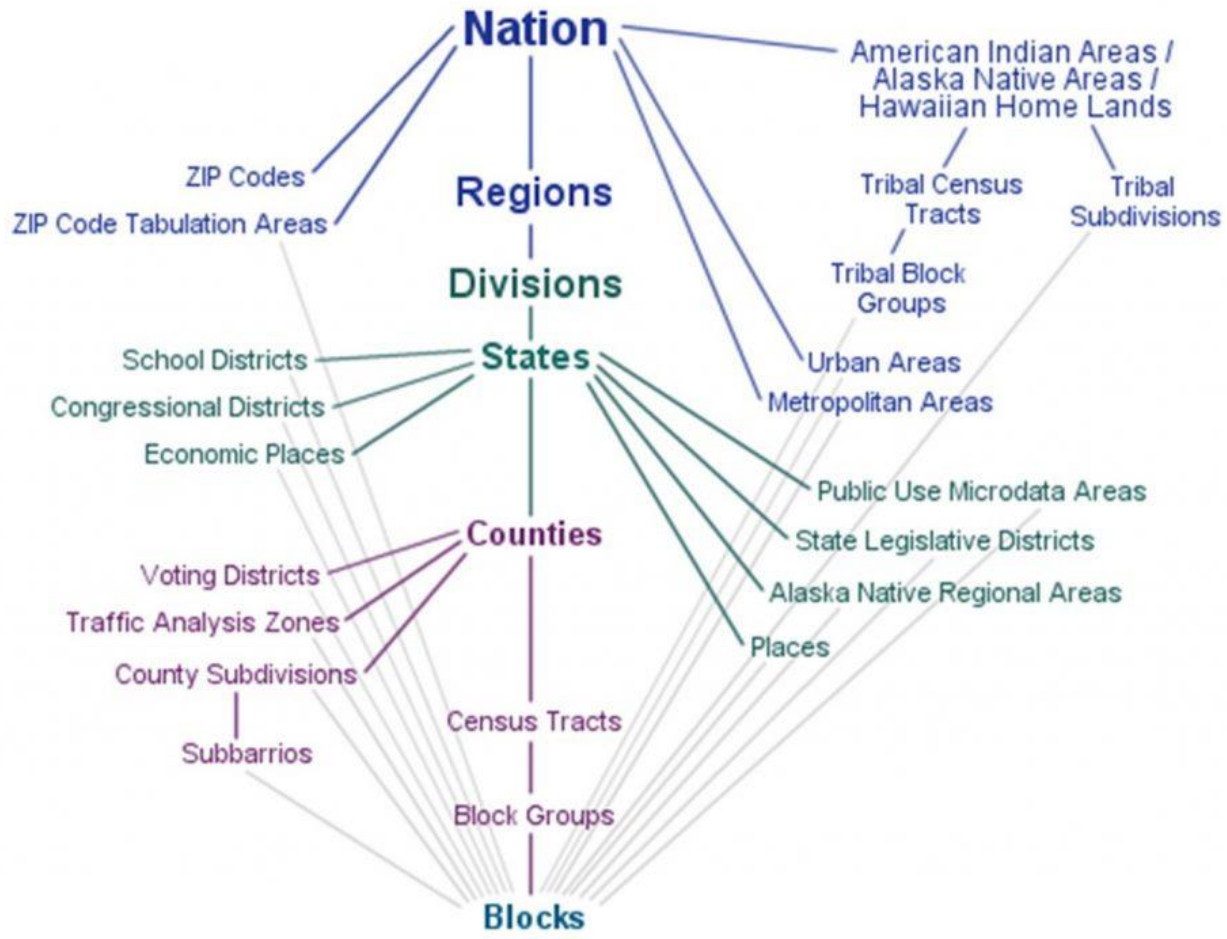
Impact Type	Category	Subcategory	Potential DEA Metrics
Utility System	Provision of Service	Reliability	Change in reliability metrics
		Shutoffs	Change in number of shutoffs or frequency of shutoffs
Host Customer	Non-energy impacts	Health, safety, and comfort	Physical health: change in medical costs, change in lost workdays, lost school days, maternal health impacts
		Reliability and resilience	Reduction in number and duration of outages at the customer-level
Societal	Public Health	Health impacts	Physical health: change in hospital admissions, asthma, cancer risk
		Impacts of GHG related events	Expected annual loss of life (fatalities and injuries) from climate hazards
		Jobs	Workforce development, clean energy apprenticeships
		Utility dollars invested	Funding available or funds invested in priority populations
Rates, Bills, and Participation	Rates	Change in rate	Percent change in rate
	Bills	Change in bills	Percent change in bills
		Energy burden	Percent change in energy burden
	Participation	Participation for the DER being evaluated	Percent of eligible participants

Data and Analytical Tools

DEA requires a lot of data; some publicly available, some not

Demographic and socio-economic data	Often can be obtained from nationally available public data, e.g., the US Census Bureau. Can also be collected through community surveys, opt-in participation questions, or other state and local data collection.
Utility data	Includes billing data, customer account data and addresses, rate information, bill information, participation in DER programs, geographic data, and more. Can often be obtained from utilities, but there are significant data privacy and security challenges.
Utility impacts	Some utility impacts can be captured using publicly available data, such as government-collected health or environmental data.

Hierarchy of Geographic Areas for US Census Bureau Data



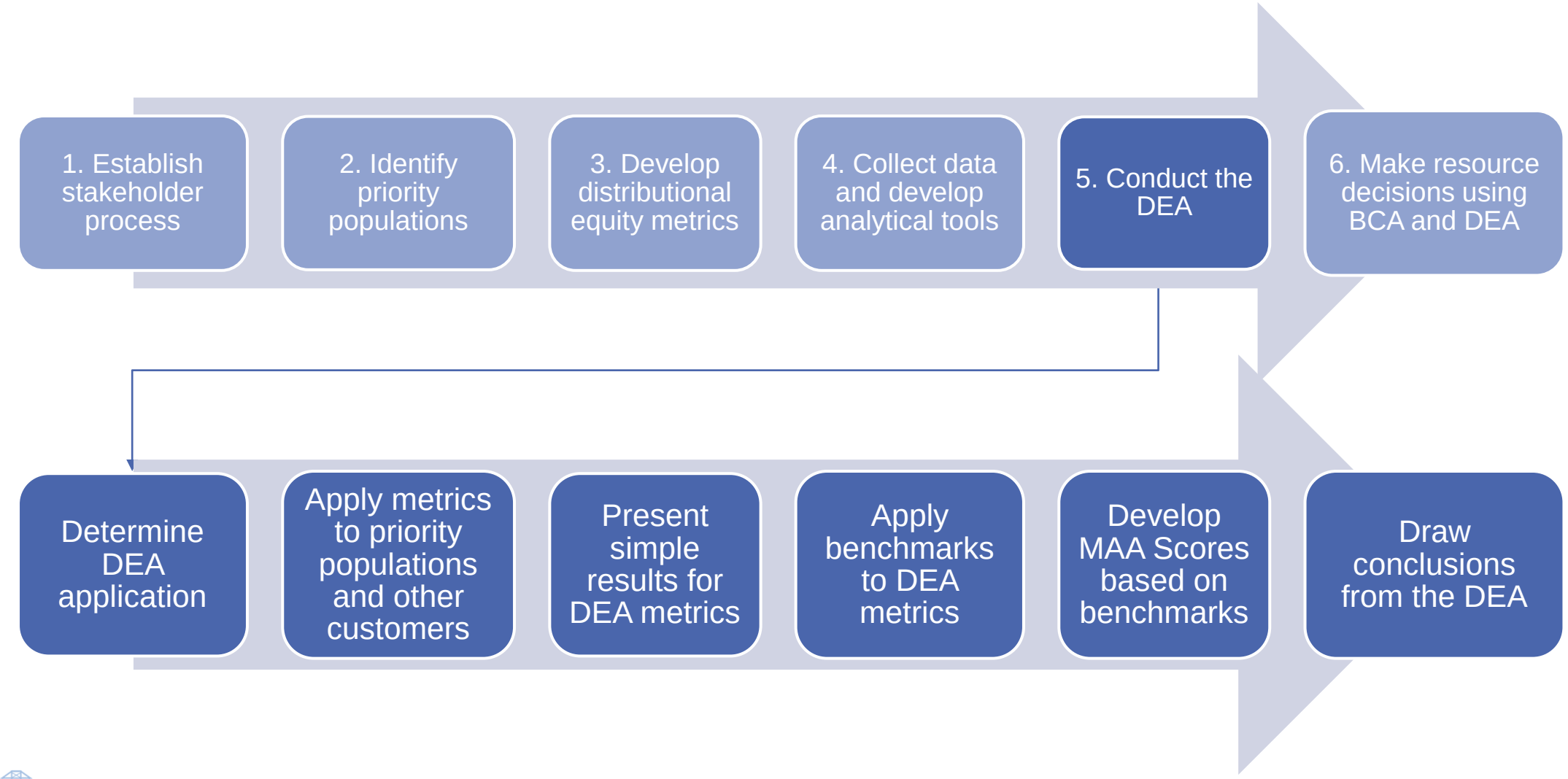
Source: US Census Bureau, 2021

A key challenge of DEA is to map the demographic data, which might be available by Census Blocks or Block Groups, to the utility data, which might be available by street addresses and accounts.

Many Tools are Available for Processing Equity Data

Tool	Description
Mapping tool	An interactive data visualization platform that displays spatial and geographic data.
EJ screening tool	A type of mapping tool that combines environmental, health, socio-economic, and demographic information, overlaid in an interactive mapping format, to assist policymakers, researchers, and communities with decision-making in the context of environmental justice.
Dashboard	A platform that consolidates utility performance information in a central location and presents the data in a transparent and meaningful way. 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.

Key Steps for Conducting the BCA



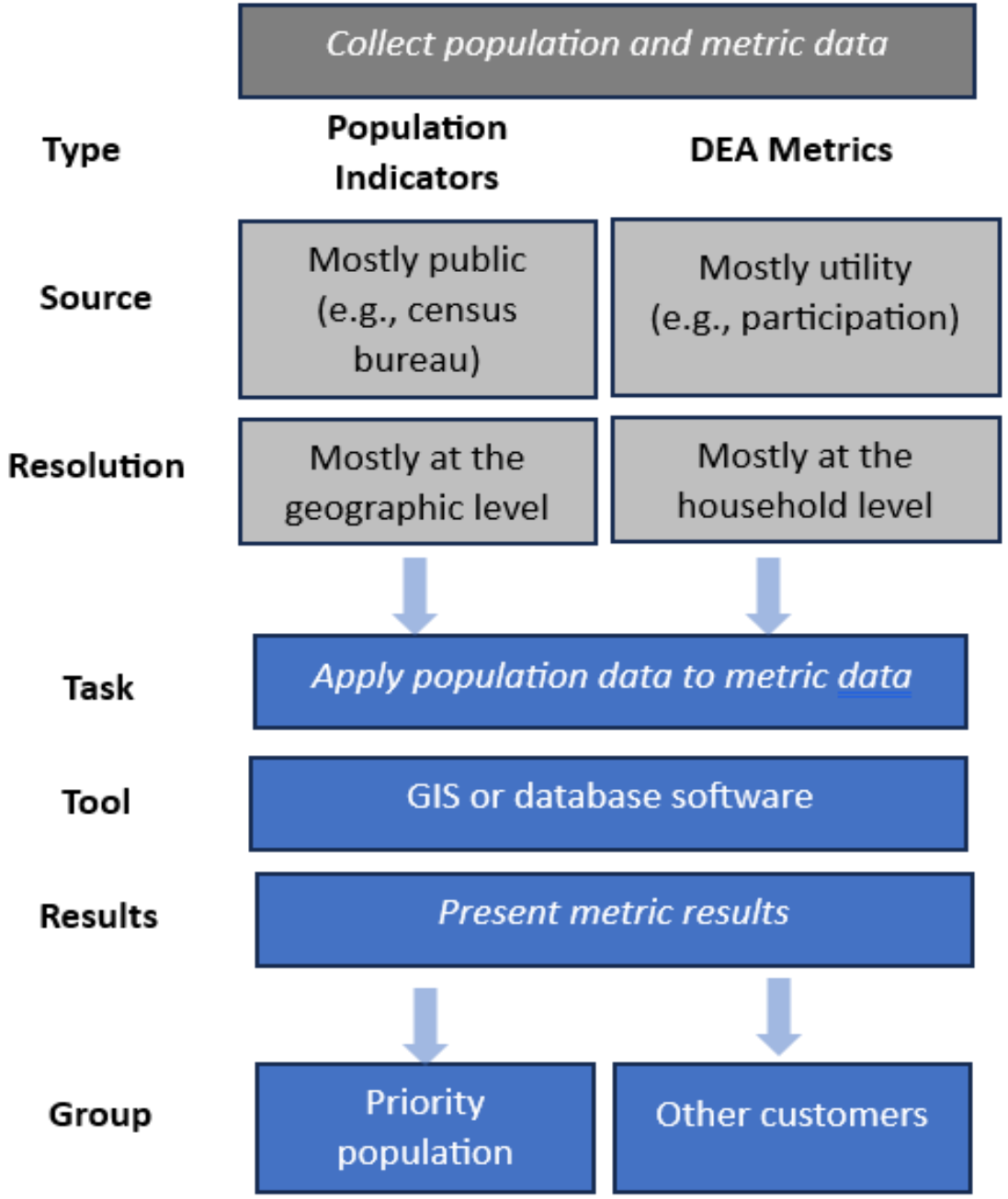
Determine the DEA Application – this will affect how to interpret DEA results

Single DER	For assessing one DER program in isolation. *Examples: A single EE program, a low-income EE program, a single DG program, a community solar program, a distributed battery program.*
Multiple DERs	For assessing and comparing different DERs, either of the same type or different types. *Examples: EE versus EE; DG versus DG; EE versus DG; DG versus storage.*
DER Portfolio	For assessing multiple "like" DERs in aggregate. *Examples: an EE portfolio, a portfolio of net energy-metered practices, a portfolio of distributed battery programs*
Multiple DER Portfolios	For assessing and comparing portfolios of differentDER types, to optimize all DERs within a utility's service area. *Examples: portfolio of EE vs. portfolio of DG vs. portfolio of distributed batteries*

Apply Metrics to Priority Populations

In order to apply metrics to priority populations, the data for each need to be at the same level of resolution.

For example, if the population indicators are available at the geographic level (such as census tract), and the DEA metric data are at the household level (such as utility account addresses), then the household level data must be aggregated up to the geographic level.



Present DEA Results: Simple Results

Metric	Priority Population	Other Customers
Participation (% of eligible population)	11%	22%
Long-Term Average Rates (% change)	1.4%	1.4%
Participant Bills (% change)	-5.6%	-1.5%
Participant Energy Burden (% change)	-5.6%	-1.5%
Non-Participant Bills (% change)	1.4%	1.4%
Non-Participant Energy Burden (% change)	1.4%	1.4%
Asthma Emergency Room Visits (% change)	-4%	-2%
Number of shutoffs avoided	20	1
Customer reliability (% change in CEMI)	-2%	-5%

Conclusions:

- Priority customers' participation is lower than other customers.
- Long-term average rates will increase for all customers.
- Priority customers that do participate will see significant reductions in bills and energy burden.
- DER will reduce ER visits, and more for the priority population because they are exposed to more air emissions to begin with.
- DER will reduce shutoffs, mostly for priority population.
- DER will provide modest benefits in terms of reliability, but less so for the priority population.

Bottom Line:

- Participation is much lower for priority customers.
- Rates increase for all customers.
- Customers that participate are much better off.

Present DEA Results: Use Benchmarks to Put the Results in Context

Metric	Target Population	Other Customers	Benchmarks
Participation (% of eligible population)	11%	22%	20%
Long-Term Avg. Rates (% change)	1.4%	1.4%	2%
Participant Bills (% change)	-5.6%	-1.5%	-3%
Participant Energy Burden (% change)	-5.6%	-1.5%	-3%
Non-Participant Bills (% change)	1.4%	1.4%	1%
Non-Participant Energy Burden (% change)	1.4%	1.4%	1%
Asthma Emergency Room Visits (% change)	-4%	-6%	-2%
Number of shutoffs avoided	20	3	5
Customer reliability (% change in CEMI)	-3%	-7%	-3%

Conclusions:

- Priority customers' participation is below benchmark.
- The average rate increase is below the benchmark (a good outcome).
- Priority customers bills and energy burden reductions exceed the benchmark (a good outcome).
- DER will have generally positive equity impacts (relative to benchmarks) on ER visits, shutoffs, and reliability.

Bottom Line:

- Participation of priority customers is well below the benchmark.
- Rate increase is acceptable, relative to the benchmark.

Present DEA Results: Use Multi-Attribute Analysis

Multi-attribute analysis (MAA) is a technique for scoring and weighting results (metrics) that cannot be added together because they are in different units and some are non-monetary.

- Example results: costs ($), benefits ($), DER participation (% of eligible customers), rate impacts (% of rate), energy burden (% of all costs), reliability (# outages)

Key MAA steps

- Put each metric on a consistent scale (e.g., 0-1), by choosing a max and min.
- Use the scale to create a normalized score for each metric.
- The normalized scores can be used to compare each metric.
- The normalized scores can be added together to get a total score for the DEA.
- The normalized scores can be weighted for importance, so that when they are added together the total score accounts for priorities across metrics.

MAA is very convenient, but it is also subject to misinterpretation and manipulation.

- It should be used only with great caution.

Present DEA Results: Use Multi-Attribute Analysis - Example

Everything is normalized on a scale between 0 and 1 (if an impact can only be positive), or A -1 and +1 (if an impact can be either positive or negative).

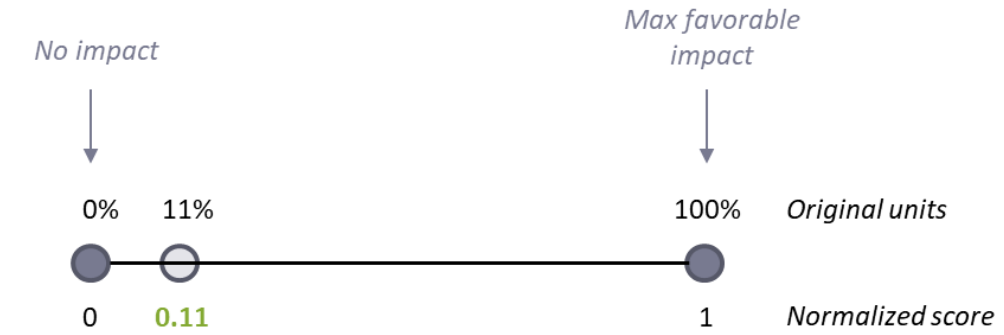
Requires setting a maximum favorable outcome and, if applicable, a maximum unfavorable outcome.

- Ex 1: The maximum participation rate is 100% and the minimum is 0%. If the priority population's participation is 11%, it gets a normalized DEA score of **0.11**.

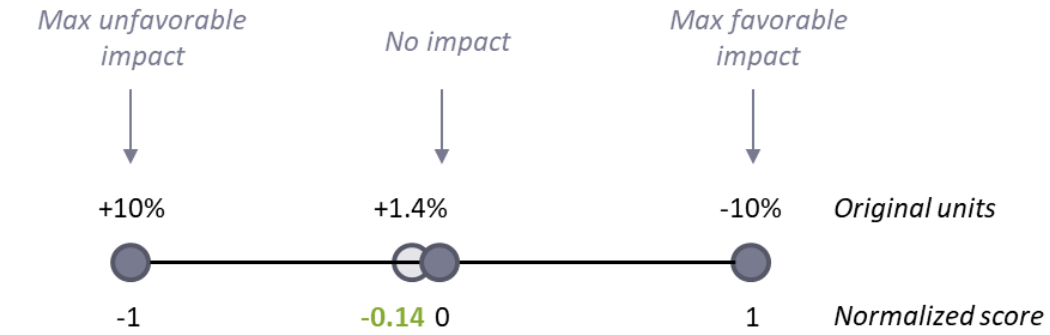
- Ex 2: The maximum favorable rate impact this DER could have is a 10% rate reduction. The maximum unfavorable impact is a 10% rate increase. If a program increases rates 1.4%, it receives a score of **-0.14** .

Weights are applied to *each* metric based on metric importance.

Example 1



Example 2



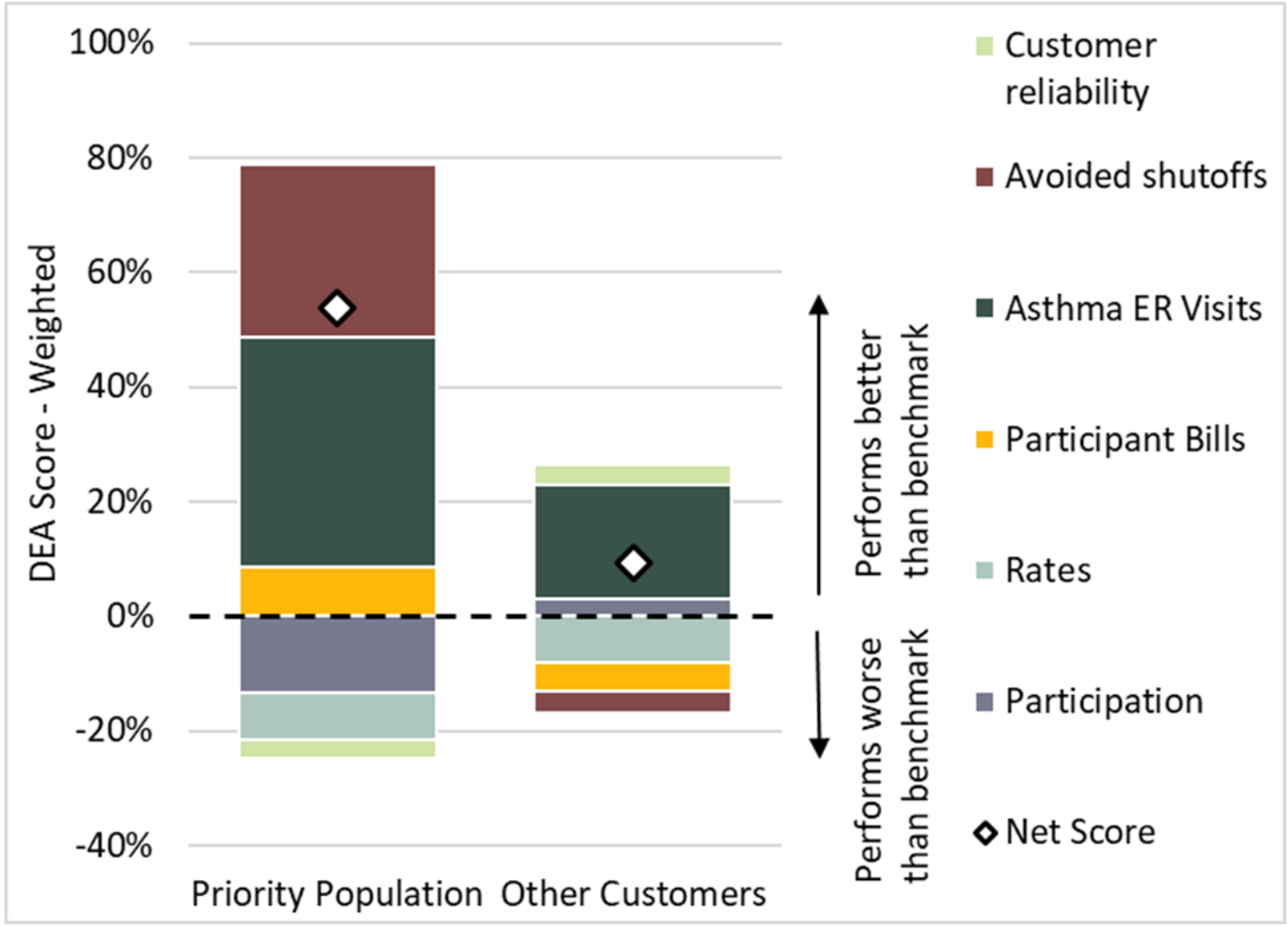
Example MAA Results: Unweighted Scores for Each Metric

Unweighted scores presented separately for each metric shows implications of each metric.

In this presentation, results are relative to the benchmarks.

For example, bills go down for all participants. The bill reduction for priority customers exceeds the benchmark. but is below the benchmark for other customers.

Example MAA Results: Weighted Scores and Net Scores

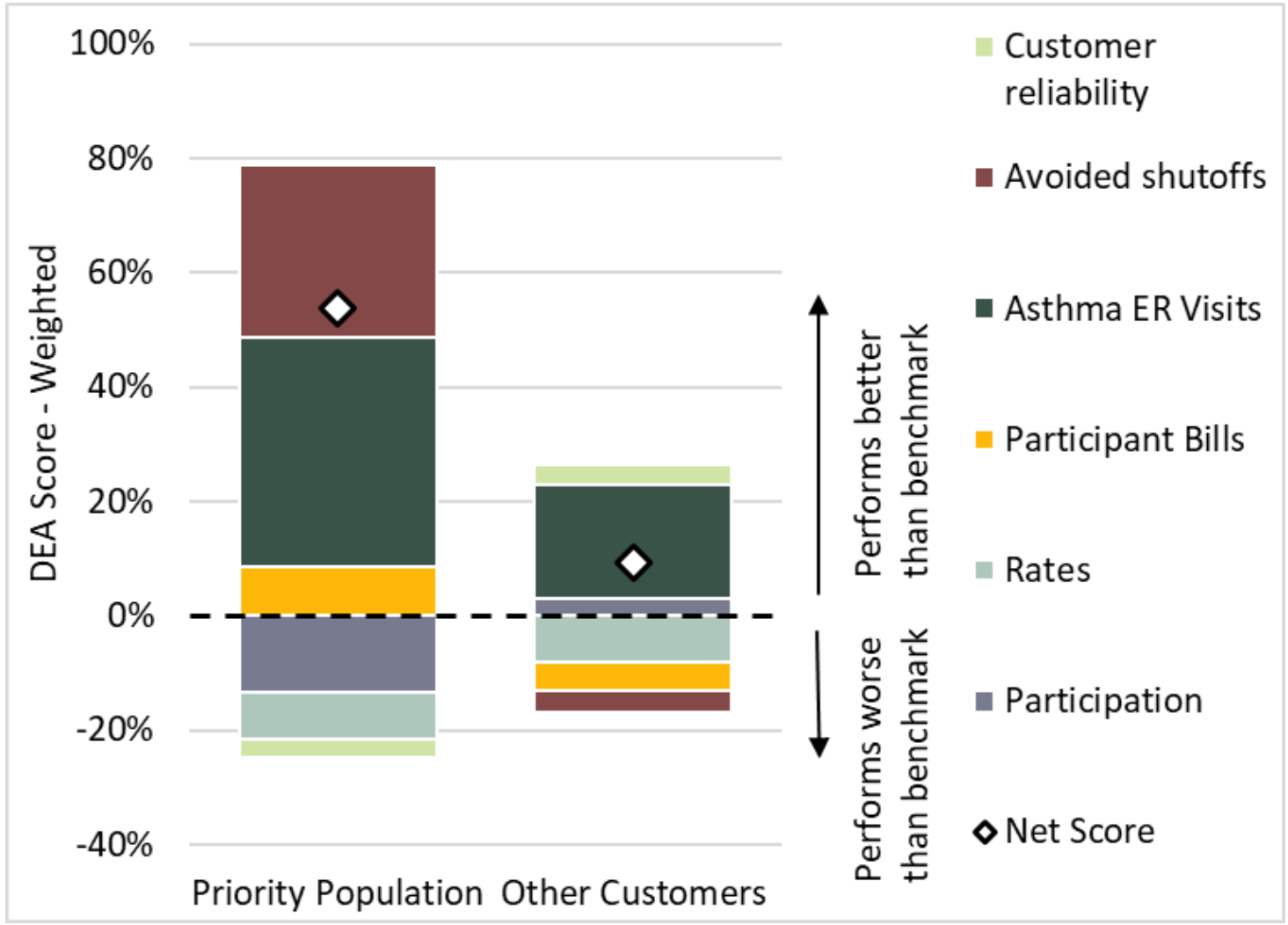


Weighted scores for each metric can be added together to see the combined results.

Net scores can be calculated to account for both positive and negative equity.

Net scores can be compared to see how priority customers fare relative to other customers.

Draw Conclusions From the MAA



Net scores suggest that priority populations will see more equity benefits than other customers.

Different Approaches Address Different Questions

Question of Interest	Simple Results	Simple Results with Benchmarks	MAA Scores
Does DER improve or worsen equity?	✓	✓	✓
For which metrics does DER improve or worsen equity?	✓	✓	✓
To what extent does DER improve or worsen equity: for each metric?	-	✓	✓
To what extent does DER improve or worsen equity: for all metrics combined?	-	-	✓
Can the DER program be modified to improve equity?	✓	✓	✓

The Limits of Multi-Attribute Analysis for BCA

The results of the BCA and the DEA should be used together to make decisions on utility investments in DERs.

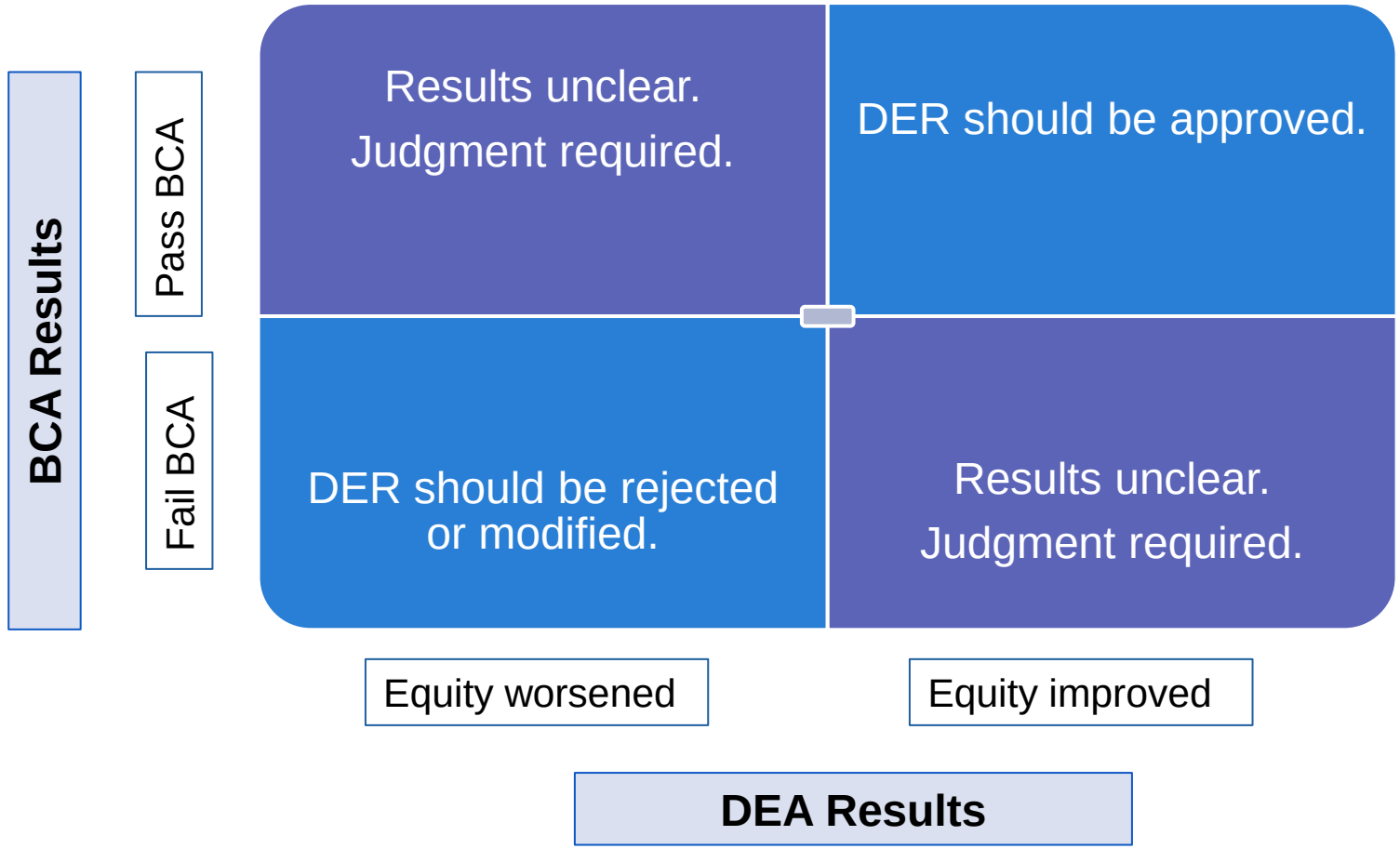
While MAA is a useful technique for normalizing and summarizing the results of DEA, we do not recommend applying it to the results of the BCA.

- Applying MAA requires establishing a maximum and minimum scale in order to normalize results. For BCA this would require creating a maximum and a minimum for either net benefits or benefit-cost ratios.
- A max-min scale for either net benefits or benefit-cost ratios would be meaningless because the maximum could be chosen to be any value.
- The choice of max-min scale will dramatically affect the result of the MAA.
- Therefore, applying MAA results creates a very high risk (near certainty) that the results will be misinterpreted or manipulated.

In sum, we recommend using MAA for the DEA results but not for the BCA results.

Draw Conclusions from the DEA and the BCA

- If BCA passes and equity is improved, then DER program should be approved.
- If BCA fails and equity is worsened, then DER program should be rejected or modified.
- Otherwise, the combined results are unclear, and judgment is required.
  - There might be situations where equity benefits outweigh negative BCA results.
  - There might be situations where BCA benefits outweigh negative equity impacts.



Questions & Answers

Examples of Useful References

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DEA Project Team - Berkeley Lab

Berkeley Lab's Electricity Markets and Policy Department informs public and private decision making within the U.S. electricity sector through independent, interdisciplinary analysis of critical electricity policy and market issues. We envision a clean, efficient, reliable, and affordable electricity system that meets the United States' diverse and growing energy needs. This project builds on a strong analytical foundation on energy efficiency and DERs.

Example equity research:

- Assessing the Current State of U.S. Energy Equity Regulation and Legislation
- Advancing Equity in Utility Regulation
- Characterizing local rooftop solar adoption inequity in the US
- National Community Solar Partnership
- An Assessment of Evaluation Practices of Low- And Moderate-Income Solar Programs
- Energy Efficiency Financing for Low- and Moderate-Income Households
- Customer outcomes in Pay-As-You-Save programs
- Who is participating in residential energy efficiency programs?
- Deferred Payment Loans for Energy Efficiency

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Lisa Schwartz

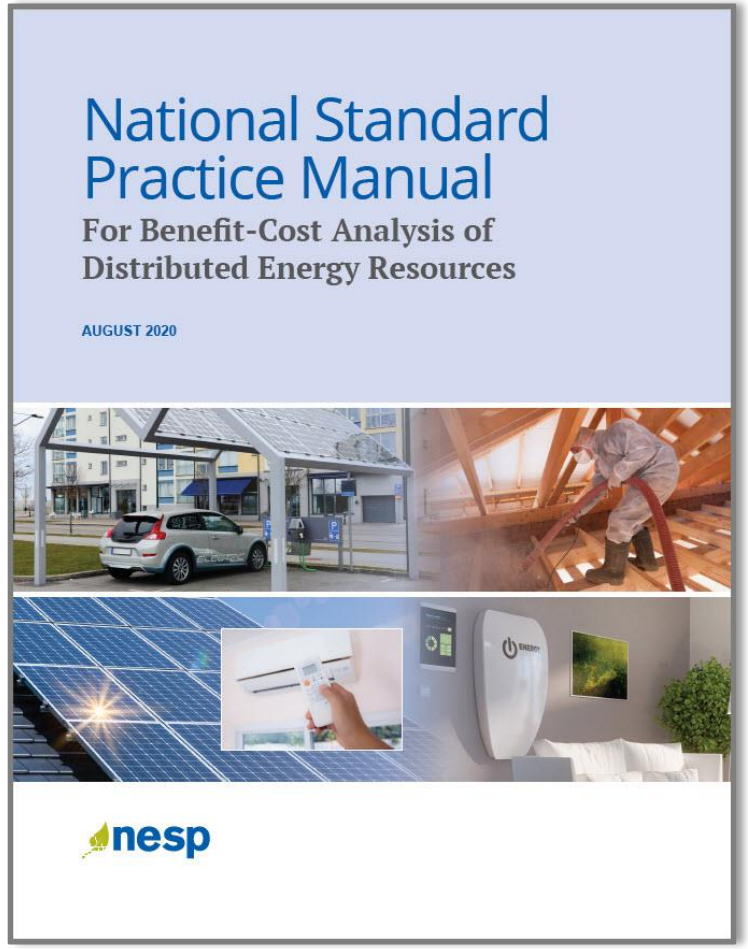
DEA Project Team – E4TheFuture

E4TheFuture – manages and coordinates the National Energy Screening Project, a stakeholder organization that works to improve cost-effectiveness screening practices for distributed energy resources (DERs).

Key products to date:

- National Standard Practice Manual for DERs
- Methods, Tools and Resources Handbook for Quantifying DER Impacts for Benefit-Cost Analysis
- Database of Screening Practices

Julie Michals
Director of Valuation



DEA Project Team – Synapse Energy Economics

Synapse Energy Economics

- Leader for public interest and government clients in providing rigorous analysis of the electric power and natural gas sectors
- Staff of 40+ includes experts in energy, economic, and environmental topics

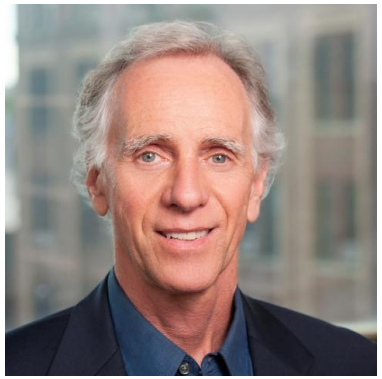
Tim Woolf

- Lead author of National Screening Practice Manual and companion documents

Alice Napoleon

- In charge of Synapse equity initiatives

Synapse is committed to providing meaningful data and analysis to support important dialogue and efforts towards an equitable distribution of energy system benefits and burdens.



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Acknowledgements

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Appendix

Systemwide Equity Assessment, DEA, and BCA