Who Benefits? Approaches and Challenges in Identifying Disadvantaged Communities to Benefit from Energy Programs

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Abstract

As energy efficiency programs expand, ensuring benefits reach disadvantaged communities (DACs) has become a critical challenge. Across the U.S., various federal and state entities have used different criteria to define disadvantaged communities, each with significant implications for who qualifies and who is excluded. A simple tweak to the model selection criteria can shift eligibility entirely, leaving some communities unable to access critical investments and benefits. The Illinois Solar for All (ILSFA) program, launched in 2017, provides an innovative model for affordable solar access, targeting income-eligible residents. This program is committed to allocating a substantial portion of its funds to support disadvantaged communities, referred to as Environmental Justice Communities (EJCs) within the program.

This paper (1) examines and compares the ILSFA program's criteria for defining EJCs with other federal level disadvantaged community designation to showcase overlaps and gaps in approaches, (2) models the impacts of different criteria within the state, demonstrating how definitional changes can affect eligibility and ultimately impact project distribution, and (3) discusses common challenges in identifying disadvantaged communities, offering potential solutions in four key areas: developing methodologies without a definitive source of truth, avoiding sharp eligibility cutoffs, creating mechanisms for communities to advocate for DAC designation based on local knowledge of barriers and lived experience, and navigating scenarios where rule-based constraints shape methodological choices.

DACs origin and evolution

The term DAC refers to communities facing systemic challenges that derive from long-standing social, economic, environmental, and infrastructural inequities. These challenges often include limited access to quality education, healthcare, clean air and water, reliable transportation, economic opportunities, and public safety. The objective of identifying DACs is generally to target public investment and policy interventions toward communities that are more vulnerable to adverse outcomes due to systemic inequities.

Haaland, et al (2022) describe an overview of the historical evolution of the term in the context of DAC designations that included environmental components. The terminology surrounding disadvantaged communities in the United States has legislative roots dating back to the mid-1990s. California's Safe Drinking Water Act of 1995 first formally defined disadvantaged communities as areas "in which MHI is less than 80 percent of the statewide median". This income-based approach initially focused on directing funding for drinking water infrastructure to financially constrained communities, establishing the foundation for a much broader conceptual framework. The scope of DAC definitions expanded significantly in 2012 when California's Senate Bill 535 required 25 percent of cap-and-trade proceeds to benefit disadvantaged communities, but notably did not reference the existing water code definitions. Instead, the legislation tasked the California Environmental Protection Agency (CalEPA) with developing new criteria that emphasized communities disproportionately affected by pollution. To achieve this, California's Office of Environmental Health and Hazard Assessment (OEHHA) created the CalEnviroScreen tool, which employs various environmental vulnerability metrics to identify disadvantaged communities. Since then, multiple agencies and states have developed their own interpretations of disadvantaged and established diverse technical definitions.

This paper utilizes different DAC designations in Illinois as a case study to examine how varying definitions of disadvantaged communities influence program access. It compares the criteria used by the ILSFA program with those of the former Justice40 framework, identifying key areas of convergence and divergence. Through a simulation, the paper illustrates how changes in designation criteria can meaningfully shift which communities qualify for support. Finally, it outlines solutions to familiar challenges in developing DAC methodology.

Illinois DAC designations

ILSFA is an Illinois Power Agency (IPA) program launched in 2017 that provides an innovative model for affordable solar access, targeting income-eligible residents and committing to allocating a substantial portion of its funds to support disadvantaged communities, referred to as EJCs within the program. The IPA Act[1] determines that ILSFA must allocate at least 25% of program funds for projects in or serving EJCs. ILSFA also uses EJCs as part of the project selection process (e.g., projects sited in EJCs score higher in funding rankings). The IPA designates EJCs using a scoring system that takes into account environmental and demographic factors. Its methodology for identifying EJCs is based on the CalEnviroScreen tool, with some indicators added or removed based on considerations such as relevance and implementation challenges (Illinois Power Agency, 2024).

Following IPA's methodology, ILSFA (n.d.) defines EJCs as communities with a "demonstrated higher risk of exposure to pollution based on environmental and socioeconomic factors." ILLUME Advising (2024) analyzed how this designation compared to other state and federal designations to understand which indicators, and thus, which populations, could be currently included and excluded. In this section, we describe and compare the Justice40 federal initiative with the EJC definition.

The Justice40 Initiative was a federal effort launched by the Biden administration in 2021 to ensure that historically underserved and overburdened communities benefit equitably from investments in climate, clean energy, and infrastructure. The initiative mandated that at least 40% of the overall benefits from certain federal programs, particularly those related to clean energy, energy efficiency, affordable and sustainable housing, clean transit, workforce development, and pollution reduction, are directed to disadvantaged communities. This designation included environmental, economic, and sociodemographic indicators like ILSFA EJCs and added others related to health, housing, and transportation factors. Although this initiative was eliminated in January 2025 with the new administration, it allows us to compare how program participation might be influenced under different designations. ILLUME's report (2024) includes a detailed comparison between methodologies and indicators of ILSFA EJCs and Justice40 DACs.

Figure 1 shows the geospatial differences between ILSFA EJCs and Justice40, with ILSFA EJCs tending to be in urban areas, and Justice40 having a more dispersed presence across Illinois.

[1] 571 20 ILCS 3855/1-56(b)(2)(A), (B), (C).

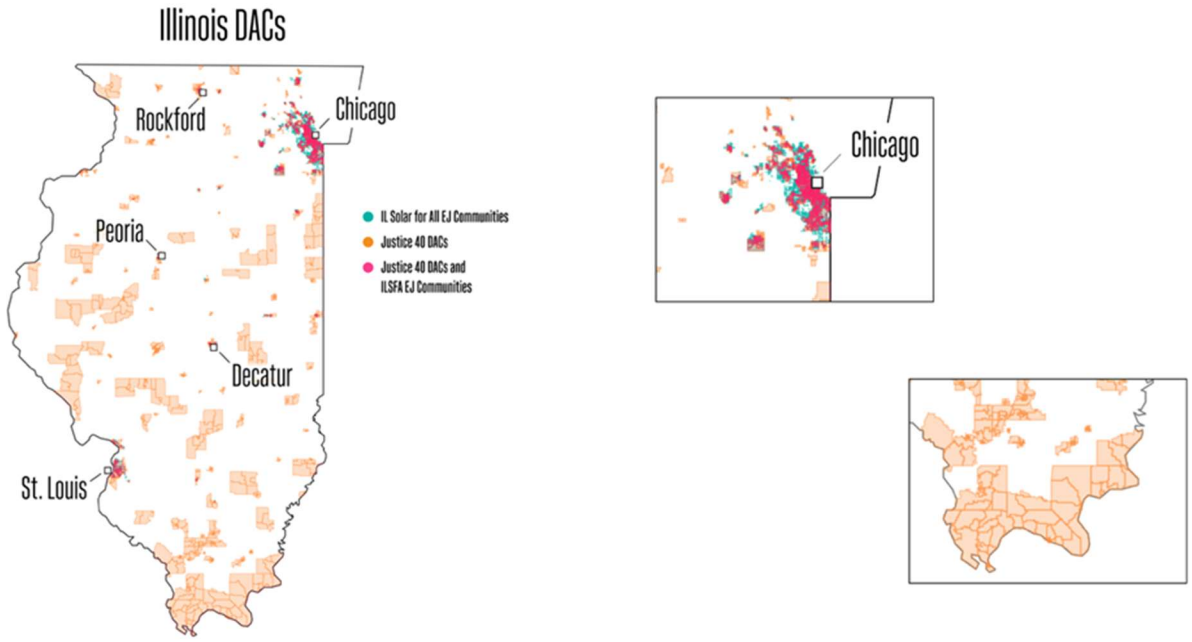

Figure 1. ILSFA EJCS and Justice40 DACs distribution.

The potential impacts of different Illinois DAC designations

Program funds can depend on DAC identification. Thus, identification mechanisms require considerable attention. Decisions have significant implications for who qualifies and who does not. Simple tweaks to methodologies can shift eligibility, leaving communities unable to access critical investments and benefits.

Figure 2 illustrates a simulation of how different DAC designations can impact project distribution. Each dot represents a simulated solar project that is randomly assigned to block groups. In the first case, with randomly assigned DACs, all block groups have an equal probability of receiving a project regardless of DAC status; this allocation accounts for 75 percent of the simulated projects (out of 1,000). The second case shows how the remaining 25 percent of projects would be distributed if reserved for ILSFA EJCs, while the third case shows the distribution if reserved for Justice40 DACs. Although this equal-probability approach does not accurately reflect real-world conditions, where factors such as workforce availability or the presence of approved vendors influence feasibility, it illustrates how outcomes can differ depending on the designation method. In particular, the more substantial rural presence in the Justice40 designation results in a more visible concentration of projects outside urban areas.

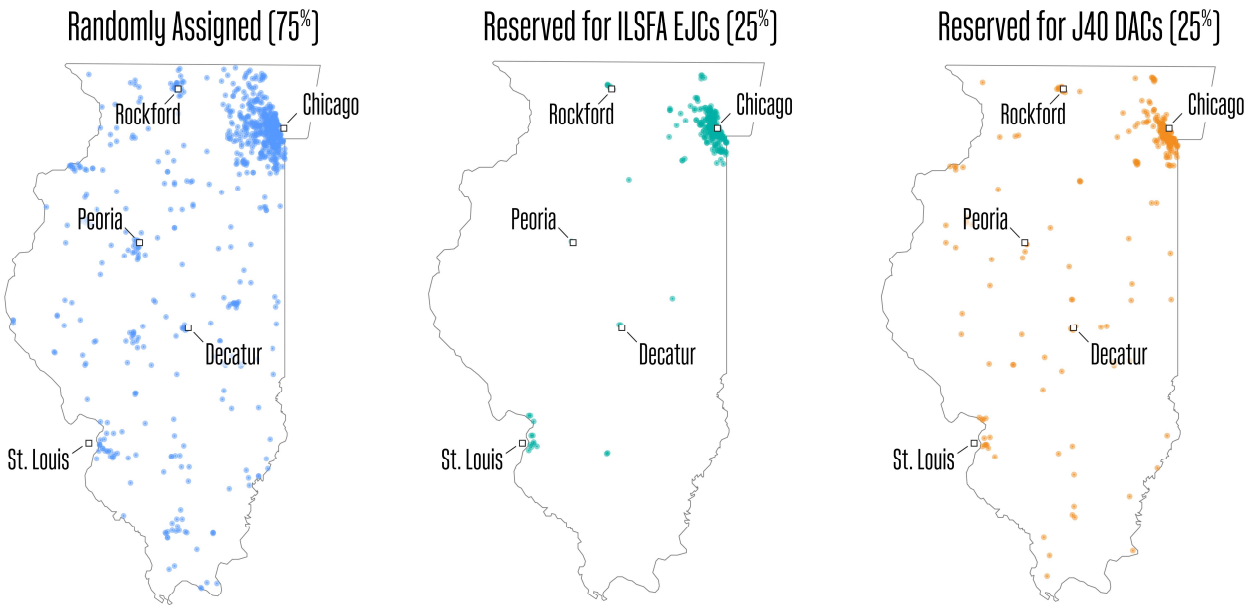

Figure 2. Simulated Project Allocation with 25% Reserved for EJCs.

Challenges and Potential Solutions

The simulation above highlights how different designations can significantly impact the distribution of program participation. However, developing these identification methodologies is not a straightforward process. This next section outlines tools and considerations for challenges that often arise when defining DACs.

Data-Driven Definitions and the Challenge to Validate Results

One major challenge in identifying Disadvantaged Communities is the uncertainty around the validity of the chosen methodology. Without a clear "source of truth," it can be challenging to determine whether the selected methodologies result in outputs that meaningfully reflect disadvantage.

Establishing a Working Group to guide the development of methodologies can be crucial for achieving outcomes that meaningfully reflect disadvantages. This group could include community advocates, environmental justice advocates, and representatives from different geographic areas who know local challenges and the lived experiences of the communities they represent. This group should have a dedicated technical advisor who can communicate complex concepts and data in clear, accessible ways to support evidence-based decision-making.

An example of this can be found in the Washington Environmental Health Disparities Map. The map was developed by the Washington Environmental Justice Mapping Working Group, which included Front and Centered—an environmental justice coalition rooted in communities of color—in partnership with the University of Washington Department of Environmental & Occupational Health Sciences, the Washington State Department of Health, the State Department of Ecology, and the Puget Sound Clean Air Agency (Min et. al 2019). Another good example is New York State's approach under the Climate Act. The Climate Justice Working Group (CJWG), established by the New York State Department of Environmental

Conservation (NYSDEC), worked alongside staff from NYSDEC, NYSERDA, NYSDOH, and NYSDOL (collectively, the State Agencies), with assistance from technical experts at ILLUME Advising and Abt Associates to develop the DAC methodology (New York State Climate Justice Working Group 2023). Without community representation and technical support, the final DAC designation methodology may yield results that are disconnected from the local realities. For example, in the process of identifying New York DACs, the ILLUME team received input from a working group member to add infant mortality as an indicator, given its connection to environmental and social stressors that disproportionately impact disadvantaged communities. This indicator was then reviewed and incorporated into the methodology.

Once the working group has developed an initial methodology, technical teams can validate it and iterate over it by ground truthing the results: using local knowledge and community input to ensure that the method captures disadvantage meaningfully and adjusts accordingly. Public comments can offer additional insights by highlighting gaps in methodological approaches. For example, in defining the methodology to identify New York DACs, a public comment highlighted a need for improvement in the methodology to identify landfills. The working group took action to incorporate feedback and improve their previous methods (New York Climate Justice Working Group 2024).

Beyond binary representations of DACs

A common challenge in DAC identification is the use of binary classifications: communities are either "in" or "out" based on an often-arbitrary threshold. For example, 25% of communities with higher levels of disadvantage are considered DACs, while the remaining 75% are not. This raises equity concerns: are two communities on either side of the cutoff profoundly different in terms of need? In many cases, minor changes in indicator values or model parameters can shift a community's status, resulting in eligibility for some and exclusion for others, even when underlying conditions are similar.

Non-binary methods are employed in many DAC identification methodologies to assign relevance based on indicators. Rather than applying binary thresholds to each indicator (e.g., assigning a score of 1 if exposure to air pollution exceeds a set limit, and 0 otherwise) these approaches often use continuous metrics to capture a community's relative standing across multiple metrics (e.g., a community at the 90th percentile for pollution is more affected than 90% of other communities, contributing more heavily to its overall disadvantage score). Final scores are typically aggregates of these continuous measures, with higher values reflecting greater disadvantage.

However, the designation of DACs is often still binary: only the top x% of communities are selected as DACs. Introducing a sliding scale at this final stage could reduce sharp cutoffs between communities with similar scores. For example, instead of designating only the top 25% of communities as DACs and excluding those just below the cutoff, a sliding scale could assign scores from 0 to 100 based on levels of disadvantage. Communities scoring between 80 and 100 would receive the highest priority for resources and support, while those scoring between 60 and 80 could be recognized as moderately disadvantaged and still partially eligible for specific programs. This is an example with two tiers, but the sliding window system could include more categories to better reflect varying degrees of need. This could allow more communities to access benefits, with the level of support proportional to their degree of disadvantage. Such an approach acknowledges that disadvantage is not all-or-nothing and could better reflect the nuanced reality of community conditions.

The practicality of implementing a sliding scale might depend on program specifics. For example, tracking and managing funding can be more complex in programs where designations are used to allocate designation-specific budgets. In contrast, for programs where DAC status influences a scoring system, it may be easier to expand the eligible window and score projects based on the communities where they are located. For example, a community at the 70th percentile of disadvantaged might earn fewer points than the community at the 95th percentile.

Mitigating DAC identification blind spots through self-designation

Self-designation offers an important complementary approach to data-driven methodologies for identifying DACs. It recognizes that quantitative indicators and methods may not fully capture local knowledge, historical context, or community-specific experiences of disadvantage. Through self-designation, communities can apply or petition to be recognized based on criteria such as factors that may not be reflected in public datasets and defined methodologies.

This approach can help mitigate the limitations of rigid thresholds or percentile rankings, ensuring that communities on the margins of eligibility or those uniquely impacted are not excluded from resources or programs due to data gaps or methodological blind spots. The ILSFA program exemplifies how self-designation can be operationalized by recognizing a broad set of qualitative indicators: a community may point to media coverage of high toxin levels to illustrate environmental effects or cite their proximity to an undocumented cleanup site to highlight exposure. High rates of chronic diseases like COPD can indicate sensitive populations, while civic actions such as housing protests can signal underlying socioeconomic stressors (ILSFA n.d). By allowing these types of additional contextual evidence, ILSFA ensures that communities have a voice in how disadvantage is defined and creates a mechanism to formally include those voices in the designation process.

Policymakers and program coordinators need to ensure that processes to review applications follow transparent methodologies and evaluations. ILSFA accomplishes this by developing a transparent methodology, a scoring rubric, and convening an EJC Self-Designation Committee that reviews the proposals and whose members serve for staggered two-year terms (IPA, 2025). A key risk policymakers and program coordinators should consider with this approach is that it relies on communities taking the initiative to document and present their conditions, which may require significant effort, resources, and coordination, factors that could limit participation, especially in already overburdened areas.

Navigating rule-based restrictions

Legal limitations on which type of indicators can be used can constrain the development or updating of a DAC designation methodology. A technical team can still work to understand how the restricted indicators would have influenced the outcomes and explore how their absence might lead to overlooking communities that might be left behind.

Shrestha et al. (2023) explore the differences between the Climate and Economic Justice Screening Tool (CEJST) Beta version and version 1. CEJST was the tool created by the Biden administration to help federal agencies identify DACs. The CEJST Beta version excluded race due to legal concerns. CEJST 1.0 indirectly addressed race by adding the historic underinvestment indicator defined by the old Home Owner's Loan Corporation redlined areas. This indicator, along with indicators for access to green space and proximity to underground storage tanks, captures higher shares of minority populations in this analysis. The authors also quantify how the updated methodology changes the percentage of communities now identified as DACs, providing insight into how each indicator contributes to different outcomes across the population segments of interest.

Technical teams can conduct similar exercises in their specific regions to see how the inclusion and exclusion of indicators impact outcomes. Pairwise correlation analysis between available indicators can be a powerful technique for identifying variables that serve as proxies for restricted variables. Dimensionality reduction techniques, such as Principal Component Analysis (PCA), can offer additional insight into multivariate relationships that reflect complex patterns in the data. Unlike simple correlations between two variables, PCA can consider the joint variation across multiple indicators simultaneously.

This allows teams to capture more complex relationships and identify combinations of variables that, together, can approximate the restricted indicator. This analysis can provide insights into how to effectively model underlying social and environmental realities in the absence of restricted indicators through one or more alternative indicators.

Restrictions on data are common, whether due to regulatory rules or limited availability. Alternative approaches can be explored by reviewing academic literature and analyzing accessible data. The choice of indicators and modeling techniques should align with the specific goals of DAC identification. Efforts should focus on optimizing the data and the methodology towards those objectives.

Conclusion

Defining and identifying Disadvantaged Communities (DACs) is a complex yet critical task that directly impacts how resources are allocated and how equity-focused programs achieve their goals. The criteria and thresholds used to determine DAC eligibility can significantly influence who receives support, with even minor methodological changes potentially excluding communities in need.

This paper provided a comparative analysis of the ILSFA program's approach to defining EJCs against other DAC frameworks, highlighting both areas of alignment and distinction. Notably, these differences can manifest even among designations that share similar equity objectives. For example, comparing the J40 initiative and ILSFA EJC criteria, both designed to advance environmental justice, demonstrates that methodological choices can substantially affect which communities qualify and how benefits are distributed. Given these potential differences in outcomes, the analysis further examined several recurring challenges associated with DAC identification and proposed solutions related to identifying DACs in the absence of a clear validation standard, using binary versus more flexible eligibility thresholds, incorporating community insight into designation processes, and developing methodologies under the constraints of regulatory limitations.

Overall, the findings underscore that both the definition and operationalization of DAC criteria have significant potential implications for program access and benefit allocation. Ongoing attention to methodological rigor, transparency, and adaptability is critical for addressing the complexities inherent in identifying disadvantaged communities across diverse policy contexts.

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