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EQUITY AND ENVIRONMENTAL JUSTICE CONSIDERATIONS FOR A CLEAN ENERGY TRANSITION

KEY INSIGHTS

Disadvantaged communities can benefit from the clean energy transition. The transition to cleaner energy offers opportunities to engage with and meet the needs of disadvantaged and disproportionality impacted communities by delivering environmental benefits, economic opportunities, and innovation.

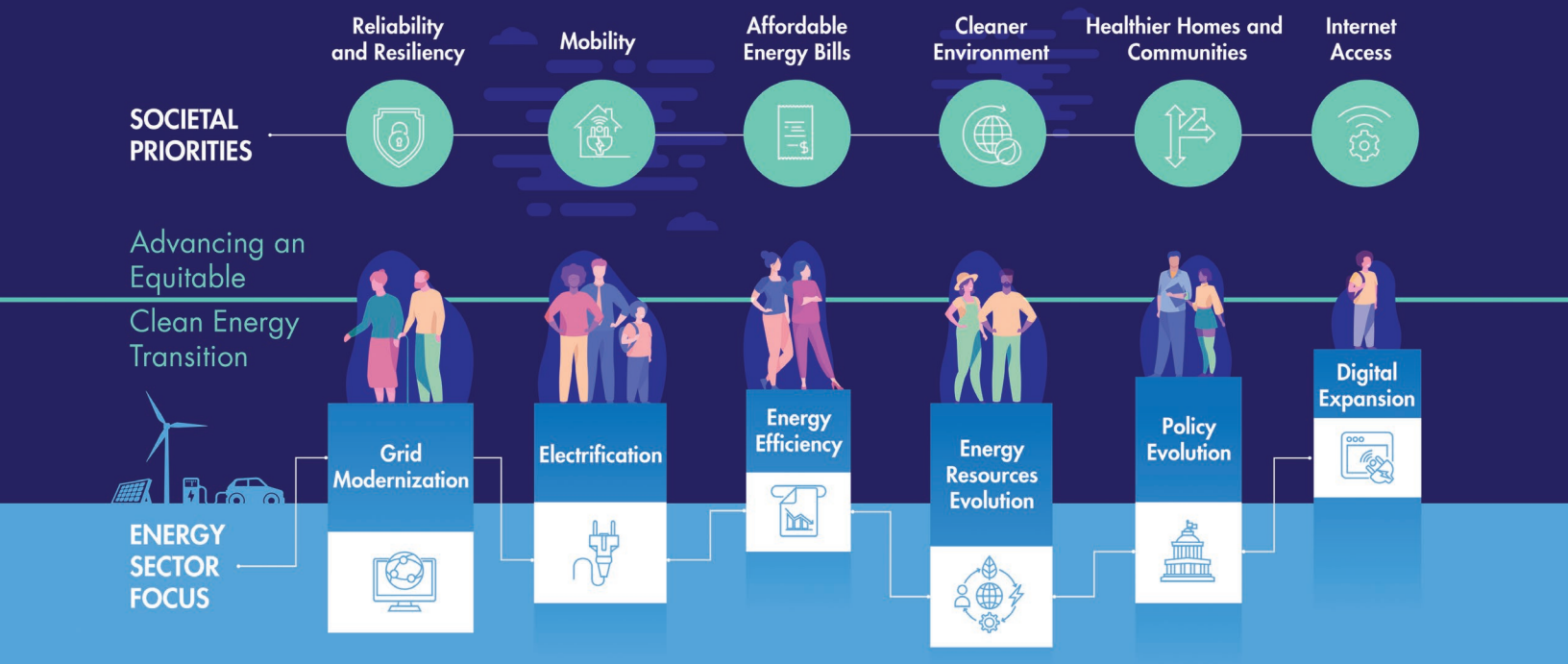
Equitably distributing decarbonization costs and benefits requires deliberate planning and program implementation. Disadvantaged communities may be advanced, impacted, or left behind by decarbonization and electrification initiatives, energy efficiency programming, digital transformation, grid modernization, and power generation transitions. New technologies, policies, business models, processes, and programs must be designed, developed, and deployed with the needs of disadvantaged communities in mind to reduce carbon and equitably distribute costs, opportunities, impacts, and benefits.

Public and private sector decision-making will directly impact equity and environmental justice. Managing the distribution of costs required to achieve decarbonization goals involves critical public and private sector decisions. There are many technical and economic questions to be addressed as this sector seeks to reduce regional and global emissions. At the same time, all stakeholders need to understand and manage the transition's implications and opportunities for equity and justice.

Ensuring distributive and procedural justice is important to a beneficial transition. Key frameworks for researching and informing decarbonization's equity and justice impacts and opportunities are distributive justice (e.g., just allocation of resources) and procedural justice (e.g., fairness in the processes that allocate resources).

Collaborative R&D is critically important to transition to a clean energy future and to meeting decarbonization goals while addressing reliability, affordability, and social equity. Public-private and economy-wide collaboration that brings together a variety of backgrounds, experiences, and perspectives will be key to defining the research agenda, identifying actionable goals, and building the tools and technologies that enable a better-informed and inclusive path forward.

New analytical tools and demonstration projects can deliver early benefits. Collaboration with local community organizations with existing trust-based relationships and residents themselves can better inform transition efforts respecting local priorities and cultures for the benefit of neighborhoods in need.



INTRODUCTION

With a growing demand for a low-carbon energy future, the distributional implications and opportunities of a clean, reliable, and affordable transition are priorities for the public and the electric power sector. This transition offers opportunities to engage locally and better meet the needs of disadvantaged and disproportionality impacted communities.

Decarbonization will come at a cost, and how society manages and distributes its costs and benefits involve critical public and private sector decisions. There are many technical and economic questions to address as we seek to reduce regional emissions and manage the distributional effects of decarbonization. These effects include access to clean, reliable, and affordable energy that can improve societal health and prosperity.

Awareness of social inequity problems is growing in the United States and globally. New U.S. administration policies to address climate change and secure an equitable economic future includes a commitment to environmental and economic justice and a goal that 40% of the overall benefits from federal investment flow to disadvantaged communities.[i] This intersects with a growing foundation of equity-focused initiatives and statements, including the 2015 United Nations Sustainable Development Goals (e.g., *UNSDG 7 – Affordable and Clean Energy*);[ii] the Business Roundtable's 2019 statement to redefine the purpose of a company focusing on value creation for all stakeholders to "ensure more inclusive prosperity;"[iii] and BlackRock CEO Larry Fink's statement, "Governments and the private sector must work together to pursue a transition that is both fair and just – we cannot leave behind parts of society, or entire countries in developing markets, as we pursue the path to a low-carbon world."[iv]

Addressing these broad-based challenges could profoundly impact society depending on where the electric power sector invests and engages with its many stakeholders. The sector and its customers, enterprises in other sectors, governments, stakeholders, and the public can drive more effective and equitable change through collaboration.

This paper presents key areas of decarbonization with equity dimensions and the role of research in informing policy, technology, and program development. Research and analyses, technology innovations, demonstration projects, program designs, and local community and collaborative connections are needed to leverage the energy transition to help accelerate a more equitable, just future. It is primarily focused on the distribution of effects and implications of the clean energy transition and is intended to initiate a focused dialog on the linkages between essential elements of the clean energy transition – clean electricity, efficiency, efficient electrification, grid modernization – and social equity. To start the discussion, we focus on the U.S. Many of the opportunities and challenges may have direct analogs to other developed countries, which will primarily replace their current energy systems. Emerging economies face many of the same hurdles, as well as the additional challenges of providing commercial energy to many who are presently not served and many more who are underserved.

We need to understand the clean energy transition's implications to better manage and mitigate impacts to disadvantaged communities and pursue opportunities for their benefit. We also need to understand how policy design and company programs can impact and address distributional and procedural equity. The following is a starting point for a research agenda to incorporate distributional considerations into the pursuit of a decarbonized economy, based on EPRI research into accelerating decarbonization in the decades ahead focused on the areas of efficient electrification, cleaning the power generation fleet, and informing program and policy design.[v] With EPRI's public-benefit mission and portfolio of technical research and expertise, the Institute is well suited to advance this evolving dialogue by evaluating analytical tools to understand impacts and tradeoffs, and supporting demonstration projects that, when executed in tandem with local organizations, can deliver early benefits to historically disadvantaged communities.

BACKGROUND

Characterizing the benefits and costs of decarbonization are important to local communities, particularly to low-income households that face disproportionate economic, environmental, and resiliency challenges and other barriers that make it difficult to participate in the energy transition. Consider energy burden – the percentage of gross household income spent on energy costs. According to the U.S. Department of Energy, national average energy burden for low-income households is 8.6%, three times higher than the estimated 3% for non-low-income households. In some areas, energy burden can be as high as 30%, as housing in low-income communities tends to be older and less energy efficient.[vi] Local communities, economies, businesses, and workers will be impacted as energy facilities and infrastructure are closed, converted, or built. Similarly, some communities have been disproportionately impacted by energy facilities, policies, and programs that the clean energy transition could address. Research and development can help identify and hone opportunities to better manage these costs and impacts.

Key frameworks for researching and informing decarbonization's equity and justice impacts and opportunities are distributive justice (fair allocation of resources) and procedural justice (fairness in the processes that allocate resources). As industry stakeholders increasingly use terms such as "just transition," "affordable decarbonization," and "climate justice," there is a need to understand different interpretations of these concepts and explore public and private sector opportunities to pursue them. Similarly, the terms "energy justice" (access to affordable energy) and "environmental justice" (disparate impacts from industrial pollution) are becoming more intertwined with the growing climate change discussion (e.g., hotter environments impact health and increase energy needs and burdens).

Decarbonization initiatives may make communities more dependent on electricity as a final energy source and, therefore, a reliable electric grid. Enhanced resiliency for all communities is critical; especially as extreme weather events can disproportionately impact low-income communities and communities of color. Evaluating opportunities and costs for microgrids, community solar, and energy storage technologies that can improve reliability and resiliency will be important. While not detailed here, EPRI conducts extensive research concerned with various aspects of resiliency.

EXPANDING EFFICIENT ELECTRIFICATION FOR ALL

Industrial and commercial electrification programs, including electric transportation, can help meet regional decarbonization targets, reduce customer energy costs, and improve air quality. Understanding the most effective approaches and enabling conditions, as well as their costs, benefits, and distributional implications, can help decision-makers design effective policies and programs, prioritize investments, and ensure equity. Moreover, involving communities in these initiatives and projects can reveal pressing needs and effective solutions. Key considerations for research include the following areas:

- Electrification can lead to improvements in local and regional air quality, reducing pollution exposure for disadvantaged communities which are disproportionally affected by poor air quality.
- Transportation electrification could directly address the challenges of many disadvantaged communities in locations of traditionally poor air quality, especially near busy roads. Electrification efforts could prioritize these communities, with a focus on access to charging infrastructure and the electric vehicle resale market to support uptake, and electrification of public transit to provide more immediate benefits.
- Electrification of agriculture through the use of augmented greenhouses, container farms, or agriculture warehouses can reduce environmental impacts (e.g., water consumption, pesticide use, carbon emissions) and create local jobs. Also, technology demonstrations may facilitate access to fresh, local produce if sited in areas lacking fresh food.
- Electrification of heating for communities with existing natural gas infrastructure requires thoughtful consideration. Even if initial costs can be offset over time by lower energy use through technologies such as heat pumps, those initial costs are often prohibitive; unintended economic burden may be addressed through additional research and programmatic development. In many cases, technology and retrofit challenges exist for different housing configurations, including multi-family housing. Ongoing research seeks to address these challenges, for example in relation to service sizing[vii] to accommodate heat pumps and high-lift heat pump technologies[viii] for large buildings.

ADVANCING ENERGY EFFICIENCY

Residential energy efficiency can reduce costs and produce healthier homes and communities. U.S. electric and natural gas utilities spend more than $6 billion per year on customer programs promoting energy efficiency, many of which already focus on disadvantaged communities. However, the Consortium for Energy Efficiency estimates that as of 2015, 3% of U.S. electric energy efficiency spending was focused on low-income programs, resulting in only 2% of total energy efficiency savings.[ix] Dramatically expanding and refocusing these programs and making them fuel agnostic could speed the clean energy transition and aid disadvantaged communities with high energy burdens. The technology advances, business models, processes, and programs to significantly reduce the cost of retrofits can accelerate progress toward energy efficiency and decarbonization goals. Key considerations for research include:

- Weatherization (e.g., adding insulation, replacing windows), lighting, and other building improvements can reduce customer energy costs, increase customer resiliency, and enable efficient leverage of existing utility assets. According to Architecture 2030, approximately 2/3 of the buildings today will still exist in 2050 so retrofits are a significant challenge to overcome.[x]
- Addressing the "split incentives" of landlords and tenants (i.e., where landlords bear the capital cost and tenants pay the utility bills), while improving resident quality of life and minimizing negative impacts of gentrification is critical to scaling up energy efficiency programs in multifamily and low-income communities.

ADDRESSING THE DIGITAL DIVIDE

Rural broadband initiatives can leverage electric grid modernization efforts to reach underserved communities with new fiber projects. Key considerations for research include:

- Operational networks' fiber installations can be used for additional services, such as distributed energy resources, to support equity and economic development in underserved communities.
- Specific to the power system, lack of broadband access can limit participation in outage notifications and diagnostics designed to improve reliability, as well as involvement in energy efficiency programs designed to benefit customers (e.g., providing user-friendly interfaces for more control over heating and cooling). Utility energy efficiency programs that address internet access and the connection of devices could result in bill savings for the community and enable utilities to leverage these new resources as a flexible load. These programs reduce residents' electricity costs while providing grid services that create value for all utility customers – value that could be applied to delivering the internet access required to close broadband gaps in underserved communities.

REIMAGINING POWER GENERATION

Power plant closures and new energy facilities and infrastructure projects can impact economic activity, employment opportunities, the tax base, land use and the environmental footprint from energy infrastructure. Identifying and understanding these implications is a first step toward considering equity. Reskilling and training – including through programs such as EPRI U[xi] and GridEd[xii] – can support the transition for some workers. Additionally, decommissioned power plants represent a significant legacy to be managed through the clean energy transition, with a variety of considerations and opportunities recognizing the both the benefits and risks these transitions present. Analyses and decision-making tools that support these decisions and projects are needed. Key considerations for research include:

- From 2011 to mid-2020, 95 gigawatts (GW) of U.S. coal capacity were closed or switched to another fuel and another 25 GW are slated to shut down by 2025.[xiii] These plant closures have impacted local jobs and community development, amplifying calls for a "just transition" including retraining and community-tailored economic development support. Even if replaced with new generation, new technologies may require fewer and different jobs. Further, new generation and fuel switching to natural gas, while very likely providing an overall reduced environmental footprint, may need to be evaluated in the environmental justice context. Concurrently, these plant closures, along with clean energy and decarbonization initiatives, can provide tangible local economic and environmental benefits spanning air, water, and waste – particularly if effective restoration can be undertaken. Monitoring and measuring these impacts and benefits can support community development, remediation, and land-use decisions, as well as inform mitigation for disproportionately impacted communities.
- As fossil power plants retire, the sites could be repurposed for brownfield economic development opportunities; community-focused resources serving local needs; or, with their existing grid, river and rail connections, repowering by locating hydrogen, battery, solar, small modular reactors (SMRs), and other clean energy technologies.
- Alternatively, fossil sites can be repurposed for open space or parkland, providing access to recreation for surrounding communities that may lack these resources.[xiv] Restoring or rehabilitating these sites can provide ecosystem services that improve the area's water quality and habitats.
- Another option is to redevelop sites for sites for reforestation or agriculture, taking advantage of large tracts of land with infrastructure supporting transport, potentially leveraging electrification and indoor agriculture.
- Redevelopment and decarbonization can help employees at these facilities and other workers in disadvantaged communities as the industry considers simultaneous workforce transition. Potential and expanded partnerships in workforce development can be crucial to successful workforce transitions.
- Nuclear power is the only existing resource capable of providing 24/7 carbon-free generation, and nuclear plants provide important contributions to the local tax base. Exploring ways for nuclear plants to remain economically viable in the clean energy transition could reduce the financial impact to local communities and advance a successful and affordable transition.
- Utility-scale, rooftop, and community solar and storage are key resources for the clean energy transition. Community solar is an alternative to rooftop solar that can provide access and resiliency options to disadvantaged communities where the cost and ability to locate an installation are prohibitive. Low-cost solar energy also can help offset higher electricity bills associated with less-efficient space and water heating.
- Understanding and mitigating the impacts of new energy facilities and infrastructure projects presents an ongoing need accelerated by the clean energy transition and decarbonization targets. These new facilities can include transmission lines and substations, renewable energy and storage facilities, production, delivery, and use of alternate energy carriers such as hydrogen, and peaking and back-up power installations. Environmental analyses focusing on disadvantaged and disproportionately impacted communities can be enhanced through improved screening tools and with community engagement.

INFORMING EFFECTIVE POLICY AND COMPANY PROGRAM DESIGN

Policy design and details affect the societal costs of decarbonization and the distribution of those costs. Collaboration between communities, stakeholders, and decision-makers can produce more effective policy and program designs. The most cost-effective decarbonization policies are often not well understood or selected by governments, stakeholders, and consumers. Similarly, policy influences investments and where and how their benefits accrue. Key considerations for research include:

- Economic and climate policy design modeling of alternatives, uncertainties, and response options can identify risks and opportunities and support policy, research and development, and program designs and decisions at federal, regional, state, and local levels. EPRI's REGEN model is used to evaluate various impacts of environmental and energy policies in both the electric and non-electric sectors. This model could be enhanced with the addition of equity-focused updates centered on household affordability and investment choices by income class. Planning and decision-making models and screening tools (e.g., EJSCREEN,[xv] CalEnviroScreen,[xvi] MD EJSCREEN[xvii]) can be enhanced to better incorporate societal and sustainability priorities in the development or assessment of public- and private-sector strategies and collaborations. This could enable better identification and assessment of tradeoffs and synergies across social priorities, including distributional effects. Analyzing energy system transition distributional implications and energy system transitions for multiple societal priorities are key areas of research.
- Collaborative research, partnerships, and outreach regarding policy design and company program options can facilitate dialogue, educate stakeholders and decision-makers, and inform approaches. Further, decision-making frameworks and tools that incorporate economic, environmental, social, and distributional factors can help enable more equitable solutions and advance transparency and dialogue.
- Fundamental economic research to understand options for including equity in the social cost of carbon and other greenhouse gases has been identified as a central need in updating these economic estimates, which have been used to guide regulatory and policy decisions for the last decade.

EXAMPLE ANALYSES AND DEMONSTRATION PROJECTS

With many aspects of decarbonization potentially impacting and offering opportunities for disadvantaged communities, strategically placed demonstration projects that engage collaboratively with local residents and community organizations can better inform research efforts, advance future technology scaling, and potentially deliver early benefits to neighborhoods in need.

The following provides a sampling of research addressing opportunities focusing on communities, the digital divide, electrification and transportation, and environmental justice. EPRI conducts additional research spanning all aspects of electric power, including customer and community engagement and behaviors; energy efficiency and energy management; health benefits evaluation; strategic decision analyses; and brownfield to brightfield reuse, among other capabilities.

Environmental Justice Tools and Screens: EPRI compiled a resource for understanding key concepts that underlie environmental justice initiatives and implementation of policies at the state and federal levels – including state-specific profiles. This body of work provides a summary of some key tools used to map and identify communities that may have environmental justice concerns, including a review of factors and metrics. Updating this work and further development of analyses, data, tools, and metrics to identify and assess inequities would help focus efforts and investments in areas with greater needs and potential for advancing equity. New research can inform and support use of environmental justice-focused technical tools and models during new asset siting to address clean energy transition goals and characterize legacy impacts and their mitigation.

Affordable Communities: Large-scale affordable housing and community solar demonstrations are already underway. Researchers are evaluating greenhouse gas emissions, electricity and natural gas savings, and non-energy impacts, such as indoor air quality, community resilience, and customer satisfaction. Multi-stakeholder demonstrations (convening tenants, community-based organizations, builders, technology providers, utilities, researchers, and others) conducted between 2016 and 2020 show that efficiency and electrification can lower community-level greenhouse gas emissions by 40%, while reducing tenant energy burden and property owner energy costs. Evaluations of affordable housing with community solar show the possibility for savings, as well as challenges associated with power purchase agreements for affordable housing owners. New demonstration activities seek to inform improved construction techniques to enable net-zero-ready manufactured housing in rural areas, as well as identify pathways for achieving improved efficiency in urban multifamily buildings by electrifying water and space heating. This activity would bring stakeholders to the table with utilities to help understand low-carbon pathways for manufactured and multi-family housing. Additional demonstrations would seek to build on existing collaborations and research to understand and develop technology packages that enable affordable decarbonization in disadvantaged communities – including multi-tenant buildings – and business models to pay for it. Demonstrations would include new building construction, but the main emphasis could be building retrofits to assess technology and labor needs, as well as testing program delivery models that could significantly lower delivery costs[xviii]

Connectivity in Disadvantaged Communities: Mesh networks used to interconnect locations without services can be extended and adapted to support energy efficiency programs in disadvantaged communities. This primary connectivity would be more than just keeping people connected when their Wi-Fi is out. New projects can define and help pilot an architecture that is scalable from urban high-density housing to rural communities.

Indoor Agriculture: Launched in 2019, EPRI's National Indoor Agriculture Demonstration Collaborative sites container farms in communities where research can enhance understanding of grid impacts and local opportunities of this growing industry. In addition, many of the projects donate the produce to support disadvantaged communities. For example, the container farm established at the University of Tennessee in collaboration with the Tennessee Valley Authority and Knoxville Utilities Board donates kale to Second Harvest in support of its mission to feed the hungry in East Tennessee. Continuing to site new demonstrations in disadvantaged communities could advance skills development and support local produce offtake to those in need.[xix]

Electrification and Mobility: EPRI conducted a study for the California Energy Commission demonstrating that widespread electrification could substantially reduce concentrations of fine particulate matter (PM2.5) in disadvantaged communities.[xx] New analyses could expand electrification activities in support of disadvantaged communities. Electrifying transportation (especially deploying electric medium/heavy duty vehicles) offers an opportunity to measure changes in local air quality at and near locations where this transition is being carried out (e.g., at a bus yard or distribution center). A national demonstration could take a multi-pronged approach to deliver electric transportation via passenger vehicles, public transit, and ride-sharing programs through collaboration with local municipalities, utilities, and community-based organizations.

CONCLUSION

The electric power sector is working together to achieve a clean energy transition that equitably distributes decarbonization costs and benefits among disadvantaged communities that have historically been disproportionately impacted by industrial assets and activities. This opportunity spans the sector value chain—from reimagining and repurposing the power generation fleet to designing new energy utilization programming for energy efficiency and electrification, the sector and the communities they serve are on a course to realize the full benefits of decarbonization. These opportunities will depend on strategic collaboration beyond traditional public-private partnerships, including reliance on the long-standing community organizations that have earned these communities' trust over decades. Understanding meeting core community needs while simultaneously driving innovation and technological progress is critical to success. This paper intends to spark ongoing dialog, with EPRI poised to contribute analytical and technical expertise where appropriate to explore the equity impacts and opportunities of clean energy transition activities in partnership with others. There are few times when industry evolution has converged in tandem with a societal need. This moment in time offers great opportunity that energy sector stakeholders can realize through focused engagement, commitment, innovation, and investment.

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