



# Practical Approaches To Embed Energy and Environmental Justice Into DOE Technology Portfolios

August 2021–August 2024

David Oonk and Darshan MA Karwat

*Arizona State University*

NREL Technical Monitor: Ben Maurer

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National Renewable Energy Laboratory  
15013 Denver West Parkway  
Golden, CO 80401  
303-275-3000 • [www.nrel.gov](http://www.nrel.gov)

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## List of Acronyms

ASU	Arizona State University
DEI	diversity, equity, and inclusion
DOE	U.S. Department of Energy
EEJ	energy and environmental justice
EERE	Office of Energy Efficiency and Renewable Energy
FOA	funding opportunity announcement
NREL	National Renewable Energy Laboratory
TRL	technology readiness level
WPTO	Water Power Technologies Office

## Executive Summary

This document is intended to be a resource for the U.S. Department of Energy (DOE) Water Power Technologies Office and other interested science and technology offices within DOE seeking to incorporate energy and environmental justice (EEJ) into their programs and portfolios. It provides (1) background information on EEJ principles; (2) how those principles apply to foundational research and technology development through deployment and commercialization; and (3) tangible and immediate steps that can be taken to infuse EEJ into ongoing programmatic efforts.

# Table of Contents

<b>Executive Summary</b> .....	<b>iv</b>
<b>1 Introduction</b> .....	<b>1</b>
<b>2 Principles of Energy and Environmental Justice</b> .....	<b>3</b>
<b>3 Applying EEJ Principles in Energy Technology Design and Program Development</b> .....	<b>5</b>
<b>4 Developing Justice-Informed Practice in WPTO</b> .....	<b>8</b>
4.1 Developing EEJ Goals and Priorities .....	8
4.2 Developing and Managing Programs .....	8
<b>5 Conclusion</b> .....	<b>11</b>
<b>References</b> .....	<b>12</b>

# 1 Introduction

In Executive Order 14008 “Tackling the Climate Crisis at Home and Abroad,” the Biden administration made the most recent federal push to further environmental justice in the United States. The executive order established the Justice40 Initiative, which addresses issues of energy and environmental justice (EEJ) challenges in the United States and directs 40% of overall benefits from covered federal programs to disadvantaged communities (Office of Environmental Management n.d.). Federal government agencies are now mobilizing to identify relevant offices and programs that can address EEJ challenges. The executive order presents an opportunity but also a challenge. It is imperative for federal agencies to think critically about how past programs and policies have not necessarily accounted for justice and equity, so that moving forward, federal government efforts to more directly assist disadvantaged communities and other stakeholders can be successful. Doing so, however, will likely require each agency and office therein to understand how and where justice and equity applies to their efforts and how they can strategically mobilize their offices to action. There is a real opportunity for agency- and office-level leadership in Justice40 and in incorporating justice and equity into programs more broadly in the future. With increasing public awareness of EEJ challenges, incorporating principles of EEJ into programmatic work in the U.S. Department of Energy (DOE) will continue to be important as part of the transition to a clean energy economy.

In response to calls to embed EEJ in government programs, DOE and its Office of Economic Impact and Diversity developed specific guidance for DOE offices. DOE identified energy-centric justice and equity goals and measurable impacts. These include decreasing energy burden, increasing energy resilience and democracy, decreasing negative environmental exposures for disadvantaged communities, and increasing access to low-cost capital and enterprise creation (Office of Economic Impact and Diversity n.d. [a]).

DOE’s Office of Energy Efficiency and Renewable Energy (EERE) houses technology offices in energy efficiency, sustainable transportation, and renewable power. The renewable power sector contains the Geothermal Technologies Office, Solar Energy Technologies Office, Wind Energy Technologies Office, and Water Power Technologies Office (WPTO). Each has different technology portfolios (EERE n.d. [a]) that vary in technology readiness level (TRL) (EERE n.d. [b]), target beneficiaries and stakeholders, and environmental risks and hazards. The EEJ implications for each will vary based on these factors, and it will be up to the offices themselves to determine the best pathways to advance EEJ. This work presented below was carried out with a focus on the activities of the WPTO. While there are clear energy-centric goals outlined by DOE and EERE, additional information can support offices within EERE as they take steps to advance EEJ and meet Justice40.

This report was developed at the conclusion of a year-and-a-half-long research and evaluation study by a team at Arizona State University (ASU). The ASU team was contracted by the National Renewable Energy Laboratory (NREL) and funded by WPTO to assess if and how WPTO’s programs prior to the implementation of the Justice40 initiative aligned with EEJ. The research and evaluation work (Oonk et al. in press) found the following:

1. WPTO was able to innovate and create justice-aligned programs, efforts, and best practices that incorporated EEJ values specific to their technology portfolio prior to the Justice40 initiative.
2. There is a need for tailored information that will help WPTO progress toward the overarching goals of programs like Justice40 and DOE's energy-specific Justice40 goals.
3. Offices like WPTO have the capacity to continue to develop programs aligned with justice and equity that are specific to the technology portfolio they administer. There exist several opportunities for WPTO to further infuse justice goals and best practices into its program.

This report, informed by the research, is designed to address the barriers to incorporating EEJ into WPTO's programs, and can be used by other technology offices at different stages of their EEJ adoption and experience.



## 2 Principles of Energy and Environmental Justice

While sometimes used interchangeably, justice and equity have distinct definitions and purposes (Reckien et al. 2018), but they are intertwined. Equity refers to the fair distribution of resources and direct resolution of unfairness issues. Justice means thinking long term, being proactive, and grappling with the root causes and barriers that lead to inequity. This report and the approach outlined herein focus more on justice than equity and seek to inform energy technology offices as they build durable perspectives and practices concerning EEJ. Below is a set of justice-related values as defined by researchers, scholars, and practitioners. These foundational concepts can be applied to many different contexts, agencies, offices, or sectors to highlight the nature of injustices and how they can be addressed.

**Distributive justice** refers to the just distribution of impacts and benefits of goods, services, policies, and programs. Injustice exists when there is a lack of equitable distribution of risks and negative environmental externalities, or the concentration of benefits in affluent and high socio-economic communities (Baker, DeVar, and Prakash 2019).

In the context of DOE's technology-related activities, thinking about distributive justice can mean, for example, asking questions about the distribution of costs and benefits associated with energy products and services (Sovacool and Dworkin 2015). For example, while fossil fuel power plants provide reliable power in large quantities to populations across the United States, many of the communities living around the power plants are the ones exposed to the high levels of air pollution created by those plants. Addressing issues of distributive justice requires intentionally allocating the distribution of positive impacts equitably, preventing inequitable allocation of negative impacts, and reducing barriers that lead to such injustices. Offices can develop technologies and renewable energy applications for specific end-beneficiaries with high energy costs or at-risk energy systems (due to, say, extreme weather events).

**Recognition justice** refers to the clear recognition and acknowledgment of groups of individuals and communities affected by policies, programs, and decisions (Jenkins et al. 2016). Oftentimes, communities face negative impacts of energy systems, such as high energy burden or exposure to pollution, and these impacts are not understood or recognized by society at large. In the context of DOE's technology-related activities, thinking about recognition justice can mean, for example, understanding whether certain demographics of people can competitively apply for awards and financial assistance. Smaller nonprofit organizations representing environmental justice communities may not be applying for DOE funding because they do not have the administrative resources to do so. If smaller nonprofit organizations are not recognized as possible recipients of DOE funding, it is likely that funding processes will not be designed to accommodate them. Addressing issues of recognition justice requires bringing attention to impacted communities and raising awareness to end their exclusion from decision-making processes. Doing this means that DOE staff seeking out under-heard perspectives and elevating the importance of nontraditional stakeholders in decision-making.

**Procedural justice** has to do with impacted peoples, groups, or communities being intentionally or unintentionally excluded from decision-making, legal, or other formalized processes (Jenkins et al. 2016). Addressing procedural justice and including people in decision-making processes does in many cases prevent issues of recognition justice as well. In the context of DOE's

technology-related activities, procedural justice perspectives can, for example, uncover whether and how engaging with DOE might be limited for certain groups of people for linguistic or administrative reasons. Addressing procedural justice necessitates reducing and eliminating the formal and informal barriers that prevent people from participating in decision-making and other processes and creating inclusionary processes that expand access to DOE programs and expertise overall.

**Restorative justice** is the compensation or resolution for people impacted and the remediation of damages (Heffron and McCauley 2017). In the context of DOE’s technology-related activities, offices can fund opportunities to intentionally improve negative environmental conditions or foster enterprise creation in historically disadvantaged communities (Office of Economic Impact and Diversity n.d. [b]).

**Cosmopolitan justice** refers to when the negative impacts of programs, policies, projects, and decisions are pushed onto other communities outside of state or national boundaries (Office of Economic Impact and Diversity n.d. [b]). This means that justice is not limited by state or national boundaries, and that while it is not inherently unjust to focus on people in need in a specific area or region, programs, policies, projects, and decisions can be unjust if they are at the detriment of peoples elsewhere. In the context of DOE’s technology-related activities, for example, clean energy technologies require rare earth minerals (International Energy Agency 2021) that when mined have impacts on water and soil quality (U.S. Environmental Protection Agency 2022). In this instance to prevent issues of cosmopolitan justice DOE-funded activities would have to ethically source these materials and not rely on wasteful and hazardous mines in foreign countries.

Just outcomes often come from best practices that use a combination of the values above. For example, reaching distributive justice may require sophisticated stakeholder collaboration and decision-making process changes informed by recognition and procedural justice principles. Meeting Justice40 goals and allocating benefits as directed in the executive orders will necessitate engaging and implementing aspects of all justice principles in different ways.

Outcomes important to EERE activities, like energy access, affordability, security, burden, resilience, and energy democracy can be thought of as the justice principles above applied to the energy system. These outcomes implicate environmental, social, and economic concerns and can inform the ways in which just outcomes can be understood, measured, and addressed. DOE’s stated Justice40 goals and outcomes provide targeted impacts for offices to strive toward (Office of Economic Impact and Diversity n.d. [a]). However, further guidance on how these values apply to technology policy and development can help offices understand their progress toward those goals.

### 3 Applying EEJ Principles in Energy Technology Design and Program Development

Researchers and scholars of science, technology, and policy studies have shown that socio-cultural factors influence science (Stanford Encyclopedia of Philosophy 2019) as well as where and how justice and equity principles apply to foundational scientific research and technology development (Ottinger 2011; Sclove 1997). Justice and equity concerns vary depending on the technology. For example, these concerns could include considering what goals the technology is designed to achieve, what design or deployment stage it is in, and its design features. Even though applying justice and equity is case-specific, program developers can use broad justice-informed evaluative questions and considerations to critically review their office and programs.

Justice considerations can be included in the design, development, and implementation of technology programs such as the ones that form the core activities of EERE offices. For example, justice or equity may inform the goals of a program that funds technological commercialization to support specific communities with specific needs. EERE office staff may not be aware of the specific in situ assets and needs of a target community so consultation with disadvantaged communities during initial program development phases may help shape the program to better meet their needs and address their challenges. Justice considerations can also be embedded at later stages (higher TRL) of the technological development process.

Table 1 contains justice- and equity-informed questions and considerations for programs and technologies at various stages of development. These are based on the justice values presented above in combination with research and peer-reviewed scholarship in just technology development (Ottinger 2011; Jasanoff 2016; Byrum and Benjamin 2022). The questions and considerations in Table 1 are organized by stage and approximate TRL. They cover technologies and applications from ideation through commercialization.

**Table 1. A Set of Evaluative Questions and Considerations That Can Be Used To Infuse Justice Into the Energy Technology Development Process**

Technology Stage	Approximate TRL	Evaluative Questions	Justice and Equity Considerations
Strategy Development, Problem Area Definition, Foundational Research	1–3	<ul style="list-style-type: none"> <li>• Who are the likely end users and end beneficiaries of the technology?</li> <li>• Which disadvantaged communities could likely benefit from the technology?</li> <li>• How will disadvantaged communities likely benefit?</li> <li>• What are the likely site- and community- specific assets and needs?</li> <li>• How can the awardee team likely consult with disadvantaged communities to help define their assets and technical needs?</li> </ul>	<ul style="list-style-type: none"> <li>• Engaging and collaborating with stakeholders early to define needs and assets.</li> <li>• Identifying technologies and applications that are likely to reduce environmental risks and impacts.</li> <li>• Pursuing strategies and programs that target services specifically for disadvantaged communities.</li> </ul>
Technology Development	4–6	<ul style="list-style-type: none"> <li>• How can the device or system be designed to be accessible, easy-to-use, operate, and fix?</li> <li>• How can disadvantaged stakeholders consult or collaborate with the engineering/scientific or design team?</li> <li>• How can design changes decrease waste and increase sustainability of technology components?</li> <li>• What materials are used to develop the technology and what sourcing and disposal impacts are known or considered?</li> </ul>	<ul style="list-style-type: none"> <li>• Engaging with stakeholders early for technology co-design.</li> <li>• Collaborating with stakeholders so technology meets end-user needs and addresses concerns over environmental, social, or economic impacts.</li> <li>• Prioritizing design features that ensure ease-of-use, maintenance, and repair for disadvantaged community users.</li> </ul>
Technology Demonstration and Deployment	7–9	<ul style="list-style-type: none"> <li>• How can disadvantaged stakeholders consult in and guide the deployment of the energy technology?</li> <li>• What are other disadvantaged stakeholders and locations that can benefit from the energy device?</li> <li>• What design changes may be needed to better meet the disadvantaged stakeholder’s needs?</li> <li>• What negative environmental impacts appear during and after deployment and how can they be mitigated?</li> <li>• Will disadvantaged stakeholders own the technology and benefit from the use and sale of the technology or its produced resources (electricity, water, etc.)? Or if not, will they have a meaningful role in decision-making (e.g. in deployment/siting)?</li> <li>• What are the impacts of resources used and what are the impacts of the eventual disposal of the technology?</li> </ul>	<ul style="list-style-type: none"> <li>• Engaging and collaborating with stakeholders to identify deployment site and define possible site risks.</li> <li>• Co-developing deployment strategy with stakeholders.</li> <li>• Co-defining relevant goals of deployment and required learning and data collection.</li> <li>• Prioritizing equitable technology deployment and distribution of positive and negative impacts.</li> <li>• Pursuing sustainable resourcing, recycling, and disposal of resources.</li> </ul>

Table 1 can inform WPTO staff as they think about and apply justice and equity principles in creating strategic plans, developing novel programs (from funding opportunity announcements to prizes and technical assistance programs), and scoring and evaluating applications for those programs. It also informs WPTO staff as they manage programs and work with awardees. The questions and considerations can assist staff to encourage applicants and awardees to engage with diverse stakeholders, end users, and disadvantaged communities specifically. They can also provide guidance on justice-informed technological features like ease of use, modularity, and easy operations and maintenance. The questions can be a helpful resource to potential applicants and current awardees interested in infusing justice and equity principles into their projects. Applicants can use the questions to critically review their proposed project and better align it with justice and equity. Note that once a technology progresses to TRL 9 and to commercialization, it is no longer within the purview of EERE technology offices.

## 4 Developing Justice-Informed Practice in WPTO

Durable EEJ outcomes can be enhanced with justice-informed practices that account for the institutional structure and programmatic capabilities in WPTO. The WPTO-specific application of justice and equity principles can be strategic and scoped to its mission and technology portfolio and can utilize various funding mechanisms. Justice and equity principles can inform how WPTO identifies goals and priorities and can assist in developing and managing programs that allow for greater justice-oriented activities in the application and awardee process.

### 4.1 Developing EEJ Goals and Priorities

Technology offices like WPTO can survey their existing programs and identify topic areas where their technology portfolio can directly support disadvantaged communities and other disadvantaged stakeholders. These topics can be technology-focused and prioritized according to novel applications of existing technologies and prototypes that meet specific needs of disadvantaged communities. Alternatively, goals can be oriented around meeting a specific social, environmental, or economic need of a disadvantaged community. For example, the ASU research demonstrates how WPTO was able to develop EEJ-aligned programs by focusing on pollution reduction and environmental impact mitigation of hydropower facilities (Oonk et al. in press). Technology offices can utilize national lab resources and lab call research studies to find connections between the technology portfolios and disadvantaged community needs. (Refer to “Strategy Development, Problem Area Definition” in Table 1 for specific questions and considerations to guide this exercise.) Explicitly tying EEJ to the goals and priorities of a program or set of programs can ensure that metrics that measure impact of these programs are also measuring progress toward Justice40 as necessary.

### 4.2 Developing and Managing Programs

Technology offices can develop resources and communicate new EEJ goals and priorities with past applicants and current awardees. Meanwhile, offices can work to reduce barriers to applying and conduct outreach to nontraditional applicants (EERE n.d. [c]). For example, WPTO’s efforts signal that developing programs with explicit equity goals have broadened their applicant pool. Offices can follow other agencies and institute double-blind or other unbiasing processes (Watson 2021) in application review. Other changes can be made to further bring the application scoring of technology priorities in line with justice and equity principles (e.g., prioritizing ease of use, modularity, ease of repair). Offices can also prioritize applicants that engage more directly and collaborate with end beneficiaries and disadvantaged communities. After awarding funds, project managers and monitors can track progress toward justice and equity goals. For example, in reviews of annual operating plans and statements of project objectives, office staff can require progress updates and expectations for the awardee’s diversity, equity, and inclusion (DEI) plan, disadvantaged community engagement plans, and the alignment between an awardee project’s stated environmental goals and progress towards those goals.

In short, there are a range of ways to strengthen internal processes to align priorities, goals, and programs with EEJ. These changes can be done systematically, using a step-by-step implementation process; Table 2 provides an example of such a step-by-step implementation. It details an approach to build toward medium- and long-term EEJ goals that are actionable and measurable. This approach may not be applicable to every program across a given office.

Instead, it is an example for how to think about, develop, and track EEJ-related efforts. This approach was developed based on the assessment of the WPTO EEJ-aligned efforts and how it has utilized the available funding mechanisms and worked with a program portfolio at various TRL stages (Oonk et al. in press).

**Table 2. Sketch of a Phased Implementation of EEJ Into Office Practices**

Phase	Actions
Phase 1: Define scope and priorities	<ul style="list-style-type: none"> <li>• Build knowledge capacity: gather information, identify resources, and provide trainings</li> <li>• Scope office-specific justice and equity goals, priorities, and potential “covered” programs</li> <li>• Initiate communications with disadvantaged and other stakeholders and solicit feedback on goals and priorities</li> <li>• Identify potential impact metrics in line with priorities and goals</li> <li>• Communicate and provide resources to applicants and awardees on Justice40 and other justice equity priorities</li> </ul>
Phase 2: Initial approaches of EEJ in office activities	<ul style="list-style-type: none"> <li>• Identify and incorporate and institute justice- and equity-informed best practices into current programs (e.g., stakeholder collaboration, diversity, equity, and inclusion plans and reporting, targeted environmental goals)</li> <li>• Develop novel pilot programs that intentionally target justice and equity outcomes or adhere to best practices.</li> </ul>
Phase 3: Refined approaches of EEJ in office activities	<ul style="list-style-type: none"> <li>• Evaluate initial programs through awardee and stakeholder feedback</li> <li>• Evaluate results of programmatic changes to existing awardee projects</li> <li>• Evaluate pilot programs</li> <li>• Institute metric collection protocols to track progress toward goals and priorities</li> </ul>
Phase 4: Ongoing approaches of EEJ in office activities	<ul style="list-style-type: none"> <li>• Evaluate initial metric collection protocols, expand metric collection, and conduct baseline analyses</li> <li>• Continue metric collection toward medium- and long-term goals</li> <li>• Scale initial programs into larger programs (e.g., funding opportunity announcements [FOAs])</li> <li>• Identify knowledge gaps and conduct regular trainings with project monitoring staff</li> <li>• Initiate regular communications and portfolio review with disadvantaged communities and other stakeholders</li> </ul>

In Phase 1, a technology office can build initial capacity through learning, information gathering, resource collection and generation, and trainings that help inform the staff about justice and equity principles in ways that apply to the office’s portfolio. During this phase, office staff may engage with disadvantaged communities and other stakeholders not previously engaged by the office. These could be nongovernmental organizations, minority serving institutions, and community stakeholders. These efforts will help the office understand disadvantaged community needs and assets and help scope their justice and equity efforts. Offices can also increase capacity by hiring new staff with diverse backgrounds or expertise in justice and equity.

Justice and equity goals and priorities can be identified by the office. Evaluative questions and considerations in Table 2 can be used to develop programs with the explicit purpose of addressing justice and equity. During this stage an office can raise awareness of priorities and goals to existing awardees and potential applicants. Also, during this phase the office can start to identify relevant process and impact metrics. Metrics will vary depending on the program and

the TRL. For example, for early-stage technologies, measuring a program's Justice40 impact based on DOE's targets (e.g., reduce energy burden) may be challenging. However, if justice and equity efforts are infused into the core goals and priorities of a program, successful development and execution of the program brings the office a step closer to longer-term Justice40 goals. For example, the expressed purpose of WPTO's Waves to Water Prize was to foster development of technologies to meet the needs of energy and environmentally vulnerable communities after disasters (DOE 2021). While the prize did not result in a measurable increase in a specific community's resilience, the successful development of prototypes is considered progress toward that eventual goal.

During Phase 2, an office can initiate development of pilot programs and make adjustments to ongoing programs. Pilot programs can be developed with expressed justice and equity goals (e.g., the Inclusive Energy Innovation Prize [DOE n.d.]) and can utilize programs with lower financial and application burdens (e.g., prizes or WPTO's seedlings and saplings (EERE n.d. [d])). This may allow for programmatic experimentation and a broader pool of nontraditional applicants. An office can also identify if and how justice and equity considerations can be added to existing programs. These can include WPTO's DEI plan and community impact plan requirements in FOAs. At the conclusion of Phase 2 an office would be able to identify exemplary DEI plans and Justice40 programs specific to their office and technologies. Exemplary plans can then serve as reference points for future applicants and awardees. Finally, during this phase an office can start to collect accessible process and impact metrics.

In Phase 3 an office can review and evaluate the initial approaches from Phase 2. This review can seek to inform a next round of novel pilot programs or transform initial pilot programs into larger programs (e.g., FOAs). Formal and informal feedback from applicants, awardees, and stakeholders can be sought to identify issues and needs. For example, an office may identify knowledge and capacity needs for applicants after reviewing the DEI and community impact plans. This may inform the development of training resources to better equip the next generation of applicants. In this phase, an office can develop novel metric collection protocols (that could themselves be evaluated and standardized in the future) that track progress toward justice and equity goals.

Finally, in Phase 4, an office can continue evaluation and learning from Phase 3 as it scales up pilot programs, makes them replicable, or develops novel programs. An office can conduct ongoing analyses on process and impact metrics. Metric collection can be expanded with new protocols. For example, the public value mapping approach developed by Oonk et al. (in press) can be leveraged to create a mapping tool to keep track of the extent to which the range of programs in an office maps to the various dimensions of justice. Based on the results of this tracking, an office can conduct regular reviews to identify ongoing resource and training needs for its program monitoring staff to ensure justice and equity goals are being met. Finally, offices can continue to engage and collaborate with disadvantaged communities and other stakeholders and use feedback to review offices' goals and priorities.



## 5 Conclusion

There is no cookie-cutter approach to infusing principles of EEJ into the goals and outcomes of a technology portfolio, or into the day-to-day work practices of an office managing it. The approach can be tailored to suit the capabilities and needs of an office, and to the particularities of the technologies being advanced by an office. EEJ is an ever-evolving field, and its various aspects and features share overlaps with ideas like resilience and sustainability. There is ample opportunity for DOE to continue to advance energy technologies in ways that are just and equitable. As the breadth and depth to which EEJ informs and shapes a program increases and continues to gain importance, and as an office passes through different phases of EEJ implementation in its programs, there will be a simultaneous evolution in the roles and responsibilities of office staff in ways that make EEJ part of how an office operates. Such process evolutions could also impact job postings and hiring decisions for staff. Regardless of approach or office, the aims of EEJ in DOE are attainable.

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